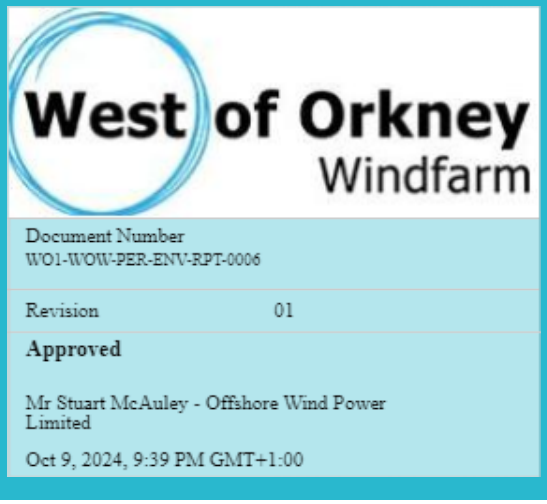
Offshore Wind Power Limited

West of Orkney Windfarm Offshore EIA Report Addendum

Marine Mammals and Megafauna Additional Information



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West of Orkney Windfarm

REVISIONS & APPROVALS

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CONTENTS

Executive Summary

Offshore Wind Power Limited (OWPL) ('the Applicant') submitted an application for consent of the offshore elements of the West of Orkney Windfarm ('the offshore Project') in September 2023, supported by an Offshore Environmental Impact Assessment (EIA) Report ('the Offshore Application').

Following the review of the Offshore Application and upon receipt of representations from consultees, Marine Directorate – Licensing Operations Team (MD-LOT) issued Additional Information Requests to the Applicant on 8th February 2024 and 8th April 2024. The following key topics were relevant to marine mammals and megafauna:

- Justification for not assessing bottlenose dolphin and for the density estimates used in assessment for some species;
- Revision of the sensitivity scoring for underwater noise impacts that takes account of cetacean conservation value and status;
- Clarity on embedded mitigation and magnitude scoring revision;
- Revision of the significance conclusion to account for the change in magnitude and sensitivity scores;
- Revision of cumulative assessment to consider all appropriate impacts, mitigation and additional species;
- Further consideration of the predicted EIA outcomes in the context of European Protected Species (EPS) licensing; and
- Clarification of discrepancies and further consideration of mitigation within the Outline Plan 2: Marine Mammal Mitigation Protocol (MMMP).

This document is an addendum to chapter 12: Marine mammals and megafauna of the Offshore EIA Report to address the MD-LOT Additional Information Request and other relevant specific clarification points from NatureScot. Stakeholder consultation, in the form of meetings and written correspondence with NatureScot, has been undertaken to inform the additional information provided within this document.

The Applicant has provided a revised assessment for underwater noise pressures to marine mammals, having accepted the advice from NatureScot regarding sensitivity and magnitude criteria. However, none of the changes affected the conclusions of the EIA, which remained non-significant in EIA terms.

Further work on cumulative effects has been completed, using iPCoD for harbour porpoise, minke whale and harbour and grey seal species. This work concluded that there are no population level impacts of disturbance to any species and that a magnitude of negligible is appropriate on this basis. The modelling indicated there was no significant cumulative impact to any of the assessed species. This conclusion has not changed from the Cumulative Effects Assessment (CEA) of the Offshore EIA Report. Only with estimated mortality from collision with the tidal turbines at MeyGen included in the iPCoD model for harbour seal, was the decline of their population exacerbated, but not in the presence of disturbance from the offshore Project.

The Applicant reaffirms the commitment to the mitigation of predicted impacts to marine mammals, through the updated Outline Marine Mammal Mitigation Protocol (MMMP) (Appendix B) and consideration, at this stage, of the implications to EPS. The Project continues to conduct further investigations of the site into 2025, and refined parameters will inform revised underwater noise modelling, the Piling Strategy and the EPS Licence application post-consent.

Finally, an assessment of potential impacts to otter seaward of Mean High Water Springs (MHWS) is provided. This assessment is provided alongside the assessment presented within the Addendum to the Report to Inform Appropriate Assessment – All Topics (Excluding Ornithology). For all impact pathways it has been concluded that there will be no significant impacts.

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1 INTRODUCTION

Offshore Wind Power Limited (OWPL) ('the Applicant') is proposing the development of the West of Orkney Windfarm ('the Project'), an Offshore Wind Farm (OWF), located at least 23 kilometres (km) from the north coast of Scotland and 28 km from the west coast of Hoy, Orkney.

The Applicant submitted an application for consent under Section 36 of the Electricity Act 1989 and Marine Licences under Part 4 of the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009 to Scottish Ministers in September 2023 ('the Offshore Application') for the offshore components of the Project seaward of Mean High-Water Springs (MHWS) ('the offshore Project'). The offshore Project will consist of Wind Turbine Generators (WTGs) and all infrastructure required to transmit the power generated by the WTGs to shore.

In accordance with relevant EIA Regulations[1], an Offshore Environmental Impact Assessment (EIA) Report was submitted to Marine Directorate – Licensing Operations Team (MD-LOT) as part of the Applicant's Offshore Application. Chapter 12: Marine Mammals and Megafauna of the Offshore EIA Report provided the assessment of likely significant effects on marine mammal receptors, both from the offshore Project alone and cumulatively with other projects, plans and activities, and whole Project perspective.

Following the review of the Offshore Application, and upon receipt of representations from consultees, MD-LOT issued Additional Information Requests to the Applicant on 8th February 2024 and 8th April 2024, covering the following key topics:

- Justification for not assessing bottlenose dolphin and for the density estimates used in the assessment for some species;
- Revision of the sensitivity scoring for underwater noise impacts that takes account of cetacean conservation value and status;
- Clarity on embedded mitigation and magnitude scoring revision;
- Revision of the significance conclusion to account for the change in magnitude and sensitivity scores;
- Revision of cumulative assessment to consider all appropriate impacts, mitigation and additional species;
- Further consideration of the predicted EIA outcomes in the context of European Protected Species (EPS) licensing; and
- Clarification of discrepancies and further consideration of mitigation within the Outline Plan 2: Marine Mammal Mitigation Protocol (MMMP).

This document is an addendum to chapter 12: Marine mammals and megafauna of the Offshore EIA Report and provides the additional information in response to the Additional Information Request and to address other relevant specific clarifications points from consultees. It has been prepared by HiDef Aerial Surveying Ltd. Appendix A has been produced by SMRU Consulting.

[1] *The relevant EIA Regulations include the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, the Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017, and the Marine Works (Environmental Impact Assessment) Regulations 2007.*

The relevant documents previously submitted as part of the Offshore EIA Report that should be read alongside this document include:

- Offshore EIA Report Volume 1 – Chapter 12: Marine Mammals and Megafauna;
- Offshore EIA Report Volume 2 – Supporting Study 9: Marine Mammal and Megafauna Baseline Report;
- Offshore EIA Report Volume 2 – Supporting Study 10: Marine Mammal Underwater Noise Assessment;
- Offshore EIA Report Volume 2 – Supporting Study 11: Underwater noise modelling report; and
- Offshore EIA Report Volume 3 - Outline Plan 2: Marine Mammal Mitigation Protocol (MMMP) (an updated Outline MMMP has been submitted as part of the Additional Information (see Appendix B)).

The Applicant also submitted a Report to Inform Appropriate Assessment (RIAA) in support of the Offshore Application in accordance with the Habitats Regulations Appraisal (HRA) process. The HRA process for the offshore Project screened out any Likely Significant Effects (LSE) on European sites designated for marine mammals (as documented within the original RIAA). The MD-LOT Additional Information Request includes one point in relation to the Habitats Regulations Appraisal (HRA) and potential impacts on otter in the nearshore area around the cable landfall, this has been considered within a separate Addendum to the Report to Inform Appropriate Assessment – All Other Topics (Excluding Ornithology).

2 STRUCTURE OF THIS DOCUMENT

This document has been structured as follows:

- Section 3 – summary of the Additional Information Request and other relevant specific clarification points from consultees;
- Section 3 – additional information in response to the requests outlined in section 2;
- Section 5 – summary and conclusions;
- Section 6 – references; and
- Section 7 – acronyms.

3 REQUEST FOR ADDITIONAL INFORMATION

MD-LOT requested (8th February 2024) that additional information was provided with regards to the marine mammal assessment, based on NatureScot responses to the Offshore Application (13th December 2023).

A summary of the key issues raised in the MD-LOT Additional Information Request together with other relevant specific clarification points from consultees are included in Table 3-1, alongside the Applicant's response, or cross references to where further information has been provided within this document where appropriate. This Offshore EIA Report Addendum reflects the advice provided by NatureScot in their letter dated 13th December 2023 (CNS REN OSWF ScotWind – N1 – Offshore Wind Power Limited – West of Orkney) and subsequent request for additional information from MD-LOT (8th February 2024). Further advice was received from NatureScot in their letter 5th April 2024 (CNS REN OSWF-ScotWind-N1 - West of Orkney – Application).

Table 3-1 Summary of MD-LOT Additional Information Request relevant to marine mammals

REQUEST	RESPONSE
Otter impacts	
NatureScot has advised that assessment of impacts to otter under HRA and EPS licensing, including in nearshore waters and at the coast, should be captured within the onshore EIA Report. MD-LOT note that it was agreed in the HRA screening response (dated 22 November 2022) that impacts to otter could be screened out on the basis that impacts within the sub-tidal zone would be assessed as part of the onshore HRA. If this is not taken forward in the onshore EIA/HRA then this should be considered within the offshore assessments as additional information.	Potential impacts to otter in the nearshore area and at the coast (to MHWS) were not assessed in the onshore HRA This assessment is provided in the Addendum to the Report to Inform Appropriate Assessment – All Topics (Excluding Ornithology). For completeness, an assessment is provided in section 4.1 of this addendum to chapter 12: Marine mammals and megafauna of the Offshore EIA Report in relation to impacts on otter from the offshore Project from an EIA perspective. The impacts to otters in the context of EPS licensing is provided in section 4.5.1.3.
Chapter 12: Marine mammals and megafauna of the Offshore EIA Report	
Revision of the sensitivity scoring for minke whale for auditory injury and disturbance impacts.	This request relates to the sensitivity scoring for minke whale to general, non-piling construction activities. This includes activities such as cable laying, dredging, drilling, rock placement and trenching. NatureScot advice received 5th April 2024 stated "Injury to marine mammals from geophysical surveys (all species) – sensitivity score should be High". Sensitivity to disturbance from these activities was assessed as low because the review of literature supported the view that minke whales tolerate temporary displacement. Section 4.3.1 presents the review of sensitivity criteria related to minke whale auditory injury and disturbance impacts. The updated assessment is based on revised

REQUEST	RESPONSE
	sensitivity criteria, following NatureScot advice, is given in Table 4-4.
Revision of the sensitivity scoring for harbour porpoise for disturbance from non-piling activities.	The text in this section of chapter 12: Marine mammals and megafauna of the Offshore EIA Report stated the sensitivity score for disturbance from non-piling activities (vessel movement) was Negligible, however the summary table stated that the sensitivity score was low. The Applicant is content that the score should be Low. This does not affect the significance conclusion which remains Negligible and Not Significant under EIA Regulations. Section 4.3.1 presents the review of sensitivity criteria related to harbour porpoise disturbance from non-piling activities. The updated assessment (Table 4-4) is based on revised sensitivity criteria and follows NatureScot advice.
Revision of the cumulative assessment to consider all appropriate impacts and mitigation options to reduce predicted impacts.	The cumulative assessment presented within chapter 12: Marine mammals and megafauna of the Offshore EIA Report follows industry standards. This section of chapter 12: Marine mammals and megafauna of the Offshore EIA Report considers the potential for other developments, plans and activities to interact with the offshore Project. It is usual practice to assume the PTS-onset risk is minimised across all included projects, because of the requirement for embedded piling mitigation including soft-start and ramp up. The Applicant cannot suggest additional mitigation measures for all developments, plans and activities. Auditory injury (PTS-onset) during pre-construction and construction is excluded from CEA as suitable mitigation will be put in place for all developments considered as a requirement for each EPS Licence application, marine licence and S36 consents. For the offshore Project, additional information has been included (section 4.5.1.2.3) that relate to SEL_{cum} predicted impacts and the current status of mitigation options available and consideration of the practicality of further mitigation options (section 4.5.1.2.4).
Supporting Study 9: Marine mammal and megafauna baseline report	
Justification as to why bottlenose dolphin has been screened out from the assessment of impacts across the offshore array area and export cable corridor.	Section 4.2.1 provides supporting information that justifies the exclusion of bottlenose dolphin from assessment.
Supporting Study 10: Marine mammal underwater noise impact assessment	
Section 3.7.1 **Revision of the sensitivity score (to underwater noise impacts) for harbour porpoise.**	Section 4.3.1 presents the review of sensitivity criteria to account for the conservation value of all cetaceans. The updated assessment is based on revised sensitivity to underwater noise impacts for harbour porpoise and follows NatureScot advice given in Table 4-4.

REQUEST	RESPONSE
Section 7 **Revision of the sensitivity score used for UXO clearance to reflect the conservation value of cetaceans.**	Section 4.3.1 presents review of sensitivity criteria to account for the conservation value of all cetaceans. The updated assessment (Table 4-4) is based on revised sensitivity criteria and follows NatureScot advice received 5th April 2024.
Section 7 **Revision of the magnitude score for Permanent Threshold Shift ("PTS") from UXO clearance.**	The revision of magnitude scores was requested on the misunderstanding that additional mitigation had been considered during the assessment. Section 4.3.2.1 provides clarification regarding the embedded mitigation considered during the assessment of magnitude and sets out the assessment of magnitude.
Section 8 **Revision of the magnitude scoring for PTS from piling for harbour porpoise, seals and minke whale.**	The revision of magnitude scores was requested on the misunderstanding that additional mitigation had been considered during the assessment. Section 4.3.2.1 provides clarification regarding the embedded mitigation considered during the assessment of magnitude. The Applicant confirms that only soft start and ramp up procedures were considered embedded at this stage and were incorporated into the underwater noise modelling. No further mitigation was considered in assessing the magnitude of underwater noise impacts on marine mammals.
Section 8 **Revision of sensitivity score for harbour porpoise for PTS piling to reflect their conservation value.**	Section 4.3.1 presents the review of sensitivity criteria to account for the conservation value of all cetaceans. The updated assessment is based on revised sensitivity score for harbour porpoise for PTS-onset due to impact piling (Table 4-4) and follows NatureScot advice received 5th April 2024.
Section 8.3.1 **Revision of the magnitude scores for disturbance from piling.**	Table 4-3 and Table 4-4 presents the magnitude scores for underwater noise disturbance due to piling and the updated assessment conclusions, respectively. These scores are based on soft start and ramp up embedded mitigation as this is accounted for within the underwater noise modelling but does not include consideration of any further mitigation measures (e.g. Marine Mammal Observer (MMO), PAM, ADD). Changes to the magnitude scores did not result in a change to the assessment outcome i.e. conclusions remained Not Significant in EIA terms.
Section 8.3.1 **Revision of the sensitivity score for all species to reflect their conservation status and value.**	Section 4.3.1 presents the review of sensitivity criteria to account for the conservation value of all cetaceans. The updated assessment is based on revised sensitivity criteria, following NatureScot advice is given in Table 4-4.

REQUEST	RESPONSE
Section 8 **Revision of the significance conclusion to account for the change in magnitude and sensitivity scores as described in NatureScot's representation.**	The updated assessment based on revised sensitivity and magnitude scores is given in Table 4-4.
Section 9 **Revision of the grey seal sensitivity for assessment of disturbance from pile driving.**	Following NatureScot advice (5th April 2024), the sensitivity of all species of marine mammal to disturbance from pile installation should be Medium. The updated assessment is presented in Table 4-4.
Section 9 **Clarification, and potential revision to the sensitivity scoring for all species for non-piling sources.**	Section 4.3.1 presents the review of sensitivity criteria to account for the conservation value of all cetaceans. The updated assessment (Table 4-4) is based on revised sensitivity scoring for all species for non-piling sources and follows NatureScot advice dated 5th April 2024.
Section 11 **Further consideration of how predicted mortality from collision with tidal stream developments can be incorporated into the assessment.**	Section 4.4 provides a summary of all issues relating to the CEA.; Appendix A provides detail of how predicted collisions at the MeyGen tidal turbine site have been incorporated into the population modelling using Interim Population Consequences of Disturbance (iPCoD).
Section 11 **Further justification, beyond the reliance of the single study reference to support cumulative assessment conclusion for harbour porpoise.**	Section 4.4 provides a summary of all issues relating to the CEA. Population modelling has been conducted (Appendix A) for harbour porpoise to support the conclusion presented in section 11 of Supporting Study 10: Marine mammal underwater noise assessment of the Offshore EIA Report, based on the Nabe-Nielson *et al.* (2018) study.
Section 11 **Revision of the cumulative assessment for minke whale.**	Section 4.4 provides a summary of all issues relating to the CEA. Appendix A provides detail of population modelling using iPCoD for minke whale.
Section 11 **Revision of the cumulative assessment to include population modelling when considering impacts to seal species.**	Section 4.4 provides a summary of all issues relating to the CEA. Appendix A provides detail of population modelling using iPCoD for seals.
Outline Plan 2: MMMP	
Clarification of the discrepancies between the MMMP and Supporting Study 11: Underwater Noise Modelling Report to ensure the values presented for	Section 4.6 provides a summary of the mitigation currently identified and to be deployed during the construction phase. Further detail is provided in the revised Outline MMMP. The revised Outline MMMP (see Appendix B) also corrects discrepancies between the submitted document with Supporting

REQUEST	RESPONSE
piling durations and number of hammer blows etc, are accurate. **Further consideration of mitigation at application stage.**	Study 11: Underwater noise modelling report of the Offshore EIA Report; these corrections make no difference to the impact assessment, nor predicted outcomes.
MD-LOT agrees with NatureScot's advice regarding the stage that mitigation should be applied for considering impacts to EPS during the application stage and advise that its comments on this topic must be fully addressed. Firm commitments must be made in the EIA to any mitigation relied upon to reduce magnitude of impact.	Section 4.3.2.1 provides clarification regarding the embedded mitigation considered during the assessment of magnitude. The Applicant confirms that only soft start and ramp up procedures, were considered embedded at this stage (and will be commitments within the Piling Strategy) and were incorporated into the underwater noise modelling. No further mitigation was considered in assessing the magnitude of underwater noise impacts on marine mammals. In the context of the separate process for EPS licencing, a review of potential further mitigation options is detailed in Section 4.5.1. All options will be reviewed once piling parameters are refined and further geotechnical data become available.
Other clarifications and queries	
NatureScot requested the correction of minor inconsistencies to be included in the additional information.	At the first post-Offshore Application consultation meeting with NatureScot and MD-LOT (26th February 2024), a number of inconsistencies in the chapter 12: Marine mammals and megafauna of the Offshore EIA Report were discussed. These inconsistencies primarily concerned scoring of sensitivity in the text versus tables, or vice versa, or between chapter 12: Marine mammals and megafauna of the Offshore EIA Report, Outline Plan 2: Marine Mammal Mitigation Protocol (MMMP) and Supporting Studies, which were identified by NatureScot. However, these inconsistencies are now addressed in the provision of revised scoring and sensitivity assessment in this additional information (section 4.3) and updated MMMP (Appendix B).
Orkney Islands Council (OIC) noted that relevant protected species licences should be applied for, including EPS licence(s) and potentially basking shark derogation licence(s).	Relevant applications will be made for all licences required for European and other protected marine mammal and megafauna species.

4 ADDITIONAL INFORMATION

4.1 Assessment of offshore impacts to otter under EIA

Eurasian otter (*Lutra lutra;* hereafter 'otter') are semi-aquatic mammals which may inhabit rivers, lakes, coastal, and marshy areas some distance from open water. Coastal populations utilise shallow, inshore marine areas for feeding but depend on fresh water for bathing and terrestrial areas for resting and breeding holts. Otter particularly utilise waters less than 10 m deep and within 100 m from shore, where foraging dives are most likely to occur (Kruuk, 2006).

This assessment of otter draws from information submitted in support of both the Onshore and Offshore EIA Reports.

Impacts to otter from the onshore Project are assessed in chapter 10: Terrestrial non-avian ecology of the Onshore EIA Report, which concluded that with the implementation of the embedded mitigation measures and taking into account the temporary and short-term nature of the proposed works, the impact upon otter is considered to be of Negligible magnitude and resultant effects are assessed as Not Significant.

Impacts to otter as a feature of Caithness and Sutherland Peatlands Special Area of Conservation (SAC) are assessed in the Onshore RIAA (for impacts landward of MHWS) and the Addendum to the Report to Inform Appropriate Assessment – All Topics (Excluding Ornithology) (for impacts seaward of MHWS). All assessments concluded that there will be no adverse effects on site integrity of the Caithness and Sutherland Peatlands SAC during construction, maintenance or decommissioning activities.

4.1.1 Otter surveys

As detailed in the onshore Project application and the Addendum to the Report to Inform Appropriate Assessment – All Topics (Excluding Ornithology), protected mammal surveys detected evidence of otter (spraint) occurring at the coast near Crosskirk, however no activity was recorded in the nearshore area to 100 m. Full details of the survey methodology and results can be found in Onshore EIA Report Supporting Study 6: Terrestrial non-avian ecology technical survey report.

4.1.2 Potential pathways for impact

Potential impact pathways screened in for the offshore Project, and the justification for those screened out, are the same as those presented in section 3.1.3.2 of the Addendum to the Report to Inform Appropriate Assessment – All Topics (Excluding Ornithology). Only the following potential impact pathways from construction, maintenance[2] and decommissioning of the offshore export cables have been screened into this assessment (activities detailed in chapter: 5 Project description of the Offshore EIA Report):

- Visual/physical disturbance or displacement;

[2] *There is no pathway for impact in relation to the operation of offshore export cables.*

- Vessel collision; and
- Indirect impacts to otter and their foraging and commuting habitats.

4.1.3 Embedded mitigation measures

Embedded mitigation measures have been proposed in both section 10.5.4 of chapter 10: Terrestrial non-avian ecology of the Onshore EIA Report section 12.5.4 of chapter 12: Marine mammals and megafauna of the Offshore EIA Report, which reduce the potential for impacts to otter and have been considered within the following assessments.

Embedded mitigation measures detailed in chapter 12: Marine mammals and megafauna of the Offshore EIA Report include production and approval of an Environmental Management Plan (EMP), which will include measures to protect wildlife such as adherence to guidance and protocols supplied in the Guide to Best Practice for Watching Marine Wildlife (SNH, 2017). This guidance includes measures to reduce the potential for harm to otter, thus further reducing the potential for disturbance or interaction with otter.

Specific otter embedded mitigation measures listed in the Onshore RIAA (Table 6-5, O1 to O9 and listed in Appendix A of the Addendum to the Report to Inform Appropriate Assessment – All Topics (Excluding Ornithology) include appropriate methods of work and exclusion zones which will also reduce potential for impact to otter from the Project. As discussed in section 6.4 (Table 6-5) of the Onshore RIAA and listed in Appendix A of the Addendum to the Report to Inform Appropriate Assessment – All topics (Excluding Ornithology), this includes the creation and implementation of a Species and Habitat Protection Plan (SHPP) to prevent harm to otter (and other protected species). The implementation of the SHPP will include pre-construction surveys for protected mammals (such as otter) as well as potentially notable habitats and this has been conditioned in the Planning Permission in Principle (PPP).

4.1.4 Assessment of potential effects

The potential pathways for impact have been assessed using the sensitivity criteria in section 4.3.1 of this document and magnitude criteria defined in the chapter 7: EIA Methodology of the Offshore EIA Report. It is anticipated that any impacts associated with the offshore Project during maintenance and decommissioning will be equal to or less than those during construction. Therefore, the following assessments consider the worst case impacts during construction and are applicable across Project stages.

4.1.4.1 Visual/physical disturbance or displacement

Whilst Project vessels, equipment and/or people may cause temporary disturbance, otter are highly mobile and are likely to move to another nearby location for foraging whilst construction, maintenance or decommissioning activities are occurring, such as along the River Thurso and Forss Water, or elsewhere along the coastline away from the Project activities. It is expected that otter will quickly be able to return to the area once construction, maintenance or decommissioning activities are completed.

Production and approval of an EMP, which will include measures such as adherence to guidance and protocols supplied in the Guide to Best Practice for Watching Marine Wildlife (SNH, 2017) will reduce the potential for harm to otter, thus further reducing the potential for disturbance. Therefore, given the temporary and localised effect of the

proposed activities, and the implementation of embedded mitigation measures, otter are assessed as having **Low sensitivity** to disturbance or displacement, with **Low magnitude**, meaning the overall impact is assessed as **Negligible (Not Significant).**

4.1.4.2 Collision with vessels

Vessels will be operating in the nearshore environment (<100 m) during cable landfall activities during construction, maintenance (if required) and decommissioning. As such, there is a risk of collision between otter and Project vessels which could cause injury or death.

The key risk factors that contribute to collision are slow-moving, large-bodied animals, and moving vessels travelling at speed (Schoeman *et al*., 2020). Whilst engaged in any proposed Project activities in the nearshore, any vessel will be either stationary or travelling slowly, allowing otter to predict the movement of the vessels and allowing time to avoid collision. Additionally, it is anticipated that the presence of vessels, work crews and other equipment in the nearshore and coastal areas during the proposed activities will deter individuals from using the nearshore and coastal area during works. Embedded mitigation measures such as production and approval of an EMP, which will include adherence to guidance and protocols supplied the Guide to Best Practice for Watching Marine Wildlife (SNH, 2017), which will also further reduce the potential for interaction between otter and Project vessels.

Production and approval of an EMP, which will include measures such as adherence to guidance and protocols supplied the Guide to Best Practice for Watching Marine Wildlife (SNH, 2017) will reduce the potential for harm to otter, thus further reducing the potential for disturbance. Therefore, given the temporary and localised effect of the proposed activities, and the implementation of embedded mitigation measures, otter are assessed as having **Low sensitivity** to disturbance or displacement, with **Low magnitude**, meaning the overall impact is assessed as **Negligible (Not Significant).**

4.1.4.3 Indirect impacts to otter and their foraging and commuting habitats

Whilst Project vessels, equipment and/or people may cause temporary disturbance of otter prey species in the vicinity of the works, otter are highly mobile and are likely to move to another nearby location for foraging whilst construction, maintenance or decommissioning activities are occurring, such as along the River Thurso and Forss Water, or elsewhere along the coastline away from the Project activities. It is expected that otter will quickly be able to return to the area once construction, maintenance or decommissioning activities are completed.

Therefore, given the temporary and localised effect of the proposed activities, and the ability of otter to forage in other areas, otter are assessed as having **Low sensitivity** to disturbance or displacement, with **Low magnitude**, meaning the overall impact is assessed as **Negligible (Not Significant).**

4.1.4.4 Assessment of cumulative impacts

The assessment of potential impacts to otter in-combination with other projects is presented in the Addendum to the Report to Inform Appropriate Assessment – All Topics (Excluding Ornithology) also applies here. This assessment concluded that, assuming other developments also follow industry standard practice guidance and implement appropriate mitigation measures where necessary, no measurable increase in potential effects upon this protected

species is predicted. Therefore, there is considered to be no potential for a significant impact to otter from the offshore Project alone, or cumulatively with other developments.

4.1.5 Summary and conclusions

The potential for impacts to otter from the offshore Project have been assessed here from an EIA perspective. For all potential impact pathways assessed, it was concluded that the potential impacts to otter were Negligible (Not Significant), for both the Project alone and cumulatively with other developments.

4.2 Species and density in assessment

4.2.1 Bottlenose dolphin

NatureScot requested that justification as to why bottlenose dolphin has been screened out from the assessment of impacts across the Option Agreement Area (OAA) and offshore Export Cable Corridor (ECC) to be provided.

Agreement was received from NatureScot to screen out the Moray Firth Special Area Conservation (SAC) from the Habitats Regulation Appraisal (HRA) "as there are very few sightings of bottlenose dolphin on the north coast of Scotland and around Orkney, and no evidence of connectivity of individuals to the SAC" (NatureScot, 2022).

Bottlenose dolphins from the offshore population were recorded in the OAA, albeit in low numbers. Any bottlenose dolphin with the potential to be present in the OAA is likely to be part of either the Greater North Sea or the Offshore Waters Management Unit population (IAMMWG, 2022; 2023). During the 27 months of site-specific digital aerial survey (DAS) only a single bottlenose dolphin was detected. There were further records (12 sightings) recorded by Marine Mammal Observers during pre-application geophysical surveys and the species was also detected through e-DNA sampling. However, NatureScot acknowledge the low occurrence of this species off northern Scotland (NatureScot, 2022); during the Small Cetaceans in European Atlantic waters and the North Sea (SCANS)-III survey[3] in July 2016, a single sighting of two animals occurred in Block S (density 0.004 animals/km^2, CV 1.007) (Hammond *et al.*, 2021) whilst none were recorded during SCANS-IV (July 2021) (Gilles *et al.*, 2023) in survey blocks west of Orkney. The offshore Project is located within SCANS-III blocks K and S, and there were no sightings in block K. SCANS-IV relevant blocks are CS-J and CS-K). Due to the relatively low density of bottlenose dolphin in the OAA, any assessment would have been qualitative. NatureScot agreed (5th April 2024 CNS REN OSWF-ScotWind-N1 - West of Orkney – Application) that considering the low densities and conclusions for other species, that an assessment for this species would conclude Low or Negligible significance and were therefore content that an assessment was not provided in the chapter 12: Marine mammals and megafauna of the Offshore EIA Report.

[3] *Small Cetaceans in European Atlantic Waters and the North Sea, known as SCANS. A large-scale transect survey for cetaceans.*

4.2.2 Species density

NatureScot advised that in some instances, the density values used in the assessment were not the most precautionary. Therefore, they considered that the subsequent assessments had higher uncertainty and needed to be more precautionary. This is reflected in NatureScot's consideration of magnitude of impacts in the assessments.

The densities used in the impact assessment were considered at the marine mammal consultation meeting with NatureScot 22nd March 2023. The densities used for harbour porpoise and white-beaked dolphin in particular, were discussed at that meeting as those chosen for use in chapter 12: Marine mammals and megafauna of the Offshore EIA Report, were approximately half of the highest estimates collated in the Supporting Study 9: Marine Mammal and Megafauna Baseline Report of the Offshore EIA Report.

For harbour porpoise, the model-based density estimate from site specific DAS was used which is equivalent to that from the SCANS-III survey (Block S) (Hammond *et al.*, 2021) but half that of the adjacent Block K. For white-beaked dolphin, model-based density estimates for the summer were used, which was higher than the mean of the estimates from the two relevant SCANS blocks, but lower than the annual average from the site-specific surveys. The Applicant has reassessed the changes in magnitude scoring had the highest densities been used in the assessment of impacts from underwater noise for harbour porpoise and white-beaked dolphin. The changes in density alone do not change the magnitude scoring (Table 4-1) and consequently there would be no change to conclusions of significance in EIA terms, as assigned in the chapter 12: Marine mammals and megafauna of the Offshore EIA Report.

Table 4-1 Proportion of the UK Management Unit (MU) impacted and resultant magnitude for harbour porpoise (HP) and white-beaked dolphin (WBD) using the most precautionary density estimates for assessment purposes

DENSITY	HARBOUR PORPOISE	WHITE-BEAKED DOLPHIN	SOURCE
Most precautionary density (n/km^2)	0.308	0.390	HP: Block K SCANS-III July 2016 WBD: Model-based average from 27 months DAS surveys
Density used in assessment (for comparison) (n/km^2)	*0.150*	*0.19*	*HP Site-specific DAS (absolute model-based; overall average); WBD: site specific DAS (absolute model-based summer average)*
IMPACT	**MAX % UK MU**		**MAGNITUDE**
	HARBOUR PORPOISE	**WHITE-BEAKED DOLPHIN**	
PTS – pile driving	<1	<1	Negligible
Disturbance – pile driving	<1.5*	10	Negligible* / Medium
PTS - UXO	<1	<0.01	Negligible
Disturbance – UXO	<1	<0.1	Negligible

Disturbance – geophys. (static)	<0.1	<1	Negligible
Disturbance – geophys. (moving)	<0.1	<0.5	Negligible

Conclusion supported by iPCoD modelling.

4.3 Scoring and significance conclusion revisions

4.3.1 Sensitivity

Within chapter 12: Marine mammal and megafauna of the Offshore EIA Report the assessment criteria for sensitivity were based on the receptors' ability to tolerate, recover and adapt behaviour to maintain vital rates in response to pressures. MD-LOT and NatureScot required the sensitivity scoring of marine mammals to injury from pre-construction geophysical surveys, Unexploded Ordnance (UXO) clearance and pile driving installation and also disturbance from pile installation to be revised, based on criteria that also recognise the conservation value of cetaceans. All cetaceans are of high conservation value and strictly protected within national legislation[4].

The revised sensitivity scoring criteria are presented in Table 4-2 and the updated assessments for all species for the relevant pressures in Table 4-4. The changes in scores (Table 4-4) acknowledge the known sensitivity of marine mammals to underwater noise but ultimately do not change the significance of the effect which is, Negligible or Minor (Not Significant) in EIA terms.

Table 4-2 Sensitivity criteria used for the marine mammal assessment

SENSITIVITY	DEFINITION
High	• Receptor has no ability to tolerate a particular effect causing a significant change in individual vital rates (survival and reproduction); • Receptor has no ability to recover from any effect on vital rate (survival and reproduction); • Receptor has no ability to adapt behaviour so that individual vital rates (survival and reproduction) are highly likely to be significantly affected; and/or • Receptor of conservation / economic value to an extent that is international or nationally important.
Medium	• Receptor has a limited ability to tolerate a particular effect which may cause a significant change in individual vital rates (survival and reproduction);

[4] *The Conservation (Natural Habitats, &c.) Regulations 1994 (applying within 12 nm); The Conservation of Habitats and Species Regulations 2017 http://www.legislation.gov.uk/uksi/2017/1012/contents/made; The Conservation of Offshore Marine Habitats and Species Regulations 2017 http://www.legislation.gov.uk/uksi/2017/1013/contents/made.*

SENSITIVITY	DEFINITION
	• Receptor has a limited ability to recover from any effect on vital rates (survival and reproduction); • Receptor has a limited ability to adapt behaviour so that individual vital rates (survival and reproduction) may be significantly affected; and/or • Receptor of conservation / economic value to an extent that is regionally important.
Low	• Receptor has some tolerance to a particular effect with no significant change in individual vital rates (survival and reproduction); • Receptor is able to recover from any effect on vital rates (survival and reproduction); • Receptor has a limited ability to adapt behaviour so that individual vital rates (survival and reproduction) may be affected, but not at a significant level; and/or • Receptor of conservation / economic value to an extent that is locally important.
Negligible	• Receptor is able to tolerate a particular effect without any impact on individual vital rates (survival and reproduction); • Receptor is able to return to previous behavioural states/activities once the impact has ceased; • Receptor is able to adapt behaviour so that individual vital rates (survival and reproduction) are not affected; and/or • Receptor is widespread / common and is of low conservation / economic value.

4.3.2 Magnitude

In the NatureScot response, 13th December 2023 (CNS REN OSWF ScotWind - N1 - Offshore Wind Power Limited - West of Orkney), it was stated "We do not agree with the approach where by mitigation is being considered at this stage of the assessment to reduce the magnitude score. Mitigation should be applied afterwards to reduce the risk". MD-LOT and NatureScot requested clarification regarding the stage in the EIA that embedded mitigation had been taken into consideration; furthermore, the details of the embedded mitigation to be relied upon are clearly specified.

4.3.2.1 Embedded mitigation

With regards to the assessments undertaken in the Supporting Study 10: Marine mammal underwater noise impact assessment, the Applicant confirms that the estimated conclusions on significance of effects presented did not include consideration of all proposed mitigation measures. Supporting Study 11: Underwater noise modelling report did take account of embedded mitigation measures (i.e. piling soft start and ramp up in hammer energy) and as such these measures were integral to the assessment of effects on marine mammals. However, no additional mitigation measures (see below) were considered in the original assessment reported in chapter 12: Marine mammals and megafauna of the Offshore EIA Report.

To clarify, the assessment of auditory injury and assessment of disturbance from UXO clearance in the chapter 12: Marine mammals and megafauna of the Offshore EIA Report presents the number of animals and proportion of the

UK portion of the Management Unit (MU) impacted per UXO clearance day, in the absence of mitigation measures (Table 4-3).

The assessment of auditory injury from pile driving in the chapter 12: Marine mammals and megafauna of the Offshore EIA Report presents the number of animals and proportion of the UK portion of the MU impacted per piling day, in the absence of mitigation measures (other than the soft-start and ramp-up procedure in the piling profile assumed for the underwater noise modelling). The assessment of disturbance from pile driving in the chapter 12: Marine mammals and megafauna of the Offshore EIA Report presents the number of animals and proportion of the UK portion of the MU impacted per piling day, in the absence of mitigation measures.

On the basis of the %MU impacted for each species and pressure presented in Table 4-3, the Applicant has reviewed the assigned magnitude scores and agrees with NatureScot (5th April 2024 CNS REN OSWF-ScotWind-N1 - West of Orkney – Application) that a "Low" rather than "Negligible" score better describes magnitude of injury and disturbance due to pile driving for all species, considering the spatial and temporal scale of the activity and duration and intensity of piling schedule:

- Minor shift away from baseline conditions but unlikely to have a significant effect on the conservation status or integrity of the receptor;
- Impact occurs over a local to medium scale / spatial l extent and/or has a short (i.e. one to five years) to medium-term duration; and
- Impact is unlikely to occur or at a low frequency (occurring occasionally / intermittently for short periods of time at a low intensity).

The resultant significance for of underwater noise for all marine mammal species in line with NatureScot advice is summarised in Table 4-4.

Table 4-3 Proportion of the UK MU impacted (as per original assessment) and the resulting magnitude score for unmitigated impacts (other than the soft-start and ramp-up procedure in the piling profile assumed for the underwater noise modelling), as presented in the chapter 12: Marine mammals and megafauna of the Offshore EIA Report and updated following NatureScot advice (5th April 2024 CNS REN OSWF-ScotWind-N1 - West of Orkney – Application) that a "Low" rather than "Negligible" score better describes magnitude of disturbance due to pile driving. Note that assessment for PTS and disturbance from UXO and PTS pile driving are unchanged due to the fact that additional mitigation had not been considered in the original assessment presented in the chapter 12: Marine mammals and megafauna of the Offshore EIA Report.

IMPACT	SPECIES	MAX % UK MU IMPACTED PER DAY (WITHOUT MITIGATION)	ORIGINAL MAGNITUDE ASSESSMENT	REVISED MAGNITUDE (WITHOUT ADDITIONAL MITIGATION)
PTS from UXO	Porpoise	0.03%	Negligible	While PTS is a permanent change in the hearing sensitivity within a specific frequency range, the proportion of the UK MU impacted is not expected to result in any population level change. This aligns with a Negligible magnitude: *Very slight change from baseline condition that will not affect the conservation status or integrity of the receptor*.
	Dolphins	<0.01%		
	Minke whale	<0.01%		
	Harbour seal	<0.05%		
	Grey seal	0.02%		
Disturbance from UXO	Porpoise	• 0.08% for high order 247 kg UXO; and • <0.01% for low order.	Negligible	Negligible magnitude: *Very slight change from baseline condition that will not affect the conservation status or integrity of the receptor. Impact is short term with full rapid recovery expected to result in very slight or imperceptible changes to baseline conditions or receptor population. The impact is very unlikely to occur and if it does will occur at very low frequency* (note: low-order clearance will be used, not high-order).
	Dolphins	• <0.01% for both high and low order.		
	Minke whale	• 1.81% for high order 247 kg UXO; and • <0.01% for low order.		

IMPACT	SPECIES	MAX % UK MU IMPACTED PER DAY (WITHOUT MITIGATION)	ORIGINAL MAGNITUDE ASSESSMENT	REVISED MAGNITUDE (WITHOUT ADDITIONAL MITIGATION)
	Harbour seal	• 0.28% for high order 247 kg UXO; and • <0.05% for low order.		
	Grey seal	• 1.00% for high order 247 kg UXO; and • <0.05% for low order.		
PTS from pile driving	Porpoise	0.14% (concurrent piling)	Negligible	Low magnitude: *Minor shift away from the baseline conditions but unlikely to have a significant effect on the conservation status or integrity of the receptor; Impact occurs over a local to medium scale/spatial extent and/or has a short (i.e. one to five years) to medium-term duration; and/or Impact is unlikely to occur or at a low frequency (occurring occasionally / intermittently for short periods of time at a low intensity.*
	Dolphins	0.00%		
	Minke whale	0.44% (concurrent piling)		
	Seals	0.00%		
Disturbance from pile driving	White-beaked dolphin	• 5.02% monopile single location; and • 4.28% jacket single location.	Medium[5]	Low magnitude: *Minor shift away from the baseline conditions but unlikely to have a significant effect on the conservation status or integrity of the receptor; Impact occurs over a local to medium scale/spatial extent and/or has a short (i.e. one to five years) to medium-term duration; and/or Impact is unlikely to*

[5] *Following NatureScot most recent advice 5th April 2024 (CNS REN OSWF-ScotWind-N1 - West of Orkney – Application) "Disturbance to marine mammals from pile installation (all species) – sensitivity should be Medium. Magnitude should be Low (see advice below), so significance would be Minor".*

IMPACT	SPECIES	MAX % UK MU IMPACTED PER DAY (WITHOUT MITIGATION)	ORIGINAL MAGNITUDE ASSESSMENT	REVISED MAGNITUDE (WITHOUT ADDITIONAL MITIGATION)
	Risso's dolphin	• 1.4% monopile single location; and • 1.2% jacket single location.	Low	*occur or at a low frequency (occurring occasionally / intermittently for short periods of time at a low intensity).*
	Common dolphin	• 0.16% monopile single location; and • 0.13% jacket single location.	Low	
	Minke whale	• 0.87% monopile single location; and • 0.74% jacket single location.	Low	
	Porpoise	• 0.73% monopile single location; and • 0.62% jacket single location.	Negligible	
	Harbour seal	• 9.00% monopile single location; and • 8.1% jacket single location.	Negligible	
	Grey seal	• 8.4% monopile single location; and	Negligible	

IMPACT	SPECIES	MAX % UK MU IMPACTED PER DAY (WITHOUT MITIGATION)	ORIGINAL MAGNITUDE ASSESSMENT	REVISED MAGNITUDE (WITHOUT ADDITIONAL MITIGATION)
		• 7.6% jacket single location.		

Table 4-4 Summary of updated significance of effect[6] for injury to marine mammals from noisy activities and disturbance from pile driving

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF IMPACT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
Construction (including pre-construction) and decommissioning						
Injury to marine mammals from pre-construction geophysical surveys	All marine mammals	High	Negligible	Negligible (Not Significant)	*See Outline MMMP (Appendix B)*	Negligible (Not Significant)

[6] *Refer to Table 7-3 in chapter 7: EIA methodology of the Offshore EIA Report.*

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF IMPACT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
Disturbance to marine mammals from pre-construction geophysical surveys	All marine mammals[7]	Low	Negligible	Negligible (Not Significant)	*None required over embedded mitigation*	Negligible (Not Significant)
Injury to marine mammals from UXO clearance	All marine mammals	High	Negligible[8]	Negligible (Not Significant)	*See Outline MMMP (Appendix B)*	Negligible (Not Significant)
Injury to marine mammals from pile installation	All marine mammals	High	Low[9]	Minor (Not Significant)	*See Outline MMMP (Appendix B)*	Minor (Not Significant)

[7] Includes acceptance of interim advice from NatureScot 13th December 2023 CNS REN OSWF ScotWind - N1 - Offshore Wind Power Limited - West of Orkney, with regards to "revision of the sensitivity scoring to 'low' for harbour porpoise for disturbance from non-piling activities". It also corrects the error and inconsistency between Tables 12-31 and Table-32 in the original assessment chapter 12: Marine mammals and megafauna of the Offshore EIA Report - minke whale is scored Low sensitivity to disturbance from pre-construction geophysical surveys.

[8] In the NatureScot letter 5th April 2024, CNS REN OSWF-ScotWind-N1 - West of Orkney – Application, it states "injury to marine mammals from UXO clearance (all species) – sensitivity score should be High. We agree that the magnitude is Negligible (very short-term impact), so the significance would be Minor". We conclude that there is a mistake in this advice; based on the matrix of significance used for assessment, a combination of High sensitivity and Negligible magnitude results in a Negligible consequence.

[9] NatureScot advice has developed and changed since the interim. The Applicant letter 13th March 2023 W01-WOW-CON-CN-LT-0005, clarified that "additional mitigation" (other than embedded ramp up and soft start) had not been taken into account when conducting the assessment. NatureScot confirmed (5th April 2024, CNS REN OSWF-ScotWind-N1 - West of Orkney – Application) that the clarification was welcome; therefore their 13th December 2023 advice, CNS REN OSWF ScotWind - N1 - Offshore Wind Power Limited - West of Orkney, to assign more precautionary magnitude scores is negated.

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF IMPACT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
Disturbance to marine mammals from pile installation	All marine mammals	Medium[10]	Low	Minor (Not Significant)	*See Outline MMMP (Appendix B)*	Minor (Not Significant)

[10] In the NatureScot letter 5th April 2024, CNS REN OSWF-ScotWind-N1 - West of Orkney – Application, it states "We have undertaken a review of scoring for marine mammals for other Scottish offshore wind projects.....we advise that sensitivity for PTS from piling should be Hight and for disturbance should be Medium" . Furthermore, the letter states "Disturbance to marine mammals from pile installation (all species) – sensitivity should be Medium. Magnitude should be low (see advice below), so significance would be Minor".

4.4 Cumulative effects assessment

NatureScot responses to the Supporting Study 10: Marine mammal underwater noise impact assessment of the Offshore EIA Report, set out further requirements of the Applicant regarding the Cumulative Effects Assessment (CEA). Specifically, NatureScot stated that they required:

- Further consideration of how predicted mortality from collision with tidal stream developments can be incorporated into the assessment;
- Further justification, beyond the reliance of the single study reference to support the cumulative assessment conclusion for harbour porpoise (i.e. to use iPCoD to cumulatively assess harbour porpoise);
- Revision of the cumulative assessment for minke whale; and
- That the cumulative assessment for impacts to seal species include population modelling.

The Applicant's approach to address all of the points above was to undertake iPCoD modelling and was confirmed in the Applicant letter to NatureScot 13th March 2024 (W01-WOW-CON-CN-LT-0005). The correspondence set out the scope of the modelling work, including the species (minke whale, grey and harbour seal) and Scottish projects, constructing between 2026 and 2031 inclusive, to be considered. Additionally, the letter proposed how mortality from collision with tidal projects would be included. NatureScot confirmed (5th April 2024 CNS REN OSWF-ScotWind-N1 - West of Orkney – Application) they were content with the approach but asked that iPCoD also be run for CEA for harbour porpoise. Detail of the iPCoD approach and results are reported in Appendix A.

The results of the modelling demonstrate that there are no impacts as a result of disturbance from pile driving on the conservation status or the integrity of the receptor from disturbance on harbour porpoise, minke whale or seals. In all cases, the counter-factual metric indicates that the impacted population remains 100% of the unimpacted population size (i.e. the noise impacts assessed do not impact the population). This aligns with a magnitude score of Negligible: very slight or imperceptible changes to baseline conditions or receptor population. For harbour seals, iPCoD was run with and without estimates of annual collisions with underwater tidal turbines (i.e. direct mortality rather than disturbance) from the MeyGen project. Without collisions a magnitude score of negligible is concluded; very slight or imperceptible changes to baseline conditions or receptor population. This result was not unexpected given that the impacts of disturbance were unlikely to significantly change the baseline trajectory of an already declining population. However, when collisions are included, the rate of decline is exacerbated. As the harbour seal population was unimpacted in the "no collisions" scenario, this indicates that the predicted hastened population decline can be entirely ascribed to the impacts of the tidal energy device (i.e. collision), with the offshore Project (and other offshore windfarm projects) having no contribution to this decline.

Cumulative iPCoD modelling indicated there was no significant cumulative impact to any of the assessed species. This conclusion has not changed from the CEA of chapter 12: Marine mammals and megafauna of the Offshore EIA Report.

4.4.1 Auditory injury

NatureScot noted that the CEA excluded consideration of auditory injury (PTS) from activities such as pile driving and UXO clearance. The Applicant confirms that auditory injury was screened out of the CEA given the expectation that all offshore Projects will put in place suitable mitigation to reduce injury risk to marine mammals to negligible levels

(as a requirement of EPS legislation). NatureScot confirmed that they were content that auditory injury had been screened out of the CEA on that basis in their response dated 5th April 2024 (CNS REN OSWF-ScotWind-N1 - West of Orkney – Application).

4.5 EIA and European Protected Species (EPS)

The purpose of the EIA process is to assess the significance of potential impacts of a proposed Project to the reference population/MU for marine mammals upon which the impacts will act. An assessment of the risk of injury and disturbance to EPS (all cetaceans) is not required at the EIA stage, however NatureScot expressed concern regarding disconnect of the submitted Offshore EIA Report from consideration of risk to EPS. NatureScot requested that the assessed impacts must be acknowledged in the context of the likely need for an EPS Licence subsequent to consent.

The design layout, installation and foundation options are being further developed by the Applicant, with a view to refining parameters that impact the ecological assessment and to develop a Piling Strategy. There is a full geotechnical campaign planned for 2025 and there will be an iterative process based on new data and further modelling work. Therefore, outcomes from the ongoing site investigation will not be available for the additional information schedule.

Nevertheless, post-consent, a detailed Risk Assessment Report will be presented with the EPS Licence application, using the best available data and good practice methodology available at that time. This will include updated noise modelling and associated impact assessment based on refined construction parameters. Within the modelling, there will be an assessment of varied ramp up strike rates to reduce the risk to EPS and piling sequences will have input from the construction team. Also included will be an assessment of the deterrence effect of Acoustic Deterrent Device (ADD) mitigation to inform decisions for additional mitigation. As noted in the consultation on 21st May 2024, the current stance from NatureScot is that ADD use would primarily be associated with cumulative PTS, but that it is acknowledged that cumulative PTS ranges are large over-estimates. Cumulative PTS will be addressed in the EPS Risk Assessment Report. It is expected that this will require consultation and agreement post-consent before the EPS Risk Assessment is conducted. The Risk Assessment Report will include the consideration of mitigation measures such as ADDs for cumulative PTS, as required. Overall, the EPS assessment will be a 'risk based' assessment and will consider available mitigation measures and good practice.

4.5.1 EPS licensing

Predicted impacts (cumulative injury and disturbance) to EPS during the construction phase of the offshore Project means that EPS License requirements need to be considered. Cetacean species currently listed on Annex IV of the Habitats Directive, identified as potentially at risk from negative impacts associated with the offshore Project are:

- Harbour porpoise;
- White-beaked dolphin;
- Minke whale;
- Common dolphin;
- Risso's dolphin;
- White-sided dolphin;
- Killer whale; and

- Humpback whale.

Seals and basking sharks (the other marine mammal and megafauna species assessed within the offshore Project EIA) are not listed under Annex IV of the Habitats Directive, therefore they do not require an EPS Licence[11] and are not considered further within the outline MMMP (Appendix B). It is unlikely that all species listed above will need protection under licence as the EPS guidance suggests species included should be limited to those 'likely' to be present within the area of activity which may cause disturbance or injury.

This review is in line with Marine Scotland (2020a) guidance, which outlines how to apply for an EPS Licence and the guidance for the protection of EPS within Scottish waters.

The following three tests must be met for the application for an EPS Licence to be granted:

- The proposed activity is for one of the purposes specified within the Habitats Regulations;
- There are no satisfactory alternatives to the proposed activity; and
- Licensing the activity will not affect the Favourable Conservation Status (FCS) of the species of interest, within their natural range.

Where there is a risk of injury, killing or disturbance that cannot be removed, or sufficiently removed using alternatives or mitigation, an EPS Licence is needed to enable the activity to proceed. The Applicant is not aware of any impediment to the grant of an EPS Licence.

4.5.1.1 EPS inshore and offshore regulations

Due to the OAA being located in both territorial (within 12 Nautical Miles (nm) of the coast) and offshore (beyond 12 nm of the coast) waters, this Project will need to consider both Inshore and Offshore Regulations:

- The Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended) applies where works/activities may affect European protected species in the offshore area (beyond 12 nm); and
- The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) applies to Scottish inshore waters (within 12 nm of the coast).

Changes were made to the 1994 and 2017 Regulations following European Union (EU) exit to ensure that Scotland maintains the same standards as was provided by the EU Habitats directives (Marine Scotland, 2020b), therefore this legislation remains in effect.

There are slight differences to the Inshore and Offshore legislation. The Offshore Regulations, provide protection for cetaceans against deliberate killing, injury, and disturbance. Whereas the Inshore Regulations provide protection for the deliberate or reckless capture, injury, killing and disturbance of EPS. The Inshore Regulations include an additional

11 Part 6 of the Marine (Scotland) Act 2010 makes it an offence to kill any seal at any time, except under specific licence or for animal welfare reasons to end suffering. Licensing requirements for basking shark are required under the Wildlife and Countryside Act 1981 (as amended)

protection in relation to *reckless*. In both Regulations, the risk of PTS-onset to an individual is considered an injury offence[12].

4.5.1.2 Cetaceans

4.5.1.2.1 UXO

The need for an injury/disturbance EPS Licence will be reviewed and discussed in the EPS Licence Risk Assessment for the EPS Licence application once the number and type/size of confirmed UXOs is understood, together with an understanding of the clearance method to be used.

4.5.1.2.2 Impact piling

The risk of instantaneous PTS-onset will be mitigated using measures described in the outline MMMP (see section 4.6 and Appendix B). However, the current PTS-onset range predictions for very high frequency (VHF) and low frequency (LF) cetaceans based on SEL_{cum} are beyond the range that can be mitigated using typical mitigation (i.e. MMO/Passive Acoustic Monitoring (PAM)) (Table 4-5). As a result, it is necessary to review the options for further mitigation (see section 4.5.1.2.4) in order to establish whether there are any satisfactory alternatives to the activities being undertaken as part of the Project, which would otherwise reduce the level of risk of accumulated PTS-onset to acceptable levels.

Table 4-5 Impact range and number of animals at risk of PTS-onset based on SEL_{cum}

SPECIES	IMPACT RANGE (KM)	# INDIVIDUALS AT RISK OF PTS-ONSET
LF (minke whale)	47	27
High Frequency (HF) (delphinid)	<1	<1
VHF (harbour porpoise)	17	93

4.5.1.2.3 SEL_{cum} modelling uncertainties

Section 14.2 in Supporting Study 10: Marine mammal underwater noise impact assessment of the Offshore EIA Report, presented a thorough review of the uncertainties related to the prediction of PTS-onset based on the SEL_{cum} metric.

[12] *There are differences between the Inshore and Offshore Regulations in relation to the risk of a disturbance offence. Inshore the risk of disturbance is considered at the individual level, bit offshore, the risk is considered in terms of the local population. Disturbance is not covered in the outline MMMP as this relates to mitigation to avoid the risk of injury.*

This suggests that the impact ranges and therefore the number of individuals at risk of PTS-onset are likely to be a significant over-prediction.

The recent publication of the Range Dependant nature of Noise (RaDIN) report (ORJIP, 2024) provides useful supporting context for the consideration of the SEL_{cum} over-precaution. Section 14.2.2 of Supporting Study 10: Marine mammal underwater noise impact assessment of the Offshore EIA Report discusses impulsive characteristics and the issues with using an impulsive threshold over extended distances. The RaDIN publication highlights the following:

- Current assessment methodologies use the nature of the sound at source, rather than the signal features likely to be received by the receptor in determining the impact threshold used (i.e. impulsive);
- The study found a decrease in impulsiveness as sound travels further away from the source. There was a marked decrease noted in all metrics of impulsiveness within the first five kilometres from the piling location;
- Comparison of construction piling logs with the assessments conducted within EIA showed that the assumptions used in the noise impact assessments result in an overestimation of the auditory injury impact ranges (median percentage reduction in PTS impact area of 57%);
- The potential for recovery between strikes needs to be considered; and
- The time between subsequent blows in the first 45 minutes of piling is a key parameter in driving PTS-onset ranges, with longer gaps between pile strikes resulting in smaller impact ranges.

4.5.1.2.4 Additional mitigation methods

Industry standard mitigation measures (i.e. MMO/PAM/ADD) cannot mitigate impact ranges as currently predicted (17 – 47 km – Impact piling). Therefore, to avoid the risk to an individual animal (ignoring the SEL_{cum} uncertainties for the moment) supplementary mitigation methods should be considered to investigate whether implementation is possible.

Seasonal (temporal mitigation)

The reduction of the number of animals potentially available to be injured or disturbed may be achieved through seasonal restriction of construction, provided scheduling is possible. A seasonal restriction can limit noise exposure to marine mammal species which are present in high abundance or more sensitive to injury or disturbance from underwater noise within a particular period within a year. Minke whales are generally more common over the summer months (Hammond *et al.*, 2021) in UK waters, and research suggests that harbour porpoise sensitivity to disturbance may be higher in the summer when their energetic requirements are high (e.g. Gilles *et al.*, 2009).

However, due to weather and metocean constraints in this location, piling for the offshore Project is anticipated to occur between April and October (in April only preparatory activities associated with piling are expected to occur, with piling occurring from May onwards). Seasonal constraints on piling would dramatically extend the overall construction period, and potentially result in greater environmental effects. Therefore, temporal mitigation is unlikely to be practical, or a satisfactory alternative, for this project.

Soft start and ramp up for piling

Underwater noise modelling methodology includes soft start and ramp up hammer energy, strike rate and duration of piling at each stage through the installation sequence. Extending the phase of soft start/ramp up such that lower

than maximum hammer energies, and low blow rates are used for a longer duration may reduce the potential for accumulated PTS-onset (Thompson *et al.*, 2020; ORJIP, 2024). The ability to extend the soft start and ramp up period will depend on the sediment characteristics, and the practicality of this measure will be investigated in the updated underwater noise modelling conducted at the Piling Strategy stage.

Noise abatement systems, and applicability in the offshore Project location

Worst case noise modelling has highlighted that there may be a PTS-onset risk (SEL_{cum}) for cetaceans of 17 km (harbour porpoise) and 47 km (minke whale)[13]. These ranges are determined using an impulsive noise threshold, and it is generally accepted that it is unlikely that the noise characteristic is impulsive at such ranges (see uncertainties, section 4.5.1.2.3).

Industry standard mitigation methods (MMO/PAM/ADD) cannot ensure that cetaceans are clear of such ranges ahead of activities beginning. Reducing the noise levels at source would therefore reduce the PTS-onset risk and the levels of disturbance from the offshore Project construction. In general, noise from impact piling foundation installation can be reduced either by using an alternative foundation, or by abating the noise generated. The use and development of noise abatement systems (NAS) increased pace from the early 2000s when Germany set noise limit threshold criteria for offshore wind impact piling during construction (Verfuss *et al.*, 2019). Since then, a similar approach has been taken in other European countries (Denmark, Belgium and the Netherlands). The three systems typically used are Bubble curtains, the Noise Mitigation Screen (NMS) and the Hydro-sound Damper (HSD). To date, noise abatement systems have not been employed, or developed in the same way in UK waters for offshore wind construction. Bubble curtains have however, been used in Scotland to mitigate the noise levels from harbour development (i.e. Aberdeen Harbour Expansion Project[14]) and are required by the Marine Management Organisation/ Natural England during UXO clearance projects in English waters for high order detonations greater than 50 kg.

Several noise reduction methods and NAS are discussed in this section of the addendum to chapter 12: Marine mammals and megafauna of the Offshore EIA Report in the context of the offshore Project: in terms of their deployment readiness, and in the applicability of these systems within the metocean conditions relevant to the site. The options considered for use at the offshore Project were:

- Alternative foundation types (noise reduction):
  - Suction bucket;
- Alternative hammers (noise reduction):
  - BLUE piling technology;
  - Vibratory hammer;
- Bubble curtains (noise abatement);
- Casings (noise abatement);
  - Noise mitigation Screen;
  - HydroNAS;
  - Resonators (noise abatement);

[13] *Modelling based on water depths of 54-70 m; a pile diameter of 14 m; max blow energy of 5,000 kJ.*

[14] *marine.gov.scot/sites/default/files/drilling_blasting_methodology_-_environmental_controls_marine_mammals_rev_7_redacted_0.pdf.*

- Hydrosound damper; and
- AdBm Noise Abatement System.

Much of the following information has been taken from Verfuss *et al.* (2019). Although published a few years ago, the information within remains the best available at the time of writing (2024).

Alternative foundation types (noise reduction)

Alternative foundation types are not NAS as they reduce the noise levels by changing the foundation type thus reducing the noise at source, rather than abating the noise emitted. Suction bucket foundations have been used in Scottish waters at Aberdeen Bay[15]. Suction buckets do not require piling, instead they are installed by allowing the bucket to sink into the seabed under its own weight. Any remaining seawater trapped in the bucket is suctioned out resulting in a pressure difference that holds the foundation in place. However, the ability to use this method is reliant on the presence of suitable substrate, and metocean conditions. The feasibility of suction bucket foundations for use at the West of Orkney development is still under consideration.

Alternative hammers (noise reduction)

Alternative hammer technologies reduce impulsive noise at source, in comparison to impact piling. Vibro-piling techniques have been used extensively for harbour developments but are now also being developed for use in offshore wind installations (e.g. Moray West OWF[16]). The effectiveness of vibro-piling is dependent on the substrate type and the size of piles (e.g. Moray West - pile diameter is up to 10 m). Vibro-piling has a different noise characteristic to impact piling. Instead of a sharp impulsive blow, vibro-piling vibrates the pile into the seabed, thus generating a non-impulsive (continuous) noise source. As there is no sharp impulse of sound, this noise characteristic presents less of a risk to marine mammals of auditory injury (Southall *et al.*, 2019). The feasibility of using vibro-piling at the offshore Project is still under consideration, and will take into account the final pile design and ground condition.

It may be possible to use noise reduction units, these are positioned between the driving hammer and pile to dampen the impact and thus the noise emitted (e.g. PULSE, IQIP[17]). Novel methods are being developed, for example the BLUE Piling technology (IQIP), instead of an impact force knocking the monopiles into the sediment, this technology uses the weight of a large water mass to create the downwards force. This method is not yet commercially available and may not be suitable for piling at West of Orkney.

Bubble curtains (noise abatement)

Bubble curtains act as a barrier to the noise generated by piling. The curtain is formed by compressed air being pumped through nozzle hose(s) laid around the piling locations (at several tens of meters from the pile). In deep water, the number of compressors required can be significant. German regulations limit this number to 22 generators

[15] Suction Bucket Jacket Foundations | Ørsted (orsted.com).

[16] 8460005-dbha04-mww-pln-000003_moray_west_revised_piling_strategy_19042023.pdf (marine.gov.scot).

[17] PULSE - Piling Under Limited Stress Equipment - IQIP.

to minimise fuel consumption (Verfuss *et al.*, 2019). Bubble curtains have shown to be reduce noise by 7-11 dB SEL_{ss} and by 8-18 dB SEL_{ss} source level, for single and double bubble curtains respectively, which would significantly reduce PTS impact ranges (Verfuss *et al.*, 2019). However, bubble curtains have only been used for offshore wind projects in water depths up to 40-45 m. Additionally, these systems are easily affected by metocean conditions such as current speed (see Verfuss *et al.*, 2019) and therefore may be ineffective in the water depths and metocean conditions west of Orkney. Bubble curtains have not yet been used on large diameter piles.

Casings (noise abatement)

Casings are hard or soft shells made of sound insulating or reflective material which surround the piles and trap the sound close to the source. Two casing options, NMS (IHC IQIP[18]) and HydroNas (W3G Marine Limited[19]), consist of an outer tube with an air-filled cavity which creates an unbroken column of air around the pile from the seabed to the surface, impeding noise transmission. NMS has been used for offshore wind construction in depths up to 50 m, although in theory could be used up to 70 m. HydroNAS has not yet been used for a commercial offshore wind project and has only been tested in water depths up to 20 m.

Resonators (noise abatement)

Resonators are an array of 'resonating units' that surround the pile throughout the water column. The resonating units are air-filled structures that act to absorb the emitted sound. The HSD (OffNoise Solutions GmbH[20]) and AdBm-NAS (AdBm Technologies[21]) the most widely available systems. However, neither system has been commercially tested in water deeper than 50 m and 40 m respectively. However, it is unlikely that such technology would be compatible with WOW site conditions.

Assessment of applicability

The current environmental operating parameters of the NAS under consideration are detailed in Table 4-6 and Table 4-7 and can be compared to the metocean conditions at the West of Orkney development location (Table 4-9) with the comparison summarised in Table 4-10 together with a yes/no conclusion as to their use. Table 4-8 highlights the potential noise reduction from the use of the NAS reviewed.

[18] *Gode Wind, Noise Mitigation System in Germany - IQIP (Accessed 10/05/2023).*

[19] *Underwater Noise Mitigation | W3G Marine (Accessed 10/05/2023).*

[20] *OffNoise-Solutions GmbH (Accessed 10/05/2023).*

[21] *AdBm Technologies – Sound. Science. (Accessed 10/05/2023).*

Table 4-6 Water depths at which the NAS reviewed can be deployed and operated (adapted from Verfuss et al., 2019)

SYSTEM	WATER DEPTH		
	FIELD PROVEN	COMMERCIALLY DEPLOYED	
		OWF PROJECTS	NON-OWF PROJECTS
Vibro-hammer	>70 m	To 40 m	To 70 m
BLUE Hammer	To 30 m	--	--
Bubble curtain	To 50 m	To 50 m	To 70 m
NMS*	To 50 m	To 50 m	--
HydroNAS	10 – 20 m	--	--
HSD*	To 50 m	To 50 m	--
AdBm- NAS*	To 40 m	--	--

** Theoretical deployment depths of up to 70 m.*

Table 4-7 Environmental limitations of the NAS for deployment (DEPL.) and operation (OP) (adapted from Verfuss et al., 2019)

SYSTEM	WIND SPEED (@10M)		SIGNIFICANT WAVE HEIGHT (M)		CURRENT SPEED (M/S)	
	DEPL.	OP	DEPL.	OP	DEPL.	OP
Vibro-hammer	Limitation determined by installation vessel					
BLUE Hammer	Limitation determined by installation vessel					
Bubble curtain	10-13	10-13	1.5-2	1.5-2	1-3	1-3

SYSTEM	WIND SPEED (@10M)		SIGNIFICANT WAVE HEIGHT (M)		CURRENT SPEED (M/S)	
	DEPL.	OP	DEPL.	OP	DEPL.	OP
NMS	Crane ltd	Crane ltd	1.5-2	1.5-2	1	1
HydroNAS	15	--	3	--	1	--
HSD	--	15	--	1-1.5	--	--
AdBm- NAS	--	--	4	4	3	3

Table 4-8 Potential noise reduction (from Bellmann et al., 2018 in Verfuss et al., 2018)

SYSTEM	WATER DEPTH (M)	NOISE REDUCTIONΔ SEL_{SS} (DB)
NMS	Up to 40	13-16
HSD	Up to 40	10-12
Bubble curtain	~ 40	7-11
Double bubble curtain	~ 40	8-18
Double bubble curtain	> 40	15-16

Table 4-9 Metocean conditions at the offshore Project area

	CURRENT SPEED (M/S)				
	SPRING	SUMMER	AUTUMN	WINTER	ALL TIME
Max	1.03	0.91	1.03	1.25	1.25
Average	0.3	0.29	0.3	0.3	0.3
Proportion Time <1 m/s (%)	99.99	100	99.99	99.98	100
Proportion Time <2 m/s (%)	100	100	100	100	100
	WIND SPEED @ 10M (M/S)				
	SPRING	SUMMER	AUTUMN	WINTER	ALL TIME
Max	23.49	17.63	20.77	34.07	34.07
Average	9.09	6.92	9.97	11.19	9.11
Proportion Time <10 m/s (%)	60.93	83.34	48.88	41.95	61.39
Proportion Time <13 m/s (%)	82.12	95.2	78.35	65.38	81.14
	WAVE HEIGHT (M)				
	SPRING	SUMMER	AUTUMN	WINTER	ALL TIME
Max	8.9	4.68	7.79	13.17	13.17
Average	2.67	1.61	2.77	3.61	2.63
Proportion Time <2m (%)	42.78	78.04	24.16	11.7	39.99
Proportion Time <3m (%)	67.32	95.47	63.39	40.43	68.41

Table 4-10 Comparison of NAS ability to operate in the metocean conditions found in the offshore Project area

SYSTEM	DEPTH	WINDSPEED	WAVE HEIGHT	CURRENT SPEED	POTENTIAL USE
Vibro-hammer	y	Limitation determined by installation vessel			y
BLUE Hammer	n	Limitation determined by installation vessel			n
Bubble curtain	n	y	n	y	n
NMS	n	n	n	y	n
HydroNAS	n	n	n	y	n
HSD	n	?	n	?	n
AdBm- NAS	n	y	ltd	y	n

Additional mitigation options conclusion

This review has highlighted that the majority of NAS are currently not proven to operate within the conditions at the offshore Project area (Table 4-7). Once more information is known about the ground conditions at this location, it will be possible to review this conclusion (see section 4.6.4). Possible options may be the use of a vibro-hammer in conjunction with, or instead of, an impact pile-driver, or to include noise reduction units to reduce noise at source. All options will be reviewed once piling parameters are refined and further geotechnical data available. Furthermore, logistical and economical constraints will also have to be understood. A Piling Strategy, together with updated noise modelling, risk assessment and MMMP, will be submitted to MD-LOT post-consent, following consultation with NatureScot.

4.5.1.3 Otter

As an EPS, otter are protected under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended), which are relevant to inshore waters <12 nm.

It is therefore an offence to deliberately or recklessly:

- Kill, injure, capture or harass an otter;
- Disturb an otter whilst it is occupying a holt (underground den) or other place it uses for shelter or protection, or while it is rearing or otherwise caring for its young, or in any way that impairs its ability to survive or breed, or significantly affects the local distribution or abundance of otter; or
- Obstruct access to an otter breeding site or resting place, or otherwise prevent their use.

And whether or not deliberate or reckless:

- To damage or destroy an otter breeding site or resting place.

Embedded mitigation measures will reduce the potential for death, injury or disturbance to otter. It is considered highly unlikely that any otter will be affected by the Project activities in the nearshore and coastal environment. Additionally, it is considered that the offshore Project will have no potential to disturb otters at their holts or other shelter.

As discussed in section 4.1.3 and in the Addendum to the Report to Inform Appropriate Assessment – All Topics (Excluding Ornithology) a SHPP will be created and implemented to prevent harm to otter (and other protected species). The implementation of the SHPP will include pre-construction surveys for protected mammals (such as otter) as well as potentially notable habitats. These surveys will be undertaken to identify any otter making use of the Project area, which will include coastal and nearshore areas, ahead of works.

4.6 Outline MMMP

The outline MMMP has been updated to correct table inconsistences and make firmer commitments regarding mitigation. These commitments are summarised here and detailed in the revised outline MMMP.

The Applicant confirms commitment to embed the approaches to mitigation set out below.

4.6.1 Piling mitigation

Pre-piling mitigation requirements will be based upon the instantaneous risk of PTS-onset. The maximum instantaneous PTS-onset predicted for very high frequency (VHF) cetaceans (harbour porpoise) using the unweighted SPL_{peak} metric is 720 m, and for all other species groups this is less than 100 m, typically 50-60 m. However, post consent underwater modelling will be updated based on finalised construction plans and it is acknowledged that the maximum range predicted for PTS onset may change. The risk of PTS-onset to all marine mammals will be mitigated by a commitment to use the standard mitigation protocols provided by JNCC (2010a), specifically by employing:

- Marine Mammal Observers (MMO);
- Passive Acoustic Monitoring (PAM); and
- Soft start, i.e. further tweaks to the soft start scenarios considered to date in the underwater noise modelling assumptions.

The MMO will follow JNCC guidelines to ensure the required mitigation zone is monitored; the guidance states that "The radius of the mitigation zone should be no less than 500 m, and this is measured from the pile location". The MMO and PAM operative will be located on the most appropriate viewing platform (e.g. vessel) to ensure effective coverage of the mitigation zone. The MMO will also require a platform that provides a good all-round view of the sea with sufficient height above sea-level.

4.6.2 UXO mitigation

The maximum predicted instantaneous PTS-onset range from high-order clearance of the largest size UXO was 9.9 km for harbour porpoise (based on the unweighted SPL_{peak}, metric). The maximum predicted instantaneous PTS-onset range from low-order clearance was 0.58 km for harbour porpoise (based on the unweighted SPL_{peak}, metric). The Applicant will negate the risk of injury by a commitment to the use of low-order detonation techniques, in addition to a commitment to the use of MMO, PAM and ADD mitigation measures as per JNCC draft guidance (JNCC, 2023).

4.6.3 Geophysical survey mitigation

The risk of PTS-onset from the types of geophysical equipment considered was assessed to be negligible (Ultra-short baseline (USBL)) or no risk to all species, and it is not expected that mitigation measures will be required. However, the Applicant will reassess this as part of any EPS Licence application when the equipment to be used for pre-construction geophysical surveys will be known.

4.6.4 Process for refinement of additional mitigation

This review has highlighted that the majority of currently available NAS are currently not proven to operate within the conditions of the offshore Project area (Table 4-7). Possible options may be the use of a vibro-hammer in conjunction with, or instead of, an impact pile-driver, or to include noise reduction units to reduce noise at source. However, the need for and development of additional mitigation can only be determined once further site investigation work has been completed. The further work and iterative processes to examine geotechnical data, project design/ installation and underwater modelling, will inform preparation of the Piling Strategy.

Design features, including foundation options, confirmation of embedment depth and diameter and a driveability assessment at each WTG location are being undertaken in 2024. This work will confirm the feasibility of the layout and/or hammer size required for the offshore Project. Concurrently, the Applicant is engaging with hammer suppliers and is considering the noise reduction systems that may be embedded in the hammer equipment. New underwater noise modelling will be undertaken to revisit noise propagation and predicted impact ranges for marine mammals. If revised impact ranges are comparable to those of the assessment in chapter 12: Marine mammal and megafauna of the Offshore EIA Report, then additional mitigation will be reviewed. An important factor in determining what additional mitigation would be available is its applicability to the offshore Project and proven efficacy. Currently, ADD are available and have been used as effective additional mitigation during construction activities on other projects. The use of ADD will be considered within the EPS Licence Risk Assessment, along with other potential mitigation measures, and will be subject to consultation and agreement post-consent. Similarly, the feasibility of adjusting the embedded mitigation for piling activities (soft start and ramp up) to align with the conclusions of the RaDIN report (ORJIP, 2024) will also be assessed. The progression of NAS will be kept under review by the Applicant to ensure awareness of any changes to its applicability for the offshore Project. The Piling Strategy, together with updated noise modelling risk assessment and MMMP, will be submitted to MD-LOT, following consultation with NatureScot, post-consent.

5 SUMMARY AND CONCLUSIONS

This document is an addendum to chapter 12: Marine mammals and megafauna of the Offshore EIA Report to address the MD-LOT Additional Information Request and other relevant specific clarification points from NatureScot. Additional information has been provided to address the points raised by both MD-LOT and NatureScot.

An assessment on otter in relation to impacts seaward of MHWS from the offshore project from an EIA perspective has been provided. For all potential impact pathways assessed, it was concluded that the potential impacts to otter were Not Significant in EIA terms, for both the Project alone and cumulatively with other developments.

The Applicant has provided a revised assessment for underwater noise pressures to marine mammals, having accepted the advice from NatureScot regarding sensitivity and magnitude criteria. However, none of the changes affected the conclusion of the EIA, which remained Not Significant in EIA terms.

Further work on cumulative effects has been completed, using iPCoD for harbour porpoise, minke whale and harbour and grey seal species (Appendix A). This work concluded that there are no population level impacts of disturbance to any species and that a magnitude of negligible is appropriate on this basis. The modelling indicated there was no significant cumulative impact to any of the assessed species. This conclusion has not changed from the CEA of the Offshore EIA Report. Only with estimated mortality from collision with the tidal turbines at MeyGen included in the iPCoD model for harbour seal, was the decline of their population exacerbated but not in the presence of disturbance from the offshore Project.

The additional information affirms the Applicant's commitment to mitigation of predicted impacts to marine mammals, through the updated outline MMMP (Appendix B) and consideration, at this stage, of the implications to EPS (section 4.5). The Project continues to conduct further investigations of the site into 2025, and refined parameters will eventually inform revised underwater noise modelling and the Piling Strategy and EPS Licence application post-consent.

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7 ACRONYMS

ACRONYM	DEFINITION
ADD	Acoustic Deterrent Device
CEA	Cumulative Effects Assessment
DAS	Digital Aerial Survey
DEPL	Deployment
ECC	Export Cable Corridor
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPS	European Protected Species
EU	European Union
FCS	Favourable Conservation Status
HF	High Frequency
HP	Harbour Porpoise
HRA	Habitats Regulation Appraisal
HSD	Hydro-Sound Damper
iPCoD	Interim Population Consequences of Disturbance
JNCC	Joint Nature Conservation Committee
km	kilometre
LF	low frequency

ACRONYM	DEFINITION
LSE	Likely Significant Effects
MD-LOT	Marine Directorate - Licensing Operations Team
MD-SEDD	Marine Directorate – Science, Evidence, Data & Digital
MHWS	Mean High Water Springs
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Mammal Observer
MU	Management Unit
NAS	Noise Abatement Systems
nm	Nautical Miles
NMS	Noise Mitigation Screen
OAA	Option Agreement Area
OIC	Orkney Islands Council
OP	Operation
OWF	Offshore Wind Farm
OWPL	Offshore Wind Power Limited
PAM	Passive Acoustic Monitoring
PPP	Planning Permission in Principle
PTS	Permanent Threshold Shift
RaDIN	Range Dependant nature of Noise

ACRONYM	DEFINITION
RIAA	Report to Inform Appropriate Assessment
SAC	Special Area of Conservation
SCANS	The Small Cetaceans in European Atlantic Waters and the North Sea
SHPP	Species and Habitat Protection Plan
UK	United Kingdom
USBL	Ultra-short Baseline
UXO	Unexploded Ordnance
VHF	Very High Frequency
WBD	White-Beaked Dolphin
WTG	Wind Turbine Generators

APPENDIX A IPCOD MODELLING TO SUPPORT THE CUMULATIVE PURPOSE

Prepared by SMRU Consulting.

A.1 Purpose

NatureScot responses to the Supporting Study 10: Marine mammal underwater noise impact assessment, set out further requirements of the Applicant in regard to Cumulative Effects Assessment (CEA). Specifically, NatureScot stated that they required:

1. Further consideration of how predicted mortality from collision with tidal stream developments can be incorporated into the assessment;
2. Further justification, beyond the reliance of the single study reference to support the cumulative assessment conclusion for harbour porpoise;
3. Revision of the cumulative assessment for minke whale; and
4. That the cumulative assessment for impacts to seal species include population modelling.

This report therefore provides population modelling to compliment the conclusions of the marine mammal CEA in the chapter 12: Marine mammals and megafauna of the Offshore EIA Report.

A.2 Method

A.2.1 iPCoD model

The potential risk of injury and/or disturbance to marine mammals during construction of offshore renewable energy developments has been identified as a key consenting risk for projects in UK waters. Possible consequences of exposure to underwater noise from piling include disturbance that could cause marine mammals to either move away or change behaviour or temporary and permanent hearing damage.

To address this, the Scottish Government Marine Directorate Science, Evidence Data and Digital (MD-SEDD formerly Marine Scotland Science) and other UK partners have supported the development of the Interim Population Consequences of Disturbance framework (iPCoD). This development has been carried out by a team of researchers at the University of St Andrews, led by Prof. John Harwood (King *et al.*, 2015, Harwood *et al.*, 2014). The framework was developed in the computing language R and the original model was released in 2013. This assessment was conducted using v5.2 of the iPCoD model[22].

The iPCoD model has been used here to assess the impacts of disturbance from piling and collision mortality from operational tidal turbines. The inputs include information about the management unit (MU) (for the species and

[22] https://www.smruconsulting.com/population-consequences-of-disturbance-pcod.

population in question) and the developments that could impact them (e.g. a calendar of days of activity, the numbers of animals impacted etc.). The outputs provide the forecast of the population trajectory with and without the simulated disturbance.

A.2.2 Projects included

While all offshore projects within each species Management Unit (MU) were included in the CEA section of chapter 12: Marine mammals and megafauna of the Offshore EIA Report, as per the approach used in the Moray West and the SeaGreen CEAs, it was agreed with NatureScot that the quantitative population level assessment for the West of Orkney Windfarm should focus on the potential impacts from other Scottish projects only. As per the CEA presented in the chapter 12: Marine mammals and megafauna of the Offshore EIA Report, projects in the long-list with no offshore construction timeline have been scoped out. The population level CEA therefore includes Scottish offshore wind projects expected to be constructed between 2026 and 2031 inclusive, which is coincident with the expected construction phase for the proposed Project. This screens in the following projects in addition to West of Orkney:

- Pentland (floating);
- Berwick Bank (fixed);
- Green volt (floating);
- Cenos (floating) *(not included in seal CEA as not within the relevant MU);* and
- Caledonia (combination of fixed and floating).

Note: Salamander, Ossian, Marram, Stromar, Arven etc are screened out due to no construction timeline information.

Additionally, operational tidal energy projects located in the North Coast and Orkney MU have been included to account for ongoing potential collisions, as requested by NatureScot[23]: MeyGen (MeyGen ES did not quantify collision risk, but it was quantified for harbour seals in Band *et al.* (2016)). *Note: EMEC Billia Croo, Scapa Flow and Shapinsay Sound do not have a quantitative collision mortality assessment available so are screened out.*

A.3 iPCoD input parameters

A.3.1 Piling Schedule

To run iPCoD, information on the piling schedule for each of these Projects is required, as is the expected number of individuals disturbed of the relevant species throughout the construction period. Information available on the piling schedule for each project is presented in Table 7-1. In the absence of detailed information on project piling schedules, reasonable schedules were created based on a series of assumptions. These assumptions are informed by knowledge of the number of turbines, expected number of piling days and likely installation methods. The assumptions associated with each project are summarised in Table 7-1.

[23] *NatureScot raised concerns specifically relating to harbour seals given the already declining North Coast & Orkney MU and the potential for collision mortality from tidal turbines to exacerbate this decline.*

Table 7-1 Piling schedules for Scottish OWF projects screened into the iPCoD modelling. Blue shaded cells indicate the years in which piling is expected to take place and the number corresponds to the number of days of construction. Green shaded cells indicate years in which a tidal turbine project is operational.

DEVELOPMENT	TYPE	INFORMATION SOURCE	PILING ASSUMPTIONS	2026	2027	2028	2029	2030	2031
West of Orkney	OWF	Chapter 12: Marine mammals and megafauna of the Offshore EIA Report	Piling schedule available from project alone assessment: • 500 pin piles for WTGs + 80 pin piles for OSPs = total 580 pin piles[24]; • Assuming 2 pin piles are installed per day = 290 days piling; • Three-year piling window with piling days randomly spread across the 6-month piling window in each year (May-Oct inclusive); and • This is the temporal worst case scenario compared to monopiles.			97	96	97	
Pentland	OWF	EIA Report	From Maximum Design Scenario (MDS) table: • 63 days piling; and • 63 days spread evenly across Apr, May, Jun, Jul 2026.	63					
Berwick Bank	OWF	EIA Report	From MDS table: 372 piling days From iPCoD appendix:	124	124				124

[24] *The scenario run for the iPCoD modelling for disturbance from pile driving activities for the Project alone was for piled jacket foundations, since this represented the worst case scenario in terms of number of piling days.*

DEVELOPMENT	TYPE	INFORMATION SOURCE	PILING ASSUMPTIONS	2026	2027	2028	2029	2030	2031
			• 2026: Apr - Dec inclusive; • 2027: Apr – Dec inclusive; and • 2031: Apr – Dec inclusive. Evenly distribute 372 piling days over specified months.						
Green Volt Floating	OWF	EIA Report	From MDS table: • Piling is not an option for turbine moorings; • Piling only for 1 OSP= 4 pin piles in total; and • 1 pile/day = 4 days over 1 month in Q1 2027.		4				
Cenos	OWF	Scoping Report	• 70-100 floating WTGs (no piled anchors); • 1 OSP = 12 pin piles; • Assume 4 piles/day = 3 days; • Assume 15 km EDR; and • Assume piling in 1 month in summer 2028.			3			
Caledonia	OWF	Scoping Report	111 fixed foundations • 1 day/foundation = 111 days; and • Assume 26 km EDR. Followed by 39 floating foundations		38	38	37	37	

DEVELOPMENT	TYPE	INFORMATION SOURCE	PILING ASSUMPTIONS	2026	2027	2028	2029	2030	2031
			• 1 day/foundation = 39 days; and • Assume 15 km EDR. Evenly distribute 150 piling days across the 4 years.						
MeyGen	Tidal	Collision risk report[25]	No piling. Collision mortality included only.	*Annual collision mortality throughout operational period*					

[25] *Band, B., C. Sparling, D. Thompson, J. Onoufriou, E. San Martin, and N. West. (2016). Refining Estimates of Collision Risk for Harbour Seals and Tidal Turbines. Scottish Marine and Freshwater Science 7.*

Figure 7-1- Summaries of the timeline for pile driving activity for the projects screened into the assessment

A.3.2 Disturbance

Information on the number of animals forecasted to be disturbed by each development are required to run iPCoD. Where available, the number of animals disturbed was obtained from project specific EIA Reports. For projects with no quantitative assessment available in the public domain, the number of animals disturbed was estimated on a fixed Effective Deterrence Range (EDR)[26] (JNCC, 2020) approach using a representative density at the site. These are detailed for both fixed and floating foundations for each species in Table 7-2 -Table 7-5.

Table 7-2 Harbour poproise cumulative effect of disturbance from underwater noise. Numbers denote the number of animals predicted to be disurbed per day at each project in each year. Floating foundation numbers are shown in italics. Two numbers in a cell indicates both fixed and floating foundations are in plans.

DEVELOPMENT	INFORMATION SOURCE	2026	2027	2028	2029	2030	2031
West of Orkney	Offshore EIA Report (pin-piles)			1149	1149	1149	

[26] *The EDR is the radius of the circular area that is assumed to be impacted by disturbance. EDRs used: 26 km from monopiles, 15 km for pin piles (including piled anchors) as per JNCC (2020).*

DEVELOPMENT	INFORMATION SOURCE	2026	2027	2028	2029	2030	2031
Pentland	EIA Report	*641*					
Berwick Bank	EIA Report	1,754	1,754				1754
Green Volt Floating	EIA Report		*537*				
Cenos	Estimated using a 15 km EDR and SCANS III density (0.599/km^2)		*1,272*	*1,272*	*1,272*	*1,272*	
Caledonia	Estimated using a 26 km EDR for fixed/ 15 km EDR for floating and SCANS III block density (0.152/km^2)			323 *107*	323 *107*	323 *107*	
MeyGen	Collision risk report			Not assessed			

Table 7-3 Minke whale cumulative effect of disturbance from underwater noise. Numbers denote the number of animals predicted to be disturbed per day at each project in each year. Floating foundation numbers are shown in italics. Two numbers in a cell indicates both fixed and floating foundations are in plans.

DEVELOPMENT	INFORMATION SOURCE	2026	2027	2028	2029	2030	2031
West of Orkney	Offshore EIA Report (pin-piles)			77	77	77	
Pentland	EIA Report	*40*					
Berwick Bank	EIA Report	82	82				82
Green Volt Floating	EIA Report		*2*				
Cenos	Estimated using a 15 km EDR and SCANS III density (0.0387/km^2)		*27*	*27*	*27*	*27*	
Caledonia	Estimated using a 26 km EDR for fixed/ 15 km EDR for floating and SCANS III block density (0.0095/km^2)			20 *7*	20 *7*	20 *7*	

DEVELOPMENT	INFORMATION SOURCE	2026	2027	2028	2029	2030	2031
MeyGen	Collision risk report			Not assessed			

Table 7-4 Harbour seal cumulative effect of disturbance from underwater noise. Numbers denote the number of seals predicted to be disurbed per day at each project in each year or number of annual mortalities at tidal projects. Floating foundation numbers are shown in italics.

DEVELOPMENT	INFORMATION SOURCE	2026	2027	2028	2029	2030	2031
West of Orkney	Offshore EIA Report (pin-piles)			158	158	158	
Pentland	EIA Report	*116*					
Green Volt Floating	EIA Report		*0*				
Caledonia	Estimated using a 26 km EDR for fixed/ 15 km EDR for floating and mean density (habitat preference map) within Caledonia array area			3 *0*	3 *0*	3 *0*	
MeyGen	Collision risk report	69	69	69	69	69	69

Table 7-5 Grey seal cumulative effect of disturbance from underwater noise. Numbers denote the number of seals predicted to be disurbed per day at each project in each year. Fixed foundations are shown in bold, floating foundations are shown in italics. Two numbers in a cell indicates both fixed and floating foundations are in plans.

DEVELOPMENT	INFORMATION SOURCE	2026	2027	2028	2029	2030	2031
West of Orkney	Offshore EIA Report (pin-piles)			2,596	2,596	2,596	
Pentland	EIA Report	*1,890*					
Green Volt Floating	EIA Report		*3*				
Caledonia	Estimated using a 26 km EDR for fixed/15 km EDR for floating and mean density (habitat preference map) within Caledonia array area.			675 *225*	675 *225*	675 *225*	

DEVELOPMENT	INFORMATION SOURCE	2026	2027	2028	2029	2030	2031
MeyGen	Collision risk report			Not assessed			

A.3.3 Summary of iPCoD parameters

Table 7-6 provides a summary of all parameter values used in iPCoD simulations for this CEA. The demographic parameters were obtained from those recommended in Sinclair *et al.* (2020) for each species. Please see the iPCoD version 5 helpfile for full details on each user-selected parameter in the model (Sinclair *et al.*, 2019).

Table 7-6 iPCoD input parameters for each species[27]

PARAMETER	DESCRIPTION	HARBOUR PORPOISE NS MU	HARBOUR PORPOISE UK PORTION OF NS MU	MINKE WHALE CGNS MU	MINKE WHALE UK PORTION OF CGNS MU	HARBOUR SEAL NC&O MU (NO COLLISIONS)	HARBOUR SEAL NC&O MU (WITH COLLISIONS)	GREY SEAL NC&O MU
nboot	Number of simulations run	1,000	1,000	1,000	1,000	1,000	1,000	1,000
spec	Species modelled	HP	HP	MW	MW	HS	HS	GS
pmean	Population size	375,537	183,937	20,118	10,288	1,951	1,951	34,191
Surv [1]	Calf/pup survival rate	0.8455	0.8455	0.7	0.7	0.24	0.24	0.222
Surv[7]	Juvenile survival rate	0.85	0.85	0.77	0.77	0.86	0.86	0.94
Surv[13]	Adult survival rate	0.925	0.925	0.96	0.96	0.8	0.8	0.94
Fertility	Fertility rate	0.34	0.34	0.91	0.91	0.9	0.9	0.84

[27] *NS = North Sea, CGNS = Celtic and Greater North Seas, NC&O = North Coast and Orkney.*

PARAMETER	DESCRIPTION	HARBOUR PORPOISE NS MU	HARBOUR PORPOISE UK PORTION OF NS MU	MINKE WHALE CGNS MU	MINKE WHALE UK PORTION OF CGNS MU	HARBOUR SEAL NC&O MU (NO COLLISIONS)	HARBOUR SEAL NC&O MU (WITH COLLISIONS)	GREY SEAL NC&O MU
age1	Age at independence form mother	1	1	1	1	1	1	1
age2	Age at first birth	5	5	9	9	4	4	6
pile_years	Number of piling years	6	6	6	6	6	6	6
vulnmean	Proportion of population vulnerable to impact	c(1)	c(1)	c(1)	c(1)	c(1)	c(1)	c(1)
days	Days of "residual" disturbance associated with each day of actual disturbance	0	0	0	0	0	0	0
prop_days_dist	Proportion of disturbed animals that experience "days"	1	1	1	1	1	1	1
pilesx1	Number of piling operations	7	7	7	7	7	7	7

PARAMETER	DESCRIPTION	HARBOUR PORPOISE NS MU	HARBOUR PORPOISE UK PORTION OF NS MU	MINKE WHALE CGNS MU	MINKE WHALE UK PORTION OF CGNS MU	HARBOUR SEAL NC&O MU (NO COLLISIONS)	HARBOUR SEAL NC&O MU (WITH COLLISIONS)	GREY SEAL NC&O MU
numDt[1,]	Number of animals disturbed per piling day at each operation	1,149, 641, 1,754, 537, 1,272, 323, 107	1,149, 641, 1,754, 537, 1,272, 323, 107	77, 40, 82, 2, 27, 20, 7	77, 40, 82, 2, 27, 20, 7	158, 116, 0, 0, 0, 3, 0	158, 116, 0, 0, 0, 3, 0	2,596, 1,890, 0, 3, 0, 675, 225
numPt[1,]	Number of animals with PTS per piling day at each operation	0,0,0,0,0,0,0	0,0,0,0,0,0,0	0,0,0,0,0,0,0	0,0,0,0,0,0,0	0,0,0,0,0,0,0	0,0,0,0,0,0,0	0,0,0,0,0,0,0
Avoid	Do animals avoid all piling operations during residual disturbance	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
years	Number of years modelled	25	25	25	25	25	25	25
NCollisions	Number of annual collisions (deaths)	0	0	0	0	0	69	0

A.4 Limitations

There is a lack of empirical data on the way in which changes in behaviour and hearing sensitivity may affect the ability of individual marine mammals to survive and reproduce. Therefore, in the absence of empirical data, the iPCoD framework uses the results of an expert elicitation process conducted according to the protocol described in Donovan *et al.*, (2016) to predict the effects of disturbance and PTS on survival and reproductive rate. The process generates a set of statistical distributions for these effects and then simulations are conducted using values randomly selected from these distributions that represent the opinions of a "virtual" expert. This process is repeated many 100s of times to capture the uncertainty among experts.

There are several precautions built into the iPCoD model and this specific scenario that means that the results are considered to be highly precautionary and likely over-estimate the true population level effects. These include:

- The fact that the model assumes minke whales will not forage for 24 hours after being disturbed[28];
- The lack of density dependence in the model (meaning the population will not respond to any reduction in population size);
- The level of environmental and demographic stochasticity in the model; and
- The estimates of the number of animals disturbed come from noise impact assessments with many levels of precaution.

A.4.1 Duration of disturbance: minke whales and bottlenose dolphins

The iPCoD model for minke whale and bottlenose dolphin disturbance was last updated following the expert elicitation in 2013 (Harwood *et al.*, 2014). When this expert elicitation was conducted, the experts provided responses on the assumption that a disturbed individual would not forage for 24 hours after being disturbed. However, the most recent expert elicitation in 2018 highlighted that this was an unrealistic assumption for harbour porpoises (generally considered to be more responsive than minke whales and bottlenose dolphins), and was amended to assume that disturbance resulted in 6 hours of non-foraging time (Booth *et al.*, 2019). Unfortunately, neither minke whale nor bottlenose dolphins were included in the updated expert elicitation for disturbance, and thus the iPCoD model still assumes 24 hours of non-foraging time after being disturbed for both minke whales and bottlenose dolphins. This is unrealistic considering what we now know about marine mammal behavioural responses to pile driving. A recent study estimated energetic costs associated with disturbance from sonar, where it was assumed that 1 hour of feeding cessation was classified as a mild response, 2 hours of feeding cessation was classified as a strong response and 8 hours of feeding cessation was classified as an extreme response (Czapanskiy *et al.*, 2021). Assuming 24 hours of feeding cessation for both minke whales and bottlenose dolphins in the iPCoD model is significantly

[28] *In the updated expert elicitation in 2018, the duration of disturbance for harbour porpoise, harbour seals and grey seals was assumed to be 6 hours BOOTH, C. G., HEINIS, F. & J., H. 2019. Updating the Interim PCoD Model: Workshop Report - New transfer functions for the effects of disturbance on vital rates in marine mammal species. Report Code SMRUC-BEI-2018-011, submitted to the Department for Business, Energy and Industrial Strategy (BEIS), February 2019 (unpublished).. Unfortunately, minke whales were not included in the updated expert elicitation so the duration of disturbance remains 24 hours, as used in the original expert elicitation in 2013.*

beyond that which is considered to be an extreme response; therefore, this assumption is considered to be unrealistic and will over-estimate the true disturbance levels expected from the offshore Project.

A.4.2 Lack of density dependence

Density dependence is described as "*the process whereby demographic rates change in response to changes in population density, resulting in an increase in the population growth rate when density decreases and a decrease in that growth rate when density increases*" (Harwood *et al.*, 2014). The iPCoD scenario run assumes no density dependence, because previously there has been no means to parameterise this relationship for UK marine mammal species. Essentially, what this means is that there is no ability for the modelled impacted population to increase in size back up to carrying capacity following disturbance (carrying capacity is typically assumed to be equal to the size of un-impacted population – i.e. it is assumed the un-impacted population is at carrying capacity). At a recent expert elicitation, conducted for the purpose of modelling population impacts of the Deepwater Horizon oil spill (Schwacke *et al.*, 2021), experts agreed that there would likely be a concave density dependence on fertility, which means that in reality, it would be expected that the impacted population would recover to carrying capacity, rather than continuing at a stable trajectory that is smaller than that of the un-impacted population.

A.4.3 Environmental and demographic stochasticity

The iPCoD model attempts to model some of the sources of uncertainty inherent in the calculation of the potential effects of disturbance on marine mammal population. This includes demographic stochasticity and environmental variation. Environmental variation is defined as "*the variation in demographic rates among years as a result of changes in environmental conditions*" (Harwood *et al.*, 2014). Demographic stochasticity is defined as "*variation among individuals in their realised vital rates as a result of random processes*" (Harwood *et al.*, 2014).

The iPCoD protocol describes this in further detail: "*Demographic stochasticity is caused by the fact that, even if survival and fertility rates are constant, the number of animals in a population that die and give birth will vary from year to year because of chance events. Demographic stochasticity has its greatest effect on the dynamics of relatively small populations, and we have incorporated it in models for all situations where the estimated population within an MU is less than 3000 individuals. One consequence of demographic stochasticity is that two otherwise identical populations that experience exactly the same sequence of environmental conditions will follow slightly different trajectories over time. As a result, it is possible for a "lucky" population that experiences disturbance effects to increase, whereas an identical undisturbed but "unlucky" population may decrease*" (Harwood *et al.*, 2014).

This is clearly evidenced in the outputs of iPCoD where the un-impacted (baseline) population size varies greatly between iterations, not as a result of disturbance but simply as a result of environmental and demographic stochasticity. In the example provided in Figure 7-2, after 25 years of simulation, the un-impacted population size varies between 6,692 (lower 2.5%) and 16,516 (upper 97.5%). Thus, the change in population size resulting from the impact of disturbance is significantly smaller than that driven by the environmental and demographic stochasticity in the model.

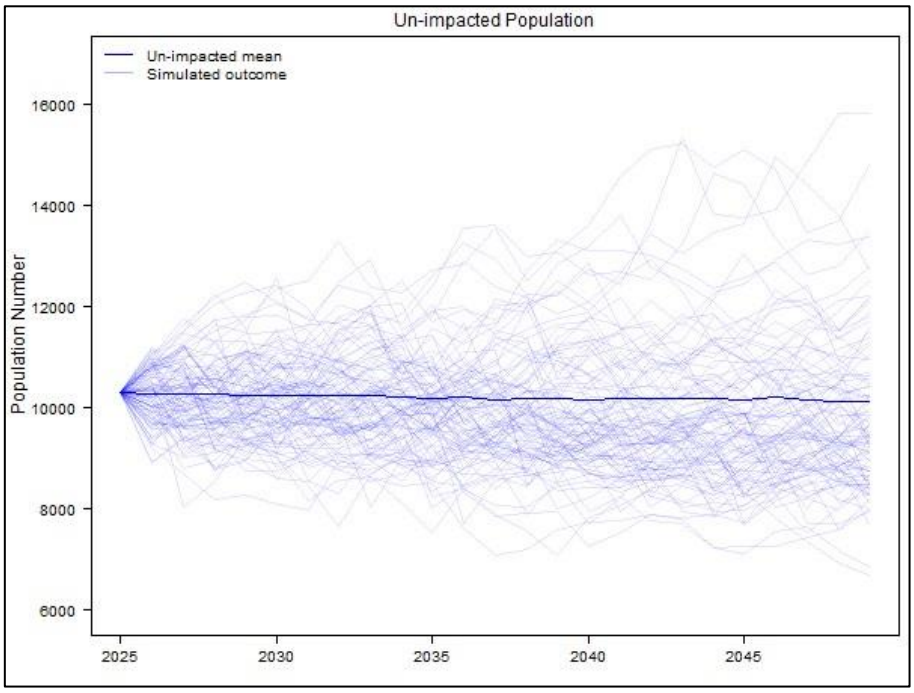

Figure 7-2 Simulated un-impacted (baseline) population size over the 25 years modelled

A.4.4 Summary

All of these precautions built into the iPCoD model mean that the results are considered to be highly conservative. Despite these limitations and uncertainties, this assessment has been carried out according to best practice and using the best available scientific information. The information provided is therefore considered to be sufficient to carry out an adequate assessment, though a level of precaution around the results should be taken into account when drawing conclusions.

A.5 Results

A.5.1 Harbour porpoise

North Sea MU

Figure 7-3 and Table 7-7 show the results for the CEA iPCoD simulations for harbour porpoise (using the North Sea MU). These results indicate that the proposed cumulative activity assessed using iPCoD has little to no impact on the harbour porpoise conservation status or the integrity of the receptor. The counter-factual metric indicates that the impacted population remains 100% of the unimpacted population size (i.e. the noise impacts assessed do not impact the population). This aligns with a magnitude score of Negligible: very slight or imperceptible changes to baseline conditions or receptor population.

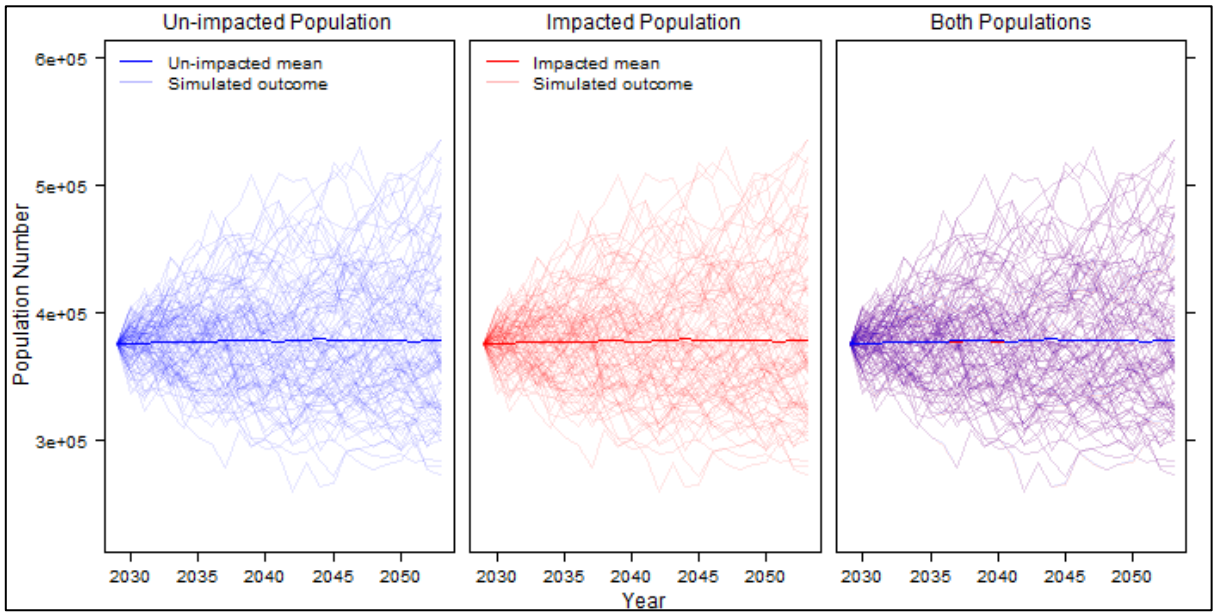

Figure 7-3 Results of the harbour porpoise WOW CEA iPCoD simulations for the entire North Sea MU. Blue (left panel) shows the trajectory of the un-impacted population (i.e. no disturbance in the CEA) with a dark line representing the median (and range of uncertainty shown), Red (middle panel) shows the impacted population with a dark line representing the median (and range of uncertainty shown). The right panel shows both these forecasts together in a single frame.

Table 7-7 Results of the harbour porpoise WOW CEA iPCoD simulations, for the entire North Sea MU, at different timesteps. The mean un-impacted and impacted population sizes are shown, along with the counterfactual of the two metrics at each timestep.

	MEAN UN-IMPACTED POPULATION SIZE	MEAN IMPACTED POPULATION SIZE	IMPACTED AS % OF UN-IMPACTED POPULATION SIZE
Start 2026 (before CEA piling starts)	375,538	375,538	100.0
End of 2026 (after 1 year CEA piling)	375,169	375,156	100.0
End of 2027 (after 2 years CEA piling)	375,742	375,699	100.0
End of 2028 (after 3 years CEA piling)	376,772	376,706	100.0
End of 2029 (after 4 years CEA piling)	377,037	376,953	100.0
End of 2030 (after 5 years CEA piling)	377,337	377,237	100.0

	MEAN UN-IMPACTED POPULATION SIZE	MEAN IMPACTED POPULATION SIZE	IMPACTED AS % OF UN-IMPACTED POPULATION SIZE
End of 2031 (after 6 years CEA piling)	377,237	377,125	100.0
End of 2032 (1 year after piling ends)	377,309	377,187	100.0
End of 2037 (6 years after piling ends)	377,332	377,221	100.0
End of 2043 (12 years after piling ends)	377,851	377,740	100.0
End of 2049 (18 years after piling ends)	378,699	378,588	100.0

UK portion of the North Sea MU

Figure 7-4 and Table 7-8 show the results for the CEA iPCoD simulations for harbour porpoise (using the UK portion of the North Sea MU). These results indicate that the proposed cumulative activity assessed using iPCoD has little to no impact on the harbour porpoise conservation status or the integrity of the receptor. The counter-factual metric indicates that the impacted population remains 100% of the unimpacted population size (i.e. the noise impacts assessed do not impact the population). This aligns with a magnitude score of Negligible: very slight or imperceptible changes to baseline conditions or receptor population.

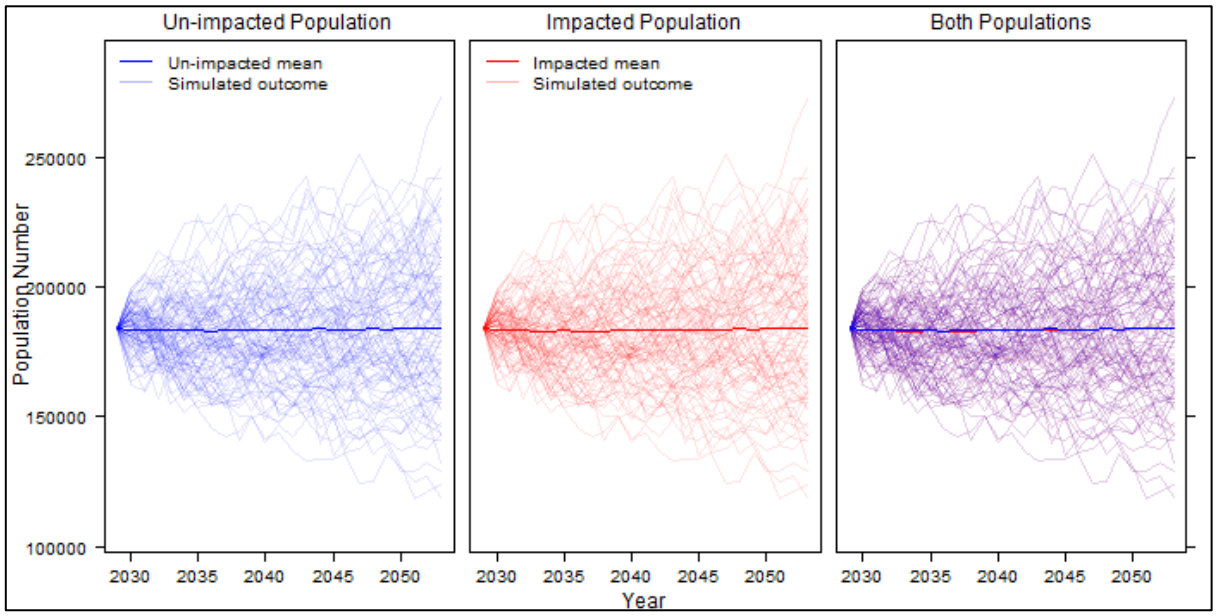

Figure 7-4 Results of the harbour porpoise WOW CEA iPCoD simulations for the UK portion of the North Sea MU. Blue (left panel) shows the trajectory of the un-impacted population (i.e. no disturbance in the CEA) with a dark line representing the median (and range of uncertainty shown), Red (middle panel) shows the impacted population with a dark line representing the median (and range of uncertainty shown). The right panel shows both these forecasts together in a single frame.

Table 7-8 Results of the harbour porpoise WOW CEA iPCoD simulations, for the UK portion of the North Sea MU, at different timesteps. The mean un-impacted and impacted population sizes are shown, along with the counterfactual of the two metrics at each timestep.

	MEAN UN-IMPACTED POPULATION SIZE	MEAN IMPACTED POPULATION SIZE	IMPACTED AS % OF UN-IMPACTED POPULATION SIZE
Start 2026 (before CEA piling starts)	183,936	183,936	100%
End of 2026 (after 1 year CEA piling)	183,896	183,884	100%
End of 2027 (after 2 years CEA piling)	183,873	183,827	100%
End of 2028 (after 3 years CEA piling)	183,662	183,591	100%
End of 2029 (after 4 years CEA piling)	183,277	183,191	100%
End of 2030 (after 5 years CEA piling)	183,314	183,214	100%

	MEAN UN-IMPACTED POPULATION SIZE	MEAN IMPACTED POPULATION SIZE	IMPACTED AS % OF UN-IMPACTED POPULATION SIZE
End of 2031 (after 6 years CEA piling)	183,414	183,300	100%
End of 2032 (1 year after piling ends)	183,132	183,011	100%
End of 2037 (6 years after piling ends)	183,485	183,372	100%
End of 2043 (12 years after piling ends)	183,836	183,722	100%
End of 2049 (18 years after piling ends)	184,316	184,201	100%

A.5.2 Minke whale

Celtic and Greater North Seas MU

Figure 7-5 and Table 7-9 show the results for the CEA iPCoD simulations for minke whale (using the Celtic and Greater North Seas MU). These results indicate that the proposed cumulative activity assessed using iPCoD has little to no impact on the minke whale conservation status or the integrity of the receptor. The counter-factual metric indicates that the impacted population remains 100% of the unimpacted population size (i.e. the noise impacts assessed do not impact the population). This aligns with a magnitude score of Negligible: very slight or imperceptible changes to baseline conditions or receptor population.

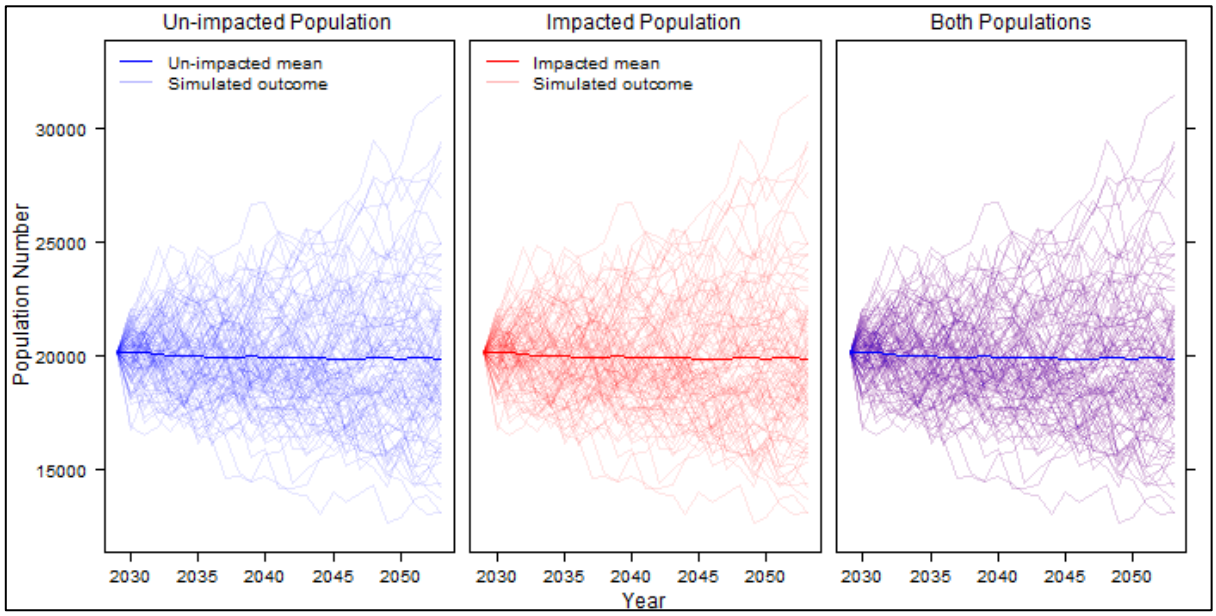

Figure 7-5 Results of the minke whale WOW CEA iPCoD simulations for the Celtic and Greater North Seas MU. Blue (left panel) shows the trajectory of the un-impacted population (i.e. no disturbance in the CEA) with a dark line representing the median (and range of uncertainty shown), Red (middle panel) shows the impacted population with a dark line representing the median (and range of uncertainty shown). The right panel shows both these forecasts together in a single frame.

Table 7-9 Results of the minke whale WOW CEA iPCoD simulations, for the Celtic and Greater North Seas MU, at different timesteps. The mean un-impacted and impacted population sizes are shown, along with the counterfactual of the two metrics at each timestep.

	MEAN UN-IMPACTED POPULATION SIZE	MEAN IMPACTED POPULATION SIZE	IMPACTED AS % OF UN-IMPACTED POPULATION SIZE
Start 2026 (before CEA piling starts)	20,120	20,120	100%
End of 2026 (after 1 year CEA piling)	20,124	20,124	100%
End of 2027 (after 2 years CEA piling)	20,136	20,136	100%
End of 2028 (after 3 years CEA piling)	20,084	20,084	100%
End of 2029 (after 4 years CEA piling)	19,983	19,983	100%
End of 2030 (after 5 years CEA piling)	20,001	20,001	100%

	MEAN UN-IMPACTED POPULATION SIZE	MEAN IMPACTED POPULATION SIZE	IMPACTED AS % OF UN-IMPACTED POPULATION SIZE
End of 2031 (after 6 years CEA piling)	19,948	19,948	100%
End of 2032 (1 year after piling ends)	19,920	19,920	100%
End of 2037 (6 years after piling ends)	19,899	19,899	100%
End of 2043 (12 years after piling ends)	19,812	19,812	100%
End of 2049 (18 years after piling ends)	19,854	19,854	100%

UK portion of the Celtic and Greater North Seas MU

Figure 7-6 and Table 7-10 show the results for the CEA iPCoD simulations for minke whale (using the UK portion of the Celtic and Greater North Seas MU). These results indicate that the proposed cumulative activity assessed using iPCoD has little to no impact on the minke whale conservation status or the integrity of the receptor. The counter-factual metric indicates that the impacted population remains 100% of the unimpacted population size (i.e. the noise impacts assessed do not impact the population). This aligns with a magnitude score of Negligible: very slight or imperceptible changes to baseline conditions or receptor population.

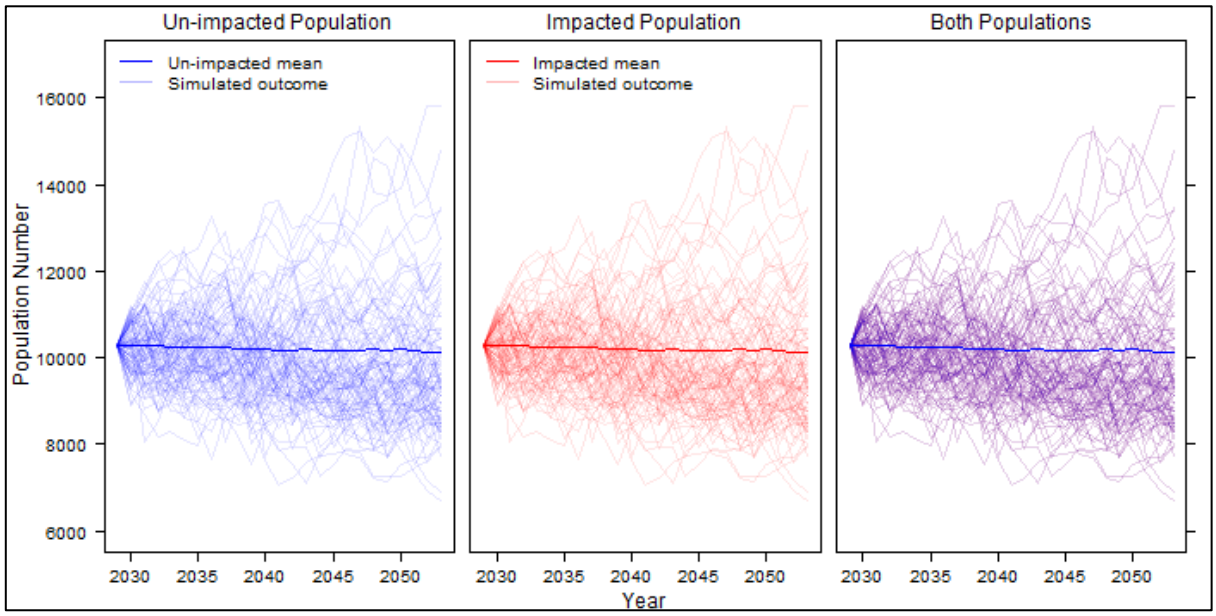

Figure 7-6 Results of the minke whale WOW CEA iPCoD simulations for the UK portion of the Celtic and Greater North Seas MU. Blue (left panel) shows the trajectory of the un-impacted population (i.e. no disturbance in the CEA) with a dark line representing the median (and range of uncertainty shown), Red (middle panel) shows the impacted population with a dark line representing the median (and range of uncertainty shown). The right panel shows both these forecasts together in a single frame.

Table 7-10 Results of the minke whale WOW CEA iPCoD simulations, for the UK portion of the Celtic and Greater North Seas MU, at different timesteps. The mean un-impacted and impacted population sizes are shown, along with the counterfactual of the two metrics at each timestep.

	MEAN UN-IMPACTED POPULATION SIZE	MEAN IMPACTED POPULATION SIZE	IMPACTED AS % OF UN-IMPACTED POPULATION SIZE
Start 2026 (before CEA piling starts)	10,288	10,288	100%
End of 2026 (after 1 year CEA piling)	10,278	10,278	100%
End of 2027 (after 2 years CEA piling)	10,282	10,282	100%
End of 2028 (after 3 years CEA piling)	10,264	10,264	100%
End of 2029 (after 4 years CEA piling)	10,245	10,245	100%
End of 2030 (after 5 years CEA piling)	10,246	10,246	100%

	MEAN UN-IMPACTED POPULATION SIZE	MEAN IMPACTED POPULATION SIZE	IMPACTED AS % OF UN-IMPACTED POPULATION SIZE
End of 2031 (after 6 years CEA piling)	10,238	10,238	100%
End of 2032 (1 year after piling ends)	10,240	10,240	100%
End of 2037 (6 years after piling ends)	10,163	10,163	100%
End of 2043 (12 years after piling ends)	10,168	10,168	100%
End of 2049 (18 years after piling ends)	10,117	10,117	100%

A.5.3 Harbour seal

NatureScot requested that the cumulative modelling include the potential for collision mortality from operational tidal turbines, specifically relating to harbour seals given the already declining North Coast & Orkney MU and the potential for collision mortality from tidal turbines to exacerbate this decline. As stated in section A.2.2, this resulted in the inclusion of collisions from MeyGen only.

North Coast & Orkney MU - no collisions

Figure 7-7 and Table 7-11 show the results for the CEA iPCoD simulations for harbour seal (this includes no collisions on the North Coast & Orkney MU population of harbour seals i.e disturbance only). These results indicate that the proposed cumulative activity assessed using iPCoD has little to no impact on the harbour seal conservation status or the integrity of the receptor. The counter-factual metric indicates that the impacted population remains 100% of the unimpacted population size (i.e. the collision impacts assessed do not impact the population). This aligns with a magnitude score of Negligible: very slight or imperceptible changes to baseline conditions or receptor population.

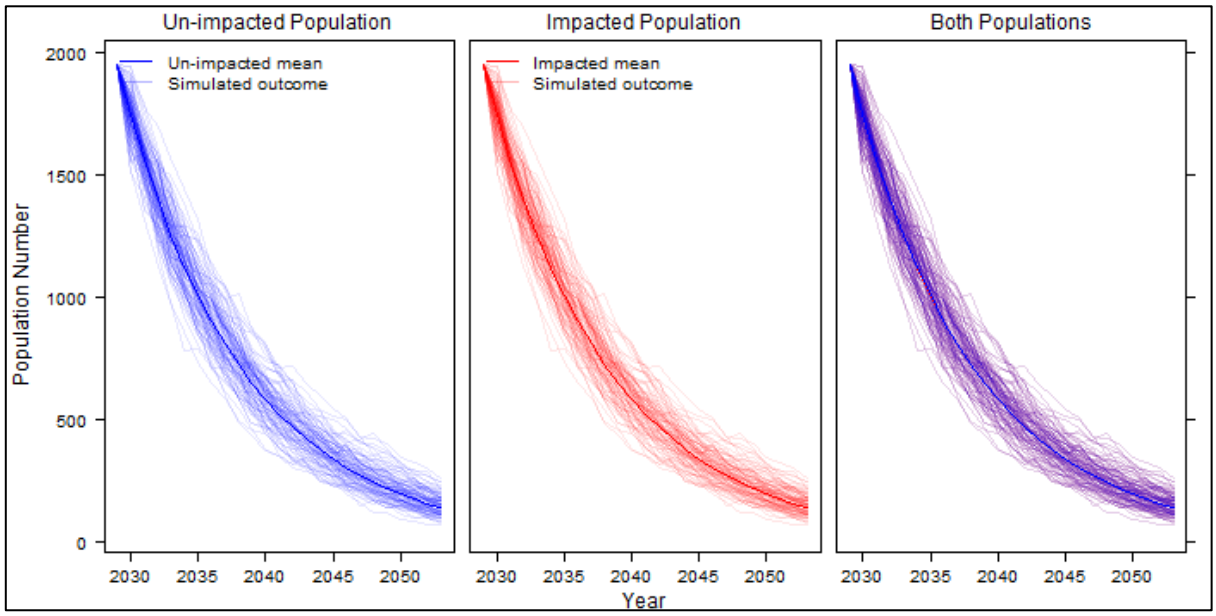

Figure 7-7 Results of the harbour seal WOW CEA iPCoD simulations using the effect of no collisions on the North Coast & Orkney MU population of harbour seals. Blue (left panel) shows the trajectory of the un-impacted population (i.e. no disturbance in the CEA) with a dark line representing the median (and range of uncertainty shown), Red (middle panel) shows the impacted population with a dark line representing the median (and range of uncertainty shown). The right panel shows both these forecasts together in a single frame.

Table 7-11 Results of the harbour seal WOW CEA iPCoD simulations, using no collisions on the North Coast & Orkney MU population of harbour seals, at different timesteps. The mean un-impacted and impacted population sizes are shown, along with the counterfactual of the two metrics at each timestep.

	MEAN UN-IMPACTED POPULATION SIZE	MEAN IMPACTED POPULATION SIZE	IMPACTED AS % OF UN-IMPACTED POPULATION SIZE
Start 2026 (before CEA piling starts)	1,950	1,950	100%
End of 2026 (after 1 year CEA piling)	1,744	1,744	100%
End of 2027 (after 2 years CEA piling)	1,561	1,561	100%
End of 2028 (after 3 years CEA piling)	1,399	1,399	100%
End of 2029 (after 4 years CEA piling)	1,251	1,251	100%
End of 2030 (after 5 years CEA piling)	1,121	1,120	100%

	MEAN UN-IMPACTED POPULATION SIZE	MEAN IMPACTED POPULATION SIZE	IMPACTED AS % OF UN-IMPACTED POPULATION SIZE
End of 2031 (after 6 years CEA piling)	1,008	1,008	100%
End of 2032 (1 year after piling ends)	900	900	100%
End of 2037 (6 years after piling ends)	522	522	100%
End of 2043 (12 years after piling ends)	270	270	100%
End of 2049 (18 years after piling ends)	140	140	100%

North Coast & Orkney MU - with collisions

Figure 7-8 and Table 7-12 show the results for the CEA iPCoD simulations for harbour seal (this includes the effect of collisions predicted from the MeyGen tidal project on the North Coast & Orkney MU population of harbour seals). These overall results indicate that the magnitude of proposed cumulative activity could be considered to have High impact on the harbour seal conservation status or the integrity of the receptor. The counter-factual metric indicates that the impacted population declines below 100% of the unimpacted population size (i.e. the collision impacts assessed do impact the population). As the harbour seal population was unimpacted in the "no collisions" scenario, this indicates that the predicted population decline can be entirely ascribed to the impacts of collisions at the tidal energy device, with West of Orkney (and other OWF projects) having no contribution to this decline.

With no consideration of impacts of the tidal energy device (i.e. focused on disturbance only) the magnitude could be considered Negligible: very slight or imperceptible changes to baseline conditions or receptor population.

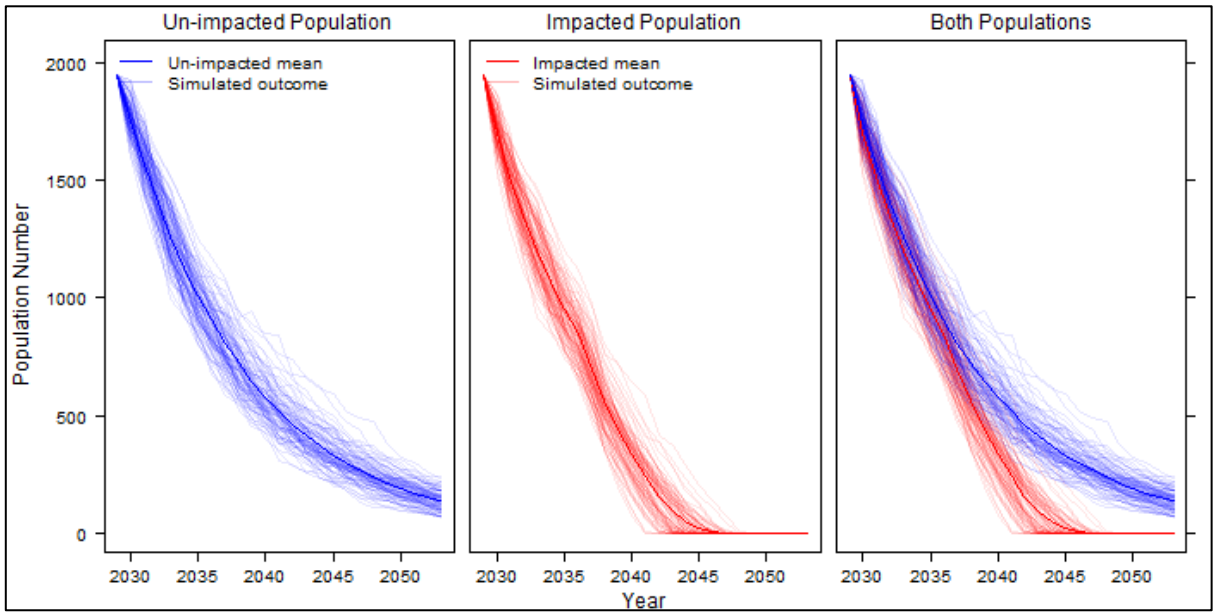

Figure 7-8 Results of the harbour seal WOW CEA iPCoD simulations including the effect of collisions on the North Coast & Orkney MU population of harbour seals. Blue (left panel) shows the trajectory of the un-impacted population (i.e. no disturbance in the CEA) with a dark line representing the median (and range of uncertainty shown), Red (middle panel) shows the impacted population with a dark line representing the median (and range of uncertainty shown). The right panel shows both these forecasts together in a single frame.

Table 7-12 Results of the harbour seal WOW CEA iPCoD simulations, including the effect of collisions on the North Coast & Orkney MU population of harbour seals, at different timesteps. The mean un-impacted and impacted population sizes are shown, along with the counterfactual of the two metrics at each timestep.

	MEAN UN-IMPACTED POPULATION SIZE	MEAN IMPACTED POPULATION SIZE	IMPACTED AS % OF UN-IMPACTED POPULATION SIZE
Start 2026 (before CEA piling starts)	1,950	1,950	100%
End of 2026 (after 1 year CEA piling)	1,751	1,695	97%
End of 2027 (after 2 years CEA piling)	1,570	1,513	96%
End of 2028 (after 3 years CEA piling)	1,402	1,346	96%
End of 2029 (after 4 years CEA piling)	1,259	1,202	95%
End of 2030 (after 5 years CEA piling)	1,127	1,070	95%

	MEAN UN-IMPACTED POPULATION SIZE	MEAN IMPACTED POPULATION SIZE	IMPACTED AS % OF UN-IMPACTED POPULATION SIZE
End of 2031 (after 6 years CEA piling)	1,009	952	94%
End of 2032 (1 year after piling ends)	905	848	94%
End of 2037 (6 years after piling ends)	520	240	46%
End of 2043 (12 years after piling ends)	270	3	1%
End of 2049 (18 years after piling ends)	139	0	0%

A.5.4 Grey seal

North Coast & Orkney MU

Figure 7-9 and Table 7-13 show the results for the CEA iPCoD simulations for grey seals in the North Coast & Orkney MU. These results indicate that the proposed cumulative activity assessed using iPCoD has little to no impact on the grey seal conservation status or the integrity of the receptor. The counter-factual metric indicates that the impacted population remains 100% of the unimpacted population size (i.e. the noise impacts assessed do not impact the population). This aligns with a magnitude score of Negligible: very slight or imperceptible changes to baseline conditions or receptor population.

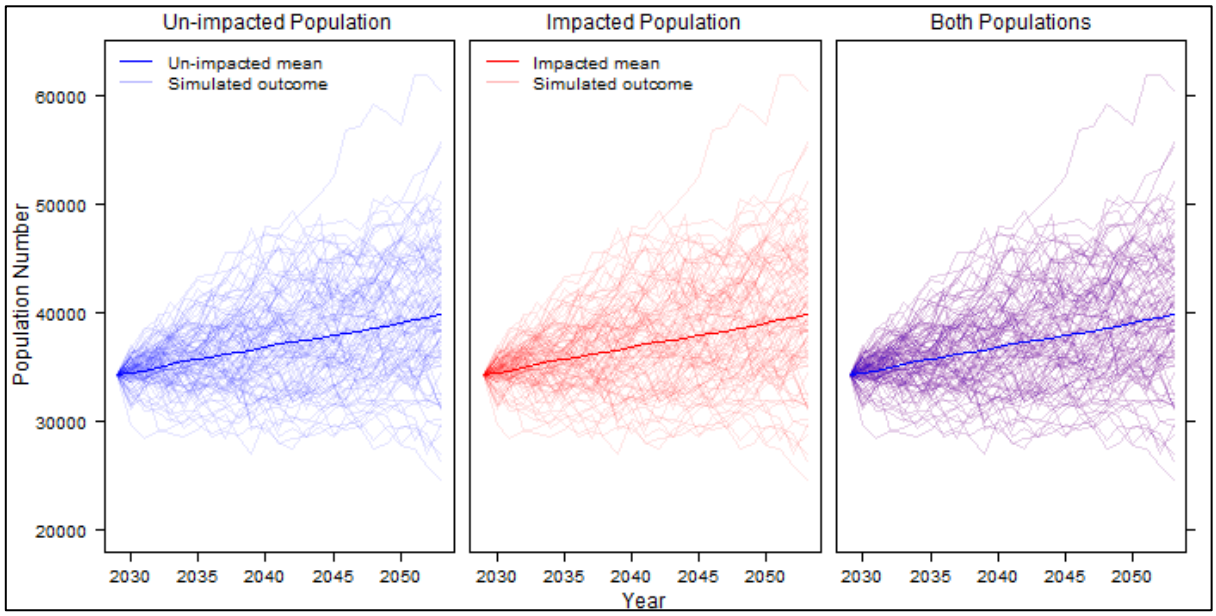

Figure 7-9 Results of the grey seal WOW CEA iPCoD simulations for the North Coast & Orkney MU. Blue (left panel) shows the trajectory of the un-impacted population (i.e. no disturbance in the CEA) with a dark line representing the median (and range of uncertainty shown), Red (middle panel) shows the impacted population with a dark line representing the median (and range of uncertainty shown). The right panel shows both these forecasts together in a single frame.

Table 7-13 Results of the grey seal WOW CEA iPCoD simulations for the North Coast & Orkney MU, at different timesteps. The mean un-impacted and impacted population sizes are shown, along with the counterfactual of the two metrics at each timestep.

	MEAN UN-IMPACTED POPULATION SIZE	MEAN IMPACTED POPULATION SIZE	IMPACTED AS % OF UN-IMPACTED POPULATION SIZE
Start 2026 (before CEA piling starts)	34,190	34,190	100%
End of 2026 (after 1 year CEA piling)	34,352	34,352	100%
End of 2027 (after 2 years CEA piling)	34,601	34,601	100%
End of 2028 (after 3 years CEA piling)	34,940	34,940	100%
End of 2029 (after 4 years CEA piling)	35,123	35,123	100%
End of 2030 (after 5 years CEA piling)	35,455	35,454	100%

	MEAN UN-IMPACTED POPULATION SIZE	MEAN IMPACTED POPULATION SIZE	IMPACTED AS % OF UN-IMPACTED POPULATION SIZE
End of 2031 (after 6 years CEA piling)	35,618	35,618	100%
End of 2032 (1 year after piling ends)	35,829	35,829	100%
End of 2037 (6 years after piling ends)	37,031	37,031	100%
End of 2043 (12 years after piling ends)	38,238	38,238	100%
End of 2049 (18 years after piling ends)	39,756	39,756	100%

A.6 Summary and conclusions

Simulations using the latest version of iPCoD and the best evidenced parameters do not predict impacts to any of the marine mammal populations or management units considered here. Specifically, the population modelling has shown no impact to any of the species from disturbance from the projects included in this modelling.

The cumulative iPCoD modelling results show no significant cumulative impact to any species (Table 7-14). This conclusion has not changed from the findings of the CEA in chapter 12: Marine mammals and megafauna of the Offshore EIA Report.

It is noted that the harbour seal population is predicted to decline severely with removal of animals from the population due to potential collisions with tidal energy developments, which would point to a magnitude of High. The decline occurs irrespective of the offshore Project or any other OWF project (as simulations without collisions show no change to counterfactuals).

Table 7-14 Conclusions obtained from the cumulative iPCoD modelling

SPECIES	MAGNITUDE RATING BASED ON IPCOD MODELLING	SENSITIVITY	SIGNIFICANCE
Harbour porpoise	Negligible: very slight or imperceptible changes to baseline conditions or receptor population.	Low	Negligible (Not Significant)
Minke whale	Negligible: very slight or imperceptible changes to baseline conditions or receptor population.	Low	Negligible (Not Significant)
Harbour seal	Without collisions: Negligible: very slight or imperceptible changes to baseline conditions or receptor population.	Low	Without collisions: Negligible (Not Significant)

SPECIES	MAGNITUDE RATING BASED ON IPCOD MODELLING	SENSITIVITY	SIGNIFICANCE
	With collisions: High: Total change or major alteration to the conservation status or integrity of the receptor or key elements / features of the baseline conditions		With collisions: Minor (Not Significant)
Grey seal	Negligible: very slight or imperceptible changes to baseline conditions or receptor population.	Negligible	Negligible (Not Significant)

A.7 References

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APPENDIX B OUTLINE MARINE MAMMAL MITIGATION PROTOCOL

WEST OF ORKNEY WINDFARM

Offshore EIA Report, Volume 3, Revised Outline Plan 2: Marine Mammal Mitigation Protocol

OWPL Document Number	Originator Document Number	Revision	Status	Date
WO1-WOW-CON-EV-PL-0003	HC0077-1009-07-03	6	IFU	24/07/2024

West of Orkney Windfarm

Values Teamwork Empowerment Commitment

Document Role

Role	Company	Name	Aconex Signature
Author	HiDef Aerial Surveying Ltd.	Dr Caroline Carter	N/A
Checker	OWPL	Andrea Bachew	
Acceptor	OWPL	Liz Foubister	

OWPL Revision History

Revision Number	Issue Date	Document Status
1	11/05/2023	Issued for review
2	06/07/2023	Re-issued for review
3	15/08/2023	Re-issued for review
4	01/09/2023	Issued for use
5	29/05/2024	Re-issued following NatureScot review

Revision Record

Revision Number	Revised Section	Description of Changes
2	Throughout	Edits in response to OWPL and SMRUC comments. Redraft of Section 7.6.3 Noise abatement systems.
3	Throughout	Final edits.
4	Throughout	Final edits.
5	Throughout	Tables 3-1, 2, & 3 corrected. Minor edits to strengthen commitments
6	Throughout	Edits in response to OWPL comments

Contents

Summary

HiDef Surveying Ltd (“HiDef”) were commissioned to prepare an outline protocol for Marine Mammal Mitigation Protocol (MMMP) required to minimise as far as practicable the risk of injury to marine mammals from pre-construction and construction underwater noise related impacts at the proposed West of Orkney Windfarm (the ‘Project').

The underwater noise impact assessment (Offshore EIA Report, Supporting Study (SS) 10: Marine mammal underwater noise impact assessment) has highlighted the risk of auditory impairment (injury) from proposed piling activity and potential Unexploded Ordnance (UXO) clearance activities; however, in EIA terms, neither posed a significant risk but this outline MMMP also considers ensuring risk of injury to European Protected Species is mitigated. The impact assessment found that proposed geophysical surveys presented a negligible risk; however potential mitigation is presented in the event the equipment used differs from that assessed.

The aim of an MMMP is to reduce the risk of instantaneous Permanent Threshold Shift (PTS) onset. Mitigation proposed draws from the Joint Nature Conservation Committee (JNCC) guidelines (JNCC, 2010a; 2010b; 2017), together with consultation responses from NatureScot (Marine Mammal Consultee meeting on 22 March 2023; NatureScot interim advice 13 December 2023 (CNS REN OSWF ScotWind - N1 - Offshore Wind Power Limited - West of Orkney); NatureScot consultation advice 5 April 2024 (CNS REN OSWF-ScotWind-N1 - West of Orkney – Application). This outline MMMP presents the suite of mitigation measures that are currently available and will be used as appropriate to reduce any injury risk to negligible (HiDef, 2023). Protocols and mitigation will be refined and agreed in consultation with Marine Directorate – Licensing Operations Team (MD-LOT) in consultation with NatureScot post-consent to reflect refined Project parameters and to reflect the findings of the EPS risk assessment. Adherence to a finalised MMMP will be a consent condition of the Section 36 Consent/ Marine Licences.

1. Introduction

1.1 Purpose

The Outline Marine Mammal Mitigation Protocol (MMMP) was prepared by HiDef Surveying Ltd (HiDef) on behalf of Offshore Wind Power Limited (OWPL), to support the Offshore Environmental Impact Assessment (EIA) Report for the West of Orkney Wind Farm hereafter referred to as 'the offshore Project'.

Following submission of the Application, this revised MMMP has been updated to reflect NatureScot interim advice 13 December 2023) which requested:

- Clarification of the discrepancies between the aforementioned tables [Tables 3-1 and 3-2 of the outline MMMP] and Tables 3-2 and 3-3 in the underwater noise modelling report (Supporting Study 11)] / documents to ensure the values presented for piling durations and number of hammer blows etc. are accurate.

Furthermore, it was confirmed via correspondence in May 2024 that NatureScot and MD-LOT required the language of the outline MMMP to be reviewed to ensure there is clarity regarding the Applicants' commitments to mitigation.

The revised MMMP remains an outline document, and further information will be provided post-consent once relevant Project parameters have been refined.

The information provided in this document is based on the current understanding of the baseline environment and how the offshore Project will be constructed and operated in compliance with current legislation and best practice at the time of writing. Information contained within this document is accurate at the time of submission and will be reviewed as required and updated if necessary.

This outline MMMP has been reviewed with regards to the proposed mitigation measures. A Piling Strategy will be prepared and finalised post consent. This outline MMMP will be updated once the Piling Strategy has been developed. The updated MMMP will form a final MMMP once agreed and approved by MD-LOT.

1.2 Objectives

This outline MMMP has been developed to inform potential mitigation options based on the findings presented in following supporting studies within the EIA:

• Marine mammal and megafauna (HiDef, 2023)	Offshore EIA Report – Chapter 12
• Marine mammal and megafauna baseline (HiDef, 2023)	Offshore EIA Report – Supporting Study 9 (SS9)
• Marine mammal underwater noise impact assessment (Sinclair *et al*., 2023)	Offshore EIA Report – Supporting Study 10 (SS10)
• Underwater Noise Assessment (Subacoustech, 2023)	Offshore EIA Report – Supporting Study 11 (SS11)
• West of Orkney Offshore EIA Report Addendum (HiDef, 2024)	Offshore EIA Report – Chapter 12

The key components of the offshore Project that require consideration of marine mammal mitigation are:

- Impact piling (fixed foundations):
  - Up to 125 Wind Turbine Generators (WTGs), with either monopile or jacket foundation;
  - Up to 5 Offshore Substation Platforms (OSPs) with jacket foundations;
- Unexploded Ordnance (UXO) clearance; and
- Site investigation surveys (geophysical).
- The following Sections outline the worst case scenarios considered in the EIA, together with a summary of impacts and available mitigation methods. The worst case scenario assessments undertaken to inform the EIA will be updated if

required, post consent to inform the Piling Strategy and UXO clearance methodology, and the mitigation measures required in the final agreed MMMP.

- The final MMMP will be required as a condition of consent for the Section 36 Consent and Marine Licences and will be submitted to MD-LOT for approval.

1.3 Consent compliance

The MMMP fulfils the consent conditions for the preparation of a MMMP as outlined in Table 1-1.

Table 1-1 Consent conditions relating to the MMP

Consent reference	Condition	Relevant Section
[To be added post consent]		

1.4 Relevant other documents and plans

This MMMP will form part of a set of approved documents (other consent plans required under the offshore consents) that provide the framework for the construction and operations and maintenance stages of the offshore Project.

The links of this MMMP with other consent plans specifically listed in the offshore consent conditions are detailed in Table 1-2.

Table 1-2 Links with other consent plants

Other consent plans/documentation	Linkage with MMMP
[To be added post consent]	

1.5 Structure of the plan

The structure of the document is as follows:

- Section 1 – Introduction;
- Section 2 - Project background;
- Section 3 – Piling;
- Section 4 - UXO clearance;
- Section 5 - Site investigation surveys (geophysical);
- Section 6 - Summary of mitigation measures;
- Section 7 – References;
- Section 8 – Abbreviations; and
- Annex I – Efficacy of an acoustic deterrent system.

2. Project Background

The Developer is proposing the development of the West of Orkney Windfarm ('the Project'), an Offshore Wind Farm (OWF), located approximately 23 kilometres (km) from the north coast of Scotland and 28 km from the west coast of Hoy, Orkney.

The offshore Project will comprise of WTGs and all infrastructure required to transmit the power generated by the WTGs to shore. The key offshore components of the offshore Project will include:

- Up to 125 WTGs with fixed-bottom foundations (monopile or piled jacket);
- Up to five High Voltage Alternating Current (HVAC) OSPs;
- Up to 500 km of inter-array cables;
- Up to 150 km of interconnector cables; and
- Up to five offshore export cables to landfalls at Greeny Geo and/or Crosskirk at Caithness, with a total length of up to 320 km (average of 64 km per offshore export cable).

The offshore Project boundary includes the array area and the offshore Export Cable Corridor (ECC) (Figure 2-1). The array area reflects the Option Agreement Area (OAA) awarded to OWPL through the ScotWind Leasing Round. Therefore, the offshore Project boundary encompasses:

- OAA – where the WTGs and associated foundations and supporting structures, inter-array cables, interconnector cables and the OSPs (including offshore export cable connections) will be located;
- Offshore ECC – within which the offshore export cables will be located; and
- Landfall (up to Mean High Water Springs (MHWS)) – where the offshore export cables come ashore and interface with the onshore Project.

[Section to be updated post-consent with final details of offshore Project]

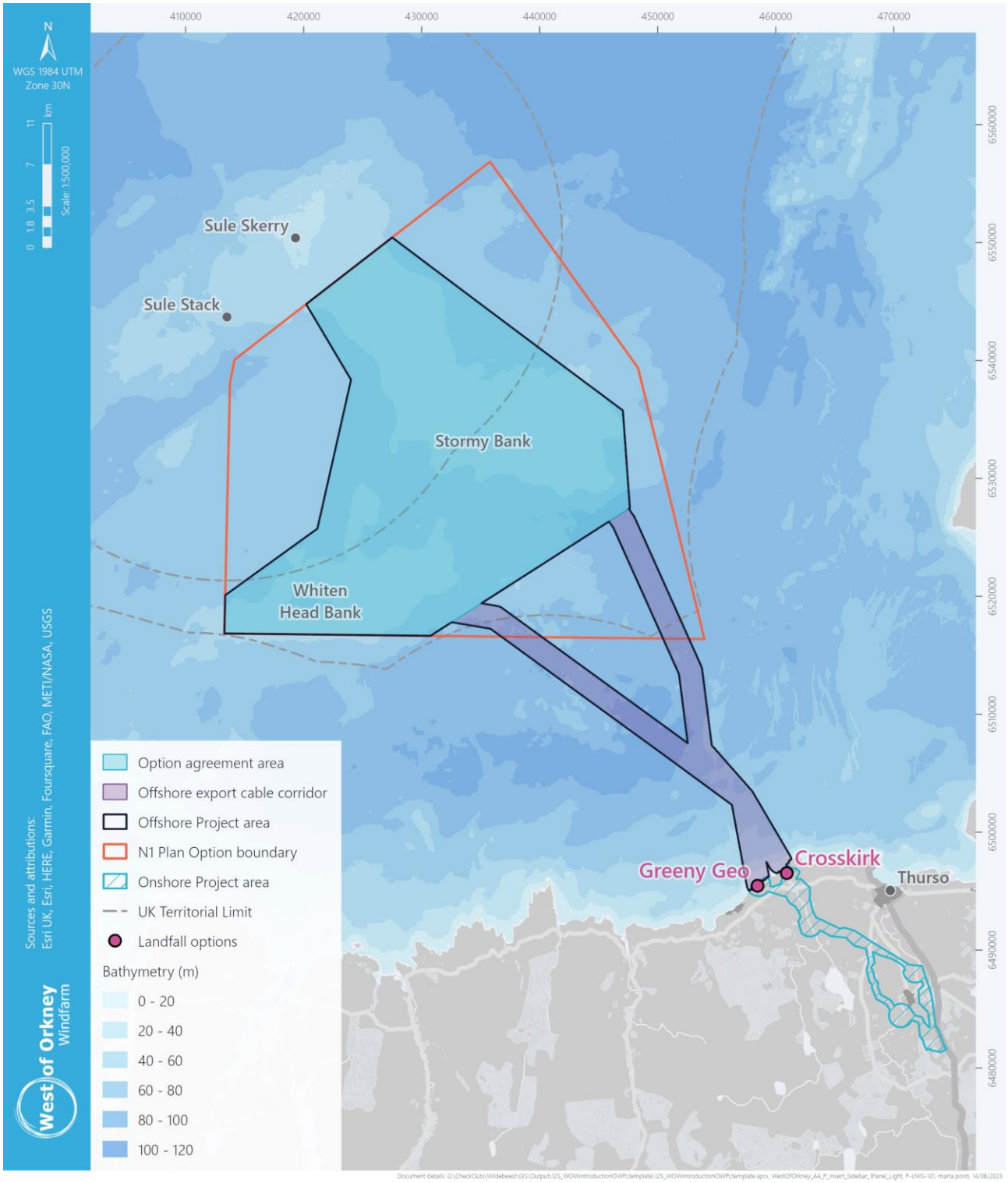

Figure 2-1 Offshore Project boundary

3. Piling

3.1 Scenarios considered

Subacoustech Environmental Ltd undertook modelling and analysis of the effects of piling noise on marine mammals based on the following scenarios (see SS11: Underwater noise modelling report for full details):

- A monopile foundation in hard sediment, installing a 14 m diameter pile with a maximum blow energy of 5,000 kJ, with one monopile installed in a 24-hour period;
- A monopile foundation in soft sediment, installing a 14 m diameter pile with a maximum blow energy of 3,000 kJ, with up to one monopile installed in a 24-hour period;
- A jacket pile foundation in hard sediment, installing 3 m diameter piles with a maximum blow energy of 3,000 kJ, with two piles installed in a 24-hour period; and
- A jacket pile foundation in soft sediment, installing 3 m diameter piles with a maximum blow energy of 3,000 kJ, with four piles installed in a 24-hour period.

Soft start and ramp up parameters[1] were also included in the modelling for the assessment of accumulated PTS-onset (Cumulative Sound Exposure Level (SEL_{cum})) (i.e. blow energies, total duration of piling and strike rate) (Table 3-1, Table 3-2 and Table 3-3).

Table 3-1 Summary of the soft start and rap up scenario used for the monopile foundation (hard sediment) modelling (SS11: Underwater noise modelling report)

Monopile (hard)	750 kJ		1,250 kJ	2,500 kJ	3,750 kJ	5,000 kJ
Number of strikes	60	400	400	400	400	45,500
Duration	10 mins	10 mins	10 mins	10 mins	10 mins	910 mins
Strike rate	6 bl/min		40 bl/min			50 bl/min
Single pile: 47,160 strikes, 16 hours total duration						

Table 3-2 Summary of the soft start and rap up scenario used for the monopile foundation (soft sediment) modelling (SS11: Underwater noise modelling report)

Monopile (soft)	450 kJ		750kJ	1,500 kJ	2,250 kJ	3,000 kJ
Number of strikes	60	400	400	400	400	21,500
Duration	10 mins	10 mins	10 mins	10 mins	10 mins	430 mins
Strike rate	6 bl/min		40 bl/min			50 bl/min
Single pile: 23,160 strikes, 8 hours total duration						

[1] 'Soft start' refers to the initial hammer energy used at the beginning of the pile installation. 'Ramp up' refers to the increasing hammer energy from the soft start to full hammer energy.

Table 3-3 Summary of the soft start and rap up scenario used for the jacket pile foundation (hard and soft sediment) modelling (SS11: Underwater noise modelling report)

Jacket pile (hard + soft)	450 kJ		750kJ	1,500 kJ	2,250 kJ	3,000 kJ
Number of strikes	60	400	400	400	400	9,500
Duration	10 mins	10 mins	10 mins	10 mins	10 mins	190 mins
Strike rate	6 bl/min	40 bl/min				50 bl/min
Single pile: 11,160 strikes, 4 hours total duration 2 piles (hard sediment): 22,320 strikes, 8 hours total duration 4 piles (soft sediment): 44,640 strikes, 16 hours duration						

3.2 Summary of impacts

3.2.1 Instantaneous PTS-onset

The maximum instantaneous PTS-onset predicted for VHF cetaceans (harbour porpoise) using unweighted Peak Sound Pressure Level (SPL_{peak}) was 720 m, and for all other species groups this was less than 100 m, typically 50-60 m (Table 3-4).

3.2.2 Cumulative PTS-onset

Whilst not used to define the mitigation zone (Section 3.3), cumulative PTS-onset is presented here for completeness. The modelling of SEL_{cum} used a fleeing animal approach. The impact ranges presented therefore represent the distance to a 'safe' starting position (see SS10: Marine Mammal Underwater noise impact assessment for cumulative PTS-onset uncertainties).

Maximum PTS-onset ranges were predicted for LF cetaceans (minke whale) using the SELcum criteria, with ranges of up to 47 km, and for Very High Frequency (VHF) cetaceans (harbour porpoise) PTS ranges are predicted up to 17 km. PTS-onset ranges for the other species groups were significantly smaller with less than 100 m for High Frequency (HF) cetaceans (dolphins) and 350 m for seals (Table 3-4).

Table 3-4 Summary of the worst-case pile driving[2] underwater noise modelling results for marine mammals, detailing instantaneous and cumulative PTS-onset impact ranges (SS9: Marine mammal and megafauna baseline)

Species	Instantaneous PTS-onset (SPLpeak) (km)	Cumulative PTS-onset (SELcum) (km)
Harbour porpoise (Very High Frequency; VHF)	0.72	17
Dolphins (High Frequency; HF)	<0.1	<0.1
Minke whale (Low Frequency; LF)	<0.05	47
Seals (Phocid Carnivores in Water; PCW)	<0.05	0.35

3.3 Mitigation methods

As agreed in the Marine Mammal Consultee meeting held 22nd March 2023 and the determination consultation 21st May 2024 with NatureScot and MD-LOT, the pre-piling mitigation requirements will be based upon the instantaneous risk of PTS-onset. This is consistent with other Scottish offshore wind developments (e.g. Beatrice Piling Strategy, 2017; Moray East Piling Strategy, 2019). Industry standard mitigation protocols (JNCC, 2010a) will be used to reduce the PTS-onset risk to negligible, based on the findings of the underwater noise modelling and assessment (SS10: Marine mammal underwater noise impact assessment; SS11: Underwater noise modelling report). The following Sections provide detail on the available mitigation methods typically employed when applying the JNCC mitigation protocols.

[2] Worst case scenario – 14 m diameter monopile; 5,000 kJ max hammer energy, hard sediment (SS11: Underwater noise modelling report).

3.3.1 Marine Mammal Observers (MMO)

The MMO team will be led by an experienced MMO, which is defined in the JNCC guidance as someone who is a trained observer with 3 years of field experience observing for marine mammals and practical experience of implementing JNCC guidelines. The role of the MMO(s) is to monitor the agreed Mitigation Zone (MZ) before piling can commence. The MZ is defined in JNCC (2010a) as the area over which an MMO keeps watch for marine mammals. Standard guidance is for the watch period to be no less than 30 minutes, with a standard MZ of no less than 500 m. The MMO(s) will visually confirm that the area is clear so that piling can commence. Depending on the Piling Protocol and vessels used, multiple MMOs may be required to ensure that the monitoring is not compromised in terms of 360-degree visibility, and/or observer fatigue.

The maximum instantaneous PTS-onset range predicted is 720 m based on the worst case scenario assessed in the EIA. This is beyond the minimum MZ of 500 m for piling; however, 720 m is a distance that can be effectively visually observed. The detailed protocol will be confirmed once the Piling Strategy has been developed (post consent).

3.3.2 Passive Acoustic Monitoring (PAM)

A passive acoustic monitoring system is used by a trained PAM operative to acoustically detect marine mammal presence. This method should be used in conjunction with visual observations, and/or as an alternative during periods of reduced visibility (dusk, night, inclement weather e.g. above sea state 4 (JNCC, 2010a)). PAM is typically used to monitor for 30 minutes prior to piling commencing. PAM is a useful supplementary monitoring method. It is worth noting the limitations of PAM in relation to detection distances for different species. For harbour porpoise this is typically approximately 300 m, therefore, it is important that a suite of complimentary methods is used.

Should an animal be detected either visually (MMO) or acoustically (PAM) within the mitigation zone, then there will be a delay to the commencement of the piling activity of 20 minutes. The MMO and PAM operative will track the detection to ensure that the animal(s) have left the mitigation zone. Confirmation from the MMO/PAM operative that the area is clear is needed before the piling activity can commence.

3.3.3 Acoustic Deterrent Device (ADD)

As no one mitigation method is 100% effective, ADD mitigation can be used as additional mitigation to supplement MMO/PAM to mitigate a larger impact area than can be covered by MMO and PAM measures. Whilst not required to mitigate the instantaneous PTS-onset ranges as predicted (720 m), the use of ADD mitigation will be considered within the Piling Strategy as good practice. ADD pre-piling mitigation has successfully been employed at other offshore wind developments (e.g. Beatrice Piling Strategy, 2017; Moray East Piling Strategy, 2019; Seagreen Piling Strategy, 2020; Moray West OfTI Piling strategy, 2022). MMO and PAM mitigation methods are passive, i.e. the occurrence of marine mammals in the MZ is monitored and if animals are observed, piling is not commenced until the area is clear. ADD pre-piling mitigation is active, such that the warning sound results in displacement of marine mammals from the MZ (A1. Annex 1 details the current knowledge regarding the efficacy of ADD mitigation).

MMO/PAM and, if used, ADD mitigation will be employed for a minimum of 30 minutes before the commencement of the piling activity. Within this period there may be other construction activities that take place in readiness for the piling activity.

It is noted that the NatureScot opinion on the consideration of cumulative PTS in an EPS risk assessment is currently under review. In the determination consultation 21st May 2024 with NatureScot and MD-LOT NatureScot acknowledged that cumulative PTS ranges are large over-estimates but suggested that cumulative PTS should be addressed in the EPS Risk Assessment Report in some way, though how is currently undecided. It is expected that this will require consultation and agreement post-consent before an EPS Risk Assessment Report is conducted. The EPS Risk Assessment will include the consideration of mitigation measures such as ADDs for cumulative PTS as required.

3.3.4 Soft Start Procedure

The soft start / ramp up procedure follows the MMO/PAM/ADD mitigation and is the incremental increase in hammer energy over a set period. Soft start is required by engineers when the pile first enters the sediment (Thompson *et al.,* 2020) The use of lower hammer energies at the beginning of the installation minimises noise exposure at the beginning of each piling sequence and allows marine mammals a longer period to flee before maximum hammer energies are reached. The noise generated by the soft start process is considered to act as a deterrent, together with effectively reducing the MZ from the modelled maximum (as this is assessed at highest hammer energy).

3.4 Reporting

Reporting will follow standard JNCC procedures (JNCC, 2010a) and will include:

- A report of MMO, PAM effort, and, if used, ADD activation, detailing durations of watch, any observations, and any non-compliances, or variation from agreed procedure;
- A log of piling activities:
  - date, location, and duration of piling – including soft start, ramp up and full power durations,
  - details of any delays, or stoppages of piling activity, and
  - a description of any technical issues, and what if any actions taken.

3.5 Additional content for the finalised MMMP

The finalised MMMP (as informed by the Piling Strategy) will detail a clear communications protocol between the mitigation personnel and the construction team. Roles and responsibilities will be defined, and a piling procedure will be detailed in terms of timing of mitigation steps and process to follow during piling mitigation including in the event of a planned, or unplanned break in piling.

4. Unexploded Ordnance (UXO) clearance

4.2 Scenarios considered

An assessment of the potential occurrence of unexploded ordnance was undertaken. Initial investigation, based on analysis (by an UXO specialist) of the extensive Project specific geophysical survey data available for the OAA and ECC, estimated that there could be 222 potential UXO (pUXO) targets (6Alpha, 2022). These may not all be UXOs, or they may not all need clearance. It is suggested that between 3-10% of these targets (6Alpha, 2022) may require clearance, which would mean that between 6 and 22 UXOs may require clearance. Regardless, the mitigation employed will be the same should there be one confirmed UXO or any number up to the maximum pUXO. The intended hierarchy of mitigation is:

- UXO avoided;
- UXO removed to a safe location;
- UXO detonated in-situ:
  - Low order methods; and
  - High order methods.

In accordance with the joint interim position statement (DEFRA, 2022) the use of low noise alternatives to high order detonations will be prioritised. The current recommendation is that mitigation should be in place to cover the worst-case scenario, i.e. high order detonation. This outline MMMP follows this advice.

The potential for PTS-onset was assessed in SS11: Underwater noise modelling report:

- Low order clearance – the noise levels emitted due to deflagration is related to the donor shape charge (Robinson *et al,* 2020). Low order impact has therefore been assessed based on the shape charge weight of 0.05 kg; and
- High order detonation – the noise level assessed was estimated on the maximum charge weight of 247 kg + 5 kg donor.

Recently published information (Abad Oliva *et al*, 2024) presents the results of noise monitoring conduced in the Moray Firth of the low-order deflagration clearance of 82 UXOs. The results from this study confirm that low-order deflagration produces significantly less noise than high order detonation. This study calculated that the worst-case PTS-onset noise levels were within 1.5km for the harbour porpoise functional hearing group. All available information will be considered in more detail for any future Marine Licence and European Protected Species (EPS) Licence applications should UXO clearance be required.

4.3 Summary of impacts

A UXO clearance event is defined as a single pulse (SS11: Underwater noise modelling report) therefore, an assessment using an accumulated dose is not appropriate (i.e. SEL_{cum}). Consequently, the impacts have been assessed using SPL_{peak} and Sound Exposure Level (single strike) (SEL_{ss}).

4.3.1 Instantaneous PTS-onset

Impacted ranges based on SPL_{peak} were greater than those predicted using SEL_{ss} and therefore have been used here to inform mitigation requirements (Table 4-1).

Table 4-1 A summary of predicted PTS-onset ranges (km) based on SPL_{peak} for low order (0.05 kg donor only) and high-order (247 charge weight + 5 kg donor)

Species	Low order (0.05 kg donor charge)	High order (247 +5 kg)
Harbour porpoise (VHF)	0.58 km	9.9 km
Dolphins (HF)	0.03 km	0.57 km
Minke whale (LF)	0.10 km	1.7 km
Seals (PCW)	0.11 km	1.9 km

4.4 Mitigation methods

Standard JNCC guidance is available for UXO mitigation (JNCC, 2010b). This follows a similar logic to the standard mitigation guidance for piling (MMO/PAM/ADD) but tailored for the injury risk from explosives.

4.4.1 Marine Mammal Observers (MMO)

The MMO team will be led by an experienced MMO (as defined in Section 4.3.1). JNCC (2010b) guidance sets out the minimum requirement of a 1 km MZ for explosives mitigation. It is probable that three MMOs will be required to fully observe the JNCC 1 km MZ. The number of personnel, however, will depend on the vessel types used for the clearance activity. Often one MMO is situated on the relatively small boat tasked to deploy the shape charges[3], initially located close to the UXO location. The elevation from this platform is unlikely to enable 1 km visibility. The second MMO is usually on a guard vessel, standing off at a distance of ~ 1 km. Observations from one point on the MZ boundary, means there is an effective 2 km range to monitor. Depending on the elevation available this may not be possible; therefore, a third MMO may be required to observe on the boundary opposite the guard vessel to provide full coverage. This requirement will be discussed and agreed for any future Marine Licence and EPS Licence applications should UXO clearance be required.

4.4.2 Passive Acoustic Monitoring (PAM)

Visual observation is ineffective during periods of darkness or poor visibility. Whilst it is likely clearance activities will only be conducted in the daytime / good visibility conditions, there may be occasion (e.g. for health and safety reasons) where clearance needs to occur at night / poor visibility conditions. In these instances, PAM would be used in combination with visual observations. Whilst there are limitations in detectability of certain species (e.g. harbour porpoise), PAM is recommended as supplementary mitigation.

Should an animal be detected either visually (MMO) or acoustically (PAM) within the mitigation zone, then there will be a delay to the commencement of the UXO clearance activity of 20 minutes. The MMO and PAM operative will track the detection to ensure that the animal(s) have left the mitigation zone. Confirmation from the MMO/PAM operative that the area is clear is needed before the UXO clearance activity can commence.

4.4.3 Acoustic Deterrent Device (ADD)

The worst case high order impact range predicted (Table 4-1) for HF cetaceans (delphinids) is within the 1 km MZ and therefore will be covered by MMO/PAM. The ranges for all other species extend beyond the standard MZ, therefore, ADD mitigation would supplement MMO/PAM (Annex 1 details the current knowledge regarding the efficacy of ADD mitigation). It is likely that the use of ADDs will reduce the risk for minke whales, as evidence shows minke whale individuals were observed fleeing from a Lofitech ADD at 1 km range from the ADD when activated (McGarry *et al.,*2017). The extent of fleeing was not fully assessed, but continuation of fleeing for a further 700 m is not unrealistic.

The worst-case high order PTS-onset range predicted for seals is 1.9 km. ADDs have only been shown to result in a behavioural response within 1 km, therefore for seals, ADD use may not add additional protection beyond 1 km. However, at this range without ADD mitigation, Table 7.1 in SS10: Marine mammal underwater noise impact assessment, predicts that < 1 harbour seal and 6 grey seals are at risk of PTS-onset at high order.

The worst-case high order PTS-onset impact range for harbour porpoise is 9.9 km. The impact range for harbour porpoise for a high order detonation is not fully mitigable with the suite of available mitigation methods. Therefore, low order clearance will be prioritised. If high order clearance methodology is unavoidable, there will be a residual risk of injury to harbour porpoise. Table 7.1 (in SS10: Marine mammal underwater noise impact assessment) illustrates that in the high order scenario 46 individuals are at risk of PTS-onset without ADD mitigation.

Fewer individuals than predicted will be affected if ADD mitigation is employed. Any residual risk will be assessed, and mitigation agreed during the Marine Licence and EPS Licence process once the number and size of UXOs is better understood, together with confirmation of the clearance methodology that will be used.

Where ADDs are used, conservative swimming speeds will be assumed for relevant species to determine an appropriate duration of ADD activation to deter animals out of the MZ while not causing more disturbance than necessary to mitigate PTS-onset.

[3] As outlined in SS11: Underwater noise modelling report, low order clearance involves the use of an initial shaped explosive donor charge.

4.4 Reporting

The reporting of marine mammal mitigation activities will follow JNCC (2010b) reporting guidance and will include:

- Where relevant, the reference number for the activity provided by the regulatory authority;
- Date and location of the activity;
- Details of the proposed operation, including information on the size of charges used, the start times of explosive detonations, the start and end times of watches by MMOs, the start and end times of any PAM, and details of all explosive activity during the relevant watches;
- Any marine mammal sightings summarised in completed “Marine Mammal Recording Forms". Although these have been developed for the seismic industry JNCC state they can be used for other applications, such as explosive use. All the forms and guidance for their completion are available on the JNCC website at http://www.jncc.gov.uk/page-1534; and
- Details of any ADDs used, and any relevant observations on their efficacy. Details of any problems encountered during the activity, including instances of non-compliance with the JNCC guidelines and any variations from the agreed procedure.

5 Site investigation surveys (geophysical)

5.1 Scenarios considered

Site investigation surveys during the pre-construction phase can result in injury or disturbance to marine mammal species depending on the acoustic characteristics of the equipment used. Pre-construction geophysical surveys for the Project may be performed using Multibeam Echosounder (MBES), Side Scan Sonar (SSS) (with piggybacked magnetometer) and Ultra-Short Baseline (USBL). Surveys using sub-bottom profilers are not planned.

There is likely to be overlap between the functional hearing of marine mammals (Table 5-1) and the sound frequency emitted from the intended geophysical survey equipment. The expected sound pressure level and frequencies for the different equipment types are presented in Table 5-2.

Table 5-1 Summary of generalised and best ranges of marine mammal functional hearing groups (NMFS, 2018, Southall *et al*., 2019)

Hearing group	Example species	Generalised Hearing range	Range of best hearing
LF (Low-Frequency cetacean)	Minke whale	7 Hz – 35 kHz	0.2 kHz – 19 kHz
HF (High-Frequency cetacean)	Delphinids	150 Hz – 160 kHz	8.8 kHz – 110 kHz
VHF (Very High-Frequency cetacean)	Porpoise	275 Hz – 160 kHz	12 kHz – 140 kHz
PCW (Phocid Carnivores in Water)	Seals	50 Hz – 86 kHz	1.9 kHz – 30 kHz

Table 5-2 Expected geophysical survey operating characteristics and overlap with marine mammal hearing capabilities (SS10: Marine mammal underwater noise impact assessment)

Equipment	Estimated source pressure level	Expected Sound Frequency	Overlap with functional hearing group			
			LF	HF	VHF	PCW
MBES	218 (peak), 213 dB rms	200 - 400 kHz	No - above all hearing ranges			

SSS	210 (peak), 242 dB rms	300 kHz & 900 kHz	No - above all hearing ranges			
USBL	194 (peak), 188 (rms)	20 – 35 kHz	No[1]	Yes[2]	Yes[2]	Yes[2]

[1] 'No' conclusion is based on the range of best hearing for LF cetaceans

[2] 'Yes' – the acoustic characteristics are within the functional hearing group range

5.2 Summary of impacts

Disturbance risk is negligible where there is no overlap between expected sound frequency range and the functional hearing of marine mammals. There may still be potential for injury (PTS-onset) if sound pressure levels are of a high enough magnitude; however, for equipment with frequencies above 200 kHz, this is likely only to be realised in close proximity to the survey vessel.

5.2.1 Instantaneous PTS-onset

Expected sound frequency content for MBES and SSS exceed all hearing ranges for the assessed functional hearing groups. Although estimated source pressure levels are above PTS-onset thresholds for VHF cetaceans, at these high frequencies, sound pressure levels rapidly attenuate below PTS-onset thresholds close to the noise source. Therefore, there is negligible risk to any marine mammal of PTS-onset.

The operating frequency of USBL overlaps with the range of best hearing frequency range of some of the assessed marine mammal groups but the estimated source pressure levels are below PTS-onset thresholds for all marine mammal species considered (Table 5-3). Therefore, there is no risk of injury to any assessed marine mammal species.

Table 5-3 PTS-onset thresholds from marine mammals exposed to impulsive noise. Peak SPL thresholds in dB re 1µPa (Southall *et al*., 2019)

Marine Mammal Hearing Group	PTS-onset: Peak SPL (unweighted) dB re1µPa
LF (Minke whale)	219
HF (delphinid)	230
VHF (porpoise)	202
PCW (seals-in water)	218

5.3 Mitigation methods

Mitigation for geophysical survey activities typically relies on MMO observations to ensure the PTS-onset zone is monitored before the geophysical equipment is activated (following JNCC, 2017 guidance). Depending on the level of risk, it is common for this role to be filled by a suitably trained crew member (dedicated to the task during the watch period). However, where the equipment in use operates at high frequencies (~>200 kHz) as is predicted here for the MBES and SSS, JNCC recommend that mitigation is not needed (JNCC *et al.,* 2010; DECC, 2011; JNCC, 2017). Further, there is no predicted risk of PTS-onset from the USBL equipment proposed.

Therefore, based on the equipment suggested for use during pre-construction geophysical surveys, it is not expected that any mitigation measures will be required. Depending on final equipment choices e.g. should USBL noise source levels be higher than have been accounted for, or alternative equipment is used, then mitigation measures (i.e. deployment of MMO and PAM) may be necessary.

7 Summary of mitigation measures

This outline MMMP presents indicative mitigation. Protocols will be refined and agreed in consultation with MD-LOT and NatureScot post-consent, to reflect refined Project parameters and to incorporate any new research outputs. The Piling Strategy and associated EPS Licence application and risk assessment will inform the final piling mitigation requirements, and once final

details of pre-construction geophysical surveys and UXO clearance activities are known final mitigation requirements for these activities will be developed. Adherence to a finalised agreed MMMP will be a consent condition of the Section 36 Consent/Marine Licences/EPS Licences.

A summary of mitigation options based on the worst case instantaneous auditory injury (PTS-onset) is presented in Table 7-1 below.

Table 7-1 Summary of worst-case impacts for impact piling, UXO clearance and geophysical surveys

Activity	Mitigation need[4]	Mitigation options / comments
Piling (PTS-onset; SPL_{peak})	720 m	MMO/PAM/ADD
Piling (disturbance)	--	None
UXO (PTS-onset; SPL_{peak}) High Order	9.9 km	Low order methods MMO/PAM/ADD
UXO (PTS-onset; SPL_{peak}) Low Order	580 m	MMO/PAM/ADD
UXO (disturbance)	--	None
Pre-construction Geophysical surveys (PTS-onset)	0 m	Not required (based on equipment assessed)

[4] Mitigation requirements indicated here are based on the worse case assessments presented in the EIA. Assessments will be updated as required post consent to inform final mitigation requirements.

8 References

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9 Abbreviations

Acronym/ abbreviation	Full Term
ADD	Acoustic Deterrent Device
ECC	Export Cable Corridor
EIA	Environmental Impact Assessment
EPS	European Protected Species
HF	High Frequency
HiDef	HiDef Surveying Ltd
HVAC	High Voltage Alternative Current
JNCC	Joint Nature Conservation Committee
km	kilometre
LF	Low Frequency
MBES	Multi-beam Echosounder
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Mammal Observer
MD-LOT	Marine Directorate - Licencing Operations Team
MHWS	Mean High Water Springs
MZ	Mitigation Zone
OAA	Option Agreement Area
OSP	Offshore Substation Platform
PAM	Passive Acoustic Monitoring
PCW	Phocid Carnivores in Water
PTS	Permanent Threshold Shift
pUXO	Possible Unexploded Ordnance
RaDIN	Range Dependent Nature of Impulsive Noise
SEL_{cum}	Cumulative Sound Exposure Level
SEL_{ss}	Sound Exposure Level (single strike)
SPL_{peak}	Peak Sound Pressure Level
SSS	Side Scan Sonar

Acronym/ abbreviation	Full Term
USBL	Ultra-Short Baseline
UXO	Unexploded Ordnance
VHF	Very High Frequency
WTG	Wind Turbine Generator

10 Glossary of terms

Term	Definition
[to be included post-consent]	

A1. Annex 1 – Efficacy of an acoustic deterrent system as pre-piling mitigation

Acoustic deterrent devices (ADDs) have been used as standard for all piling activity in Europe (Herschel *et al.*, 2013) whereas in the UK in general, ADDs are not a standard requirement. More recently, in Scotland ADDs have been used as sole mitigation in the Moray Firth (see Beatrice offshore wind farm and Moray East piling strategies), however the recommendation remains that ADDs are used in combination with MMO/PAM in advance of the soft start/ramp up process (JNCC, 2010).

Evidence of efficacy exists for (VHF) harbour porpoise, harbour seals and (LF) minke whale, but is lacking for grey seals and (HF) delphinid species.

The evidence currently is in relation to one brand of ADD, Lofitech and as such has been used so far as a multispecies deterrent. There are other brands available where evidence of efficacy is limited in the public domain but may be a suitable alternative.

Harbour porpoise

Brandt *et al.* (2013a) investigated the effects of a seal scarer (Lofitech) on harbour porpoise and found that there was a significant deterrence effect up to 7.5 km. Although porpoise detections were significantly reduced, this study did not show complete exclusion up to 7.5 km. However, within 750 m of the ADD, detections decreased between 52 % and 95 %. In a further study (Brandt *et al.,* 2013b), they observed harbour porpoise total avoidance of the seal scarer (Lofitech) within 1.9 km, and 50 % avoidance up to 2.4 km. There was no avoidance evident beyond 2.6 km. The differences in avoidance between these two studies may be due to differences in the environmental characteristics (e.g. seabed composition, depth of water column). The conclusion by the authors was that ADDs would deter animals out of potential danger zones.

Voβ *et al.* (2023) investigated the efficacy of an acoustic porpoise deterrent (e.g. FaunaGuard Porpoise module) and found that porpoise detection rates decreased by 30-100% at 750 m, and by 25-60% at 1,500 m. They highlight that although this was a small sample size (as detection rates were low before the deterrent was activated), detection rates were reduced up to distances of 2.5 km. They conclude that the acoustic porpoise deterrent was at least as effective as a seal scarer (e.g. Lofitech) but without the large-scale disturbance effect.

Thompson *et al.* (2020) monitored harbour porpoise during the construction of offshore windfarms in the Moray Firth, Scotland. Within the marine mammal monitoring programme, the authors conducted an experimental playback, using a Lofitech device. The ADD was active for 15 minutes, and the CPOD (a PAM device) detections evidenced avoidance responses. They found that there was ≥ 50 % chance of a response in the three hours following playback up to 21.7 km. This range reduced over six hours and twelve hours indicating porpoise return to the area (Figure A1-1). The minimum return time after exposure was 133 minutes (~ 2 hours).

The authors concluded that the observed changes in detections confirmed that harbour porpoise exhibited a strong behavioural response to ADD playbacks, and that the use of an ADD with the acoustic characteristics of the Lofitech (frequency content and sound level; ~ 14kHz and ~ 198 dB re 1 µPa (rms)) was potentially more effective than was needed for near field deterrence.

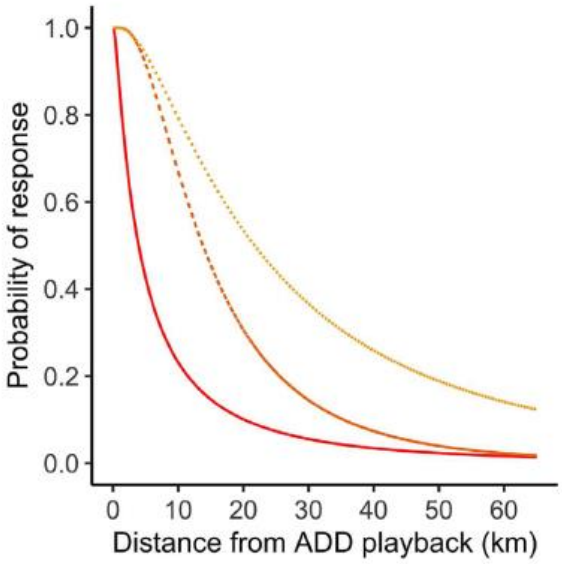

Figure A1-1 Reproduced from Thompson *et al.* (2020) The probability of a harbour porpoise response in relation to distance from ADD playback, over a period of 12 h (solid red line), 6 h (long dash orange line) and 3 h (short dash yellow line). Harbour porpoise occurrence was considered to have responded to ADD exposure when the proportional decrease in occurrence (DPH) exceeded a threshold of 0.5.

Minke whale

In 2017 ORJIP commissioned a study to investigate the responses of minke to an ADD (McGarry *et al.*, 2017). The Lofitech ADD was used as the potential mitigation ADD. Visual tracking of minke whales was undertaken in Faxaflói Bay, Iceland in August – September 2016. A total of 46 minke whales were tracked and in all cases the animal moved away when the Lofitech ADD was active, increasing their swim speed to an average of 15 kmh^{-1} (~4.2 ms^{-1}). These results suggest that the Lofitech ADD is effective in evoking a deterrence response in minke whales. The study showed a flight response to the ADD at distances of 500 m and 1 km; the study did not track the distance where the animal resumed normal activity. The study offered a recommendation that the duration of ADD activation should be twice the length of the injury zone.

Harbour seal

Gordon *et al.* (2019) tested the Lofitech ADD on tagged harbour seals in Scotland (Kyle Rhea and Moray Firth) at ranges of ~500 to 1,500 m. They found that animals typically responded to the Lofitech ADD out to a distance of 1,000 m. The percentage response decreased with increasing distance from the ADD source with 100% response out to 1,000 m and thereafter a steady decline was seen with the most distant group recorded at 4.1 km showing a 20% response (Gordon *et al.*, 2019). In this study, a "response" was not always a directed movement away from the sound source they found it depended on their activity and direction of travel at the time of the ADD activation. The minimum approach distance to the ADD was 473 m.

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