BUCHAN OFFSHORE WIND

Buchan Offshore Wind

Part 2.3 – Assessment on Special Areas of Conservation, Annex II Marine Mammals

Report to Inform Appropriate Assessment

QMS Review

Name	Company	Date	Reviewed	Approved
KGR/WBN	Natural Power	25/07/2025	LJN	SMM
RML	Buchan Offshore Wind	28/07/2025	RML	ISS

CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

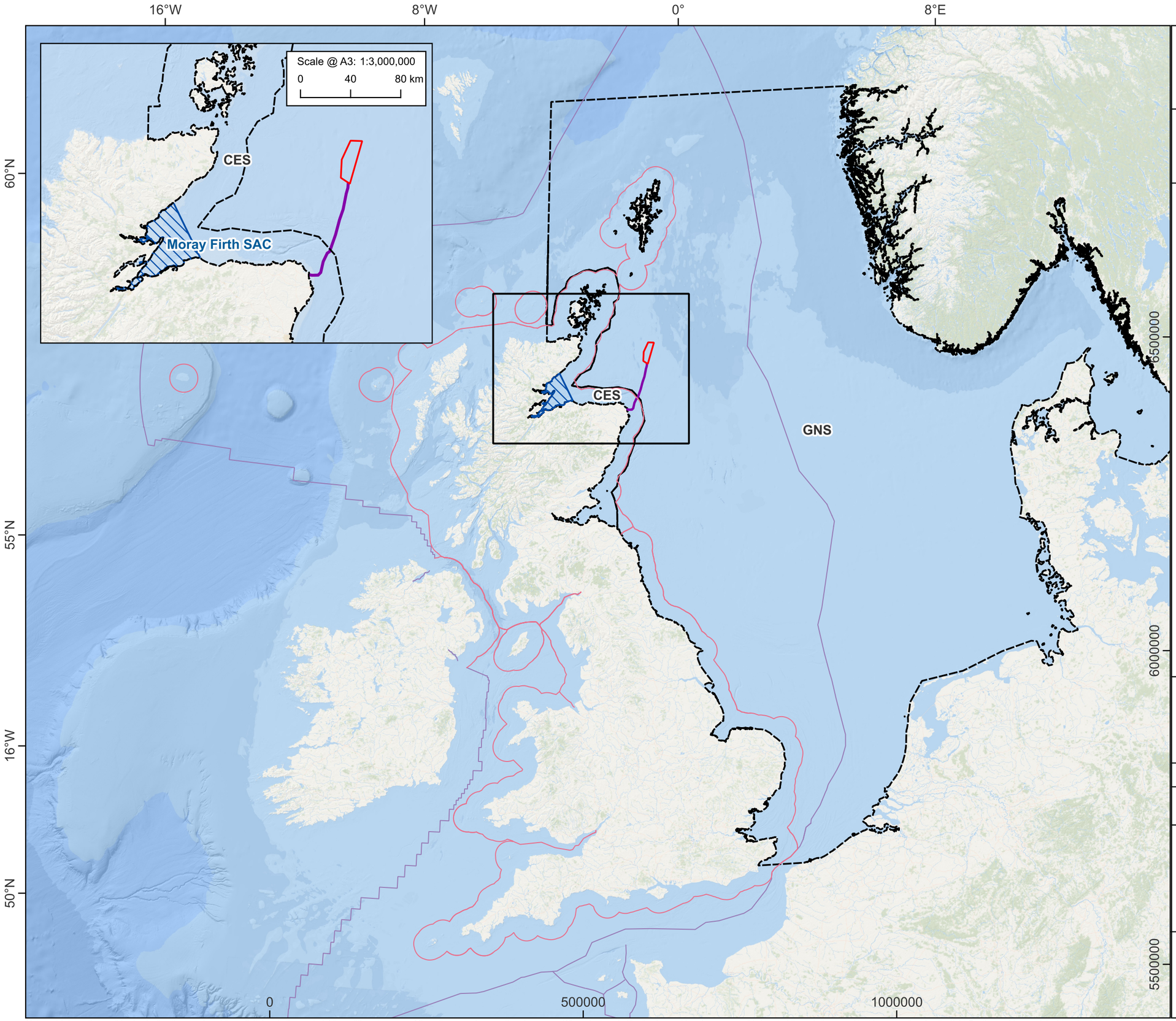
1. This document follows on from, and should be read in conjunction with, **HRA Part 1 – Report to Inform Appropriate Assessment** and **HRA Part 2.1 – Introduction to Special Areas of Conservation (SACs)** and presents the **HRA Part 2 – Assessment on SACs, Annex II Marine Mammals.**

2. This Section provides the background information and the approach taken to assess the potential impacts of the Proposed Offshore Development on European sites designated for Annex II marine mammals and to reach a conclusion on whether there are any adverse effects on the identified designated sites.

3. The potential for Likely Significant Effects (LSE) was identified for Annex II marine mammal species at 38 SACs (as presented in Section 3.2.3 of the **HRA Part 2.1 – Introduction to SACs, Figure 1-1, Figure 1-2 and Figure 1-3**).

4. Impacts arising during the construction, operation and maintenance, and decommissioning phases of the Proposed Offshore Development were considered (as presented in **Table 3.2** of the **HRA Part 2.1 – Introduction to SACs**).

5. The assessment of adverse effect on the Proposed Offshore Development alone and in-combination are presented in **Section 5** and **Section 6**, respectively.



Project:

Buchan Offshore Wind Farm, Onshore EIA Report

Title:

Figure 1-1: SACs Designated for Bottlenose Dolphin

Key

- Application site boundary
- Export Cable Corridor (ECC)
- UK Exclusive Economic Zone (EEZ)
- UK territorial waters

Bottlenose Dophin Management Unit (MU) defined by IAMWWG

- CES - Coastal East Scotland
- GNS - Greater North Sea

Designated site

- Special Area of Conservation (SAC)

Scale @ A3: 1:6,000,000

Coordinate System: WGS 84 UTM 30N

N

0 80 160 240 320 km

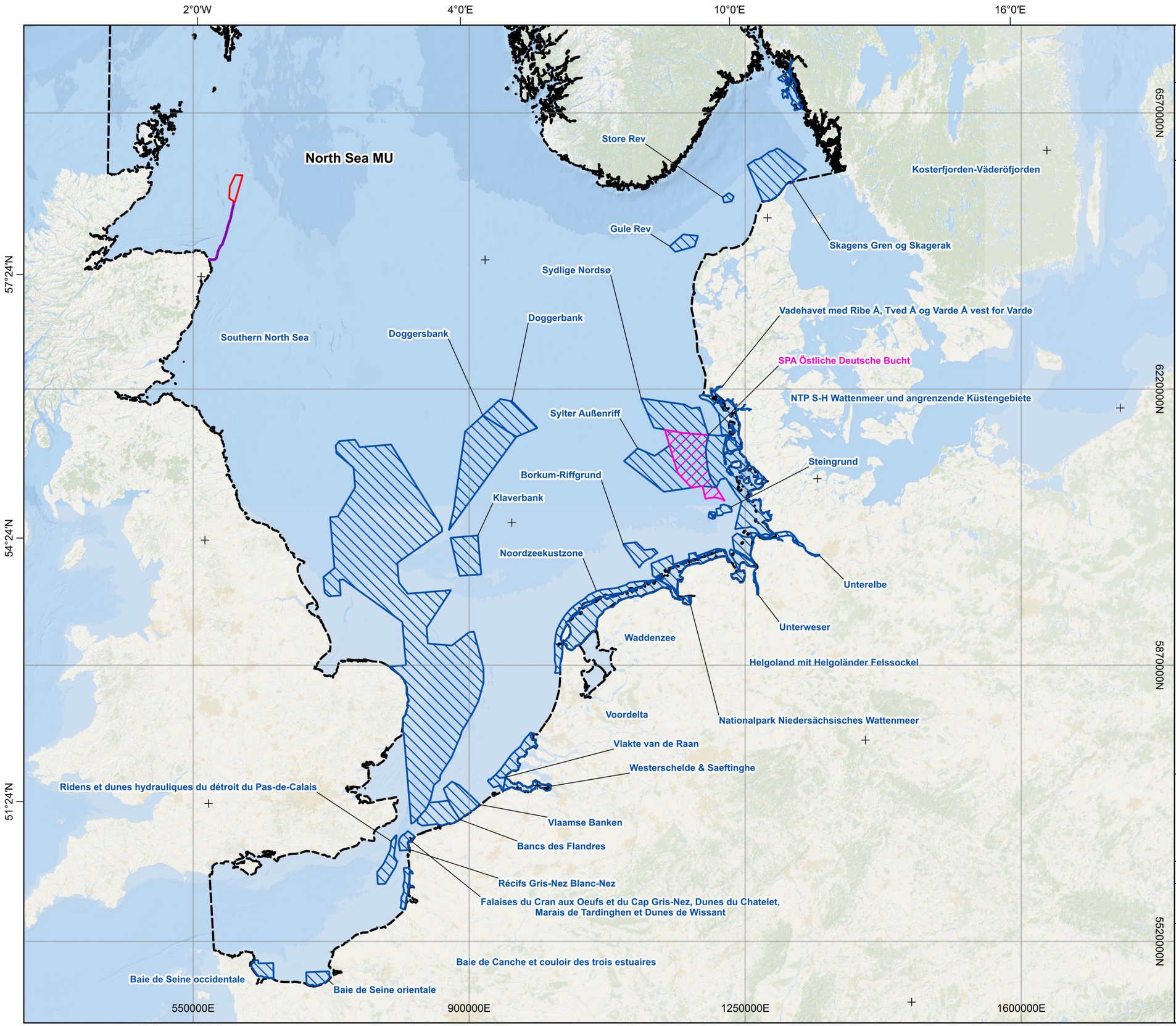
Date: 18-07-25	Prepared by: NN	Checked by: WB

EIA Ref No: BUC-C-MP-NP-0211

Map Ref: GB204095_M_297_A

Drawing by:
The Natural Power Consultants Limited
The Green House
Forrest Estate, Dalry
Castle Douglas, DG7 3XS, UK
Tel: +44 (0)1644 430008
Fax: +44 (0)845 299 1236
Email: sayhello@naturalpower.com
www.naturalpower.com

Client:
Buchan Offshore Wind Limited
Suite 3b, 58 Waterloo Street,
Glasgow,
United Kingdom,
G2 7DA



Project:

Buchan Offshore Wind EIA

Title:

Figure 1-2: SACs Designated for Harbour Porpoise

Key

- Array Area
- Export Cable Corridor (ECC)
- Harbour porpoise Management Unit (MU) defined by IAMMWG

Designated site

- Special Area of Conservation (SAC)
- Special Protection Area (SPA)

Scale @ A3:1:4,800,000

Coordinate System: WGS 84 UTM Zone 30N
Graticules: WGS84

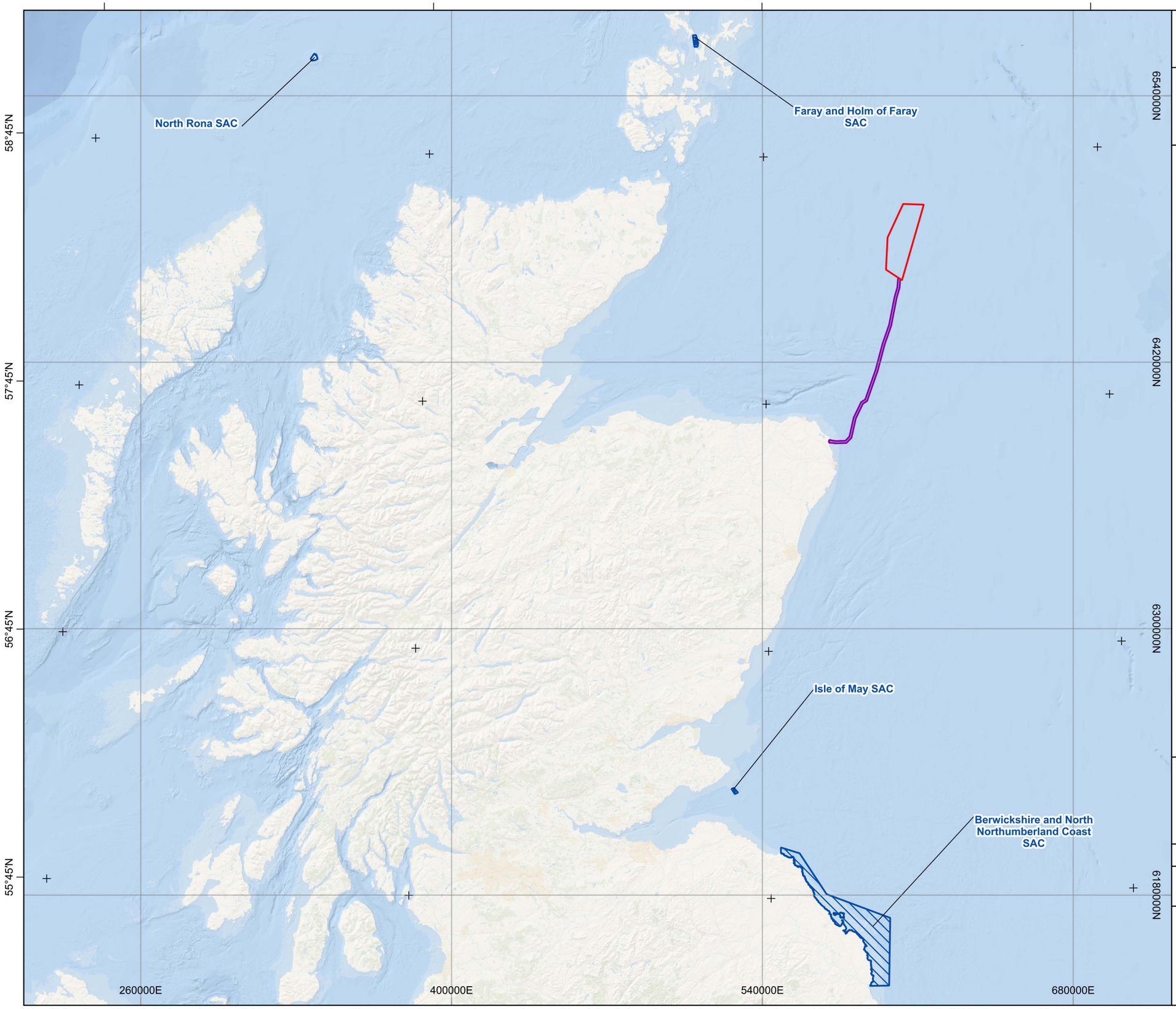
N

0 50 100 150 200 km

Date: 18-07-25	Prepared by: NN	Checked by: WB

EIA Ref No: BUC-C-MP-NP-0212
Map Ref: GB204095_M_298_A

BUCHAN OFFSHORE WIND



Project:

Buchan Offshore Wind EIA

Title:

Figure 1-3: SACs Designated for Grey Seal

Key

- Array Area
- Export Cable Corridor (ECC)

Designated site

- Special Area of Conservation (SAC)

Scale @ A3:1:1,700,000

Coordinate System: WGS 84 UTM Zone 30N
Graticules: WGS84

N

0 50 100 150 200 km

Date: 18-07-25	Prepared by: NN	Checked by: WB

EIA Ref No: BUC-C-MP-NP-0213
Map Ref: GB204095_M_299_A

BUCHAN OFFSHORE WIND

2 GENERAL FEATURE ACCOUNTS

6. Detailed feature accounts on bottlenose dolphins, harbour porpoise and grey seals are provided in full in **Volume 3, Appendix 10.1: Marine Mammals Baseline Report** of the Environmental Impact Assessment Report (EIAR) for the Proposed Offshore Development.

2.1 BOTTLENOSE DOLPHIN

7. Both inshore and offshore bottlenose dolphin ecotypes are recognised in UK waters (Hague *et al*., 2020; Darias-O'Hara and Sinclair, 2020; IAMMWG, 2023). The distribution of bottlenose dolphins within and around the Proposed Offshore Development Site is generally represented by the inshore ecotype which occurs in coastal waters; they are therefore more likely to occur in the ECC, rather than the Array Area. The inshore bottlenose dolphins are members of the east coast of Scotland population which has high connectivity between the Moray Firth SAC, the Firth of Forth (Cheney *et al*., 2013, Quick *et al*., 2014) and Flamborough Head (based on current evidence presented by Grant Ellis at the Forth and Tay Regional Advisory Group (Marine Mammals) meeting on the 12.11.2024). Bottlenose dolphins from this population are present year-round, increasing in number (Cheney *et al.,* 2024) and are the only bottlenose dolphin population which are a qualifying feature of a designated site with connectivity with the Proposed Offshore Development (there are no designated sites for offshore bottlenose dolphins).

8. An inferred density surface for the east coast of Scotland bottlenose dolphin population was created using the most recent population (2020 to 2022) estimate for the Coastal East Scotland Management Unit (MU) of 226 (95% CI: 214 to 239; Cheney *et al*., 2024). This estimate has been used as the reference population for this species (see **Section 2.4**) because it is more recent than the estimate presented in IAMMWG (2023) of 224 individuals (95% confidence interval of 214-234).

9. To create the inferred density surface the overall range of the east coast of Scotland bottlenose dolphin population was assumed to extend from the Moray Firth SAC to the southern extent of the Coastal East Scotland MU (IAMMWG, 2023). Outwith the Moray Firth SAC, the range of the east coast of Scotland population was defined using the 20 m depth contour which was used to differentiate between the 'coastal strip' (where bottlenose dolphins from this population tend to be encountered) and the 'non-coastal strip' (where bottlenose dolphins from this population tend not to be encountered). The choice of the 20 m depth contour was informed by data from the south side of the Moray Firth where > 95 per cent of sightings made were within the 20 m depth contour (Culloch and Robinson, 2008; Robinson *et al.*, 2007) and down the east coast of Scotland (Quick *et al*., 2014). Given the evidence on bottlenose dolphin use of the whole Moray Firth SAC (Bailey and Thompson, 2009), the whole SAC was included even though it extended beyond the 20 m depth contour as a conservative approach.

10. The SCANS-III Block S density (0.0037; Hammond *et al*., 2021) was used for the offshore bottlenose dolphin population.

2.2 HARBOUR PORPOISE

11. The harbour porpoise is widespread around the UK, including the North Sea, Irish Sea, the seas west of Ireland and Scotland, and northwards to Orkney and Shetland. Since the 1990s it has become much less common around the Northern Isles, but it appears to be returning

to the English Channel and southern North Sea, where it was infrequent in the late 1980s[1]. The recent SCANS-IV survey results show that the harbour porpoise population in the North Sea is stable and there is very little difference in the estimated abundance from 2016 – 2022 (Gilles *et al*., 2023).

12. Harbour porpoises were the most numerous marine megafauna species detected during the baseline site-specific DAS and were detected during most months with 142 detections being made overall (**Volume 3, Appendix 10.1: Marine Mammal and Megafauna Baseline** in the EIAR). The overall average design-based density was estimated to be 0.37 animals/km^2 (95% CI: 0 – 1.18).

13. The density surface for harbour porpoise was derived using the SCANS-IV design-based density estimates for the relevant survey blocks (Gilles *et al*., 2023). Densities (**Table 2-1**) were considered uniform within each survey block. Since confidence intervals around the density estimates were not provided by Gilles *et al*. (2023), confidence intervals were calculated by dividing the confidence intervals associated with the abundance estimates for harbour porpoise in the SCANS-IV report (Gilles *et al*., 2023) by the area of the survey block. The resulting confidence intervals are presented in **Table 2-1**.

14. The reference population for this species is 159,632 (95 % CI: 127,442 – 199,954) which is the UK portion of the Celtic and Greater North Seas MU abundance (IAMMWG, 2023; see **Section 2.4**). Abundance in the whole MU is 346,601 (95 % CI: 289,498 – 419,967).

Table 2-1: Harbour porpoise abundance and density across the relevant SCANS-IV survey blocks. LCI and UCI are the estimated lower and upper 95% confidence intervals

Species	Block	Block Area (km^2)	Abundance	LCI	UCI	Density	LCI	UCI
Harbour porpoise	NS-D	64,455	38,577	18,017	76,361	0.5985	0.2795	1.1847
	NS-E	65,423	33,735	21,757	50,324	0.5156	0.3326	0.7692
	NS-F	60,051	26,383	13,562	49,008	0.4393	0.2258	0.8161
	NS-G	49,672	51,646	30,773	79,506	1.0398	0.6195	1.6006
	NS-J	63,546	30,050	16,513	48,211	0.4729	0.2599	0.7587
	NS-K	38,339	4,740	1,337	9,414	0.1236	0.0349	0.2455
	CS-J	32,499	3,231	620	7,758	0.0994	0.0191	0.2387
	CS-K	40,378	11,357	4,946	21,173	0.2813	0.1225	0.5244

2.3 GREY SEAL

15. Grey seals are among the rarest seals in the world; the UK population represents about 40% of the world population and 95% of the EU population[2]. Grey seals spend most of the year at sea and may range widely in search of prey. They come ashore in autumn to form breeding colonies on rocky shores, beaches, in caves, occasionally on sandbanks, and on small largely uninhabited islands.

16. Four grey seals and 11 seals not identified to species level were detected during the baseline site-specific DAS (**Volume 3, Appendix 10.1: Marine Mammal and Megafauna Baseline** of

[1] https://sac.jncc.gov.uk/species/S1351/

[2] https://sac.jncc.gov.uk/species/S1364/

the EIAR). All grey seal sightings were in the first year of surveys with one seal being detected in March 2022, May 2022, August 2022 and December 2022 respectively. From design-based abundance estimation, overall average density was estimated to be <0.01 animals/km^2 (95% CI: 0 – 0.01).

17. At-sea density surfaces for grey seals were derived by scaling the UK-wide relative density surfaces provided by Carter *et al.* (2022). Carter *et al.* (2022) used telemetry data from grey seals (n = 114), collected from 26 sites across the UK and Ireland between 2005 and 2019. These telemetry data were modelled and used to predict seal relative at-sea densities over a 5 km x 5 km grid. To obtain an annual estimate of absolute at-sea density, the predicted relative density needed to be scaled using population estimates.

18. Current population assessments for grey[3] seals are carried out using aerial surveys during the month of August (SCOS, 2022). These numbers only represent hauled out individuals during the summer months, thus to obtain an annual estimate for at-sea individuals, population counts were corrected first for the proportion of hauled-out individuals during the summer months (taken from Russell and Carter (2021)) and then by the annual estimates of the proportion of the population expected to be at sea (SCOS, 2021). The equation to calculate annual at-sea estimate for scaling Carter surfaces was:

$$\widehat{N} = \frac{N}{H} \times S$$

Where N is the hauled out population count (**Table 2-2**), H is the haul out proportion, and S is the proportion at sea. The annual at sea estimate ($\widehat{N}$) was distributed across the relative density surface raster provided by Carter *et al.* (2022). This was achieved by multiplying the relative density given in Carter *et al.* (2022) as a proportion, by $\widehat{N}$, so that the sum of the abundance across the raster equalled the population estimate across the UK and Ireland. Values used are provided in **Table 2-2**. This method was used to create estimates of absolute abundance across UK and Irish waters, at 5 x 5 km resolution. The density per grid cell was also calculated by dividing the abundance by the cell area, resulting in a density of seals per km^2.

19. This process resulted in final expected at-sea abundances of 153,591 for grey seal which was used to scale the Carter *et al*. (2022) surfaces.

20. The reference population for grey seal is 100,250 (see **Section 2.4**).

Table 2-2: Input values used for grey seal relative density surface scaling.

Species	Count (hauled out, August) (N)	Proportion hauled out in August (low-high estimates) (H)	Total population size	Annual at-sea proportion (S)	Annual at-sea estimate for scaling Carter surfaces ($\widehat{N}$)
Grey seal	44,833	0.2515 (0.2907 - 0.2145)	178,262 (154,224 – 209,012)	0.8616	153,591 (132,880 – 180,084)

Source: Grey seal proportion hauled out from Russell and Carter (2021).

[3] Grey seal populations are also surveyed and estimated during their pupping season (SCOS, 2022).

2.4 REFERENCE POPULATIONS

21. Reference populations (defined in the form of species-specific MUs) are available for marine mammals in the UK to help the Statutory Nature Conservation Bodies (SNCBs) assess the environmental impacts of marine developments. For cetaceans (e.g. bottlenose dolphin and harbour porpoise) these are defined by the Inter-Agency Marine Mammal Working Group (IAMMWG) and are based on best understanding of the population structure of each species, taking into account jurisdictional boundaries and divisions already used for the management of human activities. For grey seals, MUs (sometimes referred to as management areas) were originally defined for considering licence applications to shoot seals in Scotland[4].

22. Reference populations (**Table 2-3**) for harbour porpoise have been drawn from IAMMWG (2023). For the east coast of Scotland bottlenose dolphin population a more recent estimate was used (Cheney *et al*. 2024)

23. The reference populations for grey seals (**Table 2-4**) has been drawn from Morris *et al*. (2022a).

Table 2-3 The most recent cetacean reference population abundance estimates for the relevant Management Units (MUs; IAMMWG, 2023; Cheney et al., 2024)

Species	Management Unit	Abundance of animals in the UK portion of the MU (95% CI)	Abundance of animals in the MU (95% CI)
Bottlenose dolphin – inshore population	Coastal East Scotland	226 (214 – 234)	
Harbour porpoise	North Sea	159,632 (127,442 – 199,954)	346,601 (289,498 – 419,967)

Table 2-4 The most recent grey seal reference population abundance estimates for the relevant MUs (Morris et al., 2022)

Management Unit	Minimum population estimate (N_{min})	Abundance of animals in the MU (95% CI)
3 - Western Isles	21,512	n/a
4 - North Coast and Orkney	32,043	n/a
5 - Shetland	3,760	n/a
6 - Moray Firth	6,916	n/a
7 - East Scotland	10,106	n/a
8 - Northeast England*	-	25,913 (22,418 – 30,382)
Total	**100,250**	

* No Potential Biological Removal (PBR) N_{min} estimates are available for non-Scottish MUs.

24. Therefore, the most recent (2021) August count (6,517 grey seals; Morris *et al*., 2022a) and a scalar to account for the proportion of the population which was at sea when the count was

[4] https://marine.gov.scot/information/seal-management-areas

made (25.15% (95% CI: 21.45-29.07%); Russell and Carter, 2022) were used to estimate abundance in the Northeast England MU.

3 POTENTIAL IMPACTS AND METHOD OF ASSESSMENT

25. This section details the potential impacts, an overview of underwater noise and the modelling used in assessments and the overall effect assessment.

3.1 UNDERWATER NOISE

3.1.1 Overview of the Potential Effects of Anthropogenic Noise on Marine Mammals

26. It is widely documented that marine mammals are sensitive to underwater noise with the level of sensitivity depending on the hearing ability of the species. Potential effects of underwater noise on marine mammals can be summarised as:

- auditory injury; and
- behavioural responses.

27. The hearing groups which represent Annex II marine mammal species are presented in **Table 3-1**.

Table 3-1 Annex II marine mammal hearing groups

Functional hearing group	Example species	Estimated auditory bandwidth (kHz)
High frequency cetacean	Bottlenose dolphin	0.15 - 160
Very high frequency cetacean	Harbour porpoise	0.2 - 160
Phocid carnivores in water	Grey seal	0.05 - 86

Source: Southall et al. (2019)

3.1.1.1 Auditory Injury

28. Southall *et al.* (2019) provide thresholds for received sound levels that have the potential to induce the onset of auditory injury (instantaneous Permanent Threshold Shift – PTS (SPL_{peak}) and cumulative PTS (SEL)) in marine mammals. The thresholds for Annex II marine mammal hearing groups are provided in **Table 3-2**. Due to the characteristics of the sound and thus the potential to induce the onset of auditory injury, two thresholds (for impulsive and non-impulsive noise) are provided. Sound from piling and acoustic survey and positioning equipment is generally impulsive (whereas sound from other sources e.g., vessels, is non-impulsive i.e., continuous). It is worth noting that the criteria refer only to the 'onset' of injury risk rather than a confident assessment of an occurrence of the effect. Within the assessment the potential for auditory injury was assessed based on impact ranges from the noise source within which animals may be exposed to sound levels above the thresholds.

29. Exposure to lower sound levels has the potential to cause a Temporary Threshold Shift (TTS). Although the potential for TTS onset was modelled (**Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR), it has not been assessed other than as a proxy for disturbance as a result of UXO clearance work if it is required.

Table 3-2 Permanent threshold shift (PTS) thresholds

Functional hearing group	Example species	Impulsive		Non-impulsive
		Peak Sound Pressure Level (SPL_{peak}) (dB re 1 µPa)	Sound Exposure Level (SEL) (dB re 1 μPa^2s)	SEL (dB re 1 μPa^2s)
High frequency cetacean	Bottlenose dolphin	230	185	198
Very high frequency cetacean	Harbour porpoise	202	155	173
Phocid carnivores in water	Grey seal	218	185	201

Source: Southall et al. (2019)

3.1.1.2 Behavioural Responses

30. Behavioural responses in marine mammals may arise where an activity is audible (**Table 3-1**) and at a level above ambient noise. The type and severity of a behavioural response may vary depending on the characteristics of the noise (received exposure level, impulsiveness and frequency), species-specific sensitivities (e.g., it is thought that harbour porpoises are particularly sensitive to noise, some species are more tolerant, and some species' response probability depends on behavioural state (Southall *et al.,* 2007; Southall *et al.,* 2021)), whether an individual has experienced the noise before (i.e., habituation or sensitisation, although both are difficult to identify and prove (Bejder *et al.,* 2009)) and context (Benhemma-Le Gall *et al.,* 2023).

31. As a result of the variability in behavioural responses between species, different populations and individuals it has been concluded that all-or-nothing thresholds for behavioural responses are not appropriate and may underestimate effects considerably (Tyack and Thomas, 2019; Southall *et al.,* 2021). For pile driving noise, exposure-response probabilistic functions are currently believed to be more appropriate (i.e., dose-response relationships; Graham *et al*., 2019; Whyte *et al*., 2020) where available.

32. However, to provide additional context to the impact ranges estimated using the thresholds, Effective Deterrence Ranges (EDRs) were also used to assess the potential for disturbance as a result of pile driving, UXO clearance work if required, and use of survey and positioning equipment (e.g., Sub-bottom Profiler (SBP) and Multibeam Echosounder (MBES)). The recommended EDRs (JNCC, 2023a) were derived for harbour porpoises but, without suitable alternatives, have been used to assess the potential for behavioural responses for all Annex II marine mammal species.

33. For other underwater noise sources (i.e. operational noise) EDRs are not available to assess behavioural responses. For these noise sources behavioural responses have been assessed using the best available evidence combined with professional judgement.

3.1.2 Underwater Noise Modelling

34. Underwater noise modelling was undertaken by Subacoustech Environmental (**Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR) to inform the assessment of the potential impact of underwater noise on marine mammals and fish during the construction, operation and decommissioning of the Proposed Offshore Development.

35. The underwater noise modelling report includes:

- background information covering the units for measuring and assessing underwater noise, and a review of the underwater noise metrics and criteria used to assess the possible environmental effects in marine receptors;
- discussion of the approach, input parameters, and assumptions for the detailed impact piling modelling undertaken;
- presentation and interpretation of the detailed subsea noise modelling for impact piling with regards to its effect on marine mammals and fish; and
- modelling of other noise sources expected around the construction, operation and decommissioning of the Proposed Offshore Development, including operational noise, wind turbine generator (WTG) noise and UXO clearance.

36. The underwater noise modelling was undertaken by Subacoustech Environmental using version 5.3 of their model INSPIRE. The methods used meet the requirements set by the National Physical Laboratory (NPL) Good Practice Guide 133 for underwater noise measurement (Robinson *et al*., 2014).

3.2 IMPACT 1 - INCREASED UNDERWATER NOISE – PILE DRIVING (CONSTRUCTION PHASE)

37. Underwater noise from pile driving has the potential to induce the onset of auditory injury (PTS) and behavioural responses to Annex II marine mammals. Piling noise generated during the construction period will be intermittent. Evidence suggests that some animals will continue to use the area during construction (e.g., Graham *et al*., 2017; Benhemma-Le Gall *et al*., 2021; Fernandez-Betelu *et al*., 2021) while animals which may have been displaced during noisy activities including pile driving will return to the area either immediately following departure of the vessel (decommissioning of an oil and gas platform in the Moray Firth; Fernandez-Betelu *et al*., 2024), quickly once activities cease (pile driving in the Solway Firth; Vallejo *et al*., 2017), or within a few hours (commercial two-dimensional seismic survey in the Moray Firth; Thompson *et al*., 2013).

38. The Maximum Design Scenario (MDS) considered within the assessment of increased underwater noise from pile driving is shown in **Table 4-1** and embedded mitigation measures in **Table** 4-2.

3.2.1 Approach to Pile Driving Assessment

39. The potential effects of pile driving have been assessed using the following methodology:

- description of the spatial distribution of Annex II marine mammals (**Section 3.2.1.1**);
- assessment of the spatial distribution of piling noise under different scenarios (**Section 3.2.1.2**); and
- integration of the marine mammal and piling noise spatial distributions to estimate the numbers of individuals which have the potential to be impacted (including use of the harbour porpoise (Graham *et al*., 2019) and harbour seal (Whyte *et al*., 2020) dose-response relationships for disturbance (used as a proxy for grey seals); **Section 3.2.1.3**). EDRs (Benhemma-Le Gall *et al*., 2024; JNCC, 2023a) have also been used to assess the potential for disturbance (**Section 3.2.1.3**); and

Prediction of population level effects (using the interim Population Consequences of Disturbance (iPCoD) model[5]). iPCoD has been used where significance of effect could not be ruled out using non-population modelling approaches (**Section 3.2.1.4**).

3.2.1.1 Description of the Spatial Distribution of Annex II Marine Mammals

40. The spatial distribution of Annex II marine mammals is described in **Section 2**. Density surfaces have been presented for each species.

3.2.1.2 Assessment of the Spatial Distribution of Piling Noise

41. Full details of the underwater noise modelling undertaken by Subacoustech Environmental using INSPIRE v5.3 can be found in **Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR. This section provides a summary of the key information.

42. Underwater noise modelling was undertaken at five representative locations; four covering the extents of the Array Area and one covering the Intermediate Reactive Compensation (IRC) (**Table 3-3**; see Figure 3-7 in **Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR). The five locations cover potential WTG, Operation Substation Platform (OSP) and IRC locations, giving a spread of various water depths, distances to shore and into deeper water to the north and east of the Array Area.

Table 3-3 Underwater noise modelling locations

Modelling location	Latitude (°N)	Longitude (°W)	Water depth (m)
NE corner	58.5446	001.0636	108.4
SE corner	58.2415	001.2473	88.6
W corner	58.4516	001.3500	100.1
Centre (OSP)	58.4063	001.2330	98.8
IRC	57.9112	001.4419	119.4

43. Two single location scenarios (Scenario 1 and Scenario 2) were modelled for the WTG anchors (**Table 3-4**; **Table 3-5**).

44. One concurrent scenario (i.e., three piling vessels) was also modelled (eight sequentially installed anchor piles at the NE, SE and W corners of the Array Area) which follows Scenario 1 but includes an additional slow start period of 10 minutes (**Table 3-6**).

45. One single location scenario was modelled for the OSP piles (**Table 3-7**) and one for the IRC piles (**Table 3-8**).

[5] iPCoD is a tool which may be used to assess and quantify the potential consequences for marine mammal populations of any disturbance and/or injury that may result from offshore energy developments. It was designed to use the kinds of information that are likely to be provided by developers in their Environmental Statements and HRAs. It allows the user to predict the population consequences of disturbance and/or injury on five key priority species of marine mammal found in the UK (minke whale, bottlenose dolphin, harbour porpoise, grey seal and harbour seal) (https://marine.gov.scot/information/interim-population-consequences-disturbance-model-ipcod).

Table 3-4 Soft start and ramp up parameters used for WTG anchor Scenario 1 (single location, eight piles per day)

% energy (kJ)	10% (180 kJ)	30% (540 kJ)	50% (900 kJ)	100% (1,800 kJ)
No. of strikes	200	400	400	1,600
Duration (min)	20	10	10	40
Strike rate (blows per min)	10	40	40	40
Piles per day (24 hours): 8 i.e., 10.667 hours of piling per day				

Table 3-5 Soft start and ramp up parameters used for WTG anchor Scenario 2 (single location, one pile per day)

% energy (kJ)	10% (180 kJ)	30% (540 kJ)	50% (900 kJ)	100% (1,800 kJ)
No. of strikes	200	400	400	8,400
Duration (min)	20	10	10	210
Strike rate (blows per min)	10	40	40	40
Piles per day (24 hours): 1 i.e., 4.167 hours of piling per day				

Table 3-6 Soft start and ramp up parameters used for concurrent WTG anchor piling (three locations, eight piles per day at each location). Modifications to the Scenario 1 parameters are shown in *italics*

% energy (kJ)	10% (180 kJ)		30% (540 kJ)	50% (900 kJ)	100% (1,800 kJ)
No. of strikes	5	100	400	400	1,600
Duration (min)	10	10	10	10	40
Strike rate (blows per min)	0.5	10	40	40	40
Piles per day (24 hours): 24 i.e., 10.667 hours of piling at each of the three locations per day					

Table 3-7 Soft start and ramp up parameters used for the OSPs

% energy (kJ)	10% (440 kJ)	30% (1,320 kJ)	50% (2,200 kJ)	100% (4,400 kJ)
No. of strikes	200	400	400	8,400
Duration (min)	20	10	10	210
Strike rate (blows per min)	10	40	40	40
Piles per day (24 hours): 4 i.e., 16.667 hours of piling per day				

Table 3-8 Soft start and ramp up parameters used for the IRC

% energy (kJ)	10% (440 kJ)	30% (1,320 kJ)	50% (2,200 kJ)	100% (4,400 kJ)
No. of strikes	200	400	400	8,400
Duration (min)	20	10	10	210
Strike rate (blows per min)	10	40	40	40
Piles per day (24 hours): 4 i.e., 10.667 hours of piling per day				

46. The Southall *et al*. (2019) criteria (**Table 3-2**) were used in the assessment.

47. For cumulative PTS, a fleeing animal model was used. Fleeing was considered to begin at the start of the soft start. Hearing group-specific flee speeds were drawn from the literature and agreement on their use sought from stakeholders. 'Standard' flee speeds were modelled for all hearing groups relevant for Annex II marine mammals (**Table 3-9**). Following a review of the more recent literature, more representative (increased) flee speeds were also modelled for very high frequency cetaceans (**Table 3-9**). These flee speeds were selected because they reflect appropriate animal motivation (i.e., responses to pile driving stimuli) and are therefore

likely to be more representative than the standard flee speeds. The impact assessment was conducted using the underwater noise modelling outputs for the flee speeds shown in bold in **Table 3-9**.

Table 3-9 Marine mammal flee speeds. The impact assessment was conducted using the underwater noise modelling outputs for the flee speeds shown in bold

Marine mammal hearing group	Standard flee speed (m/s)	Reference	More representative (increased) flee speed (m/s)	Reference
High frequency cetaceans	**1.52**	Bailey and Thompson (2006)	None found	-
Very high frequency cetaceans	1.4	SNH (2016)	**1.97**	Kastelein *et al.* (2018)
Phocid carnivores in water	**1.8**	SNH (2016)	None found	-

3.2.1.3 Integration of the marine mammal and piling noise spatial distributions to estimate the numbers of individuals which have the potential to be impacted

48. Full details of the modelling undertaken can be found in **Volume 3, Appendix 10.2: Marine Mammals and Other Megafauna Technical Report** of the EIAR. This Section provides a summary of the key information.

49. For each species/flee speed/scenario combination, the number of individuals which have the potential to be impacted (PTS onset or disturbance) was estimated using the modelled noise impact ranges (**Section 3.2.1.2**) and expected animal density in the area (**Section 3.2.1.1**).

50. For PTS, the species-specific density surfaces (**Section 2**) were intersected with cumulative PTS contours (**Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR) and the number of individuals of each species which have the potential to be exposed to levels of noise sufficient to induce the onset of PTS was estimated.

51. For disturbance, two approaches were used:

- Approach A: Use of Effective Deterrence Ranges (EDRs). In the absence of species-specific EDRs, the EDRs derived for harbour porpoises (JNCC, 2020) were applied to all Annex II marine mammal species. Two EDRs were used. The first (15 km) is for pin piles and comes from the JNCC Marine Noise Registry Help and Guidance (JNCC, 2023a). The second (9.4 km), which comes from Benhemma-Le Gall *et al*. (2024) as part of the PrePARED project, was estimated using passive acoustic monitoring data collected at Moray West Offshore Wind Farm in the Moray Firth during installation of large monopiles (9.5 m and 10 m diameter) without noise abatement. Despite noise levels for the installation of XXL monopiles being much higher, the response of porpoises to monopile installation at Moray West was similar to that observed in studies of pin-piling at Beatrice. Benhemma-Le Gall *et al*. (2024) suggest that their estimated EDR of < 10 km provides a strong case for reducing the current 26 km EDR for monopiles. This also suggests that the 15 km pin pile EDR is overly conservative and should be reduced. Both EDRs were used for all species. The area of potential impact for each EDR (assuming that spreading is approximately spherical) was calculated using the equation area = πr^2 where the radius

(r) is equal to the EDR. The number of individuals with potential to be present within these areas was then estimated using the density information presented in **Section 2**.

- Approach B: Use of underwater noise modelling and dose-response relationships. The species-specific density surfaces (**Section 2**) were intersected with 1 dB received noise level contours (**Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR), and a dose-response relationship was used to estimate the number of individuals likely to be disturbed sufficiently by the received noise level to induce displacement. For cetacean species, disturbance values were calculated based on responses estimated for both the first and the last pile (Graham *et al*., 2019). For seal species, the same process was applied but the dose-response relationship presented in Whyte *et al*. (2020) was used.

3.2.1.4 Prediction of population level effects

52. The iPCoD model was used to assess the possible consequences of exposure to underwater noise where significance of effect could not be ruled out using non-population level modelling methods. The model includes all Annex II marine mammals found in the UK (bottlenose dolphin, harbour porpoise, grey seal and harbour seal).

53. Full details of the modelling undertaken can be found in **Volume 3, Appendix 10.2: Marine Mammals and Other Megafauna Technical Report** of the EIAR. This section provides a summary of the key information.

54. iPCoD was run for all three WTG anchor scenarios (single location, eight piles per day, **Table 3-4**; single location, one pile per day, **Table 3-5**; concurrent, **Table 3-6**). iPCoD was not run for the OSP or IRC piling due to the limited duration (up to three days and one day, respectively) of these activities (**Table 4-1**).

55. Both cumulative PTS (**Section 3.2.2.2**) and disturbance (**Section 3.2.2.3.2**) inputs were used. This is appropriate because only instantaneous PTS has been fully mitigated as detailed in the results of the PTS Assessment (**Section 3.2.2.1**).

3.2.1.5 Conservatisms

56. There are several conservatisms in the approach used which result in precautionary predictions that need to be considered. The assessment approach has selected a precautionary approach across all of the predictions resulting in a compounded level of precaution in the final estimates of potentially impacted individuals.

57. The first three of the following sections relate to uncertainties presented by Southall (2021).

3.2.1.5.1 Hearing and auditory effects

58. Although the exposure criteria presented in Southall *et al*. (2019) represent a major step forward in integrating more realism and new evidence into noise exposure criteria, assumptions are still being made about the proportion of animals within the impact area which may develop PTS.

59. PTS onset thresholds indicate the level at which the risk of PTS increases. However, not all individuals are predicted to develop PTS. Donovan *et al*. (2017) used the data presented in Finneran *et al*. (2005) to develop the dose-response relationship implemented into the SAFESIMM (Statistical Algorithms For Estimating the Sonar Influence on Marine Megafauna) model, where only 18-19% of the animals exposed to noise above the PTS onset threshold

were predicted to experience PTS. As such, the assumption made in this assessment that all animals located within PTS onset range will develop PTS is deemed precautionary. The threshold calculated for PTS is the 'onset' to these effects, which means that this is the threshold at which the effect starts to be detected in test species, rather than where this effect is widespread (**Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR).

60. It should also be noted that current PTS onset thresholds for marine mammals have been derived from TTS thresholds, as testing for accurate PTS thresholds would be unethical. This further highlights that thresholds are based on assumptions regarding when PTS may occur in marine mammals.

3.2.1.5.2 Behavioural response severity

61. There are several uncertainties on individual behavioural responses and the severity of such responses. Progress is currently being made towards better understanding how animal behavioural responses should be expressed by exposure-response probabilistic functions (i.e., dose-response relationships; Graham *et al*., 2019; Whyte *et al*., 2020) rather than step function thresholds, which assume that above the threshold all animals will be impacted, while below the threshold no impact or response is expected (Southall, 2021). However, many uncertainties remain on behavioural responses, and their potential long-term effects, hence a conservative approach has been taken.

62. Furthermore, the Graham *et al*. (2019) dose-response relationship, which was used for all the cetacean species, was developed for harbour porpoise which are particularly sensitive to underwater noise (Southall *et al.,* 2007; JNCC, 2020; Southall *et al.,* 2021). As such the estimates for bottlenose dolphin are likely to be conservative.

63. The EDRs (also used to assess the potential for exposure to sound levels which may induce a behavioural response) were also derived for harbour porpoises (JNCC, 2020; JNCC, 2023a; Benhemma-Le Gall *et al*., 2024) but, in the absence of species-specific EDRs, have been applied to all species. As for the dose-response approach, the estimates for bottlenose dolphin are likely to be conservative.

3.2.1.5.3 Impulsive exposure criteria and sound propagation

64. How noise is measured, and exposure to individuals is quantified, has inherent implications on the estimated number of potentially impacted individuals. Although the propagation of underwater noise is relatively well understood, there are several uncertainties regarding how the sound will be received by the receptor. For example, pulse characteristics may change depending on the location of the receptor, both in terms of distance (Hastie *et al*., 2019) and position in the water column (Whyte *et al*., 2020); telemetry data demonstrate that sound exposure levels received near the surface are lower than the modelled outputs, which would significantly over-estimate the exposure level of diving species (Whyte *et al*., 2020), especially since animals may conduct shallower dives when fleeing (e.g., van Beest *et al*., 2018).

65. There are two main assumptions on how sound exposure is measured and considered in the assessment which bring major conservatisms in the interpretation of the results:

- the PTS onset thresholds used in the pile driving assessment are based on exposure to impulsive noise and assume that the sound retains its impulsive character regardless of

distance from the sound source. However, as extensively discussed in Southall (2021), recent evidence (Hastie *et al*., 2019; Matei *et al*., 2024) shows that acoustic propagation over large ranges transforms impulsive characteristics in time and frequency. The distance at which characteristics change remains uncertain, with estimates ranging from 3.5 km (Hastie *et al*., 2019) to 5 km (Matei *et al*., 2024). It is unclear how these changes may affect animal responses and potential for auditory injury other than that current approaches that consider impulsive noise impacts over large ranges are taking an overly precautionary approach (Southall, 2021); and

- the cumulative sound exposure level (SEL_{cum}) threshold assumes that the amount of sound energy an animal is exposed to will have the same effect on its auditory system whether it is received gradually over the time period or all at once (i.e., the equal energy hypothesis). The main limitation of this assumption is that it does not allow for recovery of sound-induced hearing threshold shifts between pulses (e.g., between hammer strikes or piling bouts). Specifically, in his review of noise-induced hearing loss in marine mammals, Finneran (2015) summarises the results of four studies which investigated the role of intermittency and/or exposure duty cycle on TTS in marine mammals (Mooney *et al*., 2009; Finneran *et al*., 2010; Kastelein *et al*., 2014; Kastelein *et al*., 2015). The common result was that TTS can accumulate through multiple exposures, but the resulting TTS is less than the TTS from a single continuous exposure (Finneran, 2015). The recovery could be seen even with very short intervals, for example, Kastelein *et al*. (2014) showed that 1 second of silent period in between pulses resulted in a 3 to 5 dB lower TTS for a captive harbour porpoise compared to continuous sounds.

66. In order to overcome some of these conservatisms Sinclair *et al*. (2023) and Sinclair and Verfuss (2021) suggested that to account for the same level of PTS, a noise at 25% duty cycle[6] should be assessed against a threshold that is +2 dB and +3 dB higher. As such, to illustrate the difference accounting for hearing recovery as a result of breaks in piling (between hammer blows, piles at one group of locations, piling locations) makes, +2 dB and +3 dB contours for very high frequency cetaceans were modelled by Subacoustech Environmental to account for noise being produced at a 25% duty cycle (see **Table 3-10**; **Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR). The reduction in impact range is substantial – a mean impact range of 1-2 (rather than 4.6) km for very high frequency cetaceans (harbour porpoise) at the NE location.

Table 3-10 Difference in predicted cumulative PTS impact ranges (km) for very high frequency cetaceans (harbour porpoise) for WTG anchor Scenario 2 (single location, one pile per day) at the three underwater noise modelling locations if hearing recovery between pulses is accounted for and the PTS onset threshold is increased by 2 dB or 3 dB

Threshold (dB)		**Mean** impact range (km)		
		NE	**SE**	**W**
PTS	155	4.6	4.3	4.5
PTS + 2 dB	157	2	1.8	1.9
PTS + 3 dB	158	1	0.88	0.97

[6] Duty cycle is the ratio of the on versus off time and is usually expressed as a percentage.

3.2.1.5.4 Pile driving scenario parameters

67. For WTG anchor Scenario 1 (**Table 3-4**) and concurrent WTG anchor piling (**Table 3-6**), installation of eight piles per day per vessel has been modelled. However, it is possible that the piling vessel will only have capacity to carry five piles before needing to be restocked. As such, modelling eight piles per day when only five may be installed is likely to result in conservative estimates (in terms of both cumulative impact ranges and numbers of individuals which have potential to be affected).

3.2.1.5.5 Source

68. The INSPIRE underwater noise modelling locations were chosen to provide the greatest extents of the Proposed Offshore Development Site, and specifically the locations likely to lead to maximum underwater noise transmission. The largest diameter for all types of piles has been used for the worst case. The maximum blow energies were used for a duration unlikely to occur in practice. A fast strike rate has been included for much of the ramp up. The total piling duration is at the top of expectations and not expected to be exceeded on site. See **Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR for details.

3.2.1.5.6 Transmission

69. Sound attenuates over distance from the source. The INSPIRE model considers fundamental noise spreading predictions adjusted to empirical data, accounting for frequency content, water depth, and other environmental factors, but fits to these data still err on the side of caution. See **Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR for details.

3.2.1.5.7 Flee speed

70. In order to reduce some of the conservatism associated with flee speeds, the underwater noise modelling (**Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR) has been undertaken using more representative (increased) flee speeds drawn from the literature (see **Table 3-9**). These flee speeds were selected because they reflect appropriate animal motivation (i.e., pile driving (in the case of harbour porpoise) stimuli; Kastelein *et al.* (2018)) and are therefore likely to be more representative than the standard flee speeds (also presented in **Table 3-9**).

3.2.1.5.8 Distribution of bottlenose dolphin

71. Estimates of potential for effect on bottlenose dolphins are likely to be precautionary because uniform distributions (or blocks of uniform distribution) of these highly social animals (which tend to occur in groups rather than singly e.g., Cheney *et al.*, 2024) have been assumed when deriving the density surface. As such, the assessment takes a conservative approach in assuming that bottlenose dolphins will be occurring across the whole range (or block) at any given time when, in all likelihood, no individuals will be present at a particular location for the majority of the time.

3.2.1.5.9 Concurrent WTG anchor scenario cumulative PTS ranges

72. The potential effects of concurrent piling were not modelled in cases where the individual location cumulative PTS contours were small and well separated (see **Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR). In these cases, the effect of concurrent piling is shown by the three individual location cumulative PTS contours. This is conservative because the concurrent scenario (**Table 3-6**) includes a slow start of 10 mins at 1 blow every 2 minutes while the equivalent single location scenario (**Table 3-4**) does not.

3.2.1.5.10 Disturbance from vessels

73. Estimates of the number of individuals with potential to be exposed to noise from pile driving are considered to be an over-estimate because vessel presence prior to the beginning of pile driving has been shown to act as a deterrent. For example, during the 48 hours prior to the beginning of piling in the Moray Firth, harbour porpoise acoustic detections dropped by 33% (Benhemma-Le Gall *et al*., 2023). The effects of vessel disturbance have been detected up to 3 km away (Benhemma-Le Gall *et al*., 2021; Fernandez-Betelu *et al*., 2024), which would reduce presence in the modelled impact areas (**Section 3.2.2**) and negate the potential for instantaneous PTS (**Section 3.2.2.1**).

3.2.1.5.11 iPCoD: Use of the 'first pile' dose-response relationship (Graham *et al*., 2019)

74. Harbour porpoise responses to pile driving have been shown to diminish over time. Graham *et al*. (2019) recorded a 50% probability of response within 7.4 km (95% CI = 5.7–9.4) at the first location piled at the Beatrice OWF, decreasing to 1.3 km (95% CI = 0.2–2.8) by the final location.

75. It has been assumed that all individuals which have potential to be exposed to noise from pile driving at the Proposed Offshore Development are naïve to pile driving noise. As such the 'first pile' estimates (**Section 3.2.2.3.2**) have been used in iPCoD. This assumption is precautionary because some individuals may already have been exposed to pile driving noise and may therefore be likely to display a lesser probability of response (i.e., more akin to the 'last pile' response recorded at Beatrice).

76. It should be noted that use of the dose-response-derived numbers of individuals with potential to be exposed to noise from pile driving is more precautionary than use of the numbers derived using EDRs.

3.2.1.5.12 iPCoD: Use of the worst case location behavioural response estimates

77. The worst case location estimates of the number of individuals estimated to have the potential to be susceptible to the onset of PTS and disturbed by pile driving noise were used in iPCoD (i.e., NE location estimates or SE location estimates or W location estimates). The worst case location (i.e., location with the greatest number of individuals with potential to be disturbed) varies between species.

3.2.1.5.13 iPCoD: Density dependence

78. There is no ability for an impacted population to converge with the unimpacted population size following piling. This is because iPCoD assumes no density dependence[7] because there are insufficient data to parameterise this relationship for any of the species in the model.

3.2.1.5.14 iPCoD: Mitigation

79. In addition to the reasons outlined above, the cumulative PTS inputs are also an overestimate because use of an Acoustic Deterrence Device (ADD) to negate the potential for instantaneous PTS (and therefore a reduction in the number of individuals which have potential to be affected by cumulative PTS) has not been taken into account.

3.2.2 Results of Pile Driving Assessment

3.2.2.1 Instantaneous PTS

80. The maximum instantaneous PTS ranges (**Table 3-11**) are ≤ 60 m for high frequency cetaceans (bottlenose dolphin) and phocid carnivores in water (grey seals). For very high frequency cetaceans (harbour porpoise), the maximum instantaneous PTS range varies from 570 m (for the IRC piles) to 620 m (for the WTG anchor piles at the NE modelling location; **Table 3-11**) (see **Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR).

81. To negate the potential for instantaneous PTS the use of an ADD for a maximum of 5.25 minutes (**Table 3-12**) will be sufficient to ensure that no individuals are located within the area of potential impact for instantaneous PTS. This duration has been calculated using the more representative (increased) flee speed for harbour porpoise (1.97 m/s; **Table 3-9**). This mitigation (use of an ADD) is based on the embedded mitigation (see **Section 4**) for piling noise (EM10, adoption of JNCC guidelines for minimising the risk of injury to marine mammals from piling noise; JNCC, 2010) and will be developed, in line with EM11, as part of the Proposed Marine Mammal Mitigation Protocol (Buchan Offshore Wind Ltd, 2025) and Piling Strategy (PS; or equivalent, after consultation with stakeholders; EM12).

82. **Conclusion:** The maximum instantaneous PTS ranges are sufficiently small that, with the application of mitigation measures (use of an ADD for 5.25 minutes), instantaneous PTS can be negated.

Table 3-11 Maximum instantaneous PTS ranges (m) for the underwater noise modelling locations

Hearing group	WTG anchors			OSP	IRC
	NE	SE	W		
High frequency cetaceans	<50	<50	<50	<50	<50
Very high frequency cetaceans	620	610	610	610	570
Phocid carnivores in water	60	60	60	50	50

[7] Density dependence is "…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).

Table 3-12 Duration of ADD use required to clear the area of potential impact

Modelling location	Maximum range (m)	**ADD duration required to clear** impact area (mins)
WTG anchors - NE	620	5.25
WTG anchors - SE	610	5.16
WTG anchors - W	610	5.16
OSP	610	5.16
IRC	570	4.82

3.2.2.2 Cumulative PTS

83. The cumulative PTS ranges for each species, flee speed, criteria, scenario combination have been presented in **Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR. The PTS contour for phocid carnivores in water (the seal species; **Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR)**,** and the TTS contour for high frequency cetaceans (the dolphin species; **Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR), for the concurrent WTG anchor scenario have been discounted because the only effects are from where a receptor is fleeing directly towards another noise source which is considered to be unlikely e.g., Hastie *et al*. (2015), Russell *et al*. (2016).

84. The numbers of individuals estimated to have potential to be located within the zones of potential effect for each species, flee speed, criteria, scenario combination have been presented in **Volume 3, Appendix 10.2: Marine Mammals and Other Megafauna Technical Report** of the EIAR.

85. A summary of the numbers of individuals estimated to have potential to be located within the zones of potential impact (using the more representative (increased) flee speeds outlined in **Table 3-9**) for each of the five scenarios (two single location and one concurrent scenario for the WTG anchors, one single location scenario for the OSP piles and one for the IRC piles; **Section 3.2.1.2**) has been presented in **Table 3-13** to **Table 3-17** along with the percentages of the relevant reference populations these numbers represent.

86. The number of individuals estimated to have potential to be susceptible to the onset of cumulative PTS was less than one for bottlenose dolphin and grey seal under all five scenarios (**Table 3-13** to **Table 3-17**).

87. For harbour porpoise, up to 34 individuals were estimated to have potential to be susceptible to the onset of cumulative PTS using the 155 dB criteria (**Table 3-2**). This equates to 0.021% of the reference population (the UK portion of the MU; **Table 2-3**). In comparison, two individuals have potential to be affected using the 158 dB criteria (see **Section 3.2.1.5.3**). The numbers of individuals (which have potential to be affected) are greater for the IRC piling, OSP piling and concurrent WTG anchor piling scenarios.

88. No additional mitigation measures have been proposed for cumulative PTS. This is because the underlying assumptions and conservatism of the modelling approaches used to estimate Sound Exposure Level (SEL; **Section 3.2.1.5**) lead to over-precautionary estimates. The mitigation measures applied to mitigate for instantaneous PTS (**Section 3.2.2.1**) will also reduce the potential impacts of cumulative PTS.

Conclusion: A number of individuals of harbour porpoise may be susceptible to the onset of cumulative PTS. While < 0.5% of the relevant reference populations have potential to be affected, cumulative PTS impacts have been assessed at a population level using the interim Population Consequences of Disturbance (iPCoD) model (see **Section 3.2.2.4**).

Table 3-13 WTG anchor piling Scenario 1 (single location, eight piles per day): Number of individuals (n) and percentage of reference population (%) estimated to have potential to be susceptible to the onset of cumulative PTS

Species	Flee speed (m/s)	Threshold (dB)	NE			SE			W		
			n	% UK portion	% whole MU	n	% UK portion	% whole MU	n	% UK portion	% whole MU
Bottlenose dolphin - inshore	1.52	185	<1	-	-	<1	-	-	<1	-	-
Harbour porpoise	1.97	155	23	0.014	0.007	19	0.012	0.006	21	0.013	0.006
		157	3	0.002	0.001	3	0.002	0.001	3	0.002	0.001
		158	1	0.001	0.001	0	-	-	1	0.001	0.001
Grey seal	1.8	185	<1	-	-	<1	-	-	<1	-	-

Table 3-14 WTG anchor Scenario 2 (single location, one pile per day): Number of individuals (n) and percentage of reference population (%) estimated to have potential to be susceptible to the onset of cumulative PTS

Species	Flee speed (m/s)	Threshold (dB)	NE			SE			W		
			n	% UK portion	% whole MU	n	% UK portion	% whole MU	n	% UK portion	% whole MU
Bottlenose dolphin – inshore	1.52	185	<1	-	-	<1	-	-	<1	-	-
Harbour porpoise	1.97	155	34	0.021	0.010	29	0.018	0.088	32	0.020	0.009
		157	7	0.004	0.002	5	0.003	0.002	6	0.004	0.002
		158	2	0.001	<0.001	1	0.001	<0.001	1	0.001	<0.001
Grey seal	1.8	185	<1	-	-	<1	-	-	<1	-	-

Table 3-15 Concurrent WTG anchor piling (three locations, eight piles per day at each location): Number of individuals (n) and percentage of reference population (%) estimated to have potential to be susceptible to the onset of cumulative PTS

Species	Flee speed (m/s)	Threshold (dB)	n	% UK portion	% whole MU
Bottlenose dolphin - inshore	1.52	185	<1	-	-
Harbour porpoise	1.97	155	549	0.344	0.158
		157	372	0.233	0.107
		158	310	0.194	0.089
Grey seal[8]	1.8	185	< 1	-	-

Table 3-16 OSP piling: Number of individuals (n) and percent of reference population (%) estimated to have potential to be susceptible to the onset of cumulative PTS

Species	Flee speed (m/s)	Threshold (dB)	n	% UK portion	% whole MU
Bottlenose dolphin - inshore	1.52	185	<1	-	-
Harbour porpoise	1.97	155	84	0.053	0.024
		157	26	0.016	0.007
		158	12	0.007	0.003
Grey seal	1.8	185	<1	-	-

[8] The PTS contour (for the concurrent WTG anchor scenario) for phocid carnivores in water was discounted because the only effects were from where a receptor was fleeing directly towards another noise source which is considered to be unlikely e.g., Hastie *et al*. (2015), Russell *et al*. (2016).

Table 3-17 IRC piling: Number of individuals (n) and percent of reference population (%) estimated to have potential to be susceptible to the onset of cumulative PTS

Species	Flee speed (m/s)	Threshold (dB)	n	% UK portion	% whole MU
Bottlenose dolphin - inshore	1.52	185	<1	-	-
Harbour porpoise	1.97	155	73	0.046	0.021
		157	23	0.014	0.006
		158	10	0.006	0.003
Grey seal	1.8	185	<1	-	-

3.2.2.3 Behavioural Responses

89. As described in **Section 3.2.1.3**, EDRs (Approach A) and underwater noise modelling and dose-response relationships (Approach B) were used to assess the potential for disturbance. Both approaches are valid and have been presented to allow comparison. The assessment has been undertaken using the Approach B (Use of underwater noise modelling and dose-response relationships) outputs.

3.2.2.3.1 Approach A: Use of Effective Deterrence Ranges (EDRs)

90. The numbers of individuals estimated to have potential to be disturbed using both the 9.4 km (Benhemma-Le Gall *et al*., 2024) and 15 km (JNCC, 2023a) EDRs have been presented in **Table 3-18** to **Table 3-21** along with the percentages of the relevant reference populations these numbers represent. The single location WTG anchor piling estimates were the same for all locations (NE, SE, W) for each species except for grey seal. Estimates for the worst case location (W) have been presented for grey seal. The corresponding estimates for the NE and SE locations for grey seal were 47 and 85 (9.4 km EDR) and 126 and 209 (15 km EDR) individuals, respectively.

91. The number of individuals estimated to have potential to be disturbed varies between species across the four scenarios (single location WTG anchor piling, concurrent WTG anchor piling, OSP piling, IRC piling). No individuals of species which are primarily coastally distributed (e.g. inshore bottlenose dolphin) have potential to be affected (due to the distance of the Array Area and IRC location from the coast). Less than 1% of the reference population (the UK portion of the MU) has the potential to be affected using the EDR approach for all species/scenario combinations.

92. **Conclusion:** A number of individuals of harbour porpoise and grey seal have potential to exhibit short-term behavioural responses to pile driving noise using the EDR approach. Effects on species are considered to be negligible. This is because < 1% of the relevant reference populations have the potential to be affected.

Table 3-18 Single location WTG anchor piling: Number of individuals (n) and percentage of reference population (%) estimated to have potential to be disturbed using the EDR approach

Species	9.4 km EDR			15 km EDR		
	n	% UK portion	% whole MU	n	% UK portion	% whole MU
Bottlenose dolphin - inshore	0	-	0	0	-	0
Harbour porpoise	143	0.090	0.041	365	0.228	0.105
Grey seal	107	-	0.107	264	-	0.263

Table 3-19 Concurrent WTG anchor piling: Number of individuals (n) and percentage of reference population (%) estimated to have potential to be disturbed using the EDR approach

Species	9.4 km EDR			15 km EDR		
	n	% UK portion	% whole MU	n	% UK portion	% whole MU
Bottlenose dolphin - inshore	0	-	0	0	-	0
Harbour porpoise	430	0.269	0.124	960	0.601	0.277
Grey seal	239	-	0.238	505	-	0.504

Table 3-20 OSP piling: Number of individuals (n) and percentage of reference population (%) estimated to have potential to be disturbed using the EDR approach

Species	9.4 km EDR			15 km EDR		
	n	% UK portion	% whole MU	n	% UK portion	% whole MU
Bottlenose dolphin - inshore	0	-	0	0	-	0
Harbour porpoise	143	0.090	0.041	365	0.228	0.105
Grey seal	109	-	0.109	241	-	0.240

Table 3-21 IRC piling: Number of individuals (n) and percentage of reference population (%) estimated to have potential to be disturbed using the EDR approach

Species	9.4 km EDR			15 km EDR		
	n	% UK portion	% whole MU	n	% UK portion	% whole MU
Bottlenose dolphin - inshore	0	-	0	0	-	0
Harbour porpoise	143	0.090	0.041	365	0.228	0.105
Grey seal	33	-	0.032	98	-	0.097

3.2.2.3.2 Approach B: Use of underwater noise modelling and dose-response relationships

93. Received level contours (1 dB increments) were provided by Subacoustech Environmental.

94. The numbers of individuals estimated to have potential to be disturbed (using both the first and last location piled probabilities for cetaceans; Graham *et al*., 2019) have been presented in **Volume 3, Appendix 10.2: Marine Mammals and Other Megafauna Technical Report** of the EIAR.

95. A summary of the numbers of individuals estimated to have potential to be disturbed has been presented in **Table 3-22** to **Table 3-25** along with the percentages of the relevant reference populations these numbers represent. There is only one set of results for the single location WTG anchors (**Table 3-22**) because the maximum hammer energy was the same in both scenarios (1,800 kJ; see **Table 3-4** to **Table 3-6**). The estimates using the first location piled probabilities for cetaceans (Graham *et al*., 2019) were used in the population level (iPCoD) modelling (**Section 3.2.2.4**) however, the last location piled probabilities have also been presented in the tables below to provide context for species which may previously have been exposed to noise from pile driving (and are likely to exhibit a lesser response).

96. The number of individuals estimated to have potential to be disturbed varies between species. Very few individuals of species which are primarily coastally distributed (inshore bottlenose dolphin (≤7), harbour seal (≤3)) have potential to be affected. For harbour porpoise and grey seal < 10% of the reference population has the potential to be affected.

97. **Conclusion:** Very few individuals of species which are primarily coastally distributed (inshore bottlenose dolphin (≤7), harbour seal (≤3)) have potential to be affected. Large numbers of some species have potential to exhibit short-term behavioural responses to pile driving noise (see **paragraph 37** for information on likely return rates following disturbance) using the underwater noise modelling and dose-response relationship approach. The population level

consequences of this potential disturbance has been assessed using iPCoD (see **Section 3.2.2.4**).

Table 3-22 Single location WTG anchor piling: Number of individuals (n) and percentage of reference population (%) estimated to have potential to be disturbed using underwater noise modelling and dose-response relationships for the WTG anchor underwater noise modelling locations

Species	Dose-response relationship used	NE			SE			W		
		n	% UK portion	% whole MU	n	% UK portion	% whole MU	n	% UK portion	% whole MU
Bottlenose dolphin - inshore	First pile (Graham *et al*., 2019)	1	-	0.442	2	-	0.885	1	-	0.442
Harbour porpoise		11527	7.221	0.002	10213	6.398	0.002	10039	6.289	0.002
Bottlenose dolphin - inshore	Last pile (Graham *et al*., 2019)	1	-	0.442	2	-	0.885	2	-	0.885
Harbour porpoise		7960	4.986	0.001	7136	4.470	0.001	6996	4.383	0.001
Grey seal	Whyte *et al*. (2020)	1546	-	1.542	1153	-	1.150	1711	-	1.707

Table 3-23 Concurrent WTG anchor piling: Number of individuals (n) and percentage of reference population (%) estimated to have potential to be disturbed using underwater noise modelling and dose-response relationships

Species	Dose-response relationship used	n	% UK portion	% whole MU
Bottlenose dolphin - inshore	First pile (Graham *et al*., 2019)	2		0.885
Harbour porpoise		13449	8.425	0.002
Bottlenose dolphin - inshore	Last pile (Graham *et al*., 2019)	2		0.885
Harbour porpoise		8991	5.632	0.002
Grey seal	Whyte *et al*. (2020)	2186		2.181

Table 3-24 OSP piling: Number of individuals (n) and percentage of reference population (%) estimated to have potential to be disturbed using underwater noise modelling and dose-response relationships

Species	Dose-response relationship used	n	% UK portion	% whole MU
Bottlenose dolphin - inshore	First pile (Graham *et al*., 2019)	2		0.885
Harbour porpoise		12122	7.594	0.002
Bottlenose dolphin - inshore	Last pile (Graham *et al*., 2019)	2		0.885
Harbour porpoise		8242	5.163	0.001
Grey seal	Whyte *et al*. (2020)	1934		1.929

Table 3-25 IRC piling: Number of individuals (n) and percentage of reference population (%) estimated to have potential to be disturbed using underwater noise modelling and dose-response relationships

Species	Dose-response relationship used	n	% UK portion	% whole MU
Bottlenose dolphin - inshore	First pile (Graham *et al*., 2019)	6		2.655
Harbour porpoise		9996	6.262	0.002
Bottlenose dolphin - inshore	Last pile (Graham *et al*., 2019)	7		3.097
Harbour porpoise		6955	4.357	0.001
Grey seal	Whyte *et al*. (2020)	1233		1.230

3.2.2.4 Prediction of Population Level Effects

98. iPCoD was run for inshore bottlenose dolphin, harbour porpoise and grey seal.

99. Both cumulative PTS (**Section 3.2.2.2**) and disturbance (**Section 3.2.2.3.2**) inputs were used. This is appropriate because only instantaneous PTS has been fully mitigated. However, the following modifications to the cumulative PTS inputs were applied to reduce conservatism:

- The estimates made using the +3 dB contours for very high frequency cetaceans (186 dB and 158 dB, respectively) were used to account for hearing recovery as a result of breaks in piling (see **Section 3.2.1.5.3**); and
- 18% of the numbers of individuals estimated to have potential to be susceptible to the onset of cumulative PTS was used to account for the precaution in the assumption that all individuals within the PTS onset range will develop PTS (see **Section 3.2.1.5.1**).

100. The UK portions of the relevant MUs were used for harbour porpoise (**Table 2-3**). The relevant MUs were used for inshore bottlenose dolphin (**Table 2-3**) and grey seal (**Table 2-4**).

101. Simulated population trajectories, population sizes and growth rates in the years following piling have been presented. A population growth rate of 1 means no change in the size of the population over time; a growth rate of <1 means that the population is reducing in size over time; a growth rate of >1 means that the population is increasing in size over time. Counterfactual population sizes and growth rates (the impacted estimate as a proportion of the unimpacted estimate) have also been presented to aid comparison.

102. It should be noted that in iPCoD there is no ability for an impacted population to converge with the unimpacted population size following piling. This is because iPCoD assumes no density dependence because there are insufficient data to parameterise this relationship for any of the species in the model.

3.2.2.4.1 Inshore bottlenose dolphin

103. The iPCoD modelling shows that the consequences of cumulative PTS and disturbance are not sufficient to result in long term change at the population level for any of the WTG anchor scenarios.

104. The impacted population is predicted to follow the same trajectory as the unimpacted population in the years following piling (**Figure 3-1**; **Figure 3-2**; **Figure 3-3**).

105. The impacted population sizes (**Table 3-26, Table 3-28, Table 3-30**) and growth rates (**Table 3-27**; **Table 3-29**; **Table 3-31**) are generally the same as (i.e., counterfactual = 1), or very similar to, the unimpacted population sizes and growth rates in the years following piling for all three scenarios.

106. **Conclusion:** The likely effects (cumulative PTS and disturbance) of increased underwater noise from pile driving do not affect the viability of the east coast of Scotland bottlenose dolphin population in either the short or the long term.

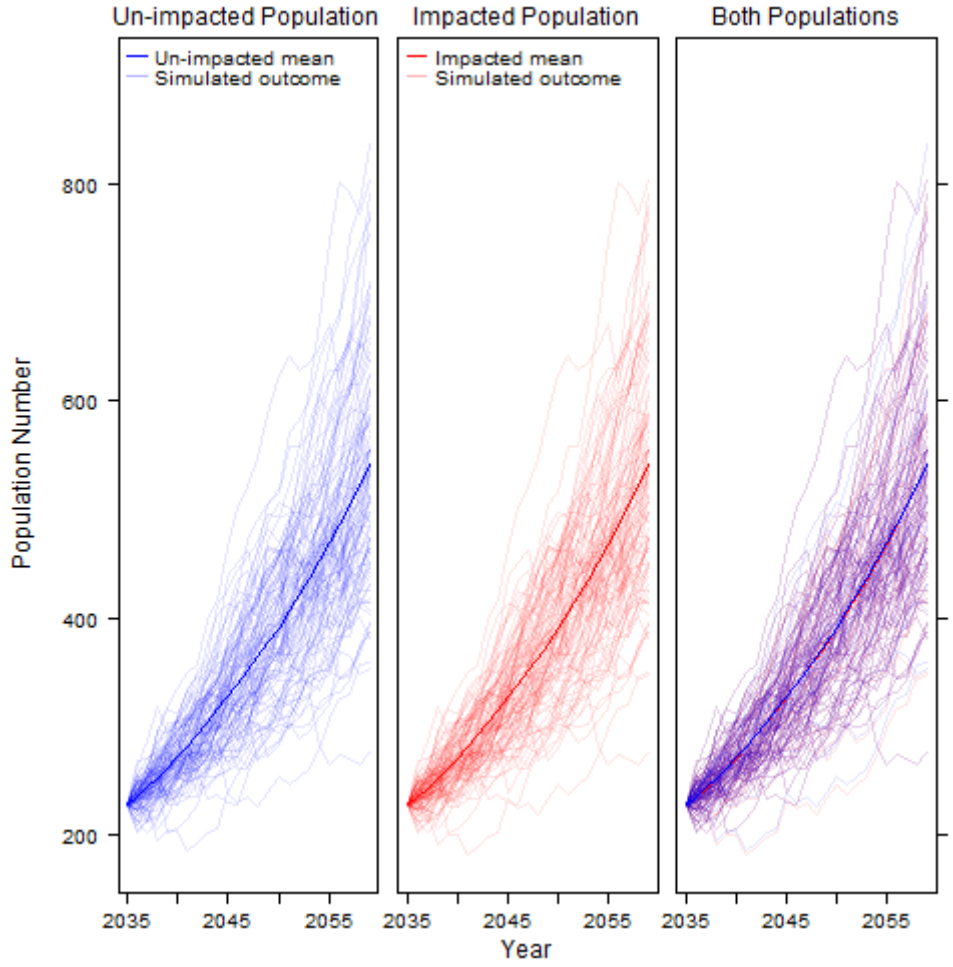


Figure 3-1: Simulated unimpacted and impacted population trajectories for inshore bottlenose dolphin in the Coastal East Scotland MU: WTG anchor Scenario 1 (single location, eight piles per day)

Table 3-26: Median (± 95% confidence intervals) predicted population sizes for inshore bottlenose dolphin in the Coastal East Scotland MU: WTG anchor Scenario 1 (single location, eight piles per day), and the counterfactual population size

Year	Description	Population size		Counterfactual population size
		Unimpacted population	Impacted population	
2036	Piling year 1	236 (210 - 256)	236 (210 - 256)	1.000
2037	Piling year 2	244 (210 - 274)	244 (210 - 274)	1.000
2038	One year following piling	252 (214 - 288)	252 (212 - 288)	1.000
2039	Two years following piling	262 (218 - 302)	262 (218 - 302)	1.000
2040	Three years following piling	272 (222 - 318)	272 (222 - 318)	1.000
2045	Eight years following piling	328 (254 - 406)	326 (254 - 406)	0.994
2050	Thirteen years following piling	390 (292 - 494)	388 (292 - 494)	0.995
2055	Eighteen years following piling	466 (328 - 624)	464 (326 - 620)	0.996
2060	Twenty-three years following piling	555 (382 - 770)	554 (378 - 766)	0.998

Table 3-27: Median (± 95% confidence intervals) predicted population growth rates for inshore bottlenose dolphin in the Coastal East Scotland MU: WTG anchor Scenario 1 (single location, eight piles per day), and the counterfactual population growth rate

Year	Description	Population growth rate		Counterfactual population growth rate
		Unimpacted population	Impacted population	
2036	Piling year 1	1.035 (0.921 - 1.123)	1.035 (0.921 - 1.123)	1.000
2037	Piling year 2	1.034 (0.960 - 1.096)	1.034 (0.960 - 1.096)	1.000
2038	One year following piling	1.034 (0.979 - 1.081)	1.034 (0.976 - 1.081)	1.000
2039	Two years following piling	1.035 (0.989 - 1.073)	1.035 (0.989 - 1.073)	1.000
2040	Three years following piling	1.036 (0.995 - 1.069)	1.036 (0.995 - 1.069)	1.000
2045	Eight years following piling	1.037 (1.011 - 1.059)	1.036 (1.011 - 1.059)	0.999
2050	Thirteen years following piling	1.036 (1.017 - 1.053)	1.036 (1.017 - 1.053)	1.000
2055	Eighteen years following piling	1.036 (1.018 - 1.052)	1.036 (1.018 - 1.051)	1.000
2060	Twenty-three years following piling	1.036 (1.021 - 1.050)	1.036 (1.020 - 1.050)	1.000

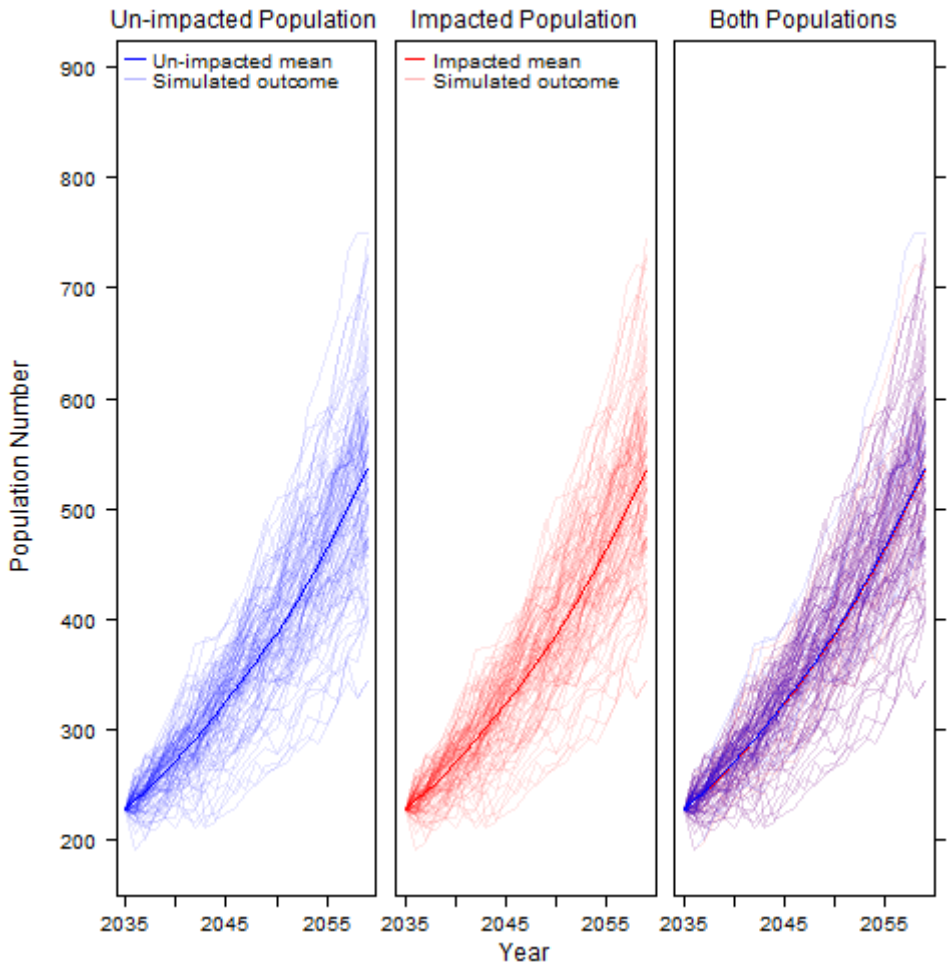


Figure 3-2: Simulated unimpacted and impacted population trajectories for inshore bottlenose dolphin in the Coastal East Scotland MU: WTG anchor Scenario 2 (single location, one pile per day)

Table 3-28: Median (± 95% confidence intervals) predicted population sizes for inshore bottlenose dolphin in the Coastal East Scotland MU: WTG anchor Scenario 2 (single location, one pile per day), and the counterfactual population size

Year	Description	Population size		Counterfactual population size
		Unimpacted population	Impacted population	
2036	Piling year 1	236 (214 - 258)	236 (214 - 258)	1.000
2037	Piling year 2	244 (214 - 274)	244 (212 - 274)	1.000
2038	Piling year 3	252 (214 - 288)	252 (212 - 288)	1.000
2039	Piling year 4	262 (218 - 304)	262 (214 - 304)	1.000
2040	One year following piling	272 (220 - 320)	272 (218 - 318)	1.000
2041	Two years following piling	282 (228 - 336)	282 (228 - 336)	1.000
2042	Three years following piling	292 (228 - 350)	290 (228 - 350)	0.993
2047	Eight years following piling	350 (260 - 436)	348 (258 - 436)	0.994
2052	Thirteen years following piling	416 (298 - 542)	416 (294 - 542)	1.000
2057	Eighteen years following piling	500 (342 - 680)	498 (340 - 674)	0.996
2060	Twenty-one years following piling	560 (370 - 752)	554 (368 - 752)	0.989

Table 3-29: Median (± 95% confidence intervals) predicted population growth rates for inshore bottlenose dolphin in the Coastal East Scotland MU: WTG anchor Scenario 2 (single location, one pile per day) table, and the counterfactual population growth rate

Year	Description	Population growth rate		Counterfactual population growth rate
		Unimpacted population	Impacted population	
2036	Piling year 1	1.035 (0.938 - 1.132)	1.035 (0.938 - 1.132)	1.000
2037	Piling year 2	1.034 (0.969 - 1.096)	1.034 (0.964 - 1.096)	1.000
2038	Piling year 3	1.034 (0.979 - 1.081)	1.034 (0.976 - 1.081)	1.000
2039	Piling year 4	1.035 (0.989 - 1.075)	1.035 (0.984 - 1.075)	1.000
2040	One year following piling	1.036 (0.993 - 1.070)	1.036 (0.991 - 1.069)	1.000
2041	Two years following piling	1.036 (1.000 - 1.067)	1.036 (1.000 - 1.067)	1.000
2042	Three years following piling	1.036 (1.000 - 1.063)	1.035 (1.000 - 1.063)	0.999
2047	Eight years following piling	1.036 (1.011 - 1.056)	1.036 (1.010 - 1.056)	1.000
2052	Thirteen years following piling	1.036 (1.016 - 1.052)	1.036 (1.015 - 1.052)	1.000
2057	Eighteen years following piling	1.036 (1.019 - 1.051)	1.036 (1.018 - 1.051)	1.000

Year	Description	Population growth rate		Counterfactual population growth rate
		Unimpacted population	Impacted population	
2060	Twenty-one years following piling	1.037 (1.020 - 1.049)	1.036 (1.019 - 1.049)	1.000

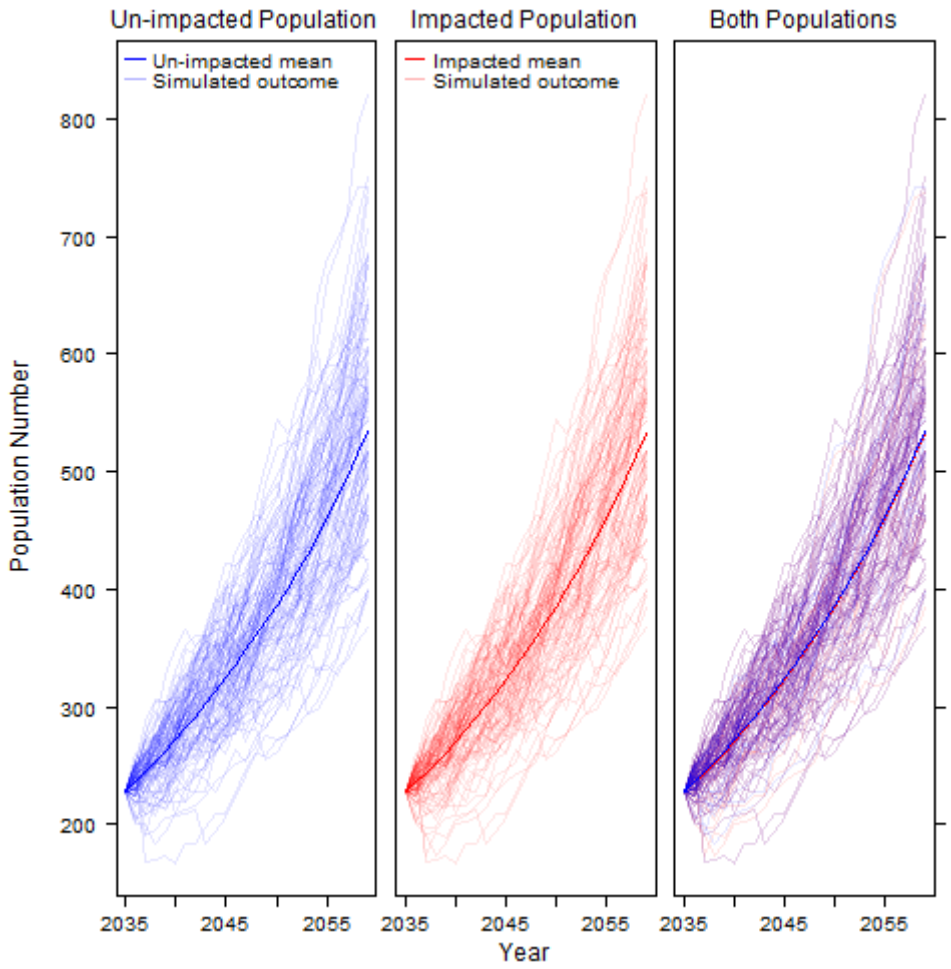


Figure 3-3: Simulated unimpacted and impacted population trajectories for inshore bottlenose dolphin in the Coastal East Scotland MU: Concurrent WTG anchor piling (three locations, eight piles per day at each location)

Table 3-30: Median (± 95% confidence intervals) predicted population sizes for inshore bottlenose dolphin in the Coastal East Scotland MU: Concurrent WTG anchor piling (three locations, eight piles per day at each location), and the counterfactual population size

Year	Description	Population size		Counterfactual population size
		Unimpacted population	Impacted population	
2036	Piling year 1	236 (212 - 254)	236 (212 - 254)	1.000
2037	Piling year 2	246 (210 - 270)	244 (208 - 270)	0.992
2038	One year following piling	254 (214 - 286)	254 (212 - 286)	1.000
2039	Two years following piling	264 (214 - 302)	262 (212 - 300)	0.992
2040	Three years following piling	274 (218 - 316)	272 (218 - 316)	0.993
2045	Eight years following piling	324 (252 - 398)	324 (252 - 398)	1.000
2050	Thirteen years following piling	386 (288 - 484)	386 (286 - 484)	1.000
2055	Eighteen years following piling	464 (318 - 602)	460 (318 - 602)	0.991
2060	Twenty-three years following piling	556 (374 - 742)	554 (374 - 742)	0.996

Table 3-31: Median (± 95% confidence intervals) predicted population growth rates for inshore bottlenose dolphin in the Coastal East Scotland MU: Concurrent WTG anchor piling (three locations, eight piles per day at each location), and the counterfactual population growth rate

Year	Description	Population growth rate		Counterfactual population growth rate
		Unimpacted population	Impacted population	
2036	Piling year 1	1.035 (0.930 - 1.114)	1.035 (0.930 - 1.114)	1.000
2037	Piling year 2	1.039 (0.960 - 1.088)	1.034 (0.955 - 1.088)	0.996
2038	One year following piling	1.037 (0.979 - 1.078)	1.037 (0.976 - 1.078)	1.000
2039	Two years following piling	1.037 (0.984 - 1.073)	1.035 (0.982 - 1.071)	0.998
2040	Three years following piling	1.037 (0.991 - 1.067)	1.036 (0.991 - 1.067)	0.999
2045	Eight years following piling	1.036 (1.010 - 1.057)	1.036 (1.010 - 1.057)	1.000
2050	Thirteen years following piling	1.036 (1.016 - 1.051)	1.036 (1.015 - 1.051)	1.000
2055	Eighteen years following piling	1.036 (1.017 - 1.050)	1.036 (1.017 - 1.050)	1.000
2060	Twenty-three years following piling	1.036 (1.020 - 1.048)	1.036 (1.020 - 1.048)	1.000

3.2.2.4.2 Harbour porpoise

107. The iPCoD modelling shows that the consequences of cumulative PTS and disturbance are unlikely to result in long term change at the population level for any of the WTG anchor scenarios.

108. Although the size of the impacted population is less than that of the unimpacted population, the impacted population is predicted to follow the same trajectory as the unimpacted population in the years following piling (**Figure 3-4**; **Figure 3-5**; **Figure 3-6**). This difference in population size is because, as noted above, there is no ability for the impacted population to converge with the unimpacted population size because iPCoD assumes no density dependence. As such, population growth rate is a more useful metric than population size (**Table 3-32, Table 3-34, Table 3-36**).

109. Under each scenario, the growth rate of the impacted population is very similar to that of the unimpacted population (**Table 3-33**; **Table 3-35**; **Table 3-37**); by between eight and 13 years following piling (depending on the scenario) the counterfactual population growth rate is 0.999.

110. **Conclusion:** The likely effects (cumulative PTS and disturbance) of increased underwater noise from pile driving do not affect the viability of the harbour porpoise population within the UK portion of the North Sea MU in the long term.

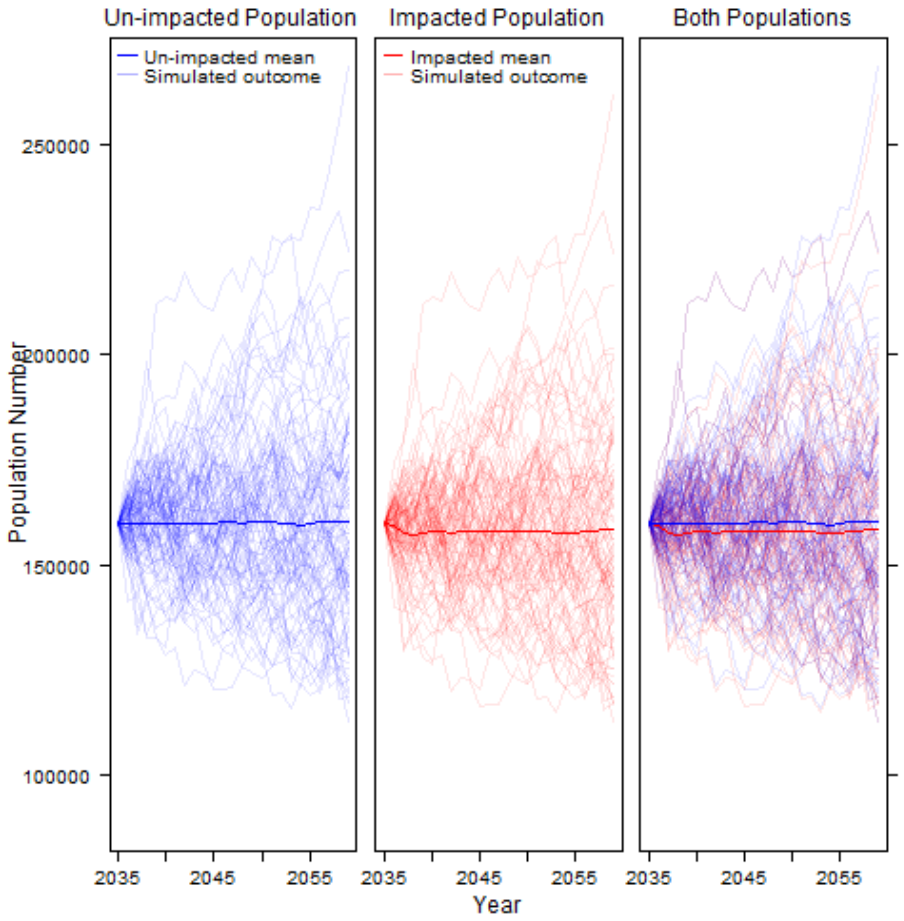


Figure 3-4: Simulated unimpacted and impacted population trajectories for harbour porpoise in the UK portion of the North Sea MU: WTG anchor Scenario 1 (single location, eight piles per day)

Table 3-32: Median (± 95% confidence intervals) predicted population sizes for harbour porpoise in the UK portion of the North Sea MU: WTG anchor Scenario 1 (single location, eight piles per day), and the counterfactual population size

Year	Description	Population size		Counterfactual population size
		Unimpacted population	Impacted population	
2036	Piling year 1	160012 (146001 - 170932)	159591 (145461 - 170404)	0.997
2037	Piling year 2	159999 (143383 - 174817)	158128 (141040 - 172550)	0.988
2038	One year following piling	159662 (141073 - 179351)	156864 (138161 - 175836)	0.982
2039	Two years following piling	160068 (138504 - 183069)	157856 (136611 - 179382)	0.986
2040	Three years following piling	159993 (136569 - 183375)	158161 (134833 - 179272)	0.989
2045	Eight years following piling	158218 (129857 - 192762)	156215 (128109 - 189944)	0.987
2050	Thirteen years following piling	157637 (125747 - 203590)	156173 (124108 - 201244)	0.991
2055	Eighteen years following piling	158299 (120334 - 209869)	156376 (119127 - 205225)	0.988
2060	Twenty-three years following piling	158185 (115441 - 214533)	156492 (113638 - 211077)	0.989

Table 3-33: Median (± 95% confidence intervals) predicted population growth rates for harbour porpoise in the UK portion of the North Sea MU: WTG anchor Scenario 1 (single location, eight piles per day), and the counterfactual population growth rate

Year	Description	Population growth rate		Counterfactual population growth rate
		Unimpacted population	Impacted population	
2036	Piling year 1	1.002 (0.915 - 1.071)	1.000 (0.911 - 1.067)	0.997
2037	Piling year 2	1.001 (0.948 - 1.046)	0.995 (0.940 - 1.040)	0.994
2038	One year following piling	1.000 (0.960 - 1.040)	0.994 (0.953 - 1.033)	0.994
2039	Two years following piling	1.001 (0.965 - 1.035)	0.997 (0.962 - 1.030)	0.997
2040	Three years following piling	1.000 (0.969 - 1.028)	0.998 (0.967 - 1.023)	0.998
2045	Eight years following piling	0.999 (0.980 - 1.019)	0.998 (0.978 - 1.018)	0.999
2050	Thirteen years following piling	0.999 (0.984 - 1.016)	0.999 (0.983 - 1.016)	0.999
2055	Eighteen years following piling	1.000 (0.986 - 1.014)	0.999 (0.985 - 1.013)	0.999
2060	Twenty-three years following piling	1.000 (0.987 - 1.012)	0.999 (0.986 - 1.011)	1.000

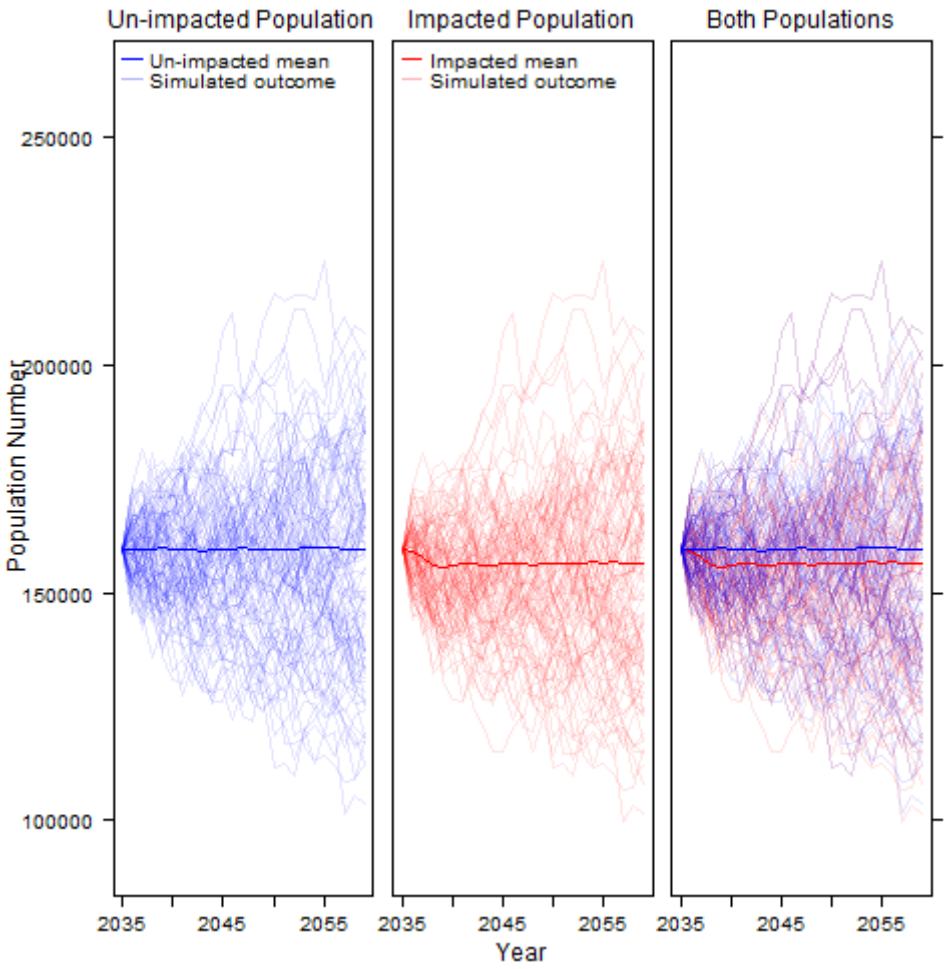


Figure 3-5: Simulated unimpacted and impacted population trajectories for harbour porpoise in the UK portion of the North Sea MU: WTG anchor Scenario 2 (single location, one pile per day)

Table 3-34: Median (± 95% confidence intervals) predicted population sizes for harbour porpoise in the UK portion of the North Sea MU: WTG anchor Scenario 2 (single location, one pile per day), and the counterfactual population size

Year	Description	Population size		Counterfactual population size
		Unimpacted population	Impacted population	
2036	Piling year 1	160028 (146596 - 171111)	159547 (146119 - 170829)	0.997
2037	Piling year 2	159885 (143667 - 175676)	157968 (140307 - 173964)	0.988
2038	Piling year 3	159374 (141407 - 177876)	156170 (136252 - 175038)	0.980
2039	Piling year 4	159576 (138292 - 180635)	155833 (133605 - 178160)	0.977
2040	One year following piling	159600 (137975 - 183715)	155884 (133368 - 180291)	0.977
2041	Two years following piling	158797 (135414 - 184566)	156048 (133095 - 180748)	0.983
2042	Three years following piling	159187 (133065 - 188401)	155731 (131212 - 185250)	0.978
2047	Eight years following piling	158345 (128143 - 198518)	155276 (125673 - 193662)	0.981
2052	Thirteen years following piling	157346 (122226 - 206499)	154568 (119247 - 202079)	0.982
2057	Eighteen years following piling	158191 (116937 - 211518)	155233 (115478 - 206504)	0.981
2060	Twenty-one years following piling	158527 (114499 - 217945)	155811 (112496 - 211722)	0.983

Table 3-35: Median (± 95% confidence intervals) predicted population growth rates for harbour porpoise in the UK portion of the North Sea MU: WTG anchor Scenario 2 (single location, one pile per day) table, and the counterfactual population growth rate

Year	Description	Population growth rate		Counterfactual population growth rate
		Unimpacted population	Impacted population	
2036	Piling year 1	1.002 (0.918 - 1.072)	0.999 (0.915 - 1.070)	0.997
2037	Piling year 2	1.001 (0.949 - 1.049)	0.995 (0.938 - 1.044)	0.994
2038	Piling year 3	0.999 (0.960 - 1.037)	0.993 (0.949 - 1.031)	0.993
2039	Piling year 4	1.000 (0.965 - 1.031)	0.994 (0.956 - 1.028)	0.994
2040	One year following piling	1.000 (0.971 - 1.028)	0.995 (0.965 - 1.025)	0.995
2041	Two years following piling	0.999 (0.973 - 1.024)	0.996 (0.970 - 1.021)	0.997
2042	Three years following piling	1.000 (0.974 - 1.024)	0.996 (0.972 - 1.021)	0.997
2047	Eight years following piling	0.999 (0.982 - 1.018)	0.998 (0.980 - 1.016)	0.998
2052	Thirteen years following piling	0.999 (0.984 - 1.015)	0.998 (0.983 - 1.014)	0.999
2057	Eighteen years following piling	1.000 (0.986 - 1.013)	0.999 (0.985 - 1.012)	0.999

Year	Description	Population growth rate		Counterfactual population growth rate
		Unimpacted population	Impacted population	
2060	Twenty-one years following piling	1.000 (0.987 - 1.013)	0.999 (0.986 - 1.011)	0.999

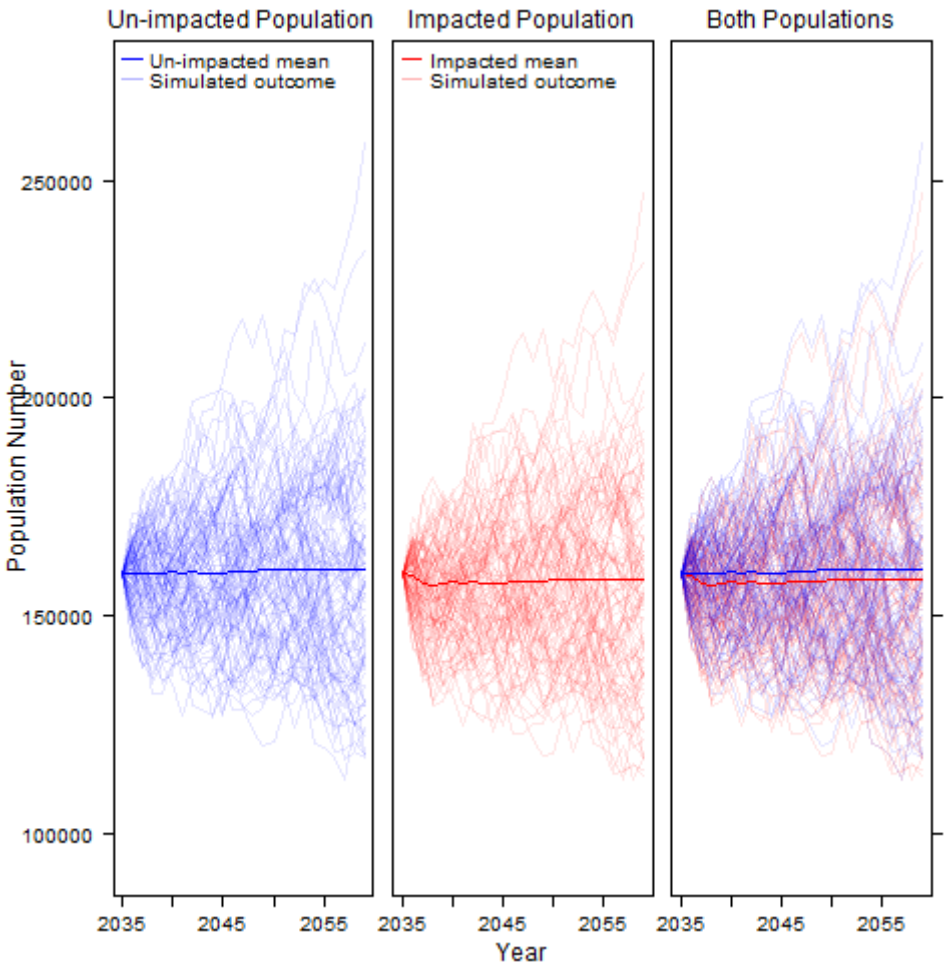


Figure 3-6: Simulated unimpacted and impacted population trajectories for harbour porpoise in the UK portion of the North Sea MU: Concurrent WTG anchor piling (three locations, eight piles per day at each location)

Table 3-36: Median (± 95% confidence intervals) predicted population sizes for harbour porpoise in the UK portion of the North Sea MU: Concurrent WTG anchor piling (three locations, eight piles per day at each location), and the counterfactual population size

Year	Description	Population size		Counterfactual population size
		Unimpacted population	Impacted population	
2036	Piling year 1	160140 (146210 - 171113)	159592 (145691 - 170391)	0.997
2037	Piling year 2	159936 (141844 - 175647)	157888 (139059 - 173494)	0.987
2038	One year following piling	159708 (140387 - 179535)	156635 (136644 - 174817)	0.981
2039	Two years following piling	159586 (138900 - 182266)	156699 (136419 - 178441)	0.982
2040	Three years following piling	159403 (137148 - 183042)	157250 (135449 - 182097)	0.986
2045	Eight years following piling	159747 (129826 - 194241)	157263 (128188 - 192346)	0.984
2050	Thirteen years following piling	159408 (124968 - 202496)	157437 (124080 - 198365)	0.988
2055	Eighteen years following piling	159103 (119668 - 211338)	156728 (117936 - 207428)	0.985
2060	Twenty-three years following piling	159484 (114821 - 213802)	156360 (113055 - 210136)	0.980

Table 3-37: Median (± 95% confidence intervals) predicted population growth rates for harbour porpoise in the UK portion of the North Sea MU: Concurrent WTG anchor piling (three locations, eight piles per day at each location), and the counterfactual population growth rate

Year	Description	Population growth rate		Counterfactual population growth rate
		Unimpacted population	Impacted population	
2036	Piling year 1	1.003 (0.916 - 1.072)	1.000 (0.913 - 1.067)	0.997
2037	Piling year 2	1.001 (0.943 - 1.049)	0.995 (0.933 - 1.043)	0.994
2038	One year following piling	1.000 (0.958 - 1.040)	0.994 (0.949 - 1.031)	0.994
2039	Two years following piling	1.000 (0.966 - 1.034)	0.995 (0.961 - 1.028)	0.995
2040	Three years following piling	1.000 (0.970 - 1.028)	0.997 (0.968 - 1.027)	0.997
2045	Eight years following piling	1.000 (0.980 - 1.020)	0.999 (0.978 - 1.019)	0.998
2050	Thirteen years following piling	1.000 (0.984 - 1.016)	0.999 (0.983 - 1.015)	0.999
2055	Eighteen years following piling	1.000 (0.986 - 1.014)	0.999 (0.985 - 1.013)	0.999
2060	Twenty-three years following piling	1.000 (0.987 - 1.012)	0.999 (0.986 - 1.011)	0.999

3.2.2.4.3 Grey seal

111. The iPCoD modelling shows that the consequences of cumulative PTS and disturbance are not sufficient to result in long term change at the population level for any of the WTG anchor scenarios.

112. The impacted population is predicted to follow the same trajectory as the unimpacted population in the years following piling (**Figure 3-7**; **Figure 3-8**; **Figure 3-9**).

113. The counterfactual population sizes (**Table 3-38, Table 3-40, Table 3-42**) and growth rates (**Table 3-39**; **Table 3-41**; **Table 3-43**) all = 1 in the years following piling for all three scenarios i.e., the impacted population sizes and growth rates are the same as (or very similar to) the unimpacted population sizes and growth rates.

114. **Conclusion**: The likely effects (cumulative PTS and disturbance) of increased underwater noise from pile driving do not affect the viability of the grey seal population within the relevant MUs in either the short or the long term.

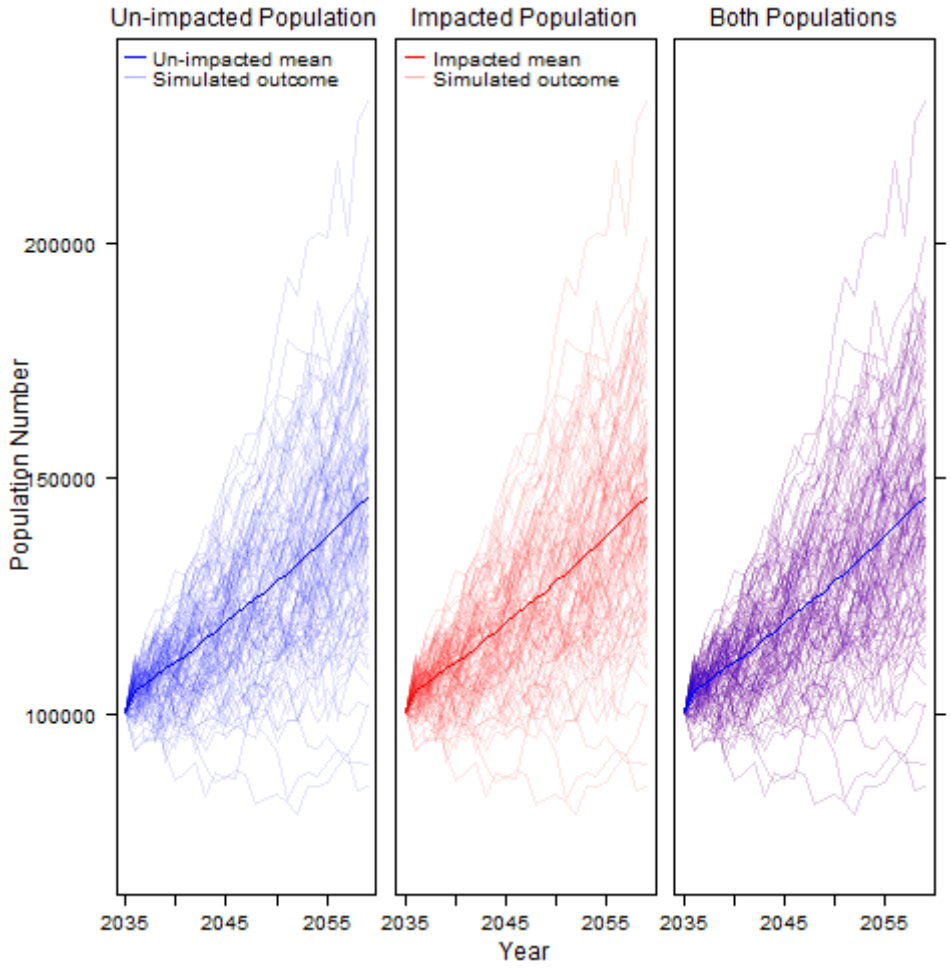


Figure 3-7: Simulated unimpacted and impacted population trajectories for grey seal in the relevant MUs: WTG anchor Scenario 1 (single location, eight piles per day)

Table 3-38: Median (± 95% confidence intervals) predicted population sizes for grey seal in the relevant MUs: WTG anchor Scenario 1 (single location, eight piles per day), and the counterfactual population size

Year	Description	Population size		Counterfactual population size
		Unimpacted population	Impacted population	
2036	Piling year 1	105199.5 (95517 - 111757)	105199.5 (95517 - 111757)	1.000
2037	Piling year 2	106631 (94113 - 115373)	106631 (94113 - 115373)	1.000
2038	One year following piling	108429.5 (93898 - 118893)	108429.5 (93898 - 118893)	1.000
2039	Two years following piling	110232 (93105 - 123049)	110232 (93105 - 123049)	1.000
2040	Three years following piling	111327 (93831 - 125150)	111327 (93831 - 125150)	1.000
2045	Eight years following piling	119323 (94685 - 145578)	119323 (94685 - 145578)	1.000
2050	Thirteen years following piling	127660.5 (92577 - 165590)	127660.5 (92577 - 165590)	1.000
2055	Eighteen years following piling	137126 (94933 - 183655)	137126 (94933 - 183655)	1.000
2060	Twenty-three years following piling	146700.5 (98647 - 208122)	146700.5 (98647 - 208122)	1.000

Table 3-39: Median (± 95% confidence intervals) predicted population growth rates for grey seal in the relevant MUs: WTG anchor Scenario 1 (single location, eight piles per day), and the counterfactual population growth rate

Year	Description	Population growth rate		Counterfactual population growth rate
		Unimpacted population	Impacted population	
2036	Piling year 1	1.049 (0.953 - 1.115)	1.049 (0.953 - 1.115)	1.000
2037	Piling year 2	1.031 (0.969 - 1.073)	1.031 (0.969 - 1.073)	1.000
2038	One year following piling	1.026 (0.978 - 1.058)	1.026 (0.978 - 1.058)	1.000
2039	Two years following piling	1.024 (0.982 - 1.053)	1.024 (0.982 - 1.053)	1.000
2040	Three years following piling	1.021 (0.987 - 1.045)	1.021 (0.987 - 1.045)	1.000
2045	Eight years following piling	1.018 (0.994 - 1.038)	1.018 (0.994 - 1.038)	1.000
2050	Thirteen years following piling	1.016 (0.995 - 1.034)	1.016 (0.995 - 1.034)	1.000
2055	Eighteen years following piling	1.016 (0.997 - 1.031)	1.016 (0.997 - 1.031)	1.000
2060	Twenty-three years following piling	1.015 (0.999 - 1.030)	1.015 (0.999 - 1.030)	1.000

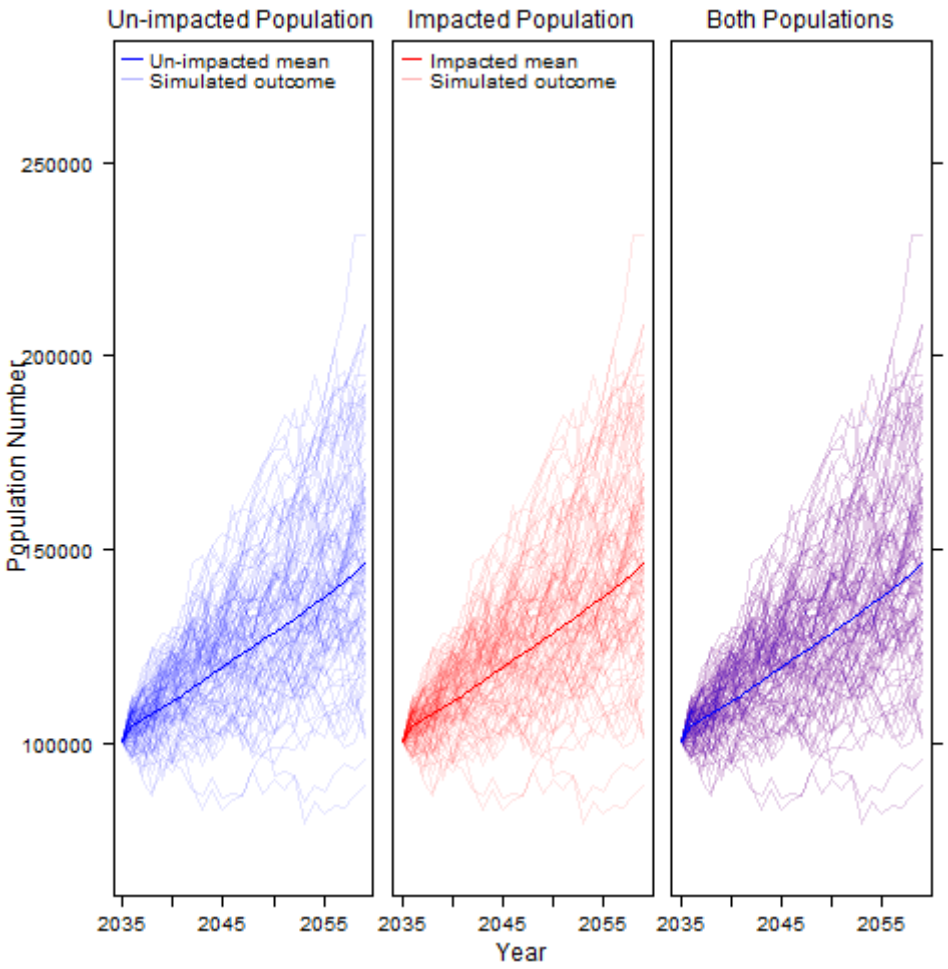


Figure 3-8: Simulated unimpacted and impacted population trajectories for grey seal in the relevant MUs: WTG anchor Scenario 2 (single location, one pile per day)

Table 3-40: Median (± 95% confidence intervals) predicted population sizes for grey seal in the relevant MUs: WTG anchor Scenario 2 (single location, one pile per day), and the counterfactual population size)

Year	Description	Population size		Counterfactual population size
		Unimpacted population	Impacted population	
2036	Piling year 1	105338 (94800 - 111874)	105338 (94800 - 111874)	1.000
2037	Piling year 2	106853 (93469 - 115521)	106853 (93469 - 115521)	1.000
2038	Piling year 3	108461 (92052 - 119702)	108461 (92052 - 119702)	1.000
2039	Piling year 4	110076 (93402 - 122379)	110076 (93402 - 122379)	1.000
2040	One year following piling	111547.5 (93556 - 126720)	111547.5 (93556 - 126720)	1.000
2041	Two years following piling	112938 (93029 - 129569)	112926 (93029 - 129569)	1.000
2042	Three years following piling	114622.5 (92634 - 134102)	114622.5 (92634 - 134102)	1.000
2047	Eight years following piling	122944 (93693 - 153053)	122944 (93693 - 153053)	1.000
2052	Thirteen years following piling	131002 (95695 - 172391)	131002 (95695 - 172391)	1.000
2057	Eighteen years following piling	140223 (96971 - 190521)	140223 (96971 - 190521)	1.000
2060	Twenty-one years following piling	147669 (98724 - 204550)	147669 (98724 - 204550)	1.000

Table 3-41: Median (± 95% confidence intervals) predicted population growth rates for grey seal in the relevant MUs: WTG anchor Scenario 2 (single location, one pile per day) table, and the counterfactual population growth rate

Year	Description	Population growth rate		Counterfactual population growth rate
		Unimpacted population	Impacted population	
2036	Piling year 1	1.051 (0.946 - 1.116)	1.051 (0.946 - 1.116)	1.000
2037	Piling year 2	1.032 (0.966 - 1.073)	1.032 (0.966 - 1.073)	1.000
2038	Piling year 3	1.027 (0.972 - 1.061)	1.027 (0.972 - 1.061)	1.000
2039	Piling year 4	1.024 (0.982 - 1.051)	1.024 (0.982 - 1.051)	1.000
2040	One year following piling	1.022 (0.986 - 1.048)	1.022 (0.986 - 1.048)	1.000
2041	Two years following piling	1.020 (0.988 - 1.044)	1.020 (0.988 - 1.044)	1.000
2042	Three years following piling	1.019 (0.989 - 1.042)	1.019 (0.989 - 1.042)	1.000
2047	Eight years following piling	1.017 (0.994 - 1.036)	1.017 (0.994 - 1.036)	1.000
2052	Thirteen years following piling	1.016 (0.997 - 1.032)	1.016 (0.997 - 1.032)	1.000
2057	Eighteen years following piling	1.015 (0.998 - 1.030)	1.015 (0.998 - 1.030)	1.000

Year	Description	Population growth rate		Counterfactual population growth rate
		Unimpacted population	Impacted population	
2060	Twenty-one years following piling	1.016 (0.999 - 1.029)	1.016 (0.999 - 1.029)	1.000

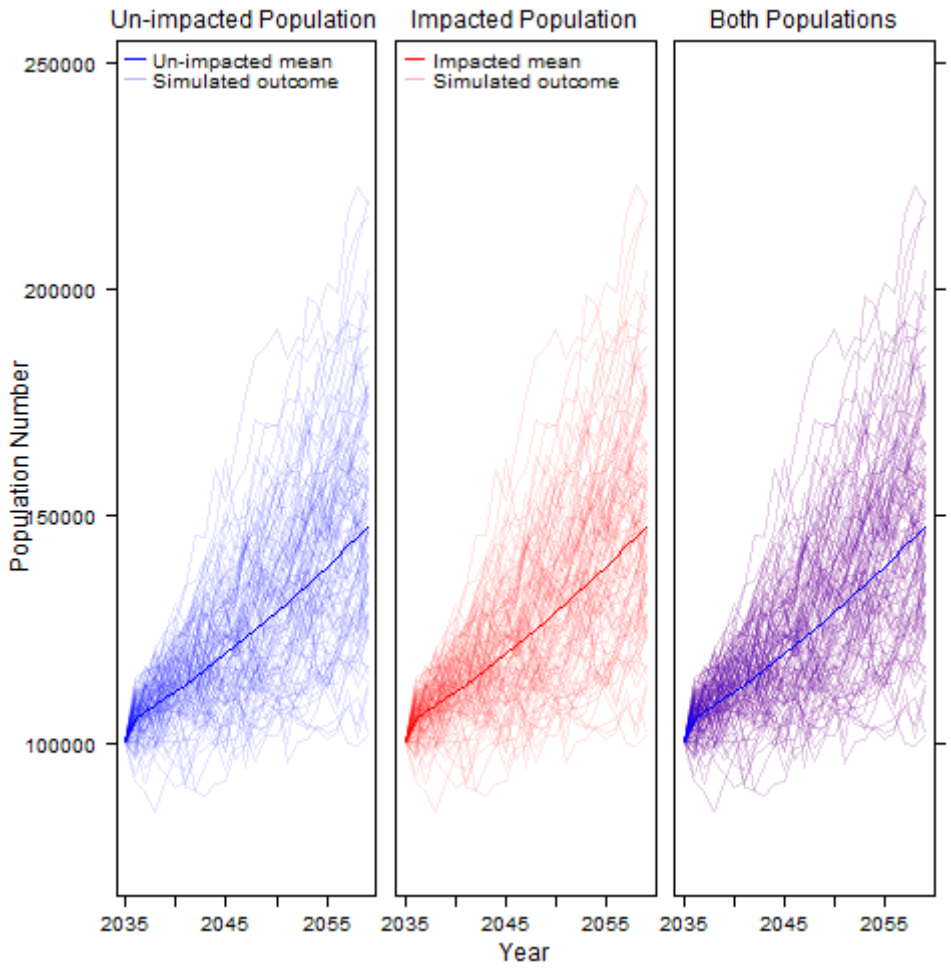


Figure 3-9: Simulated unimpacted and impacted population trajectories for grey seal in the relevant MUs: Concurrent WTG anchor piling (three locations, eight piles per day at each location)

Table 3-42: Median (± 95% confidence intervals) predicted population sizes for grey seal in the relevant MUs: Concurrent WTG anchor piling (three locations, eight piles per day at each location), and the counterfactual population size

Year	Description	Population size		Counterfactual population size
		Unimpacted population	Impacted population	
2036	Piling year 1	105396.5 (95258 - 112303)	105396.5 (95258 - 112303)	1.000
2037	Piling year 2	107381.5 (94851 - 115808)	107381.5 (94851 - 115808)	1.000
2038	One year following piling	108715 (94491 - 119511)	108717.5 (94484 - 119506)	1.000
2039	Two years following piling	110345.5 (93388 - 123212)	110342 (93382 - 123217)	1.000
2040	Three years following piling	112157 (94868 - 126099)	112155 (94875 - 126093)	1.000
2045	Eight years following piling	119567 (92757 - 145200)	119563.5 (92759 - 145188)	1.000
2050	Thirteen years following piling	128520 (95399 - 162600)	128515.5 (95387 - 162578)	1.000
2055	Eighteen years following piling	138511 (100019 - 183602)	138515 (100016 - 183546)	1.000
2060	Twenty-three years following piling	148007 (98575 - 203888)	147983 (98575 - 203888)	1.000

Table 3-43: Median (± 95% confidence intervals) predicted population growth rates for grey seal in the relevant MUs: Concurrent WTG anchor piling (three locations, eight piles per day at each location), and the counterfactual population growth rate

Year	Description	Population growth rate		Counterfactual population growth rate
		Unimpacted population	Impacted population	
2036	Piling year 1	1.051 (0.950 - 1.120)	1.051 (0.950 - 1.120)	1.000
2037	Piling year 2	1.035 (0.973 - 1.075)	1.035 (0.973 - 1.075)	1.000
2038	One year following piling	1.027 (0.980 - 1.060)	1.027 (0.980 - 1.060)	1.000
2039	Two years following piling	1.024 (0.982 - 1.053)	1.024 (0.982 - 1.053)	1.000
2040	Three years following piling	1.023 (0.989 - 1.047)	1.023 (0.989 - 1.047)	1.000
2045	Eight years following piling	1.018 (0.992 - 1.038)	1.018 (0.992 - 1.038)	1.000
2050	Thirteen years following piling	1.017 (0.997 - 1.033)	1.017 (0.997 - 1.033)	1.000
2055	Eighteen years following piling	1.016 (1.000 - 1.031)	1.016 (1.000 - 1.031)	1.000
2060	Twenty-three years following piling	1.016 (0.999 - 1.029)	1.016 (0.999 - 1.029)	1.000

3.3 IMPACT 2 - INCREASED UNDERWATER NOISE – UXO CLEARANCE WORK (CONSTRUCTION PHASE)

115. Based on the outcome of the pre-construction surveys, there may be a requirement for UXO clearance work at the Proposed Offshore Development. Once the detailed pre-construction surveys have been completed, the location, number and size of confirmed UXOs (cUXOs) will be known. Should clearance be required it will be subject to further assessment (using the new information on the location, number and size of the cUXOs) and separate (Marine and EPS) licence applications (see **Volume 1, Chapter 4: Project Description** of the EIAR). As a result of the new information on the cUXOs it is likely that the mitigation measures proposed here will be refined and, as such, further consultation (with MD-LOT and the relevant SNCBs) will be conducted.

116. For this assessment, the likelihood of encountering a UXO within the Proposed Offshore Development Site has been based on the 'Unexploded Ordnance Threat and Risk Assessment' for the Proposed Offshore Development (6 Alpha Associates, 2023). The type and size of UXO likely to be present are summarised in **Table 3-44**.

117. Depending on the clearance approach used, underwater noise from UXO clearance activities has the potential to cause mortality, injury, or behavioural response to Annex II marine mammals. Noise generated from such activities will be temporary and intermittent. Any behavioural responses will be short-term and reversible with suitable alternative habitat being available in the meantime.

118. The MDS considered within the assessment of increased underwater noise from UXO clearance work is shown in **Table 4-1** and embedded mitigation measures in **Table 4-2**.

119. A variety of options for managing UXOs on site are available and will be considered depending on the outcome of the pre-construction surveys. These options include:

- micro-siting i.e., avoidance of UXO;
- relocation ('lift and shift') of UXO, avoiding detonation;
- low order clearance (deflagration); and
- high order clearance (detonation).

120. These options will be considered on a case-by-case basis. Detonation by controlled explosion will be used as a last resort should neither avoidance nor relocation be practicable.

121. Low order clearance, such as deflagration, is preferable to high order clearance (detonation) as it avoids the high pressures associated with an explosion. Deflagration allows the explosive material within the UXO to be neutralised without detonation by 'burning away' the explosive material using a small initiation explosive. Different sized initiation explosives may be required for different sized UXOs. Noise is emitted during this low order clearance method with a predicted maximum impact considered to be equivalent to a charge weight of 0.25 kg (**Table 3-45**).

122. Underwater noise modelling was carried out on all UXO types likely to occur in the Proposed Offshore Development (**Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR). A larger net explosive quantity (NEQ) of 750 kg was also modelled in response to Natural England (2021) however these outputs have not been presented because the Natural England advice does not extend outside of English waters. The model assumes no

degradation of the UXO, which is likely overly precautionary but accounts for worst-case scenario. Should detonation ('high order' clearance) be required, a 'donor charge' of 0.25 kg will be used to initiate explosion of the UXO and has been included in the modelling.

123. A summary of the unweighted UXO clearance source levels used in the underwater noise modelling is provided in **Table 3-45**.

Table 3-44 Summary of UXO types which may pose a threat at the Proposed Offshore Development location (6 Alpha Associates, 2023)

Type of UXO	Designation	NEQ (kg)
Aerial bombs and depth charges	SC-500 HE Bomb	220
	Mark VII Airbourne Depth Charge	132
	SC-250 HE Bomb	130
	250 lb MC Bomb	67.8
	250 lb GP Bomb	30
	SC-50 HE Bomb	25
Aerial and naval torpedoes	53.3 cm G7e Torpedo	364
	18" Mark XV Torpedo	321
	45 cm F5 Torpedo	260
	50 cm G7 Torpedo	254
	50 cm G6 Torpedo	213
	18" Mark XII Torpedo	176
Naval mines	Mark XVII Mine	227
	Mark XX Mine	227
	E Mine	165
	Type H Mark II Mine	145
	UC-200 Mine	141
Projectiles and land service ammunition	6" Artillery Projectile	6.0
	Beach Type C Mine	2.04
	8.8 cm Naval Projectile	1.42
	4" Artillery Projectile	0.82
	3" Mortal Shell	0.55
	Mills Bomb	0.1

Table 3-45 Summary of the unweighted SPL_{peak} and SEL single strike (SEL_{SS}) source levels used for low and high order UXO clearance modelling

Charge weight (kg)*	SPLpeak (dB re 1 µPa @ 1 m)	SELSS (dB re 1 µPa2s @ 1 m)
Low order (0.25)	269.8	215.2
0.1 + donor	270.9	216.1
0.55 + donor	273.6	218.4
0.82 + donor	274.5	219.2
1.42 + donor	276.0	220.4
2.04 + donor	277.0	221.3
6 + donor	280.3	224.1
25 + donor	284.9	227.9
30 + donor	285.5	228.4
67.8 + donor	288.1	230.7
130 + donor	290.2	232.5
132 + donor	290.3	232.5
141 + donor	290.5	232.7
145 + donor	290.6	232.8
165 + donor	291.0	233.1
176 + donor	291.2	233.3
213 + donor	291.9	233.9
220 + donor	292.0	233.9
227 + donor	292.1	234.0
254 + donor	292.4	234.3
260 + donor	292.5	234.4
321 + donor	293.2	235.0
364 + donor	293.6	235.3

*All charge weights refer to high order clearance unless specified.

3.3.1 Pre-Mitigation Effects

3.3.1.1 Auditory Injury

124. For UXO detonation, marine mammals are highly sensitive if they are within the potential impact ranges for physical injury or auditory injury (PTS). Animals within the potential impact range are considered to have limited ability to avoid the impacts of a detonation and no potential to recover from physical injury or PTS (von Benda-Beckmann *et al.,* 2015).

125. Based on the UXO clearance from a variety of potential charge weights the spatial extent for instantaneous PTS was modelled for impulsive (**Table 3-46**) and non-impulsive sounds (**Table 3-47**) (**Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR). For low order clearance the greatest of the impulsive PTS impact ranges (Peak Sound Pressure Level (SPL_{peak})) is for very high frequency cetaceans at 0.99 km. For high order clearance the largest impact was from the 364 kg charge weight for the impulsive SPL_{peak} with a PTS impact range of 11 km for very high frequency cetaceans.

Table 3-46 Summary of the impulsive PTS impact ranges for low and high order UXO clearance

Charge weight (kg)*	Impact range (km)					
	High frequency cetaceans		Very high frequency cetaceans		Phocid carnivores in water	
	SPLpeak	SELss	SPLpeak	SELss	SPLpeak	SELss
Low order (0.25)	0.06	<0.05	0.99	0.08	0.19	<0.05
0.1 + donor	0.06	<0.05	1.1	0.1	0.21	<0.05
0.55 + donor	0.08	<0.05	1.4	0.13	0.28	0.07
0.82 + donor	0.09	<0.05	1.6	0.15	0.31	0.08
1.42 + donor	0.1	<0.05	1.8	0.19	0.36	0.1
2.04 + donor	0.12	<0.05	2	0.22	0.4	0.12
6 + donor	0.16	<0.05	2.9	0.33	0.57	0.19
25 + donor	0.26	<0.05	4.6	0.57	0.91	0.38
30 + donor	0.28	<0.05	4.9	0.6	0.96	0.42
67.8 + donor	0.37	<0.05	6.4	0.8	1.2	0.63
130 + donor	0.46	<0.05	8	0.98	1.5	0.86
132 + donor	0.46	<0.05	8	0.98	1.5	0.87
141 + donor	0.47	<0.05	8.2	1	1.6	0.9
145 + donor	0.48	<0.05	8.3	1	1.6	0.91
165 + donor	0.5	<0.05	8.6	1	1.7	0.97
176 + donor	0.51	<0.05	8.8	1	1.7	1
213 + donor	0.54	<0.05	9.4	1.1	1.8	1
220 + donor	0.55	<0.05	9.5	1.1	1.8	1.1
227 + donor	0.55	<0.05	9.6	1.1	1.8	1.1
254 + donor	0.57	<0.05	10	1.1	1.9	1.1
260 + donor	0.58	<0.05	10	1.1	1.9	1.2
321 + donor	0.62	<0.05	10	1.2	2.1	1.3
364 + donor	0.65	<0.05	11	1.3	2.2	1.4

*All charge weights refer to high order clearance unless specified.

Table 3-47 Summary of the non-impulsive PTS impact ranges for low and high order UXO clearance

Charge weight (kg)*	Impact range (km)		
	High frequency cetaceans	Very high frequency cetaceans	Phocid carnivores in water
	SEL_{ss}	SEL_{ss}	SEL_{ss}
Low order (0.25)	<0.05	<0.05	<0.05
0.1 + donor	<0.05	<0.05	<0.05
0.55 + donor	<0.05	<0.05	<0.05
0.82 + donor	<0.05	<0.05	<0.05
1.42 + donor	<0.05	<0.05	<0.05
2.04 + donor	<0.05	<0.05	<0.05
6 + donor	<0.05	<0.05	<0.05
25 + donor	<0.05	<0.05	<0.05
30 + donor	<0.05	<0.05	<0.05
67.8 + donor	<0.05	0.05	<0.05
130 + donor	<0.05	0.07	0.05
132 + donor	<0.05	0.07	0.05
141 + donor	<0.05	0.08	0.05
145 + donor	<0.05	0.08	0.05
165 + donor	<0.05	0.08	0.06
176 + donor	<0.05	0.08	0.06
213 + donor	<0.05	0.09	0.07
220 + donor	<0.05	0.09	0.07
227 + donor	<0.05	0.09	0.07
254 + donor	<0.05	0.1	0.07
260 + donor	<0.05	0.1	0.07
321 + donor	<0.05	0.11	0.08
364 + donor	<0.05	0.11	0.09

*All charge weights refer to high order clearance unless specified.

126. Using the greatest impact ranges (SPL_{peak} for harbour porpoise and grey seals), and assuming that spreading is approximately spherical (area = πr^2), the number of individuals for harbour porpoise (**Table 3-48**) and grey seals (**Table 3-49)** which have the potential to be present within the areas of potential impact for PTS has been estimated. This was calculated by multiplying the area of impact by the density for each species within that area (**see Section 2**). For harbour porpoise where multiple densities are available for the different SCANS-IV blocks which overlap the Proposed Offshore Development the largest density estimate available has been used as a precautionary approach. The percentage of the relevant reference populations for each species this represents has also been presented. For inshore bottlenose dolphins there will be less than one individual present within the areas of potential impact for PTS after UXO clearance for all of the charge weights assessed.

Table 3-48 Number of harbour porpoise which have the potential to be present within the PTS impact areas after low and high order UXO clearance at different charge weights

Charge weight (kg)*	Impulsive SPL_{peak} range (km)	Area (km^2)	Number of individuals	% of MU	% UK portion of MU
Low order (0.25)	0.99	3.08	2	0.001 %	0.001 %
0.1 + donor	1.1	3.80	2	0.001 %	0.001 %
0.55 + donor	1.4	6.16	4	0.001 %	0.002 %
0.82 + donor	1.6	8.04	5	0.001 %	0.003 %
1.42 + donor	1.8	10.18	6	0.002 %	0.004 %
2.04 + donor	2	12.57	8	0.002 %	0.005 %
6 + donor	2.9	26.42	16	0.005 %	0.010 %
25 + donor	4.6	66.48	40	0.011 %	0.025 %
30 + donor	4.9	75.43	45	0.013 %	0.028 %
67.8 + donor	6.4	128.68	77	0.022 %	0.048 %
130 + donor	8	201.06	120	0.035 %	0.075 %
132 + donor	8	201.06	120	0.035 %	0.075 %
141 + donor	8.2	211.24	126	0.036 %	0.079 %
145 + donor	8.3	216.42	130	0.037 %	0.081 %
165 + donor	8.6	232.35	139	0.040 %	0.087 %
176 + donor	8.8	243.28	146	0.042 %	0.091 %
213 + donor	9.4	277.59	166	0.048 %	0.104 %
220 + donor	9.5	283.53	170	0.049 %	0.106 %
227 + donor	9.6	289.53	173	0.050 %	0.109 %
254 + donor	10	314.16	188	0.054 %	0.118 %
260 + donor	10	314.16	188	0.054 %	0.118 %
321 + donor	10	314.16	188	0.054 %	0.118 %
364 + donor	11	380.13	228	0.066 %	0.143 %

*All charge weights refer to high order clearance unless specified.

Table 3-49 Number of grey seals which have the potential to be present within the PTS impact areas after low and high order UXO clearance at different charge weights

Charge weight (kg)*	Impulsive SPL_{peak} range (km)	Area (km^2)	Number of individuals	% of MU
Low order (0.25)	0.19	0.11	<1	-
0.1 + donor	0.21	0.14	<1	-
0.55 + donor	0.28	0.25	<1	-
0.82 + donor	0.31	0.30	<1	-
1.42 + donor	0.36	0.41	<1	-
2.04 + donor	0.4	0.50	<1	-
6 + donor	0.57	1.02	<1	-
25 + donor	0.91	2.60	1	0.001 %
30 + donor	0.96	2.90	1	0.001 %
67.8 + donor	1.2	4.52	1	0.001 %
130 + donor	1.5	7.07	2	0.002 %
132 + donor	1.5	7.07	2	0.002 %
141 + donor	1.6	8.04	2	0.002 %
145 + donor	1.6	8.04	2	0.002 %
165 + donor	1.7	9.08	2	0.002 %
176 + donor	1.7	9.08	2	0.002 %

Charge weight (kg)*	Impulsive SPL_{peak} range (km)	Area (km^2)	Number of individuals	% of MU
213 + donor	1.8	10.18	3	0.003 %
220 + donor	1.8	10.18	3	0.003 %
227 + donor	1.8	10.18	3	0.003 %
254 + donor	1.9	11.34	3	0.003 %
260 + donor	1.9	11.34	3	0.003 %
321 + donor	2.1	13.85	3	0.003 %
364 + donor	2.2	15.21	4	0.004 %

*All charge weights refer to high order clearance unless specified.

3.3.1.2 Behavioural Responses

127. The following two approaches have been used to assess the behavioural responses of Annex II marine mammals to increased underwater noise from UXO clearance work:

- Approach A: Use of the EDRs; and
- Approach B: Use of TTS as a proxy for behavioural disturbance.

3.3.1.2.1 Approach A: Use of EDRs

128. To estimate the number of individuals which have the potential to be exposed to sound levels which may induce a behavioural response, the EDRs (for harbour porpoise) for low order UXO clearance (5 km) and high order UXO clearance (26 km) were used for all species (JNCC, 2023a).

129. The areas of potential effect (assuming that spreading is approximately spherical) were calculated using the equation area = πr^2 where r = 5 for low, and 26 for high order clearance and equates to:

- Low order clearance: 78.5 km^2; and
- High order clearance: 2123.7 km^2.

130. The number of individuals with potential to be present within these areas has been estimated for each Annex II marine mammal species assessed (**Table 3-50**) using the density information presented in **Section 2.** For inshore bottlenose dolphins the area of potential effect was adjusted to account for the range of the east coast of Scotland bottlenose dolphin population which has been defined as being limited to the 20 m depth contour (see **Section 2.1**).

Table 3-50 Number of individual marine mammals which may exhibit behavioural responses following low or high order UXO clearance

Species	Low order clearance (5 km EDR)			High order clearance (26 km EDR)		
	No. individuals	% of MU	% UK MU	No. individuals	% of MU	% UK MU
Inshore bottlenose dolphin	2	0.734 %	n/a	6	2.828 %	n/a
Harbour porpoise	47	0.014 %	0.029 %	1271	0.367 %	0.796 %
Grey seal	20	0.020 %	n/a	533	0.532 %	n/a

3.3.1.2.2 Approach B: Use of TTS as a proxy

131. Without there being available thresholds for behavioural disturbance to Annex II marine mammals from UXO clearance TTS has been used as a proxy.

132. Based on the UXO clearance from a variety of potential charge weights the spatial extent for TTS was modelled for impulsive (**Table 3-51**) and non-impulsive sounds (**Table 3-52**; also see **Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR). For low order clearance the greatest of the TTS impact ranges (SPL_{peak}) is for very high frequency cetaceans at 1.8 km. For high order clearance the largest impact was from the 364 kg charge weight for the impulsive SPL_{peak} with a PTS impact range of 20 km for very high frequency cetaceans.

Table 3-51 Summary of the impulsive TTS impact ranges for low and high order UXO clearance

Charge weight (kg)*	Impact range (km)					
	High frequency cetaceans		Very high frequency cetaceans		Phocid carnivores in water	
	SPLpeak	SELss	SPLpeak	SELss	SPLpeak	SELss
Low order (0.25)	0.1	<0.05	1.8	0.75	0.36	0.57
0.1 + donor	0.11	<0.05	2	0.83	0.4	0.67
0.55 + donor	0.15	<0.05	2.7	1	0.53	1
0.82 + donor	0.17	<0.05	2.9	1.1	0.58	1.1
1.42 + donor	0.19	<0.05	3.4	1.3	0.67	1.4
2.04 + donor	0.22	<0.05	3.8	1.4	0.75	1.6
6 + donor	0.31	0.08	5.3	1.8	1	2.7
25 + donor	0.49	0.15	8.5	2.4	1.6	5.2
30 + donor	0.52	0.16	9	2.5	1.7	5.7
67.8 + donor	0.68	0.23	11	2.9	2.3	8.2
130 + donor	0.85	0.31	14	3.2	2.8	11
132 + donor	0.85	0.31	14	3.2	2.9	11
141 + donor	0.87	0.32	15	3.3	2.9	11
145 + donor	0.88	0.32	15	3.3	3	11
165 + donor	0.92	0.34	15	3.3	3.1	12
176 + donor	0.94	0.35	16	3.4	3.2	12
213 + donor	1	0.38	17	3.5	3.4	13
220 + donor	1	0.38	17	3.5	3.4	13
227 + donor	1	0.38	17	3.5	3.4	13
254 + donor	1	0.4	18	3.6	3.6	14
260 + donor	1	0.41	18	3.6	3.6	14
321 + donor	1.1	0.44	19	3.7	3.9	16
364 + donor	1.2	0.46	20	3.8	4	17

*All charge weights refer to high order clearance unless specified.

Table 3-52 Summary of the non-impulsive TTS impact ranges for low and high order UXO clearance

Charge weight (kg)*	Impact range (km)		
	High frequency cetaceans	Very high frequency cetaceans	Phocid carnivores in water
	SEL_{ss}	SEL_{ss}	SEL_{ss}
Low order (0.25)	< 0.05	0.11	0.8
0.1 + donor	< 0.05	0.13	0.10
0.55 + donor	< 0.05	0.19	0.14
0.82 + donor	< 0.05	0.21	0.16
1.42 + donor	< 0.05	0.26	0.20
2.04 + donor	< 0.05	0.29	0.24
6 + donor	< 0.05	0.44	0.39
25 + donor	< 0.05	0.73	0.78
30 + donor	< 0.05	0.77	0.85
67.8 + donor	0.06	1.0	1.2
130 + donor	0.09	1.2	1.7
132 + donor	0.09	1.2	1.7
141 + donor	0.09	1.2	1.8
145 + donor	0.09	1.2	1.8
165 + donor	0.1	1.2	1.9
176 + donor	0.1	1.3	2.0
213 + donor	0.1	1.3	2.2
220 + donor	0.11	1.3	2.2
227 + donor	0.11	1.4	2.2
254 + donor	0.11	1.4	2.3
260 + donor	0.12	1.4	2.4
321 + donor	0.13	1.5	2.6
364 + donor	0.13	1.5	2.8

*All charge weights refer to high order clearance unless specified.

Using the greatest impact ranges (impulsive SEL_{ss} for grey seals and SPL_{peak} for harbour porpoise) and assuming that spreading is approximately spherical (area = πr^2), the number of individuals for harbour porpoise (**Table 3-53**) and grey seals (**Table 3-54)** which have the potential to be present within the areas of potential impact for TTS (and therefore will show a behavioural response) from UXO clearance has been estimated. This was calculated by multiplying the area of impact by the density for each species within that area (see **Section 2**). For harbour porpoise where multiple densities are available for the different SCANS-IV blocks which overlap the Proposed Offshore Development the largest density estimate available has been used as a precautionary approach. The percentage of the relevant reference populations for each species this represents has also been presented. For inshore bottlenose dolphins there will be less than one individual present within the areas of potential impact for TTS after UXO clearance for all of the charge weights assessed.

Table 3-53 Number of harbour porpoise which have the potential to be present within the TTS impact areas and therefore show a behavioural response after low and high order UXO clearance at different charge weights

Charge weight (kg)*	Impulsive SPL_{peak} range (km)	Area (km^2)	Number of individuals	% of MU	% UK portion of MU
Low order (0.25)	1.8	10.18	6	0.002 %	0.004 %
0.1 + donor	2	12.57	8	0.002 %	0.005 %
0.55 + donor	2.7	22.90	14	0.004 %	0.009 %
0.82 + donor	2.9	26.42	16	0.005 %	0.010 %
1.42 + donor	3.4	36.32	22	0.006 %	0.014 %
2.04 + donor	3.8	45.36	27	0.008 %	0.017 %
6 + donor	5.3	88.25	53	0.015 %	0.033 %
25 + donor	8.5	226.98	136	0.039 %	0.085 %
30 + donor	9	254.47	152	0.044 %	0.095 %
67.8 + donor	11	380.13	228	0.066 %	0.143 %
130 + donor	14	615.75	369	0.106 %	0.231 %
132 + donor	14	615.75	369	0.106 %	0.231 %
141 + donor	15	706.86	423	0.122 %	0.265 %
145 + donor	15	706.86	423	0.122 %	0.265 %
165 + donor	15	706.86	423	0.122 %	0.265 %
176 + donor	16	804.25	481	0.139 %	0.302 %
213 + donor	17	907.92	543	0.157 %	0.340 %
220 + donor	17	907.92	543	0.157 %	0.340 %
227 + donor	17	907.92	543	0.157 %	0.340 %
254 + donor	18	1017.88	609	0.176 %	0.382 %
260 + donor	18	1017.88	609	0.176 %	0.382 %
321 + donor	19	1134.11	679	0.196 %	0.425 %
364 + donor	20	1256.64	752	0.217 %	0.471 %

*All charge weights refer to high order clearance unless specified.

Table 3-54 Number of grey seals which have the potential to be present within the TTS impact areas and therefore show a behavioural response after low and high order UXO clearance at different charge weights

Charge weight (kg)*	Impulsive SEL_{ss} range (km)	Area (km^2)	Number of individuals	% of MU
Low order (0.25)	0.57	1.02	<1	-
0.1 + donor	0.67	1.41	<1	-
0.55 + donor	1	3.14	1	0.001 %
0.82 + donor	1.1	3.80	1	0.001 %
1.42 + donor	1.4	6.16	2	0.002 %
2.04 + donor	1.6	8.04	2	0.002 %
6 + donor	2.7	22.90	6	0.006 %
25 + donor	5.2	84.95	21	0.021 %
30 + donor	5.7	102.07	26	0.026 %
67.8 + donor	8.2	211.24	53	0.053 %
130 + donor	11	380.13	95	0.095 %
132 + donor	11	380.13	95	0.095 %
141 + donor	11	380.13	95	0.095 %
145 + donor	11	380.13	95	0.095 %

Charge weight (kg)*	Impulsive SEL_{ss} range (km)	Area (km^2)	Number of individuals	% of MU
165 + donor	12	452.39	114	0.113 %
176 + donor	12	452.39	114	0.113 %
213 + donor	13	530.93	133	0.133 %
220 + donor	13	530.93	133	0.133 %
227 + donor	13	530.93	133	0.133 %
254 + donor	14	615.75	154	0.154 %
260 + donor	14	615.75	154	0.154 %
321 + donor	16	804.25	202	0.201 %
364 + donor	17	907.92	228	0.227 %

*All charge weights refer to high order clearance unless specified.

3.3.1.3 Mitigation Measures

133. In order to seek to ensure the absence of Annex II marine mammals in the vicinity of the UXO clearance work mitigation will be put in place.

134. The mitigation has been designed around the greatest (i.e., reasonable worst case) potential impact ranges which are those for very high frequency cetaceans (i.e., harbour porpoise). If the potential impacts on harbour porpoise are predicted to be negated through mitigation, this will also be the case for bottlenose dolphin and grey seal.

135. The mitigation has been designed using the embedded mitigation (**Table 4-2**) and other guidance for UXO clearance:

- EM10: Adoption of the JNCC guidelines for minimising the risk of injury to marine mammals from UXO clearance (JNCC, 2025);
- EM11: Development of and adherence to a MMMP (Buchan Offshore Wind Ltd, 2025));
- EM13: The Marine environment: unexploded ordnance clearance Joint Position Statement which states that low noise methods of clearance should be the default clearance method (DEFRA *et al.,* 2025); and
- the 2023 JNCC guidance for the use of PAM in UK waters for minimising the risk of injury to marine mammals from offshore activities (JNCC, 2023b).

136. The mitigation measures outlined have been proposed to negate the potential impacts of UXO clearance on Annex II marine mammals based on the information available at this time (6 Alpha Associates, 2023). It is anticipated that these measures (e.g., the period of ADD use and the use of a Noise Abatement System (NAS)[9] system) will be refined post-consent after:

- further consultation with the Regulator and SNCBs on the Proposed Marine Mammal Mitigation Protocol (Buchan Offshore Wind Ltd, 2025); and
- the detailed pre-construction surveys have been completed and the location, number and size of cUXOs is known.

[9] A NAS is a mitigation measure designed to reduce the noise propagated through the water column from offshore construction activities. Examples of NASs are bubble curtains and resonators.

137. The proposed mitigation is summarised in **Table 3-55.**

Table 3-55: Summary of UXO clearance mitigation measures

Approach	Mitigation measures
Micro-siting	Locations within the Proposed Offshore Development Site will be 'micro-sited' to avoid UXOs and prevent clearance when deemed practicable
Lift and shift	The 'lift and shift' approach (to move the UXO to another location) will be considered on a case-by-case basis where deemed safe to do so
Low order clearance	Pre-work search (min. 60 mins)
	Low order clearance
	Post-detonation search (min. 15 mins)
High order clearance	Pre-work search (min. 60 mins)
	Use of an ADD (see **Table 3-56**)
	Use of a noise abatement system (NAS) (UXO >50 kg)
	High order clearance
	Post-detonation search (min. 15 mins)

138. Methods to avoid the need for UXO clearance will be considered for every cUXO in the first instance. If deemed safe do so alternative methods include:

- micro-siting i.e., avoidance of UXO; and
- relocation ('lift and shift') of UXO (where deemed safe to do so))[10].

139. Work will only commence during the hours of daylight and in good weather conditions (i.e., when conditions are suitable for visual monitoring and visibility exceeds 1 km (so the entire mitigation zone can be seen) and sea state is below Beaufort sea state 4).

140. Low order clearance methods will be used in the first instance. Three attempts will be made before moving to high order clearance methods. High order clearance will only be used by exception with evidence provided to demonstrate that low order clearance has not been successful.

141. At least two dedicated Marine Mammal Observers[11] (MMOs) and one dedicated PAM operator[12] will conduct a minimum 60-minute visual and passive acoustic pre-work search of a 1 km radius mitigation zone to ensure the absence of marine mammals in the zone prior+ to the start of operations. The MMOs and PAM equipment and operator will be positioned such that they can effectively search the mitigation zone. Should a marine mammal be

[10] It should be noted that if relocation ('lift and shift') of any UXO is undertaken, and it is deemed that there is a potential of detonation during this process, then the full mitigation procedure for the corresponding UXO charge weight should be undertaken.

[11] MMOs will be trained (i.e., JNCC MMO certified) and experienced (i.e., experienced MMOs will have at least 20 weeks of experience within UK waters over the past 10 years (and be familiar with the identification of the marine mammal species likely to be encountered in the area) and practical experience of implementing the JNCC guidelines. Newly qualified MMOs will not work in isolation for their first few jobs).

[12] PAM operators will be suitably trained and have an appropriate level of experience of conducting PAM for mitigation (i.e., experienced PAM operators will have at least 20 weeks of experience and newly qualified PAM operators should not work in isolation for their first five PAM jobs (JNCC, 2023b)).

detected in the mitigation zone during the pre-work search by the MMOs or PAM operator, and it cannot be confirmed that the animal has moved out of the mitigation zone at the end of the search, a minimum of a 20-minute delay from the time of the last detection will be required prior to any clearance work taking place.

142. For all high order UXO clearance an ADD will be used to encourage animals to flee from the area of potential harm. Indicative periods of ADD use are shown in **Table 3-56**. The ADD used will be selected based on its effectiveness to adequately deter the marine mammal species of concern in the Proposed Offshore Development area (McGarry *et al*., 2020).

143. Where required, the ADD procedure will start after at least 30 minutes of the pre-work search has been conducted. The pre-work search by both the MMOs and PAM operator will continue throughout the period of ADD use and during the detonation procedure.

144. For high order clearance of > 50 kg charge weight a NAS (e.g., bubble curtain) will be required in order to reduce potential noise impacts (JNCC, 2025). It is thought that using a NAS will result in a 6 dB reduction in peak sound pressure level and therefore reduce the radius, within which the level is above a given threshold, by around half (as a minimum), and the corresponding area by about 75% (Verfuss *et al.* 2019). If bubble curtains are used these will not be turned on until the pre-work search and period of ADD use has been completed.

145. Following detonation of the UXO, a visual search of at least 15 minutes' duration will be conducted within the mitigation zone by the MMOs and PAM operator (JNCC, 2025).

Table 3-56 Outline of mitigation (pre-work search and indicative periods of ADD use) time for each UXO charge weight

Clearance type	Noise Abatement Required	UXO charge weight (kg)	Visual and PAM pre-work search (mins)		Total mitigation time (mins)
			Pre-ADD use search	Period of ADD use	
Low order	NAS Not required	0.25	60	0	60
High order		0.1	58	2	60
		0.55	55	5	60
		0.82	53	7	60
		1.42	51	9	60
		2.04	48	12	60
		6	38	22	60
		25	30	40	70
		30	30	44	74
	NAS Required	67.8	35	25	60
		130	30	34	64
		132	30	34	64
		141	30	35	65
		145	30	35	65
		165	30	37	67
		176	30	38	68
		213	30	42	72
		220	30	42	72
		227	30	43	73
		254	30	45	75
		260	30	45	75

Clearance type	Noise Abatement Required	UXO charge weight (kg)	Visual and PAM pre-work search (mins)		Total mitigation time (mins)
			Pre-ADD use search	Period of ADD use	
		321	30	45	75
		364	30	50	80

3.3.1.4 Post-Mitigation Effects

3.3.1.4.1 Auditory Injury

146. It is considered that a visual and PAM pre-work search (1 km radius zone) will be sufficient to negate the potential for auditory injury as a result of low order clearance work using a 0.25 kg initiation explosive. The use of an ADD or NAS will not be required.

147. For all high order UXO clearance ADD use will be required to ensure no animals will be present in the zone of potential effect for auditory injury. The ADD use durations were calculated based on the time needed to clear the greatest (i.e., worst case) potential impact ranges (which are the SPL_{peak} ranges for very high frequency cetaceans (i.e., harbour porpoise) (**Table 3-56**)) for each UXO charge weight using a conservative flee speed of 1.5 m/s[13]. The ADD durations were adjusted to include the 1 km mitigation zone cleared during the pre-work search and the reduction in PTS impact range from the use of a NAS for high order clearance >50 kg.

148. Implementing the mitigation (pre-work search, use of an ADD and NAS) outlined in **Table 3-56** there will be no individuals of all Annex II marine mammal species assessed present within the areas of potential impacts for auditory injury (PTS) for either low order or high order UXO clearance.

3.3.1.4.2 Behavioural Responses

149. The potential for behavioural responses will be reduced by the pre-work search and the use of a NAS for high order clearances > 50 kg. It is thought that using a NAS will result in a 6 dB reduction in peak sound pressure level and therefore reduce the radius, within which the level is above a given threshold, by around half (as a minimum), and the corresponding area by about 75% (Verfuss *et al*. 2019).

150. Behavioural responses will not be reduced through use of an ADD because this approach relies on inducing a behavioural response in order that animals move out of the area of a more deleterious potential effect. As such, the number of individuals likely to exhibit a behavioural response from UXO clearance without the use of a NAS (UXO ≤ 50 kg) will likely be similar to the number expected within the implementation of mitigation measures (**Table 3-50**).

151. Post-mitigation behavioural responses have been presented using both the EDR and TTS approach.

[13] A conservative flee speed of 1.5 m/s was chosen to be representative of all Annex II marine mammal species.

Approach A: Use of EDRs

152. For low order clearance the number of individuals which have the potential to be exposed to sound levels which may induce a behavioural response is the same as pre-mitigation (**Table 3-50**).

153. For high order clearance, the 15 km EDR for harbour porpoises provided in the JNCC Marine Noise Registry Help and Guidance (JNCC, 2023a) was used to estimate the number of individuals which have the potential to be exposed to sound levels which may induce a behavioural response (**Table 3-57**). The area of potential effect (706.9 km^2) was calculated using the equation area = πr^2 where r = 15.

154. It is acknowledged that >1% of the Coastal East Scotland MU (inshore bottlenose dolphins) may exhibit behavioural responses following high order UXO clearance with noise abatement using EDRs. However, research on the far-field effect of impulsive noise on the east coast of Scotland bottlenose dolphin population showed only short-term behavioural responses (potential vocalisation modifications) to a two-dimensional seismic survey and piling activity and that dolphins continued to use the impacted area throughout each offshore activity period (Fernandez-Betelu *et al*., 2021). Assuming that the impulsive underwater noise created from high order UXO clearance will cause a similar behavioural response in inshore bottlenose dolphins it is concluded that any disturbance will be short-term, sporadic, reversible, and without any likely negative effect still stands.

Table 3-57 Number of individuals which may exhibit behavioural responses following high order UXO clearance with noise abatement

Species	High order clearance with NAS (15 km EDR)		
	No. individuals	% of MU	% UK MU
Inshore bottlenose dolphin	4	1.816 %	n/a
Harbour porpoise	423	0.122 %	0.265 %
Grey seal	177	0.177 %	n/a

Approach B: Use of TTS as a proxy

155. Using the greatest impact ranges (impulsive SEL_{ss} for grey seals and SPL_{peak} for harbour porpoise) and assuming that spreading is approximately spherical (area = πr^2), the number of individuals for harbour porpoise (**Table 3-58**) and grey seals (**Table 3-59**) which have the potential to be present within the areas of potential impact for TTS (and therefore will show a behavioural response) from UXO clearance (with mitigation applied) has been estimated. For UXO charge weights <50 kg this has been calculated only taking into account the 1 km pre-work search mitigation zone. For UXO charge weights >50 kg the use of a NAS has also been incorporated.

156. For inshore bottlenose dolphins there will be less than one individual present within the areas of potential impact for TTS (and therefore a behavioural response) after UXO clearance (with mitigation applied) for all of the charge weights assessed.

Table 3-58 Number of harbour porpoise which have the potential to be present within the TTS impact areas and therefore show a behavioural response post-mitigation

Charge weight (kg)*	Noise Abatement Used	Impulsive SPL_{peak} range (km)	Area (km^2)	Number of individuals	% of MU	% UK portion of MU
Low order (0.25)	NAS Not required	0.8	2.01	1	<0.001 %	0.001 %
0.1 + donor		1	3.14	2	0.001 %	0.001 %
0.55 + donor		1.7	9.08	5	0.002 %	0.003 %
0.82 + donor		1.9	11.34	7	0.002 %	0.004 %
1.42 + donor		2.4	18.10	11	0.003 %	0.007 %
2.04 + donor		2.8	24.63	15	0.004 %	0.009 %
6 + donor		4.3	58.09	35	0.010 %	0.022 %
25 + donor		7.5	176.71	106	0.031 %	0.066 %
30 + donor		8	201.06	120	0.035 %	0.075 %
67.8 + donor	NAS Required	5.5	95.03	57	0.016 %	0.036 %
130 + donor		7	153.94	92	0.027 %	0.058 %
132 + donor		7	153.94	92	0.027 %	0.058 %
141 + donor		7.5	176.71	106	0.031 %	0.066 %
145 + donor		7.5	176.71	106	0.031 %	0.066 %
165 + donor		7.5	176.71	106	0.031 %	0.066 %
176 + donor		8	201.06	120	0.035 %	0.075 %
213 + donor		8.5	226.98	136	0.039 %	0.085 %
220 + donor		8.5	226.98	136	0.039 %	0.085 %
227 + donor		8.5	226.98	136	0.039 %	0.085 %
254 + donor		9	254.47	152	0.044 %	0.095 %
260 + donor		9	254.47	152	0.044 %	0.095 %
321 + donor		9.5	283.53	170	0.049 %	0.106 %
364 + donor		10	314.16	188	0.054 %	0.118 %

*All charge weights refer to high order clearance unless specified.

Table 3-59 Number of grey seals which have the potential to be present within the TTS impact areas and therefore show a behavioural response post-mitigation

Charge weight (kg)*	Noise Abatement Used	Impulsive SEL_{ss} range (km)	Area (km^2)	Number of individuals	% of MU
Low order (0.25)	NAS Not required	0	0	0	-
0.1 + donor		0	0	0	-
0.55 + donor		0	0	0	-
0.82 + donor		0.1	0.03	<1	-
1.42 + donor		0.4	0.50	<1	-
2.04 + donor		0.6	1.13	<1	-
6 + donor		1.7	9.08	2	0.002 %
25 + donor		4.2	55.42	14	0.014 %
30 + donor		4.7	69.40	17	0.017 %
67.8 + donor	NAS Required	4.1	52.81	13	0.013 %
130 + donor		5.5	95.03	24	0.024 %
132 + donor		5.5	95.03	24	0.024 %
141 + donor		5.5	95.03	24	0.024 %

Charge weight (kg)*	Noise Abatement Used	Impulsive SEL_{ss} range (km)	Area (km^2)	Number of individuals	% of MU
145 + donor		5.5	95.03	24	0.024 %
165 + donor		6	113.10	28	0.028 %
176 + donor		6	113.10	28	0.028 %
213 + donor		6.5	132.73	33	0.033 %
220 + donor		6.5	132.73	33	0.033 %
227 + donor		6.5	132.73	33	0.033 %
254 + donor		7	153.94	39	0.039 %
260 + donor		7	153.94	39	0.039 %
321 + donor		8	201.06	50	0.050 %
364 + donor		8.5	226.98	57	0.057 %

*All charge weights refer to high order clearance unless specified.

3.4 IMPACT 3 - INCREASED UNDERWATER NOISE – SURVEY (CONSTRUCTION, OPERATION AND MAINTENANCE AND DECOMMISSIONING PHASE)

157. Survey operations (e.g., geophysical or geotechnical surveys) will be required during pre-construction and during the construction, operation and maintenance and decommissioning phases of the Proposed Offshore Development. The use of geophysical survey and positioning equipment will increase levels of anthropogenic noise in the marine environment as it operates by producing and receiving sound and therefore has the potential to induce the onset of auditory injury (PTS), or behavioural responses, in Annex II marine mammal species.

158. The MDS considered within the assessment of increased underwater noise from survey work is shown in **Table 4-1.** The sound-emitting survey equipment that is proposed to be used during the construction phase of the Proposed Offshore Development (e.g. during pre-construction geophysical and geotechnical surveys) is summarised in **Table 3-60**.

Table 3-60 Typical equipment types and specifications for geophysical surveys

Equipment type	Typical frequency range (kHz)*	Typical source pressure level (SPL) (dB re 1 µPa @ 1 m)*
Multibeam Echosounder (MBES)	200 - 400	218 (peak), 213 (root mean square (rms))
Side Scan Sonar (SSS)	Tri-frequency capability: 230, 540 & 850	210 (peak), 242 (rms)
Sub-Bottom Profiler (SBP)	0.1 - 22	185 - 250 (peak)
Sub-Bottom Imager (SBI)	4 -14	192 (peak)
Ultra-High Resolution Seismic (UHRS)	0.1 - 5	220 – 226 (peak)
Ultra-Short Baseline (USBL)	18 - 55	194 (peak), 188 (rms)
Magnetometer	Not sound emitting	

**These are typical values for the listed equipment types when used in shallow waters (<200 m). Exact values vary depending on the equipment model and make.*

159. During the operation and maintenance phases, sound-producing survey and positioning equipment (e.g., but not limited to MBES, SSS, SBI and USBL systems) will be required during various activities, these include; annual geophysical survey of seabed and assets including cable protection; repair, replacement and re-burial of inter-array cables (ca. 10 repair events over lifetime of the project); and repair and replacement of offshore export cables (ca. four repair events over lifetime of the project).

160. During the decommissioning phase, sound-producing survey and positioning equipment (e.g., but not limited to MBES and USBL systems) will be required during the removal of inter-array cables, export cables and scour protection where required.

3.4.1 Auditory Injury

161. The high frequency sounds produced by the MBES and SSS fall outside the hearing range of all Annex II marine mammal hearing groups (**Table 3-1, Table 3-60**). There is therefore no risk of auditory injury or behavioural responses from the use of this equipment and no mitigation is required. This is supported by the advice from the JNCC, who do not advise the use of mitigation for the use of MBES in shallow waters (<200 m) (JNCC, 2017). This is because it is thought that the high frequency sounds produced by MBES attenuate more quickly than the lower frequencies used in deeper waters (JNCC, 2017).

162. The sounds produced by the SBI, SBP, UHRS and USBL do fall within the hearing range of all Annex II marine mammal hearing groups (**Table 3-1, Table 3-60)**. However, the sounds produced by the SBI and USBL do not reach the SPL threshold for PTS (**Table 3-2**) therefore there is no risk of auditory injury from the use of this equipment. Comparatively, the maximum source levels produced by the SBP and UHRS do have the potential to induce the onset of instantaneous PTS at very close range for low frequency cetaceans, high frequency cetaceans (SBP only), very high frequency cetaceans and phocid carnivores in water. As a result, mitigation will be implemented for the use of SBP, UHRS and all other equipment which emits sounds within the hearing range of marine mammals and above the SPL threshold for PTS (**Section 3.4.2**).

3.4.2 Mitigation Measures

163. Mitigation measures will follow the EM10 embedded mitigation (**Table 4-2**) and follow the JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys (JNCC, 2017) and the JNCC guidance for the use of PAM in UK waters for minimising the risk of injury to marine mammals from offshore activities (JNCC, 2023b).

164. The mitigation measures are provided in detail in the MMMP as part of the EM11 embedded mitigation (Development of and adherence to a MMMP (**Buchan Offshore Wind Ltd, 2025**)).

3.4.3 Behavioural Responses

165. The sounds emitted by the SBI, SBP, UHRS and USBL all fall within the hearing range of the marine mammals assessed and therefore have the potential to cause animals to respond behaviourally. However, because these pieces of equipment will likely be used as the survey vessel(s) are moving, and not operating if the vessel is stationary for a prolonged period (as per the mitigation protocol for breaks in operation (**Buchan Offshore Wind Ltd, 2025**)), any

behavioural avoidance in a location will likely be temporary and will not result in long-term /displacement (Thompson *et al.*, 2013).

166. Due to the uncertainty in the specifications of the geophysical survey and positioning equipment, behavioural impact ranges specific to the Proposed Offshore Development have not been modelled. Instead, a review of previously published impact ranges was undertaken. This identified that an impact range of 2.5 km, for harbour porpoises to respond behaviourally to a SBP (BEIS, 2020), was the best representative example for the use of survey equipment at the Proposed Offshore Development. This impact range, as well as the 5 km EDR for geophysical surveys for harbour porpoise (JNCC, 2023a), has been used to assess behavioural responses as a worst-case scenario. Without suitable alternatives being available these ranges have been deemed most appropriate for all the Annex II marine mammal species assessed.

167. To estimate the maximum number of individuals which may be disturbed from the use of survey equipment the area of impact was calculated at a single point in time (static source) and for a moving vessel (moving source). For a static source the area impacted would be 19.63 km^2 using a 2.5 km impact range or 78.54 km^2 using a 5 km EDR. For a moving source, assuming the worst-case scenario of a geophysical survey vessel operating for 24 hours continuously at an average speed of 4 knots (7.4 km/h), the area impacted would be 908.6 km^2 using a 2.5 km impact range or 1856.5 km^2 using the 5 km EDR. However, this is a highly precautionary approach as it is highly unlikely that a geophysical survey would undertake a single transect line of up to 187.8 km. As a result, a daily area of 256 km^2, which is the estimated daily disturbance footprint attributed to geophysical survey equipment (SBPs) in the JNCC Marine Noise Registry Help and Guidance (JNCC, 2023a), has also been assessed. Using these areas and the density of each marine mammal species (**Section 2**) the maximum number of individuals which may be disturbed was estimated for harbour porpoise and grey seal (**Table 3-61**). The percentage of the reference populations estimated to have the potential to be affected was also calculated.

168. For inshore bottlenose dolphins the area of potential impact was adjusted to account for the range of the east coast of Scotland bottlenose dolphin population which has been defined as being limited to the 20 m depth contour (see **Section 2.1**). The impacted areas for both a static source and moving source and the number of animals which may be disturbed for the east coast of Scotland bottlenose dolphin population is presented in **Table 3-62**.

Table 3-61 The number of individuals of harbour porpoise and grey seal estimated to have the potential to be disturbed by geophysical survey and positioning equipment

Species	Parameter	Static source		Moving source		
	Impact Range (km)	2.5	5	n/a*	2.5	5
	Area impacted (km^2)	19.63	78.54	256*	908.6	1856.5
Harbour porpoise	No. of disturbed individuals	12	47	154	544	1111
	% of MU	0.003 %	0.014 %	0.044 %	0.157 %	0.321 %
	% of UK MU	0.007 %	0.029 %	0.097 %	0.341 %	0.696 %
Grey seal	No. of disturbed individuals	5	20	65	228	466
	% of MU	0.005 %	0.020 %	0.064 %	0.227 %	0.465 %

*Daily disturbance area from the JNCC Marine Noise Registry Help and Guidance (JNCC, 2023a). No impact range provided.

Table 3-62 The number of individuals of the east coast of Scotland bottlenose dolphin population estimated to have the potential to be disturbed by geophysical survey and positioning equipment

Parameter	Static source		Moving source	
Impact Range (km)	2.5	5	2.5	5
Area impacted (km^2)	7.38	16.29	16.1	46.5
No. of disturbed individuals	1	2	2	5
% of MU	0.332 %	0.734 %	0.727 %	2.098 %

169. For all three Annex II marine mammal species assessed the behavioural responses from a static noise source from the use of survey and positioning equipment is negligible with <1 % of the reference population from each species being impacted from both a 2.5 km and 5 km impact range. This is also the case for a moving noise source other than for inshore bottlenose dolphins when assuming the worst-case scenario of a 5 km impact area for a vessel travelling at 4 knots over a 24-hour period. However, this scenario is highly unrealistic as it is highly unlikely that a geophysical survey would continuously produce sound over a 24-hour period (as per the mitigation protocol sound outputs will be reduced where practicable during line turns). When considering a more realistic impact area for a moving source for inshore bottlenose dolphins (16.1 km^2) the number of individuals disturbed is predicted to be negligible (<1% of the reference population).

3.5 IMPACT 4 - INCREASED UNDERWATER NOISE – OPERATION (WTGS AND MOORINGS; OPERATIONAL AND MAINTENANCE PHASE)

170. Two types of noise are emitted by floating WTGs: Operational noise from the internal machinery of the WTG (i.e., continuous noise) and intermittent noise from the mooring system (**Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR).

3.5.1 Auditory Injury

3.5.1.1 Operational WTG noise

171. The noise source for most operational WTGs is the radiating area of the foundation in the water column (**Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR). The radiating area source for a floating WTG is limited to the weighted and buoyant section that rests beneath the sea surface; this is a significantly smaller area than for a fixed foundation WTG (either monopile, jacket or tripod). Because the submerged radiating area is smaller, the amount of operational noise emitted by a floating WTG is expected to be lower than that from a fixed foundation WTG (Risch *et al*. 2023).

172. Some monitoring of the operational noise produced by floating WTGs has been conducted e.g., Martin *et al*. (2011) at Hywind Norway; Risch *et al*. (2023) at Kincardine and Hywind Scotland. The noise produced by the Kincardine WTGs is considered to be most applicable to the Proposed offshore Development because the foundations (semi-submersible platforms) are most similar to those proposed within the Proposed Offshore Development design envelope.

173. Like operational noise of fixed foundation WTGs, noise emissions at Kincardine were concentrated in the frequencies below 200 Hz and showed distinct tonal features, likely related to rotational speed, between 50 and 80 Hz (Risch *et al*., 2023). Median one-third octave band levels below 200 Hz were between 95 and 100 dB re 1 µPa at about 600 m from the closest turbine (Risch *et al*., 2023). These measured received levels are similar to those measured for operational noise from fixed offshore wind turbines at comparable distances. Emitted noise levels showed strong positive correlations with wind speed and slightly weaker positive correlations with wave height (Risch *et al*., 2023).

174. Risch *et al*. (2023) calculated and compared frequency-weighted sound exposure levels over 24 hours to recommended thresholds for auditory damage. None of the thresholds (for either permanent or temporary hearing threshold shifts) were reached for the modelled scenarios.

175. Noise with an SPL of between 131 and 134 dB re 1 µPa at 150 m is suggested for the floating WTGs at Buchan (**Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR). At a range of 100 m from the floating WTG for an hour, a receptor would receive an unweighted SEL_{cum} of 187 dB which, with weighting considered, is well below potentially injurious (and TTS) thresholds for any of the Southall *et al*. (2019) criteria. Importantly this estimate assumes a stationary animal model with an individual remaining within 100 m of a WTG for much more than a 1-hour period. This is a highly unlikely scenario. The risk of auditory injury as a result of operational WTG noise is therefore considered to be negligible.

3.5.1.2 Mooring system noise

176. The biggest difference between fixed and floating offshore WTGs in relation to underwater noise generation is the intermittent mooring cable-related noise (sometimes referred to as 'snaps'; Risch *et al*., 2023) produced at floating OWFs. These transient sounds, which are associated with strain and friction in the mooring system, increase in frequency with increased wind speed and wave height (Risch *et al*., 2023; **Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR). Individually they are generally of short duration (1 second or less) but are produced in sequences often lasting several minutes at a time (Risch *et al*., 2023).

177. Analysis of the Hywind data by Xodus (2015) for the Hywind Scotland Project predicted a potential SEL_{cum} of up to 157 dB re 1 μPa^2s caused by snapping chains. Even though this prediction made a series of worst-case assumptions (e.g., all WTGs producing the maximum number of snaps in a day, equivalent noise levels from multiple locations affecting a receptor to the same degree), this level is below any PTS criteria for marine mammals (**Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment** of the EIAR).

3.5.1.3 Behavioural responses

178. Data from both floating and fixed foundation OWFs show that marine mammals are not excluded from these areas e.g., Leemans and Fijn (2023).

179. Harbour porpoises were frequently detected by Risch *et al*. (2023) at Kincardine. Although the daily patterns of occurrence were similar at different distances from the WTG, the number of detection positive minutes was lower at the monitoring station closest to the WTG (600 m) compared to the one further away (1,500 m). Although this indicates reduced vocalisation behaviour of harbour porpoises closer to WTGs, the OWF had only been operational for a short period when the monitoring was undertaken. The observed pattern may change over time as the OWF becomes more mature and, for example, the presence of vessels reduces to routine operation and maintenance (rather than construction) levels and the mooring system noise becomes part of the new soundscape.

180. Tagging data show that seals are not dissuaded from using offshore wind farms. Although the data come from fixed foundation sites, they show that some individuals even concentrate their foraging effort at individual turbines (Russell *et al*., 2014). Therefore, while some small-scale behavioural responses may occur, disturbance or displacement to marine mammals from the Array Area is unlikely.

181. The MDS considered within the assessment of increased underwater noise from operation is shown in **Table 4-1** and embedded mitigation measures in **Table 4-2**.

3.6 IMPACT 5 - ENTANGLEMENT RISK – SECONDARY - (CONSTRUCTION, OPERATION AND MAINTENANCE AND DECOMMISSIONING PHASE)

182. There is a risk of secondary entanglement of Annex II marine mammals during all three phases of the Proposed Offshore Development. The risk will be higher during the operation and maintenance phase due to the length of time the mooring lines and IACs are in the water column. Contrastingly, it is anticipated that secondary entanglement risk will be low during the construction and decommissioning phase (which will have mooring lines and IACs in the water column for a much shorter period of time). Primary entanglement was screened out in the HRA Screening Report (Buchan Offshore Wind Ltd, 2023).

183. Secondary entanglement of marine mammals during operation of the Proposed Offshore Development could occur if marine debris such as lost fishing gear becomes snagged on mooring lines and/or cables and subsequently entangles marine wildlife (Benjamins *et al*., 2014). Entangled animals may drown or starve if they are physically restricted by the entangled gear, or they may suffer physical trauma and infections from the gear cutting into flesh. Marine mammals most at risk of entanglement with ropes, lines or cables are those with large appendages including humpback whales (Benjamins *et al*., 2014). The risk to Annex II marine mammal species (bottlenose dolphin, harbour porpoise, grey seal and harbour seal) which are small and don't have large appendages is low.

184. The Array Area is currently an area of relatively low pelagic fishing intensity (**Volume 2, Chapter 11: Commercial Fisheries** of the EIAR). As such, the potential for lost pelagic (seine netting and trawling) gear in the area is low. Debris from other types of fishing (demersal/bottom trawling, dredging) are likely to remain on the seabed rather than drift in the water column and come into contact with the Offshore Generation Infrastructure. The likelihood of marine debris in the Array Area is therefore low.

185. There is a lack of evidence of marine debris becoming snagged on the infrastructure (moorings, cables, foundations) associated with floating and fixed foundation OWFs, tidal energy projects, and oil and gas production. This is despite regular monitoring at operational projects including Robin Rigg, Blyth, Inch Cape (Met Mast), Hywind and MeyGen. The likelihood of marine debris becoming snagged on the mooring lines and cables associated with the Proposed Offshore Development is therefore low.

186. The occurrence of Annex II marine mammal species across the Array Area is relatively low (as evidenced by the number of species and individuals detected during the DAS; **Volume 3, Appendix 10.1: Marine Mammals Baseline Report** of the EIAR). The likelihood of animals occurring close to any snagged marine debris is therefore low.

187. Although marine mammal by-catch is a known issue for some fisheries (e.g., Rayner *et al*., 2024), marine mammals are likely to be less attracted to marine debris than they are to gear which is actively fishing. They may also show no behavioural change to its presence, or they may avoid it and the moorings and cables to which it is attached (COME3T, 2023). The likelihood of marine mammals being attracted to any snagged marine debris and becoming entangled as a result is therefore low.

188. The MDS considered within the assessment of secondary entanglement risk is shown in **Table 4-1** and embedded mitigation measures in **Table 4-2.**

3.7 IMPACT 6 - PRESENCE OF ELECTROMAGNETIC FIELDS (EMF; OPERATION AND MAINTENANCE PHASE)

189. EMFs occur naturally in the marine environment. The presence of export and inter-array cables associated with operational OWFs (which may be laid or buried on the seabed or present in the water column) may create altered or additional sources of EMF. Such cables are encased or protected and often buried which limits transmission of emissions. If emitted, EMFs tend to dissipate within 5-10 m of the cable (Normandeau *et al*., 2011). It is not expected that the floating WTGs, IRC or OSPs will produce EMFs at any significant level.

190. Only a few marine mammal species appear to have the sensory capabilities to sense and react to EMFs (Normandeau, 2011; Czech-Damal *et al.,* 2012; Hüttner *et al.,* 2022). The marine species most likely to encounter and, if sensitive, have the potential to be affected by EMFs are those that spend a significant portion of their lives in the vicinity of energised cables (e.g., sedentary benthic organisms). It is recognised that dynamic cables for floating OWFs are, for certain parts of the cable length, located within the water column, and as such the interaction of species with cables for floating OWFs differs from that of traditional fixed foundation OWFs. Although they may be able to detect perturbations to natural EMFs, Annex II marine mammals are unlikely to be affected by power cable EMFs because their high mobility limits their duration of exposure (Normandeau *et al*., 2011). Should they occur in very close proximity to power cable EMFs, the nature of any potential impacts is likely to be limited to small changes in their acoustic activity (Kuznetsov, 1999), orientation, and potentially direction and speed of travel (Gill *et al*. 2005). Such changes will be small in duration (a few seconds) and extent (a few metres).

191. The MDS considered within the assessment of the presence of EMF is shown in **Table 4-1** and embedded mitigation measures in **Table 4-2**.

4 MAXIMUM DESIGN SCENARIO (MDS) AND EMBEDDED MITIGATION

192. The MDS considered within the following assessment is presented in **Table 4-1** and the embedded mitigation measures are provided in **Table 4-2.**

Table 4-1 Maximum Design Scenarios Considered for Potential Impacts on Annex II Marine Mammals (Ticked Items Indicate the Relevant Development Phase for each Potential Impact)

Potential Impact	Phase[14]			Maximum Design Scenario	Justification
	C	O	D		
Impact 1 - Increased Underwater Noise – Pile Driving	✓	×	×	<u>Wind Turbine Generators (WTGs)</u> • up to 70 floating WTGs ; • a maximum of 9 anchors (on mooring lines) per WTG and therefore up to 630 anchors; • potential anchor types: Suction pile, driven pile (impact pile driving hammer or may include vibro-driven piles), drag embedment, plate (installed using a suction caisson); • maximum driven pile diameter 4.5 m; • total pile length 54 m (9 m pile stick up once installed); and • maximum hammer energy 1,800 kJ. <u>Offshore Substation Platforms (OSPs)</u> • up to 3 OSPs (located within Array Area); • the Proposed Offshore Development is assuming a 4-legged jacket design (installed using either driven or suction piles); • maximum driven pile diameter 3.4 m;	The maximum design scenario includes the reasonable worst case parameters for pile driving (which is the worst case anchor/foundation option for marine mammals related to underwater noise).

[14] C = Construction, O = Operation and Maintenance, D = Decommissioning.

Potential Impact	Phase[14]			Maximum Design Scenario	Justification
	C	O	D		
				• total pile length 68 m (5 m pile stick up once installed); and • maximum hammer energy 4,400 kJ. <u>Intermediate Reactive Compensation (IRC) platform</u> • 1 IRC located approximately midway between the OSP(s) and the onshore grid connection point; • the foundation type being considered is a jacket with up to 4 legs (installed using either drilled, driven or suction piles); • maximum driven pile diameter 3.4 m; • total pile length 45 m (5 m pile stick up once installed); and • maximum hammer energy 4,400 kJ.	
Impact 2 - Increased Underwater Noise – UXO Clearance Work	✓	×	×	Twenty-three potential UXO types have been identified within the Proposed Offshore Development (6 Alpha Associates, 2023). The largest potential UXO has a net explosive quantity (NEQ) of 365 kg. UXO avoidance or clearance methods being considered are: • avoidance of UXO; • relocation of UXO, avoiding detonation; • micro-siting to avoid UXO; • low order clearance (e.g., deflagration); and	The maximum design scenario includes the reasonable worst case for UXO clearance and considers all of the potential avoidance and clearance methods which may be used.

Potential Impact	Phase[14]			Maximum Design Scenario	Justification
	C	O	D		
				• high order detonation (will be used as a last resort if low order clearance is unsuccessful after three attempts).	
Impact 3 - Increased Underwater Noise – Survey	✓	✓	✓	Pre-construction surveys will be undertaken to determine in detail the seabed characteristics and morphology, presence of potential obstructions and hazards and potential risk of UXO, within the Array Area and ECC. The pre-construction surveys are expected to take place in 2030 and may require the use of any of the following survey equipment: • Dual Frequency Side Scan Sonar (SSS); • Magnetometer (MAG); • Multibeam Echosounder (MBES); • Sub-bottom Imager (SBI); • Sub-bottom Profiler (SBP); • Ultra-High Resolution Seismic (UHRS); and • Ultra-Short Baseline (USBL). During construction of the Proposed Offshore Development it is possible that use of some geophysical survey and positioning equipment (e.g., MBES, SBI and USBL) will be required, for example when remotely operated vehicles (ROVs) are being used for cable laying and burial. During operation and maintenance of the Proposed Offshore Development it is possible that use of some geophysical survey and positioning equipment will be required during:	The maximum design scenario includes the worst case for the use of geophysical survey and positioning equipment during all three phases of the development.

Potential Impact	Phase[14]			Maximum Design Scenario	Justification
	C	O	D		
				• annual geophysical survey of seabed and assets including cable protection; • repair, replacement and re-burial of Inter-Array Cable (IAC) section or the whole IAC (ten repair events are estimated over lifetime of the project); and • repair and replacement of offshore export cable (four repair events are expected over the lifetime of the project). During decommissioning of the Proposed Offshore Development it is possible that use of some geophysical survey and positioning equipment will be required during: • Removal of IACs, export cables and scour protection where required.	
Impact 4 - Increased Underwater Noise – Operation (WTGs and moorings)	×	✓	×	There will be up to 70 floating WTGs 70 all of which will produce underwater noise whilst in operation. The floating sub-structure components will include a floating hull, WTG transition piece, and the mooring system (which will be composed of a mooring interface structure bolted on the hull structure with mooring lines (composed of chain or wire and synthetic rope), connectors and mooring jewellery and anchors. There will be annual inspections of the foundations as well as regular cable repair and replacement (four repair events for the ECC and ten repair events for the IACs are estimated over lifetime of the project). Expected lifespan of the Proposed Offshore Development is 35 years.	The worst case scenario for operational noise has been assessed assuming 70 turbines are in operation over the lifetime of the Proposed Offshore Development.

Potential Impact	Phase[14]			Maximum Design Scenario	Justification
	C	O	D		
Impact 5 - Entanglement Risk – Secondary	✓	✓	✓	The maximum design scenario for secondary entanglement risk assumes: • a maximum of 630 mooring lines (nine per WTG assuming 70 WTGs); • a maximum of 70 IACs (one per WTG assuming 70 WTGs); • mooring lines will be composed of a combination of steel chain, steel wire, synthetic rope, buoyancy modules and connectors to attach to the foundation and anchor points; • the maximum mooring line length will be 1.75 km; • the anticipated mooring system could be a semi-taut mooring system or catenary mooring options; • the mooring lines will be installed and buoyed off prior to attachment of WTGs (and decommissioning will occur in the reverse order), therefore there is potential for secondary entanglement during all three phases; and • the expected lifespan of the Proposed Offshore Development is 35 years.	The worst case for secondary entanglement assumes nine catenary moorings on each of the 70 turbines totalling 630 areas where there is potential for marine debris and fishing gear to become snagged.
Impact 6 - Presence of electromagnetic fields (EMF)	×	✓	×	<u>IACs</u> The maximum design scenario for the IAC assumes: • each IAC will consist of a three-core dynamic HVAC cable rated between 66 kV and 132 kV; • lengths of cable in contact with the seabed may be surface laid or buried up to a depth of 1.4 m; and	The maximum design scenario for the presence of EMF includes the highest voltage cable options and the worst case burial depth for IACs and export cables.

Potential Impact	Phase[14]			Maximum Design Scenario	Justification
	C	O	D		
				• where cables cannot be buried, they may be protected using a range of cable protection methods including the use of rock, rock/grout bags, concrete mattresses and protective cable shells. <u>Export cables</u> The maximum design scenario for the IAC assumes: • up to three High Voltage Alternating Current (HVAC) export cables of between 220 kV and 275 kV; • cables will be buried with a target depth of 1.5 m but may be buried up to 2.4 m deep; and • any surface laid cables may be protected with rock berms or concrete mattresses. The maximum design scenario also assumed the expected lifespan of the Proposed Offshore Development is 35 years.	

Table 4-2 Embedded Mitigation Measures of Relevance to Annex II Marine Mammals

Reference	Embedded Mitigation Measure	Justification
EM5	Development of and adherence to an Environmental Management Plan (EMP). The EMP will include mitigation measures including chemical usage, management of invasive non-native species, dropped objects, pollution prevention and waste management measures.	The measures included in the EMP will reduce effects on Annex II marine mammal receptors. A proposed EMP (pEMP) has been submitted alongside the EIAR (Buchan Offshore Wind Ltd, 2025a)
EM6	Development of a Marine Pollution Contingency Plan (MPCP) which will outline procedures to protect any personnel working and to safeguard the marine environment alongside any mitigation measures in the event of any accidental pollution events arising from offshore operations relating to the Proposed Offshore Development.	The measures included in the MPCP will reduce effects on Annex II marine mammal receptors. A proposed MPCP (pMPCP) has been submitted alongside the EIAR (Buchan Offshore Wind Ltd, 2025b).
EM7	The production of an Invasive Non-Native Species (INNS) Biosecurity Plan which will include mitigation and control for the introduction of invasive species	The INNS will include mitigation and control for the introduction of INNS to reduce effects on Annex II marine mammal receptors. A proposed INNS Management Plan (pINNSMP) has been submitted alongside the EIAR (Buchan Offshore Wind Ltd, 2025c).
EM8	Requirement for a Decommissioning Programme to be developed	A Decommissioning Programme is required under Section 105 (2) of the Energy Act 2004 (as amended). The plan will ensure removal or safe management of offshore infrastructure to avoid long-term risks such as entanglement, habitat degradation, and residual pollution, thereby reducing impacts on Annex II marine mammals.
EM9	Development of and adherence to a CaP (Cable Plan). The CaP will confirm planned cable routing, burial and any additional protection and will set out methods for post-installation cable monitoring. The CaP will be informed by a Cable Burial Risk Assessment (CBRA).	Careful planning and burial of cables helps to reduce physical disturbance to benthic habitats, minimise electromagnetic field (EMF) exposure, and prevent potential entanglement or collision risks, which collectively reduce impacts on Annex II marine mammals.
EM10	Adoption of JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys (JNCC, 2017), piling noise (JNCC, 2010), and UXO clearance if and where required (JNCC, 2025)	Use of these guidelines is considered to represent best practice. Measures outlined in the unexploded ordnance clearance joint position statement (DEFRA *et al.,* 2025) will also be adopted.
EM11	Development of and adherence to a Marine Mammal Mitigation Protocol (MMMP)	The MMMP will outline the additional mitigation to be implemented for percussive piling, UXO clearance (if required) and use of geophysical survey and positioning equipment. A proposed MMMP

Reference	Embedded Mitigation Measure	Justification
		(pMMMP) has been submitted alongside the EIAR (Buchan Offshore Wind Ltd, 2025d).
EM12	Development of and adherence to a Piling Strategy (PS) (or equivalent, after consultation with stakeholders)	The PS will set out the mitigation measures for impact piling including soft-start and ramp-up measures.
EM13	Use of low order deflagration (where possible) should UXO clearance be required	Measures outlined in the unexploded ordnance clearance joint position statement (DEFRA *et al.,* 2025) will be adopted.
EM14	Adoption of and adherence to an Entanglement Management Plan	The measures included in the Entanglement Management Plan will reduce effects on Annex II marine mammal receptors. There is the potential for any structure to cause entanglement of gear, particularly cables in the water. The Array Area is in an area of relatively low fishing, however the ECC covers an area of higher fishing activity. Ghost fishing has the potential to attract predators to the area and increase secondary entanglement of Annex II marine mammals in the area. Fisheries liaison and other standard mitigation will allow recording of lost/snagged gear.
EM15	The development of and adherence to a Vessel Management Plan (VMP), or equivalent	Adoption of a VMP is considered to be beneficial in reducing the risk of disturbance and collision risk to Annex II marine mammals. A proposed Navigational Safety and Vessel Management Plan (pNSVMP) has been submitted alongside the EIAR (Buchan Offshore Wind Ltd, 2025e)

5 ASSESSMENT OF THE ADVERSE EFFECTS OF THE PROPOSED OFFSHORE DEVELOPMENT ONLY ('PROJECT ALONE')

193. This section provides the assessment of potential adverse effects on the integrity of Annex II marine mammal SACs as a result of the Proposed Offshore Development alone, for each screened in European designated site.

194. The six UK designated sites have been assessed independently. The 32 non-UK designated sites (with harbour porpoise as a qualifying feature) have been assessed collectively due to the likely similar adverse effects and Conservation Objectives (see **Section 5.7.1.1**).

195. In line with the Conservation and Management Advice documents for the different SACs (see NatureScot (2024a-d), Natural England (2018) and JNCC and Natural England (2019)):

- the 'viable component' Conservation Objective seeks to protect the feature (minimise the risk) from significant ***mortality or injury*** that could lead to a long-term decline of the feature within the site. It protects the feature from significant risk (of incidental killing and injury) as a result of activities both within and outwith the SAC.
- the 'disturbance/distribution' Conservation Objective seeks to ensure that the feature can continue to use and have access to all areas of the SAC by avoiding ***significant disturbance***. 'Significant disturbance' has been interpreted to mean disturbance that affects the integrity of the SAC through alteration of the distribution of the feature such that recovery cannot be expected or effects can be considered long term. This Conservation Objective has been assessed at the level of the site (i.e., within the site) though access to the Moray Firth SAC has also been considered for bottlenose dolphin due to potential for underwater noise effects within the coastal strip. The coastal strip can be defined as where bottlenose dolphins from this population tend to be encountered when they are outwith the Moray Firth SAC (Cheney *et al*., 2024). No effects are anticipated regarding access to other SACs due to their distance from the Proposed Offshore Development and the wide-ranging nature of their marine mammal features (i.e., harbour porpoise or grey seal).
- the 'supporting habitats and prey availability' Conservation Objectives seek to maintain sufficient prey resources and supporting habitats to support the distribution and population of the feature associated with the SAC. This Conservation Objective has been assessed at the level of the site i.e., within the site.

196. The relevance of each potential impact to the three types of Conservation Objectives ('viable component', 'disturbance/distribution', 'supporting habitats and prey availability') was determined (see **Table 5-1**). A potential impact was determined to be relevant to a Conservation Objective if it had potential to:

- cause significant mortality or injury that could lead to a long-term decline of the feature within the site ('viable component' Conservation Objective) i.e., activities which result in increased underwater noise, entanglement risk;
- cause significant disturbance ('disturbance/distribution' Conservation Objective) i.e., activities which result in increased underwater noise, presence of EMF; and
- affect the prey resources and supporting habitats such that the distribution and population of the feature associated with the SAC is unable to be supported ('supporting habitats and prey availability') i.e., pile driving, UXO clearance work.

Table 5-1 Relevance of each potential impact to the Conservation Objectives

Potential Impact	Relevant Conservation Objective		
	'Viable component'	'Disturbance/ distribution'	'Supporting habitats and prey availability'
Impact 1 - Increased underwater noise – Pile Driving	✓	✓	✓
Impact 2 - Increased underwater noise – UXO Clearance Work	✓	✓	✓
Impact 3 - Increased underwater noise – Survey	✓	✓	×
Impact 4 - Increased underwater noise – Operation (WTGS and moorings)	✓	✓	×
Impact 5 - Entanglement risk – Secondary	✓	×	×
Impact 6 - Presence of EMF	×	✓	×[15]

5.1 MORAY FIRTH SAC

5.1.1 Site Information

197. The Moray Firth SAC covers an area of 1,512.74 km^2 and has one Annex II marine mammal qualifying feature:

- Bottlenose dolphin.

5.1.1.1 Site Description

198. The Moray Firth SAC in north-east Scotland has been designated to protect the only known resident population of bottlenose dolphin in the North Sea. Dolphins are present all year round, and, while they range widely in the Moray Firth, they appear to favour particular areas[16].

199. The SAC contributes to the Scottish, UK and OSPAR Marine Protected Area (MPA) networks, the conservation of the wider marine environment around Scotland, and progress towards Good Environmental Status within the North-East Atlantic marine region. The main purpose of the Moray Firth SAC is to contribute to the favourable conservation status of the protected features in the UK (NatureScot, 2024a).

[15] The effect of presence of EMF on prey is assessed in the **HRA Part 2.2 – Assessment on Special Areas of Conservation, Annex II Migratory Fish**.

[16] https://sac.jncc.gov.uk/site/UK0019808 [Accessed 23/04/2025]

5.1.1.2 Conservation Objectives

200. The Conservation Objectives for the Moray Firth SAC have been developed as part of the wider conservation advice package produced by NatureScot (2024).

201. The overall Conservation Objectives are:

1. To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status; and
2. To ensure that the integrity of Moray Firth SAC is maintained or restored in the context of environmental changes by meeting objectives 2a, 2b and 2c for each qualifying feature.

- For bottlenose dolphin:

  2a. The population of bottlenose dolphin is a viable component of the site;

  2b. The distribution of bottlenose dolphin throughout the site is maintained by avoiding significant disturbance; and

  2c. The supporting habitats and processes relevant to bottlenose dolphin and the availability of prey for bottlenose dolphin are maintained.

202. It is considered that achievement of the overall Conservation Objectives (1 and 2) is met through achievement of feature-specific Conservation Objectives (2a, 2b and 2c).

5.1.1.3 Feature Accounts

5.1.1.3.1 Bottlenose dolphin

203. A general feature account for bottlenose dolphin is provided in **Section 2.1.**

204. The Moray Firth bottlenose dolphin population is known to regularly travel down the east coast of Scotland and individuals have been reported in waters off Ireland and the Netherlands (NatureScot, 2024a). Bottlenose dolphins on the continental shelf, particularly those in coastal waters, are exposed to a wide range of pressures that are both ubiquitous (e.g. pollution) and patchy (e.g. entanglement) (NatureScot ,2024a).

205. As outlined in the NatureScot, 2024a conservation and management advice bottlenose dolphin are considered sensitive to:

- removal of non-target and target species (i.e. entanglement in fishing gear and removal of their prey species).
- contaminants (e.g. through effects on water quality and bioaccumulation of contaminants that in turn affects survival and productivity rates).
- underwater noise (Noise disturbance may cause marine mammals to relocate, interfere with communication, navigation, foraging, and may disrupt social bonds. Many forms of harassment may elicit a stress response); and
- death or injury by collision (predominantly in relation to collision with various types of fast-moving vessels from commercial shipping to personal leisure craft and potentially from tidal turbines).

5.1.1.4 Condition Assessment

206. The latest (08 August 2024) assessed condition of bottlenose dolphin in the Moray Firth SAC is 'Favourable Maintained'[17].

5.1.2 Assessment of Adverse Effects

207. LSE could not be ruled out for the Moray Firth SAC and the following relevant Annex II marine mammal qualifying features:

- Bottlenose dolphin (see Section 2.1);

208. For the following impacts:

- Impact 1 - Increased underwater noise – Pile Driving[18] (see **Section 3.2**);
- Impact 2 - Increased underwater noise – UXO Clearance Work[19] (see **Section 3.30**); and
- Impact 3 - Increased underwater noise – Survey[20] (see **Section 3.4**).

209. An assessment of these impacts in relation to each relevant Conservation Objective is presented in **Table 5-2**.

It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Moray Firth SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development alone for all impacts assessed.

[17] https://sitelink.nature.scot/site/8327 [Accessed 13/04/2025]

[18] Relevant to the 'viable component' (2a), 'disturbance' (2b) and 'prey availability' (2c) Conservation Objectives.

[19] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[20] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

Table 5-2 Conclusion Summary of Site Integrity Against the Conservation Objectives of the Qualifying Features at the Moray Firth SAC for the Proposed Offshore Development Alone

Assessed Features	Conservation Objectives	Justification	Conclusion
Bottlenose dolphin	2a. The population of bottlenose dolphin is a viable component of the site	See Section 3 for detail on impacts. The Moray Firth SAC is 91.9 km from the Proposed Offshore Development at its closest point. There will be no impact on the bottlenose dolphin population which uses the Moray Firth SAC from: • Impact 1 - Increased underwater noise – Pile Driving; • Impact 2 - Increased underwater noise – UXO Clearance Work; and • Impact 3 - Increased underwater noise – Survey. This is because, with the implementation of embedded mitigation (**Table** 4-2), there is no risk of auditory injury (either instantaneous or cumulative PTS) to bottlenose dolphins as a result of increased underwater noise from pile driving (**Section 3.2.2**), UXO clearance work (**Section 3.3.1.4.1**) or survey work (**Section 3.4.1**). There is therefore no risk of hindering the Conservation Objective, and no potential for Adverse Effects on Site Integrity (AEoSI).	Impacts will not impede the achievement of the Conservation Objective 2a for bottlenose dolphin or lead to adverse effects on site integrity of the Moray Firth SAC.
	2b. The distribution of bottlenose dolphin throughout the site is maintained by avoiding significant disturbance	See **Section 3** for detail on impacts. The Moray Firth SAC is 91.9 km from the Proposed Offshore Development at its closest point. There will be no impact on the distribution of bottlenose dolphin in the Moray Firth SAC from: • Impact 1 - Increased underwater noise – Pile Driving; This is because the majority of the received noise level contours (1 dB increments; see **Section 3.2.2.3.2**) do not overlap the Moray Firth SAC. Those that do overlap a small proportion of the SAC, and their level (123-130 dB) is such that the majority (89-97%) of individuals which may be present at the time are unlikely to respond (using the Graham *et al*. (2019) dose response relationship; see **Volume 3, Appendix 10.2: Marine Mammals and Other Megafauna Technical Report** of the	Impacts will not impede the achievement of the Conservation Objective 2b for bottlenose dolphin or lead to adverse effects on site integrity of the Moray Firth SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		EIAR). Any behavioural responses (e.g., disturbance) will be short-term (see **paragraph 37**) and reversible. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. It should be noted that the dose-response relationship was developed for harbour porpoise which are particularly sensitive to underwater noise (Southall *et al*., 2007; JNCC, 2020; Southall *et al*., 2021). As such these estimates are likely to be conservative for bottlenose dolphin (see **Section 3.2.1.5.2**). • Impact 2 - Increased underwater noise – UXO Clearance Work; and This is because neither the effective deterrence ranges (EDRs; 5 km, 15 km, 26 km) nor the temporary threshold shift (TTS) impact ranges for high frequency cetaceans (0.1 km for low order clearance, 1.2 km for high order clearance for the greatest charge weight) (see **Section 3.3**) overlap the Moray Firth SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. This is the case both with and without embedded mitigation. • Impact 3 - Increased underwater noise – Survey. This is because neither the impact range for sub-bottom profilers (SBPs; 2.5 km; BEIS, 2020) nor the EDR for geophysical surveys (5 km; JNCC, 2023a) (see **Section 3.4.3**) overlap the Moray Firth SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. Although underwater noise levels in the coastal strip may be increased as a result of pile driving, UXO clearance work and survey work, any disturbance will not be significant and access to the Moray Firth SAC will be maintained for bottlenose dolphin. There is evidence that the east coast of Scotland bottlenose dolphin population shows only short-term behavioural responses (potential vocalisation modifications) to impulsive noise (a two-dimensional seismic survey and piling activity) and that they continue to use impacted areas throughout offshore activity periods (Fernandez-Betelu *et al*., 2021). As such, any post-mitigation (	

Assessed Features	Conservation Objectives	Justification	Conclusion
		Table 4-2) behavioural responses including disturbance are deemed sporadic (due to the nature of the proposed work), short-term and reversible. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI .	
	2c. The supporting habitats and processes relevant to bottlenose dolphin and the availability of prey for bottlenose dolphin are maintained	See **Section 3** for detail on impacts. The Moray Firth SAC is 91.9 km from the Proposed Offshore Development at its closest point. There will be no impact on the habitats supporting bottlenose dolphin and the availability of prey in the Moray Firth SAC from: • Impact 1 - Increased underwater noise – Pile Driving; and • Impact 2 - Increased underwater noise – UXO Clearance Work. This is because, with the implementation of embedded mitigation for pile driving and UXO clearance work (**Table 4-2**), it is concluded that the availability of bottlenose dolphin prey species (i.e., fish and cephalopods) will be maintained (see **Volume 2, Chapter 8: Fish and Shellfish Ecology** of the EIAR). No effects on the supporting habitats or processes relevant to bottlenose dolphin are anticipated as a result of increased underwater noise from pile driving or UXO clearance work. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	Impacts will not impede the achievement of the Conservation Objective 2c for bottlenose dolphin or lead to adverse effects on site integrity of the Moray Firth SAC.

5.2 FARAY AND HOLM OF FARAY SAC

5.2.1 Site Information

210. The Faray and Holm of Faray SAC covers an area of 7.81 km^2 and has one Annex II marine mammal qualifying feature:

- grey seal.

5.2.1.1 Site Description

211. Faray and Holm of Faray are two uninhabited islands in the northern part of Orkney which support a well-established grey seal breeding colony.

5.2.1.2 Conservation Objectives

212. The Conservation Objectives for the Faray and Holm of Faray SAC have been developed as part of the wider conservation advice package produced by NatureScot (2024b).

213. The overall Conservation Objectives are:

1. To ensure that grey seals at Faray and Holm of Faray SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status.
2. To ensure that the integrity of Faray and Holm of Faray SAC is maintained in the context of environmental changes by meeting objectives 2a, 2b and 2c.

For grey seal:

2a. Grey seals are a viable component of the Faray and Holm of Faray SAC;

2b. The distribution of grey seal throughout the site is maintained by avoiding significant disturbance of grey seals; and

2c. The supporting habitats and processes relevant to grey seals are maintained.

214. It is considered that achievement of the overall Conservation Objectives (1 and 2) is met through achievement of feature-specific Conservation Objectives (2a, 2b and 2c).

5.2.1.3 Feature Accounts

5.2.1.3.1 Grey seal

215. A general feature account for grey seal is provided in **Section 2.3.**

216. On Faray and Holm of Faray grey seals tend to be found in areas where there is easy access from the shore, and freshwater pools on the islands appear to be particularly important. The islands support the second-largest breeding colony in the UK, contributing around 9% of annual UK pup production[21].

[21] https://sac.jncc.gov.uk/site/UK0017096 [Accessed 23/04/2025]

5.2.1.4 Condition Assessment

217. The latest (13 August 2024) assessed condition of grey seal in the Faray and Holm of Faray SAC is 'Unfavourable Declining'[22].

5.2.2 Assessment of Adverse Effects

218. LSE could not be ruled out for the Faray and Holm of Faray SAC and the following relevant Annex II marine mammal qualifying features:

- Grey seal (see **Section 2.3**);

219. For the following impacts:

- Impact 1 - Increased underwater noise – Pile Driving[23] (see **Section 3.2**).
- Impact 2 - Increased underwater noise – UXO Clearance Work[24] (see **Section 3.3**);
- Impact 3 - Increased underwater noise – Survey[25] (see **Section 3.4**);
- Impact 4 - Increased underwater noise – Operation (WTGS and moorings) [26] (see **Section 3.5**);
- Impact 5 - Entanglement risk - Secondary[27] (see **Section 3.6**); and
- Impact 6 - Presence of EMF[28] (**Section 3.7**).

220. An assessment of these impacts in relation to each relevant Conservation Objective is presented in **Table 5-3**.

It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Faray and Holm of Faray SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development alone for all impacts assessed.

[22] https://sitelink.nature.scot/site/8254 [Accessed 23/04/2025]

[23] Relevant to the 'viable component' (2a), 'disturbance' (2b) and 'prey availability' (2c) Conservation Objectives.

[24] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[25] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[26] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[27] Relevant to the 'viable component' (2a) Conservation Objective.

[28] Relevant to the 'disturbance' (2b) Conservation Objective.

Table 5-3 Conclusion Summary of Site Integrity Against the Conservation Objectives of the Qualifying Features at the Faray and Holm of Faray SAC for the Proposed Offshore Development Alone

Assessed Features	Conservation Objectives	Justification	Conclusion
Grey seal	2a. Grey seals are a viable component of the Faray and Holm of Faray SAC	See **Section 3** for detail on impacts. The Faray and Holm of Faray SAC is 120 km from the Proposed Offshore Development at its closest point. There will be no impact on the grey seal population which uses the Faray and Holm of Faray SAC from: • Impact 1 - Increased underwater noise – Pile Driving; • Impact 2 - Increased underwater noise – UXO Clearance Work; • Impact 3 - Increased underwater noise – Survey; • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and • Impact 5 - Entanglement risk – Secondary. This is because with the implementation of embedded mitigation (**Table 4-2**): • There is no risk of auditory injury (either instantaneous or cumulative PTS) to grey seals as a result of increased underwater noise from pile driving (**Section 3.2.2**), UXO clearance work (**Section 3.3.1.4.1**), survey work (**Section 3.4.1**) or operation (**Section 3.5.1**). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI; and • Should marine debris become snagged on the mooring lines and cables associated with Offshore Generation Infrastructure, the risk of secondary entanglement is low for grey seals due to their small size and short appendages (**Section 3.6**). There is	Impacts will not impede the achievement of the Conservation Objective 2a for grey seal or lead to adverse effects on site integrity of the Faray and Holm of Faray SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	2b. The distribution of grey seal throughout the site is maintained by avoiding significant disturbance of grey seals	See **Section 3** for detail on impacts. The Faray and Holm of Faray SAC is 120 km from the Proposed Offshore Development at its closest point. There will be no impact on the distribution of grey seal in the Faray and Holm of Faray SAC from: • Impact 1 - Increased underwater noise – Pile Driving; This is because neither the received level contours (1 dB increments; see **Section 3.2.2.3.2**) nor the EDRs for pile driving (9.4 km (Benhemma-Le Gall *et al*., 2024) and 15 km (JNCC, 2023a)) (see **Section 3.2.2.3.1**) overlap the Faray and Holm of Faray SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 2 - Increased underwater noise – UXO Clearance Work; This is because neither the EDRs (5 km, 15 km, 26 km) nor the TTS impact ranges for phocid carnivores in water (0.57 km for low order clearance, 17 km for high order clearance for the greatest charge weight) (see **Section 3.3**) overlap the Faray and Holm of Faray SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. This is the case both with and without embedded mitigation. • Impact 3 - Increased underwater noise – Survey; This is because neither the impact range for SBPs (2.5 km; BEIS, 2020) nor the EDR for geophysical surveys (5 km; JNCC, 2023a) (see **Section 3.4.3**) overlap the Faray and Holm of Faray SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and	Impacts will not impede the achievement of the Conservation Objective 2b for grey seal or lead to adverse effects on site integrity of the Faray and Holm of Faray SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		Although some small-scale behavioural responses may occur as a result of operational noise (see **Section 3.5**), significant disturbance or displacement of grey seals from the Array Area is unlikely. As such, no impact on the distribution of grey seals in the Faray and Holm of Faray SAC is anticipated due to the distance of the SAC from the Array Area (120 km). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 6 - Presence of EMF. Although some small-scale behavioural responses (5 – 10 m) may occur as a result of the presence of EMFs, significant disturbance or displacement of grey seals from the Proposed Offshore Development is unlikely (see **Section 3.7**). As such, no impact on the distribution of grey seals in the Faray and Holm of Faray SAC is anticipated due to the distance of the SAC from the Proposed Offshore Development (120 km). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	2c. The supporting habitats and processes relevant to grey seals are maintained	See **Section 3** for detail on impacts. The Faray and Holm of Faray SAC is 120 km from the Proposed Offshore Development at its closest point. There will be no impact on the habitats supporting grey seal and the availability of prey in the Faray and Holm of Faray SAC from: • Impact 1 - Increased underwater noise – Pile Driving; and • Impact 2 - Increased underwater noise – UXO Clearance Work. This is because, with the implementation of embedded mitigation (**Table 4-2**), no effects on the supporting habitats or processes relevant to grey seals (including the availability of prey species i.e., fish and cephalopods; see **Volume 2, Chapter 8: Fish and Shellfish Ecology** of the EIAR) are anticipated as a result of increased underwater noise from pile	Impacts will not impede the achievement of the Conservation Objective 2c for grey seal or lead to adverse effects on site integrity of the Faray and Holm of Faray SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		driving or UXO clearance work. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	

5.3 ISLE OF MAY SAC

5.3.1 Site Information

221. The Isle of May SAC covers an area of 3.57 km^2 and has one Annex II marine mammal qualifying feature:

- grey seal.

5.3.1.1 Site Description

222. The Isle of May lies at the entrance to the Firth of Forth on the east coast of Scotland and supports a breeding colony of grey seals.

5.3.1.2 Conservation Objectives

223. The Conservation Objectives for the Isle of May SAC have been developed as part of the wider conservation advice package produced by NatureScot (2024c).

224. The overall Conservation Objectives are:

1. To ensure that the qualifying features of Isle of May SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status; and
2. To ensure that the integrity of Isle of May SAC is maintained or restored in the context of environmental changes by meeting objectives 2a, 2b and 2c for each qualifying feature.

For grey seal:

2a. Grey seals are a viable component of the Isle of May SAC;

2b. The distribution of grey seal throughout the site is maintained by avoiding significant disturbance of grey seals; and

2c. The supporting habitats relevant to grey seal are maintained.

225. It is considered that achievement of the overall Conservation Objectives (1 and 2) is met through achievement of feature-specific Conservation Objectives (2a, 2b and 2c).

5.3.1.3 Feature Accounts

5.3.1.3.1 Grey seal

226. A general feature account for grey seal is provided in **Section 2.3.**

227. The Isle of May SAC is the largest east coast breeding colony of grey seals in Scotland and the fourth-largest breeding colony in the UK, contributing approximately 4.5% of annual UK pup production[29].

[29] https://sac.jncc.gov.uk/site/UK0030172 [Accessed 23/04/2025]

5.3.1.4 Condition Assessment

228. The latest (13 August 2024) assessed condition of grey seal in the Isle of May SAC is 'Favourable Maintained'[30].

5.3.2 Assessment of Adverse Effects

229. LSE could not be ruled out for the Isle of May SAC and the following relevant Annex II marine mammal qualifying features:

- Grey seal (see Section 2.3);

230. For the following impacts:

- Impact 1 - Increased underwater noise – Pile Driving[31] (see **Section 3.2**).
- Impact 2 - Increased underwater noise – UXO Clearance Work[32] (see **Section 3.3**);
- Impact 3 - Increased underwater noise – Survey[33] (see **Section 3.4**);
- Impact 4 - Increased underwater noise – Operation (WTGS and moorings) [34] (see **Section 3.5**);
- Impact 5 - Entanglement risk - Secondary[35] (see **Section 3.6**); and
- Impact 6 - Presence of EMF[36] (**Section 3.7**).

231. An assessment of these impacts in relation to each relevant Conservation Objective is presented in **Table 5-4**.

232. **It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Isle of May SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development alone for all impacts assessed.**

[30] https://sitelink.nature.scot/site/8278 [Accessed 23/04/2025]

[31] Relevant to the 'viable component' (2a), 'disturbance' (2b) and 'prey availability' (2c) Conservation Objectives.

[32] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[33] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[34] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[35] Relevant to the 'viable component' (2a) Conservation Objective.

[36] Relevant to the 'disturbance' (2b) Conservation Objective.

Table 5-4 Conclusion Summary of Site Integrity Against the Conservation Objectives of the Qualifying Features at the Isle of May SAC for the Proposed Offshore Development Alone

Assessed Features	Conservation Objectives	Justification	Conclusion
Grey seal	2a. Grey seals are a viable component of the Isle of May SAC	See **Section 3** for detail on impacts. The Isle of May SAC is 163.8 km from the Proposed Offshore Development at its closest point. There will be no impact on the grey seal population which uses the Isle of May SAC from: • Impact 1 - Increased underwater noise – Pile Driving; • Impact 2 - Increased underwater noise – UXO Clearance Work; • Impact 3 - Increased underwater noise – Survey; • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and • Impact 5 - Entanglement risk – Secondary. This is because with the implementation of embedded mitigation (**Table** 4-2): • There is no risk of auditory injury (either instantaneous or cumulative PTS) to grey seals as a result of increased underwater noise from pile driving (**Section 3.2.2**), UXO clearance work (**Section 3.3.1.4.1),** survey work (**Section 3.4.1)** or operation (**Section 3.5.1**). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI; and • Should marine debris become snagged on the mooring lines and cables associated with Offshore Generation Infrastructure, the risk of secondary entanglement is low for grey seals due to their small size and short appendages (**Section 3.6**). There is	Impacts will not impede the achievement of the Conservation Objective 2a for grey seal or lead to adverse effects on site integrity of the Isle of May SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	2b. The distribution of grey seal throughout the site is maintained by avoiding significant disturbance of grey seals	See **Section 3** for detail on impacts. The Isle of May SAC is 163.8 km from the Proposed Offshore Development at its closest point. There will be no impact on the distribution of grey seal in the Isle of May SAC from: • Impact 1 - Increased underwater noise – Pile Driving; This is because neither the received level contours (1 dB increments; see **Section 3.2.2.3.2**) nor the EDRs for pile driving (9.4 km (Benhemma-Le Gall *et al*., 2024) and 15 km (JNCC, 2023a)) (see **Section 3.2.2.3.1**) overlap the Isle of May SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 2 - Increased underwater noise – UXO Clearance Work; This is because neither the EDRs (5 km, 15 km, 26 km) nor the TTS impact ranges for phocid carnivores in water (0.57 km for low order clearance, 17 km for high order clearance for the greatest charge weight) (see **Section 3.3**) overlap the Isle of May SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. This is the case both with and without embedded mitigation. • Impact 3 - Increased underwater noise – Survey; This is because neither the impact range for SBPs (2.5 km; BEIS, 2020) nor the EDR for geophysical surveys (5 km; JNCC, 2023a) (see **Section 3.4.3**) overlap the Isle of May SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and	Impacts will not impede the achievement of the Conservation Objective 2b for grey seal or lead to adverse effects on site integrity of the Isle of May SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		Although some small-scale behavioural responses may occur as a result of operational noise (see **Section 3.5**), significant disturbance or displacement of grey seals from the Array Area is unlikely. As such, no impact on the distribution of grey seals in the Isle of May SAC is anticipated due to the distance of the SAC from the Array Area (163.8 km). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 6 - Presence of EMF. Although some small-scale behavioural responses (5 – 10 m) may occur as a result of the presence of EMFs, significant disturbance or displacement of grey seals from the Proposed Offshore Development is unlikely (see **Section 3.7**). As such, no impact on the distribution of grey seals in the Isle of May SAC is anticipated due to the distance of the SAC from the Proposed Offshore Development (163.8 km). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	2c. The supporting habitats relevant to grey seal are maintained	See **Section 3** for detail on impacts. The Isle of May SAC is 163.8 km from the Proposed Offshore Development at its closest point. There will be no impact on the habitats supporting grey seal and the availability of prey in the Isle of May SAC from: • Impact 1 - Increased underwater noise – Pile Driving; and • Impact 2 - Increased underwater noise – UXO Clearance Work. This is because, with the implementation of embedded mitigation (**Table 4-2**), no effects on the supporting habitats or processes relevant to grey seals (including the availability of prey species i.e., fish and cephalopods; see **Volume 2, Chapter 8: Fish and Shellfish Ecology** of the EIAR) are anticipated as a result of increased underwater noise from pile driving or UXO clearance work. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	Impacts will not impede the achievement of the Conservation Objective 2c for grey seal or lead to adverse effects on site integrity of the Isle of May SAC.

5.4 BERWICKSHIRE AND NORTH NORTHUMBERLAND COAST SAC

5.4.1 Site Information

233. The Berwickshire and North Northumberland Coast SAC covers an area of 652.26 km^2 and has one Annex II marine mammal qualifying feature:

- grey seal.

5.4.1.1 Site Description

234. The Berwickshire and North Northumberland Coast SAC is an extensive and diverse stretch of coastline in north-east England and south-east Scotland.

5.4.1.2 Conservation Objectives

235. The Conservation Objectives for the Berwickshire and North Northumberland Coast SAC have been developed as part of the wider conservation advice package produced by Natural England (Natural England, 2018).

236. The overall Conservation Objectives are:

- to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:
    - the extent and distribution of qualifying natural habitats and habitats of qualifying species;
    - the structure and function (including typical species) of qualifying natural habitats;
    - the structure and function of the habitats of qualifying species;
    - the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
    - the populations of qualifying species; and
    - the distribution of qualifying species within the site.

237. It is considered that achievement of the overall Conservation Objectives is met through achievement of feature-specific Conservation Objectives.

238. The sensitivity of grey seal in the Berwickshire and North Northumberland Coast SAC to the pressures exerted by the following activities were examined using the Advice on Operations page of Natural England's Designated Sites View tool[37]; this page was last updated on 03/04/2025[38]:

- electricity from renewable energy sources – Offshore wind: during construction;
- electricity from renewable energy sources – Offshore wind: operation and maintenance;

[37] https://designatedsites.naturalengland.org.uk/

[38] Page accessed 12/05/2025.

- electricity from renewable energy sources – Offshore wind: decommissioning;
- cables – Power cable: laying, burial and protection;
- cables – Power cable: operation and maintenance; and
- cables – Power cable: decommissioning.

239. The medium-high risk pressures (i.e., "…*pressures which are commonly induced at a level that needs to be considered further as part of an assessment*…") are as follows:

- above water noise;
- underwater noise changes; and
- visual disturbance.

240. Underwater noise changes (as a result of pile driving, UXO clearance work, survey work and operation) have been assessed in **Table 5-6**.

241. Due to the distance of the Berwickshire and North Northumberland Coast SAC from the Proposed Offshore Development (184.6 km), no effects will arise as a result of above water noise or visual disturbance.

242. Other impacts screened into the assessment are also considered in **Table 5-6**, specifically secondary entanglement risk and presence of EMFs.

243. The attributes (which if safeguarded will enable achievement of the Conservation Objectives) and targets for grey seal in the Berwickshire and North Northumberland Coast SAC **(Table 5-5**) were examined using the Supplementary Advice on Conservation Objectives page of Natural England's Designated Sites View tool (https://designatedsites.naturalengland.org.uk/); this page was last updated on 09/05/2023[39]. Each target (**Table 5-5**) relates to one or more of the Conservation Objectives (**Table 5-6**), and has therefore been considered in **Table 5-6**. None of the targets will be adversely affected by the Proposed Offshore Development.

Table 5-5 Relevant attributes and targets of the Berwickshire and North Northumberland Coast SAC

Attribute	Target
Disturbance caused by human activity	Restrict the frequency, duration and/or intensity of disturbance affecting seals whilst hauled out to rest, moult, breed, or pup/suckle so that they are not significantly disturbed
Population: population size	Maintain the population size within the site
Population: recruitment and reproductive capability	Maintain the reproductive and recruitment capability of the species
Presence and spatial distribution of the species	Maintain the presence and spatial distribution of the species and their ability to undertake key life cycle stages and behaviours

[39] Page accessed 12/05/2025.

Attribute	Target
Structure and function: biological connectivity	Maintain connectivity of the habitat within sites and the wider environment to ensure recruitment, and/or to allow movement of migratory species
Structure: Non-native species and pathogens (species)	Restrict the introduction and spread of non-native species and pathogens, and their impacts
Supporting habitat: extent and distribution	Maintain the extent and spatial distribution of the following supporting habitats: haulout sites
Supporting habitat: food availability (species)	Maintain the cover/abundance of preferred food items required by the species
Supporting processes: physico-chemical properties (species)	Maintain the natural physico-chemical properties of the water. Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features, avoiding deterioration from existing levels. This target was set using the Environmental Agency 2019 water body classifications data
Supporting processes: sediment movement and hydrodynamic regime (species)	Maintain all hydrodynamic and physical conditions such that natural water flow and sediment movement is not significantly altered or constrained
Supporting processes: water quality - contaminants (species)	Reduce aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels. This target was set using the Environmental Agency 2019 water body classifications data
Supporting processes: water quality - nutrients (species)	Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features, avoiding deterioration from existing levels. This target was set using the Environmental Agency 2019 water body classifications data
Supporting processes: water quality - turbidity (species)	Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) in areas where this species is, or could be, present

5.4.1.3 Feature Accounts

5.4.1.3.1 Grey seal

244. A general feature account for grey seal is provided in **Section 2.3.**

245. There is variation in the distribution of grey seals along the length of the Berwickshire and North Northumberland Coast SAC. The north-east England coastal section is representative of grey seal breeding colonies in the south-east of its breeding range in the UK. It is the most

south-easterly site selected for this species, and supports around 2.5% of annual UK pup production[40].

5.4.1.4 Condition Assessment

246. The latest (13 August 2024) assessed condition of grey seal in the Berwickshire and North Northumberland Coast SAC is 'Favourable Maintained'[41].

5.4.2 Assessment of Adverse Effects

247. LSE could not be ruled out for the Berwickshire and North Northumberland Coast SAC and the following relevant Annex II marine mammal qualifying features:

- Grey seal (see **Section 2.3**);

248. For the following impacts:

- Impact 1 - Increased underwater noise – Pile Driving[42] (see **Section 3.2**).
- Impact 2 - Increased underwater noise – UXO Clearance Work[43] (see **Section 3.3**);
- Impact 3 - Increased underwater noise – Survey[44] (see **Section 3.4**);
- Impact 4 - Increased underwater noise – Operation (WTGS and moorings) [45] (see **Section 3.5**);
- Impact 5 - Entanglement risk - Secondary[46] (see **Section 3.6**); and
- Impact 6 - Presence of EMF[47] (**Section 3.7**).

249. An assessment of these impacts in relation to each relevant Conservation Objective is presented in **Table 5-6**.

It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Berwickshire and North Northumberland Coast SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development alone for all impacts assessed.

---

[40] https://sac.jncc.gov.uk/site/UK0017072 [Accessed 23/04/2025]

[41] https://sitelink.nature.scot/site/8207 [Accessed 23/04/2025].

[42] Relevant to the 'viable component' (2a), 'disturbance' (2b) and 'prey availability' (2c) Conservation Objectives.

[43] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[44] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[45] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[46] Relevant to the 'viable component' (2a) Conservation Objective.

[47] Relevant to the 'disturbance' (2b) Conservation Objective.

Table 5-6 Conclusion Summary of Site Integrity Against the Conservation Objectives of the Qualifying Features at the Berwickshire and North Northumberland Coast SAC for the Proposed Offshore Development Alone

Assessed Features	Conservation Objectives	Justification	Conclusion
Grey seal	Maintain or restore the populations of qualifying species The following attributes are considered relevant under this Conservation Objective: • population: population size • population: recruitment and reproductive capability • presence and spatial distribution of the species • structure: Non-native species and pathogens (species) • supporting processes: water quality - contaminants (species); and • supporting processes: water quality - nutrients (species) Relevant targets presented in **Table 5-5**	See **Section 3** for detail on impacts. The Berwickshire and North Northumberland Coast SAC is 184.6 km from the Proposed Offshore Development at its closest point. There will be no impact on the grey seal population which uses the Berwickshire and North Northumberland Coast SAC from: • Impact 1 - Increased underwater noise – Pile Driving; • Impact 2 - Increased underwater noise – UXO Clearance Work; • Impact 3 - Increased underwater noise – Survey; • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and • Impact 5 - Entanglement risk – Secondary. This is because with the implementation of embedded mitigation (**Table** 4-2): • there is no risk of auditory injury (either instantaneous or cumulative PTS) to grey seals as a result of increased underwater noise from pile driving (**Section 3.2.2**), UXO clearance work (**Section 3.3.1.4.1**), survey work (**Section 3.4.1**) or operation (**Section 3.5.1**). There is therefore no risk	Impacts will not impede the achievement of this Conservation Objective or lead to adverse effects on site integrity of the Berwickshire and North Northumberland Coast SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		of hindering the Conservation Objective, and no potential for AEoSI; and • should marine debris become snagged on the mooring lines and cables associated with Offshore Generation Infrastructure, the risk of secondary entanglement is low for grey seals due to their small size and short appendages (**Section 3.6**). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	Maintain or restore the distribution of qualifying species within the site The following attributes are considered relevant under this Conservation Objective: • disturbance caused by human activity; • population: population size; • population: recruitment and reproductive capability; • presence and spatial distribution of the species; • supporting habitat: extent and distribution; • processes: physico-chemical properties (species); • supporting processes: sediment movement and	See **Section 3** for detail on impacts. The Berwickshire and North Northumberland Coast SAC is 184.6 km from the Proposed Offshore Development at its closest point. There will be no impact on the distribution of grey seal in the Berwickshire and North Northumberland Coast SAC from: • Impact 1 - Increased underwater noise – Pile Driving; This is because neither the received level contours (1 dB increments; see **Section 3.2.2.3.2**) nor the EDRs for pile driving (9.4 km (Benhemma-Le Gall *et al*., 2024) and 15 km (JNCC, 2023a)) (see **Section 3.2.2.3.1**) overlap the Berwickshire and North Northumberland Coast SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 2 - Increased underwater noise – UXO Clearance Work; This is because neither the EDRs (5 km, 15 km, 26 km) nor the TTS impact ranges for phocid carnivores in water (0.57 km for	Impacts will not impede the achievement of this Conservation Objective or lead to adverse effects on site integrity of the Berwickshire and North Northumberland Coast SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
	hydrodynamic regime (species); and • supporting processes: water quality - turbidity (species). Relevant targets presented in **Table 5-5**	low order clearance, 17 km for high order clearance for the greatest charge weight) (see **Section 3.3**) overlap the Berwickshire and North Northumberland Coast SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. This is the case both with and without embedded mitigation. • Impact 3 - Increased underwater noise – Survey; This is because neither the impact range for SBPs (2.5 km; BEIS, 2020) nor the EDR for geophysical surveys (5 km; JNCC, 2023a) (see **Section 3.4.3**) overlap the Berwickshire and North Northumberland Coast SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and Although some small-scale behavioural responses may occur as a result of operational noise (see **Section 3.5**), significant disturbance or displacement of grey seals from the Array Area is unlikely. As such, no impact on the distribution of grey seals in the Berwickshire and North Northumberland Coast SAC is anticipated due to the distance of the SAC from the Array Area (184.6 km). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 6 - Presence of EMF. Although some small-scale behavioural responses (5 – 10 m) may occur as a result of the presence of EMFs, significant disturbance or displacement of grey seals from the Proposed Offshore Development is unlikely (see **Section 3.7**). As such, no impact on the distribution of grey seals in the Berwickshire and	

Assessed Features	Conservation Objectives	Justification	Conclusion
		North Northumberland Coast SAC is anticipated due to the distance of the SAC from the Proposed Offshore Development (184.6 km). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	Maintain or restore the extent and distribution of qualifying natural habitats and habitats of qualifying species Maintain or restore the structure and function (including typical species) of qualifying natural habitats Maintain or restore the structure and function of the habitats of qualifying species Maintain or restore the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely The following attributes are considered relevant under these Conservation Objectives: • structure and function: biological connectivity; • structure: Non-native species and pathogens (species);	See **Section 3** for detail on impacts. The Berwickshire and North Northumberland Coast SAC is 184.6 km from the Proposed Offshore Development at its closest point. There will be no impact on the habitats supporting grey seal and the availability of prey in the Berwickshire and North Northumberland Coast SAC from: • Impact 1 - Increased underwater noise – Pile Driving; and • Impact 2 - Increased underwater noise – UXO Clearance Work. This is because, with the implementation of embedded mitigation (**Table 4-2**), no effects on the supporting habitats or processes relevant to grey seals (including the availability of prey species i.e., fish and cephalopods; see **Volume 2, Chapter 8: Fish and Shellfish Ecology** of the EIAR) are anticipated as a result of increased underwater noise from pile driving or UXO clearance work. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	Impacts will not impede the achievement of these Conservation Objectives or lead to adverse effects on site integrity of the Berwickshire and North Northumberland Coast SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
	• supporting habitat: extent and distribution; • supporting habitat: food availability (species); • supporting processes: physico-chemical properties (species); • supporting processes: sediment movement and hydrodynamic regime (species); • supporting processes: water quality - contaminants (species); • supporting processes: water quality - nutrients (species); • supporting processes: water quality - turbidity (species). Relevant targets presented in **Table 5-5.**		

5.5 NORTH RONA SAC

5.5.1 Site Information

250. The North Rona SAC covers an area of 6.29 km^2 and has one Annex II marine mammal qualifying feature:

- Grey seal.

5.5.1.1 Site Description

251. North Rona is a remote and very exposed island in the North Atlantic off the north-west tip of mainland Scotland. The islands are rarely disturbed by human activities in the breeding season[48].

5.5.1.2 Conservation Objectives

252. The Conservation Objectives for the North Rona SAC have been developed as part of the wider conservation advice package produced by NatureScot (2024d).

253. The overall Conservation Objectives are:

1. To ensure that the qualifying features of North Rona SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status; and
2. To ensure that the integrity of North Rona SAC is maintained or restored in the context of environmental changes by meeting objectives 2a, 2b and 2c for each qualifying feature:

For grey seal:

2a. Grey seals are a viable component of the North Rona SAC;

2b. The distribution of grey seals throughout the site is maintained by avoiding significant disturbance; and

2c. The supporting habitats and processes relevant to grey seals are maintained.

254. It is considered that achievement of the overall Conservation Objectives (1 and 2) is met through achievement of feature-specific Conservation Objectives (2a, 2b and 2c).

5.5.1.3 Feature Accounts

5.5.1.3.1 Grey seal

255. A general feature account for grey seal is provided in **Section 2.3.**

256. Grey seals are found over much of the island and use many of the submerged sea caves that are found around the coast. North Rona supports the third-largest breeding colony in the UK, representing some 5% of annual UK pup production[48].

[48] https://sac.jncc.gov.uk/site/UK0012696 [Accessed 23/04/2025]

257. To ensure that the qualifying features of the North Rona SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status; and

5.5.1.4 Condition Assessment

258. The latest (13 August 2024) assessed condition of grey seal in the North Rona SAC is 'Unfavourable Declining'[49].

5.5.2 Assessment of Adverse Effects

259. LSE could not be ruled out for the North Rona SAC and the following relevant Annex II marine mammal qualifying features:

- Grey seal (see **Section 2.3**);

260. For the following impacts:

- Impact 1 - Increased underwater noise – Pile Driving[50] (see **Section 3.2**).
- Impact 2 - Increased underwater noise – UXO Clearance Work[51] (see **Section 3.3**);
- Impact 3 - Increased underwater noise – Survey[52] (see **Section 3.4**);
- Impact 4 - Increased underwater noise – Operation (WTGS and moorings) [53] (see **Section 3.5**);
- Impact 5 - Entanglement risk - Secondary[54] (see **Section 3.6**); and
- Impact 6 - Presence of EMF[55] (**Section 3.7**).

261. An assessment of these impacts in relation to each relevant Conservation Objective is presented in **Table 5-7**.

It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the North Rona SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development alone for all impacts assessed.

[49] https://sitelink.nature.scot/site/8340 [Accessed 23/04/2025].

[50] Relevant to the 'viable component' (2a), 'disturbance' (2b) and 'prey availability' (2c) Conservation Objectives.

[51] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[52] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[53] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[54] Relevant to the 'viable component' (2a) Conservation Objective.

[55] Relevant to the 'disturbance' (2b) Conservation Objective.

Table 5-7 Conclusion Summary of Site Integrity Against the Conservation Objectives of the Qualifying Features at the North Rona SAC for the Proposed Offshore Development Alone

Assessed Features	Conservation Objectives	Justification	Conclusion
Grey seal	2a. Grey seals are a viable component of the North Rona SAC	See **Section 3** for detail on impacts. The North Rona SAC is 269.1 km from the Proposed Offshore Development at its closest point. There will be no impact on the grey seal population which uses the North Rona SAC from: • Impact 1 - Increased underwater noise – Pile Driving; • Impact 2 - Increased underwater noise – UXO Clearance Work; • Impact 3 - Increased underwater noise – Survey; • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and • Impact 5 - Entanglement risk – Secondary. This is because with the implementation of embedded mitigation (**Table** 4-2): • There is no risk of auditory injury (either instantaneous or cumulative PTS) to grey seals as a result of increased underwater noise from pile driving (**Section 3.2.2**), UXO clearance work (**Section 3.3.1.4.1**), survey work (**Section 3.4.1**) or operation (**Section 3.5.1**). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI; and • Should marine debris become snagged on the mooring lines and cables associated with Offshore Generation Infrastructure, the risk of secondary entanglement is low for grey seals due to their small size and short appendages (**Section 3.6**). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	Impacts will not impede the achievement of the Conservation Objective 2a for grey seal or lead to adverse effects on site integrity of the North Rona SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
	2b. The distribution of grey seals throughout the site is maintained by avoiding significant disturbance	See **Section 3** for detail on impacts. The North Rona SAC is 269.1 km from the Proposed Offshore Development at its closest point. There will be no impact on the distribution of grey seal in the North Rona SAC from: • Impact 1 - Increased underwater noise – Pile Driving; This is because neither the received level contours (1 dB increments; see **Section 3.2.2.3.2**) nor the EDRs for pile driving (9.4 km (Benhemma-Le Gall *et al.*, 2024) and 15 km (JNCC, 2023a)) (see **Section 3.2.2.3.1**) overlap the North Rona SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 2 - Increased underwater noise – UXO Clearance Work; This is because neither the EDRs (5 km, 15 km, 26 km) nor the TTS impact ranges for phocid carnivores in water (0.57 km for low order clearance, 17 km for high order clearance for the greatest charge weight) (see **Section 3.3**) overlap the North Rona SAC. This is the case both with and without embedded mitigation. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 3 - Increased underwater noise – Survey; This is because neither the impact range for SBPs (2.5 km; BEIS, 2020) nor the EDR for geophysical surveys (5 km; JNCC, 2023a) (see **Section 3.4.3**) overlap the North Rona SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and Although some small-scale behavioural responses may occur as a result of operational noise (see **Section 3.5**), significant disturbance or displacement of grey seals from the Array Area is unlikely. As such, no impact on the distribution of grey seals in the North Rona SAC is anticipated due to the	Impacts will not impede the achievement of the Conservation Objective 2b for grey seal or lead to adverse effects on site integrity of the North Rona SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		distance of the SAC from the Array Area (269.1 km). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 6 - Presence of EMF. Although some small-scale behavioural responses (5 – 10 m) may occur as a result of the presence of EMFs, significant disturbance or displacement of grey seals from the Proposed Offshore Development is unlikely (see **Section 3.7**). As such, no impact on the distribution of grey seals in the North Rona SAC is anticipated due to the distance of the SAC from the Proposed Offshore Development (269.1 km). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	2c. The supporting habitats and processes relevant to grey seals are maintained	See **Section 3** for detail on impacts. The North Rona SAC is 269.1 km from the Proposed Offshore Development at its closest point. There will be no impact on the habitats supporting grey seal and the availability of prey in the North Rona SAC from: • Impact 1 - Increased underwater noise – Pile Driving; and • Impact 2 - Increased underwater noise – UXO Clearance Work. This is because, with the implementation of embedded mitigation (**Table 4-2**), no effects on the supporting habitats or processes relevant to grey seals (including the availability of prey species i.e., fish and cephalopods; see **Volume 2, Chapter 8: Fish and Shellfish Ecology** of the EIAR) are anticipated as a result of increased underwater noise from pile driving or UXO clearance work. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	Impacts will not impede the achievement of the Conservation Objective 2c for grey seal or lead to adverse effects on site integrity of the North Rona SAC.

5.6 SOUTHERN NORTH SEA SAC

5.6.1 Site Information

262. The Southern North Sea SAC covers an area of 36,951 km^2 and has one Annex II marine mammal qualifying feature:

- harbour porpoise.

5.6.1.1 Site Description

263. The Southern North Sea SAC lies along the east coast of England, predominantly in the offshore waters of the central and southern North Sea, from north of Dogger Bank to the Straits of Dover in the south.[56]

5.6.1.2 Conservation Objectives

264. The Conservation Objectives for the Southern North Sea SAC have been developed as part of the wider conservation advice package produced by JNCC and Natural England (2019).

265. The overall Conservation Objectives are:

- to ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for harbour porpoise in UK waters.

In the context of natural change, this will be achieved by ensuring that:

1. Harbour porpoise is a viable component of the site;
2. There is no significant disturbance of the species; and
3. The condition of supporting habitats and processes, and the availability of prey is maintained.

266. It is considered that achievement of the overall Conservation Objective is met through achievement of feature-specific Conservation Objectives (1, 2 and 3).

5.6.1.3 Feature Accounts

5.6.1.3.1 Harbour porpoise

267. A general feature account for harbour porpoise is provided in **Section 2.2.**

268. The Southern North Sea SAC is an area of importance for harbour porpoise, supporting an estimated 17.5% of the UK North Sea MU population[56]. Approximately two-thirds of the site, the northern part, is recognised as important for porpoises during the summer season, whilst the southern part supports persistently higher densities during the winter. The majority of this site lies offshore but does extend from the coastal areas of Norfolk and Suffolk out to the 12 nautical mile limit[56].

[56] https://jncc.gov.uk/our-work/southern-north-sea-mpa/ [Accessed 23/04/2025]

5.6.1.4 Condition Assessment

269. The latest assessed condition of harbour porpoise in the Southern North Sea SAC is 'Favourable'[56].

5.6.2 Assessment of Adverse Effects

270. LSE could not be ruled out for the Southern North Sea SAC and the following relevant Annex II marine mammal qualifying features:

- harbour porpoise (see **Section 2.2**);

271. For the following impacts:

- Impact 1 - Increased underwater noise – Pile Driving[57] (see **Section 3.2**).
- Impact 2 - Increased underwater noise – UXO Clearance Work[58] (see **Section 3.3**);
- Impact 3 - Increased underwater noise – Survey[59] (see **Section 3.4**);
- Impact 4 - Increased underwater noise – Operation (WTGS and moorings) [60] (see **Section 3.5**);
- Impact 5 - Entanglement risk - Secondary[61] (see **Section 3.6**); and
- Impact 6 - Presence of EMF[62] (**Section 3.7**).

272. An assessment of these impacts in relation to each relevant Conservation Objective is presented in **Table 5-8**.

It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Southern North Sea SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development alone for all impacts assessed.

[57] Relevant to the 'viable component' (2a), 'disturbance' (2b) and 'prey availability' (2c) Conservation Objectives.

[58] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[59] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[60] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[61] Relevant to the 'viable component' (2a) Conservation Objective.

[62] Relevant to the 'disturbance' (2b) Conservation Objective.

Table 5-8 Conclusion Summary of Site Integrity Against the Conservation Objectives of the Qualifying Features at the Southern North Sea SAC for the Proposed Offshore Development Alone

Assessed Features	Conservation Objectives	Justification	Conclusion
Harbour porpoise	1. Harbour porpoise is a viable component of the site	See **Section 3** for detail on impacts. The Southern North Sea SAC is 278.8 km from the Proposed Offshore Development at its closest point. There will be no impact on the harbour porpoise population which uses the Southern North Sea SAC from: • Impact 1 - Increased underwater noise – Pile Driving; • Impact 2 - Increased underwater noise – UXO Clearance Work; • Impact 3 - Increased underwater noise – Survey; • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and • Impact 5 - Entanglement risk – Secondary. This is because with the implementation of embedded mitigation (**Table 4-2**): • there is no risk of auditory injury (instantaneous PTS) to harbour porpoise as a result of increased underwater noise from pile driving (**Section 3.2.2.1**). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI; • the cumulative PTS contours (**Section 3.2.2.2**) do not overlap the Southern North Sea SAC. The risk of auditory injury (cumulative PTS) to harbour porpoise as a result of increased underwater noise from pile driving is unlikely to result in long term effects at the population level and will not affect the viability of the harbour porpoise population within the UK portion of the North Sea MU in the long term (**Section 3.2.2.4.2**). As such, cumulative PTS as a result of pile driving will	Impacts will not impede the achievement of this Conservation Objective for harbour porpoise or lead to adverse effects on site integrity of the Southern North Sea SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		not lead to a long-term decline of the feature within the Southern North Sea SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI; • there is no risk of auditory injury (either instantaneous or cumulative PTS) to harbour porpoise as a result of increased underwater noise from UXO clearance work (**Section 3.3.1.4.1**), survey work (**Section 3.4.1**) or operation (**Section 3.5.1**). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI; and • should marine debris become snagged on the mooring lines and cables associated with Offshore Generation Infrastructure, the risk of secondary entanglement is low for harbour porpoises due to their small size and short appendages (**Section 3.6**). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	2. There is no significant disturbance of the species	See **Section 3** for detail on impacts. The Southern North Sea SAC is 278.8 km from the Proposed Offshore Development at its closest point. There will be no significant disturbance of harbour porpoise in the Southern North Sea SAC from: • Impact 1 - Increased underwater noise – Pile Driving; This is because neither the received level contours (1 dB increments; see **Section 3.2.2.3.2**) nor the EDRs for pile driving (9.4 km (Benhemma-Le Gall *et al*., 2024) and 15 km (JNCC, 2023a)) (see **Section 3.2.2.3.1**) overlap the Southern North Sea SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 2 - Increased underwater noise – UXO Clearance Work; This is because neither the EDRs (5 km, 15 km, 26 km) nor the TTS impact ranges for very high frequency cetaceans (1.8 km for low order clearance,	Impacts will not impede the achievement of this Conservation Objective for harbour porpoise or lead to adverse effects on site integrity of the Southern North Sea SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		20 km for high order clearance for the greatest charge weight) (see **Section 3.3**) overlap the Southern North Sea SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. This is the case both with and without embedded mitigation. • Impact 3 - Increased underwater noise – Survey; This is because neither the impact range for SBPs (2.5 km; BEIS, 2020) nor the EDR for geophysical surveys (5 km; JNCC, 2023a) (see **Section 3.4.3**) overlap the Southern North Sea SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and Although some small-scale behavioural responses may occur as a result of operational noise (see **Section 3.5**), significant disturbance or displacement of harbour porpoise from the Array Area is unlikely. As such, no impact on the distribution of harbour porpoise in the Southern North Sea SAC is anticipated due to the distance of the SAC from the Array Area (278.8 km). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 6 - Presence of EMF. Although some small-scale behavioural responses (5 – 10 m) may occur as a result of the presence of EMFs, significant disturbance or displacement of harbour porpoise from the Proposed Offshore Development is unlikely (see **Section 3.7**). As such, no impact on the distribution of harbour porpoise in the Southern North Sea SAC is anticipated due to the distance of the SAC from the Proposed Offshore Development (278.8 km). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	3. The condition of supporting habitats and processes, and the availability of prey is maintained	See Section 3 for detail on impacts.	Impacts will not impede the achievement of this Conservation Objective for

Assessed Features	Conservation Objectives	Justification	Conclusion
		The Southern North Sea SAC is 278.8 km from the Proposed Offshore Development at its closest point. There will be no impact on the habitats supporting harbour porpoise and the availability of prey in the Southern North Sea SAC from: • Impact 1 - Increased underwater noise – Pile Driving; and • Impact 2 - Increased underwater noise – UXO Clearance Work. This is because, with the implementation of embedded mitigation for pile driving and UXO clearance work (**Table 4-2**), it is concluded that the availability of harbour porpoise prey species (i.e., fish and cephalopods) will be maintained (see **Volume 2, Chapter 8: Fish and Shellfish Ecology** of the EIAR). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. No effects on the supporting habitats or processes relevant to harbour porpoise are anticipated as a result of increased underwater noise from pile driving or UXO clearance work. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	harbour porpoise or lead to adverse effects on site integrity of the Southern North Sea SAC.

5.7 NON-UK SACS

5.7.1 Site Information

273. Thirty-two non-UK SACs were advanced from screening which have harbour porpoise as a qualifying feature (**Table 5-9**).

Table 5-9 Non-UK SACs with harbour porpoise as a qualifying feature which have potential for connectivity with the Proposed Offshore Development. Site assessment information is provided for each SACs NATURA 2000 Standard Data From [Accessed 01/05/2025]

SAC Name	Area (km^2)	Site assessment*				
		Data Quality	Population	Conservation	Isolation	Global
Doggersbank	4,735	M	B	B	C	B
Klaverbank	1,539	M	B	B	C	B
Noordzeekustzone	1,445	M	B	B	C	C
Waddenzee	2,649	P	C	B	C	C
Voordelta	835	G	C	B	C	C
Vlakte van de Raan	175	M	C	C	C	C
Westerschelde & Saeftinghe	441	M	C	C	C	C
Doggerbank	1,692	G	B	B	C	A
Sylter Außenriff	5,321	G	A	A	C	A
Östliche Deutsche Bucht[63]	3,140	G	A	A	C	A
Borkum-Riffgrund	625	G	C	B	C	B
NTP S-H Wattenmeer und angrenzende Küstengebiete	4,521	G	A	B	C	A
Nationalpark Niedersächsisches Wattenmeer	2,767	U	B	B	C	B
Helgoland mit Helgoländer Felssockel	55	G	C	A	C	C
Steingrund	175	G	C	C	C	C
Unterelbe	188	U	C	C	C	A
Unterweser	35	DD	D	B	B	B
Gule Rev	473	M	C	C	C	B
Sydlige Nordsø	2,473	M	B	C	C	A
Store Rev	109	M	C	C	C	B
Vadehavet med Ribe Å, Tved Å og Varde Å vest for Varde	1,359	M	C	B	C	B
Skagens Gren og Skagerak	2,704	M	B	C	C	A
Kosterfjorden-Väderöfjorden	540	D	C	B	C	B
Vlaamse Banken	1,099	M	A	C	C	A
Vlakte van de Raan	65	M	C	B	C	C
Bancs des Flandres	1,129	M	A	B	C	B
Récifs Gris-Nez Blanc-Nez	292	G	C	B	C	B

[63] Harbour porpoise is a qualifying feature of this designated site therefore it is included here even though it is an SPA rather than an SAC.

SAC Name	Area (km^2)	Site assessment*				
		Data Quality	Population	Conservation	Isolation	Global
Ridens et dunes hydrauliques du détroit du Pas-de-Calais	682	U	C	B	C	B
Falaises du Cran aux Oeufs et du Cap Gris-Nez, Dunes du Chatelet, Marais de Tardinghen et Dunes de Wissant	11	M	C	B	C	B
Baie de Canche et couloir des trois estuaires	333	P	C	B	C	B
Baie de Seine orientale	444	G	C	C	C	C
Baie de Seine occidentale	456	G	C	C	C	C

*Data Quality: G = Good, M = Moderate, P = Poor, DD = Data deficient, U = unknown (not provided on NATURA 2000 standard data form)

Population: A = >15%, B = 2-15%, C = <2%, D = non-significant population

Conservation: A = excellent conservation, B = good conservation, C = average or reduced conservation

Global: A = excellent value, B = good value, C = significant value

Isolation: A = population (almost) isolated, B = population not-isolated, but on the margins of area of distribution, C = population not-isolated within extended distribution range

5.7.1.1 Conservation Objectives

274. In order to allow a comparable assessment to be undertaken, the following Southern North Sea Conservation Objectives for harbour porpoise have been used as a proxy for the 32 non-UK SACs in the absence of equivalent Conservation Objectives:

- to ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for harbour porpoise.

In the context of natural change, this will be achieved by ensuring that:

1. harbour porpoise is a viable component of the site;
2. there is no significant disturbance of the species; and
3. the condition of supporting habitats and processes, and the availability of prey is maintained.

275. It is considered that achievement of the overall Conservation Objective is met through achievement of feature-specific Conservation Objectives (1, 2 and 3).

5.7.1.2 Feature Accounts

5.7.1.2.1 Harbour porpoise

276. A general feature account for harbour porpoise is provided in **Section 2.2.**

5.7.1.3 Condition Assessment

277. Overall condition assessments for harbour porpoise have not been undertaken for non-UK SACs. Site assessment information for each site is provided in **Table 5-9.**

5.7.2 Assessment of Adverse Effects

278. LSE could not be ruled out for all 32 non-UK SACs and the following relevant Annex II marine mammal qualifying features:

- harbour porpoise (see **Section 2.2**);

279. For the following impacts:

- Impact 1 - Increased underwater noise – Pile Driving[64] (see **Section 3.2**).
- Impact 2 - Increased underwater noise – UXO Clearance Work[65] (see **Section 3.3**);
- Impact 3 - Increased underwater noise – Survey[66] (see **Section 3.4**);
- Impact 4 - Increased underwater noise – Operation (WTGS and moorings) [67] (see **Section 3.5**);
- Impact 5 - Entanglement risk - Secondary[68] (see **Section 3.6**); and
- Impact 6 - Presence of EMF[69] (**Section 3.7**).

280. An assessment of these impacts in relation to each relevant Conservation Objective is presented in **Table 5-10**.

It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of any non-UK SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development alone for all impacts assessed.

[64] Relevant to the 'viable component' (2a), 'disturbance' (2b) and 'prey availability' (2c) Conservation Objectives.

[65] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[66] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[67] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[68] Relevant to the 'viable component' (2a) Conservation Objective.

[69] Relevant to the 'disturbance' (2b) Conservation Objective.

Table 5-10 Conclusion Summary of Site Integrity Against the Conservation Objectives of the Qualifying Features at non-UK SACs for the Proposed Offshore Development Alone

Assessed Features	Conservation Objectives	Justification	Conclusion
Harbour porpoise	1. Harbour porpoise is a viable component of the site	See **Section 3** for detail on impacts. The non-UK SACs are >380 km from the Proposed Offshore Development at their closest point. There will be no impact on the harbour porpoise populations which use any of the non-UK SACs from: • Impact 1 - Increased underwater noise – Pile Driving; • Impact 2 - Increased underwater noise – UXO Clearance Work; • Impact 3 - Increased underwater noise – Survey; • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and • Impact 5 - Entanglement risk – Secondary. This is because with the implementation of embedded mitigation (**Table** 4-2): • there is no risk of auditory injury (instantaneous PTS) to harbour porpoise as a result of increased underwater noise from pile driving (**Section 3.2.2.1**). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI; • the cumulative PTS contours (**Section 3.2.2.2**) do not overlap the non-UK SACs. The risk of auditory injury (cumulative PTS) to harbour porpoise as a result of increased underwater noise from pile driving is unlikely to result in long term effects at the population level and will not affect the viability of the harbour porpoise population within the UK portion of the North Sea MU in the long term (**Section 3.2.2.4.2**). As such, cumulative PTS as a result of pile driving will not lead to a long-term decline of the	Impacts will not impede the achievement of this Conservation Objective for harbour porpoise or lead to adverse effects on site integrity for any of the non-UK SACs.

Assessed Features	Conservation Objectives	Justification	Conclusion
		feature within the non-UK SACs. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI; There is no risk of auditory injury (either instantaneous or cumulative PTS) to harbour porpoise as a result of increased underwater noise from UXO clearance work (**Section 3.3.1.4.1**), survey work (**Section 3.4.1**) or operation (**Section 3.5.1**). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI; and • should marine debris become snagged on the mooring lines and cables associated with Offshore Generation Infrastructure, the risk of secondary entanglement is low for harbour porpoises due to their small size and short appendages (**Section 3.6**). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	2. There is no significant disturbance of the species	See **Section 3** for detail on impacts. The non-UK SACs are >380 km from the Proposed Offshore Development at its closest point. There will be no significant disturbance of harbour porpoise in any of the non-UK SACs from: • Impact 1 - Increased underwater noise – Pile Driving; This is because neither the received level contours (1 dB increments; see **Section 3.2.2.3.2**) nor the EDRs for pile driving (9.4 km (Benhemma-Le Gall *et al*., 2024) and 15 km (JNCC, 2023a)) (see **Section 3.2.2.3.1**) overlap the non-UK SACs. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 2 - Increased underwater noise – UXO Clearance Work; This is because neither the EDRs (5 km, 15 km, 26 km) nor the TTS impact ranges for very high frequency cetaceans (1.8 km for low order clearance, 20 km for high order clearance for the greatest charge weight) (see **Section**	Impacts will not impede the achievement of this Conservation Objective for harbour porpoise or lead to adverse effects on site integrity for any of the non-UK SACs.

Assessed Features	Conservation Objectives	Justification	Conclusion
		3.3) overlap the non-UK SACs. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. This is the case both with and without embedded mitigation. • Impact 3 - Increased underwater noise – Survey; This is because neither the impact range for SBPs (2.5 km; BEIS, 2020) nor the EDR for geophysical surveys (5 km; JNCC, 2023a) (see **Section 3.4.3**) overlap the non-UK SACs. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and Although some small-scale behavioural responses may occur as a result of operational noise (see **Section 3.5**), significant disturbance or displacement of harbour porpoise from the Array Area is unlikely. As such, no impact on the distribution of harbour porpoise in the non-UK SACs is anticipated due to the distance of the SACs from the Array Area (> 380 km). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 6 - Presence of EMF. Although some small-scale behavioural responses (5 – 10 m) may occur as a result of the presence of EMFs, significant disturbance or displacement of harbour porpoise from the Proposed Offshore Development is unlikely (see **Section 3.7**). As such, no impact on the distribution of harbour porpoise in the non-UK SACs is anticipated due to the distance of the SACs from the Proposed Offshore Development (> 380 km). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	3. The condition of supporting habitats and processes, and the availability of prey is maintained	See **Section 3** for detail on impacts.	Impacts will not impede the achievement of this Conservation Objective for

Assessed Features	Conservation Objectives	Justification	Conclusion
		The non-UK SACs are >380 km from the Proposed Offshore Development at its closest point. There will be no impact on the habitats supporting harbour porpoise and the availability of prey in any of the non-UK SACs from: • Impact 1 - Increased underwater noise – Pile Driving; and • Impact 2 - Increased underwater noise – UXO Clearance Work. This is because, with the implementation of embedded mitigation for pile driving and UXO clearance work (**Table 4-2**), it is concluded that the availability of harbour porpoise prey species (i.e., fish and cephalopods) will be maintained (see **Volume 2, Chapter 8: Fish and Shellfish Ecology** of the EIAR). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. No effects on the supporting habitats or processes relevant to harbour porpoise are anticipated as a result of increased underwater noise from pile driving or UXO clearance work. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	harbour porpoise or lead to adverse effects on site integrity for any of the non-UK SACs.

6 ASSESSMENT OF ADVERSE EFFECTS OF THE PROPOSED OFFSHORE DEVELOPMENT IN-COMBINATION WITH OTHER PLANS AND PROJECTS

281. This Section provides the assessment of potential adverse effects on the integrity of Annex II marine mammal SACs as a result of the Proposed Offshore Development in-combination with other plans and projects, for each screened in European designated site.

6.1 PLANS AND PROJECTS SCREENED INTO THE IN-COMBINATION ASSESSMENT FOR ANNEX II MARINE MAMMALS

282. An assessment of adverse effects on the integrity of the European Sites from the Proposed Offshore Development in-combination with other plans or projects, arising from each identified impact, is provided in the following sections.

283. It is considered that impacts and impact ranges for other plans and programmes are the same as for the Proposed Offshore Development, and that mitigation proposed by other projects will mirror that proposed for the Proposed Offshore Development. To be screened-in to the in-combination assessment, impact ranges must be great enough that exposure of an Annex II marine mammal feature to more than one plan/project for the same impact (as per those assessed in **Section 5**) is feasible. The potential impact ranges for Annex II marine mammals are large, given the mobility of species, and the large spatial area used in critical life history stages (i.e., migration and travelling to breeding and feeding grounds).

284. Other plans and projects with the same impact source occurring within the same timescale may give rise to multiple exposures and the potential for magnified effects on Annex II marine mammals or receptor groups, with the potential to impact upon a site's Conservation Objectives and therefore affect overall site integrity.

285. It is considered that the potential for in-combination effects will be greatest during the construction (and then decommissioning) phases of project(s) as the footprint for potential impact is largest during these phases.

286. Relevant plans, projects and activities which may act in-combination with the Proposed Offshore Development were initially identified using the approach outlined in in **HRA Part 2.1 – Introduction to SACs**. For Annex II marine mammals these projects have been further refined using an in-combination assessment Study Area. This area is defined using project-specific screening ranges (see **Table 6-1**).

287. The plans and projects that have been identified as having the potential for in-combination adverse effects are presented in **Table 6-2** split into specific tiers, as detailed in **HRA Part 2.1 – Introduction to SACs**.

288. The Buchan OWF onshore infrastructure (Tier 1) is screened out from the cumulative effects assessment as there is no potential for overlap in activities with the Proposed Offshore Development, and as such no potential for in-combination effects.

Table 6-1 Screening criteria for relevant plans, projects and activities which may act in-combination with the Proposed Offshore Development

Project Category	Screening range	Rationale
Offshore renewable energy developments	500 km	This range represents a precautionary maximum distance at which effects from offshore energy could occur (e.g., underwater noise from piling).
Offshore oil and gas developments	200 km	This range represents a precautionary maximum distance at which effects from oil and gas activities could occur (e.g., vessel movements associated with construction activities and underwater noise from seismic surveys).
Subsea pipeline and cable developments Port and harbour activities (including capital and maintenance dredging) and port development Marine dredging and disposal sites Other large scale coastal developments	50 km	This range represents a precautionary maximum distance at which effects could occur (e.g., vessel movements and underwater noise from vessels, survey and positioning equipment and construction activities).

Table 6-2 Other Plans and Projects with which there is Potential for In-Combination Effects on Annex II Marine Mammal Qualifying Features

Plan/Project	Summary	Status	Distance from Array Area (km)	Distance from ECC (km)	Construction Dates (if relevant)	Operational by (if relevant)	Summary of Interaction with Proposed Offshore Development
Tier 2							
Green Volt OWF (INTOG) (including export cable)	Consented floating OWF	Consented April 2024 490-560 MW 35 turbines	43.8	6.6	2025	2029	Potential overlap with construction activities due to project programmes.
Caledonia OWF (ScotWind)	Planned fixed/floating OWF	Planned, submitted EIA December 2024 2000 MW 84-140 turbines One quarter of the turbines in deeper water may require floating foundations	55.1	40.8	-	2030	Potential overlap with construction activities due to project programmes.
Salamander OWF (INTOG)	Planned floating OWF	Planned, submitted EIA received May 2024 100 MW 5-7 turbines	66.3	4.7	2026	2029	Potential overlap with construction activities due to project programmes.
Muir Mhòr OWF (ScotWind)	Planned floating OWF	Planned, EIA submitted December 2024 798 MW 40 turbines	84.8	5	2028 - 2029	2034 - 2055	Potential overlap with construction activities due to project programmes.
Eastern Green Link 2	Consented Subsea cable connecting two convertor stations	Construction planned from Oct 2024	88.9	11	October 2024	2029	Potential overlap with construction activities due to project programmes.
Bowdun OWF (ScotWind)	Planned OWF	Planned, Scoping Opinion received November 2024 1008 MW 50-60 turbines	131.7	61.4	-	2031	Potential overlap with construction activities due to project programmes.
Pentland Floating OWF	Consented Demo floating OWF	Consented, variation application granted April 2024 to reduce the number of WTGs from 7 to 6, a reduction of the WTG footprint area from 10km^2 to 5.85km^2 inclusive of reduction in associated parameters for this. Up to 100 MW 6 turbines	147.6	156.2	-	-	Due to lack of project timeline information, temporal overlap with construction activities is assumed.

Plan/Project	Summary	Status	Distance from Array Area (km)	Distance from ECC (km)	Construction Dates (if relevant)	Operational by (if relevant)	Summary of Interaction with Proposed Offshore Development
Ossian OWF (ScotWind)	Planned floating OWF	Planned, EIA submitted June 2024 2600-3600 MW 270 turbines	151.6	94.6	-	--	Due to lack of project timeline information, assume temporal overlap with construction activities.
West of Orkney Windfarm (ScotWind)	Planned OWF	Planned, submitted EIA September 2023 2000 MW 125 turbines	157.3	168.5	2026	2029	Potential overlap with construction activities due to project programmes.
Cenos OWF (INTOG)	Planned floating OWF	Planned, submitted EIA February 2025 1350 MW 68 - 90 turbines	185.7	182.5	2027	2029	Potential overlap with construction activities due to project programmes.
Seagreen Phase 1a Windfarm	Consented OWF	Consented August 2023 500 MW 36 turbines	187.9	110.9	-	-	Due to lack of project timeline information, assume temporal overlap with construction activities.
Inch Cape OWF	Consented OWF in construction	Construction (January 2024) 1080 MW 72 turbines	191.5	112.8	2024	-	Potential overlap with construction activities due to project programmes.
Berwick and Marr Bank Windfarm (OWF)	Planned OWF	Planned, submitted EIA May 2023 1400 – 4100 MW 307 turbines	193.3	118.7	2025	-	Potential overlap with construction activities due to project programmes.
Forthwind OWF	Consented Demo OWF	Consented, March 2023 20 MW 1 turbine	254.2	174.0	-	-	Due to lack of project timeline information, assume temporal overlap with construction activities.
Blyth Demonstration Phase 2 & 3	Planned (Demo) floating OWF	Consented, June 2022 58.4 MW 5 turbines	334.4	262.5	-	-	Due to lack of project timeline information, assume temporal overlap with construction activities.
Sofia	Consented OWF under construction	Construction started 1400 MW 100 turbines	406.2	365.2	2023	2026	Potential overlap with construction activities due to project programmes.

Plan/Project	Summary	Status	Distance from Array Area (km)	Distance from ECC (km)	Construction Dates (if relevant)	Operational by (if relevant)	Summary of Interaction with Proposed Offshore Development
Dogger Bank C	Consented OWF	Consented 2015 1200 MW 87 turbines	419.2	381.1	2023	2027	Potential overlap with construction activities due to project programmes.
Hornsea Project 4 (HOW04)	Consented OWF	Consented July 2023 2600 MW 180 turbines	468.1	409.7	2025	2030	Potential overlap with construction activities due to project programmes.
Hornsea Project 3 (HOW03)	Consented OWF under construction	Construction started 2023 2852 MW 200 turbines	519.4	469.0	2023	2027	Potential overlap with construction activities due to project programmes.
Outer Dowsing	Planned OWF	EIA submitted April 2024 1500 MW 75-100 turbines	535.2	476.0	2026	2030	Potential overlap with construction activities due to project programmes.
Tier 3							
Broadshore Hub - Scaraben OWF (INTOG)	Planned fixed/floating OWF	Planned, Scoping Opinion received May 2024 99.45 MW Between 3 – 6 turbines	14.2	17.1	2028	2031	Potential overlap with construction activities due to project programmes.
Broadshore Hub - Sinclair OWF (INTOG)	Planned fixed/floating OWF	Planned, Scoping Opinion received May 2024 99.45 MW Between 3 – 6 turbines	16.9	20.9	2028	2031	Potential overlap with construction activities due to project programmes.
Broadshore Hub - Broadshore OWF (ScotWind)	Planned fixed/floating OWF	Planned, Scoping Opinion received May 2024 900 MW Between 32 and 60 turbines	21.2	22.4	2029	2032	Potential overlap with construction activities due to project programmes.
Marram Wind OWF (ScotWind)	Planned floating OWF	Planned, Scoping Opinion received May 2023 3000 MW 126-225 turbines	24.2	25	2026	2030	Potential overlap with construction activities due to project programmes.
Stromar OWF (ScotWind)	Planned floating OWF	Planned, Scoping Opinion received April 2024 1000 MW 71 turbines	39.6	47.1	-	-	Due to lack of project timeline information, assume temporal overlap with construction activities.

Plan/Project	Summary	Status	Distance from Array Area (km)	Distance from ECC (km)	Construction Dates (if relevant)	Operational by (if relevant)	Summary of Interaction with Proposed Offshore Development
Ayre OWF (ScotWind)	Planned fixed/floating OWF	Planned, Scoping Opinion received March 2024 1008 MW 40-67 turbines	53.1	72.3	2029	2032	Potential overlap with construction activities due to project programmes.
Westray South	Planned tidal array	Planned, submitted Scoping November 2023 200 MW tidal array	119.3	135.8	-	-	Due to lack of project timeline information, assume temporal overlap with construction activities.
Morven OWF (ScotWind)	Planned OWF	Planned, Scoping submitted July 2023 2907 MW 191 turbines	148.9	84.2	2027	2030	Potential overlap with construction activities due to project programmes.
Bellrock OWF (ScotWind)	Planned floating/fixed OWF	Planned, scoping opinion received August 2024 1200 MW 42-80 turbines	162.6	119.6	2028	2030	Potential overlap with construction activities due to project programmes.
Arven OWF (including Arven South) (ScotWind)	Planned floating OWF	Planned, Scoping submitted May 2024 (Arven) and 2023 (Arven South) 2300 MW 161 turbines	183.5	217.7	2026	2030 - 2031	Potential overlap with construction activities due to project programmes.
Dogger Bank South West	Planned OWF	Planned, Scoping Opinion received September 2022 1500 MW 100 turbines	420.0	367.6	-	-	Due to lack of project timeline information, assume temporal overlap with construction activities.
Dogger Bank D	Planned OWF	Planned, received Scoping Opinion August 2024 2000 MW 122 turbines	428.2	392.3	2029	2034 (earliest)	Potential overlap with construction activities due to project programmes.
Dogger Bank South East	Planned OWF	Planned, Scoping Opinion received September 2022 1500 MW 100 turbines	441.0	391.5	-	-	Due to lack of project timeline information, assume temporal overlap with construction activities.

Plan/Project	Summary	Status	Distance from Array Area (km)	Distance from ECC (km)	Construction Dates (if relevant)	Operational by (if relevant)	Summary of Interaction with Proposed Offshore Development
Spittal – Peterhead Subsea Cable Link[70]	HVDC cable route	Planned, PAC events completed	40	0	-	-	Due to lack of project timeline information, assume temporal overlap with construction activities.
Tier 4							
North Connect Cable Installation	HVDC Cable Connection Between Norway and UK	Planned, EIA submitted May 2023	56.2	11.9	-	-	Due to lack of project timeline information, assume temporal overlap with construction activities.
Aspen OWF (INTOG)	Planned floating OWF	Planned, awarded INTOG March 2023 1008 MW 70 - 100 turbines	71.5	61.1	2026 - 2027	2028	INTOG project with construction periods temporally close.
Flora OWF (INTOG)	Planned floating OWF	Planned, awarded INTOG March 2023 50 MW 50 turbines	80.8	28.9	-	-	Due to lack of project timeline information, assume temporal overlap with construction activities.
Campion Wind OWF (ScotWind)	Planned floating OWF	Planned, surveys ongoing (2024) 2000 MW 100 turbines	105.8	85.4	2026	2030	Potential overlap with construction activities due to project programmes.
Cedar OWF (INTOG)	Planned floating OWF	Planned, awarded INTOG March 2023 1008 MW 100 turbines	164.7	144.8	2026 - 2027	2028	INTOG project with construction periods temporally close.
Beech OWF (INTOG)	Planned floating OWF	Planned, awarded INTOG March 2023 1008 MW 100 turbines	168.1	169.3	2026 - 2027	2028	INTOG project with construction periods temporally close.
Stoura OWF (ScotWind)	Planned floating OWF	Planned, awarded ScotWind 2022 500 MW	218.2	252.9	-	2034 - 2055	Potential overlap with construction activities due to project programmes.

[70] It is understood that the Marine Licence Application for this project was submitted in January 2025. Details have been requested from MD-LOT and the Applicant, but have not been able to be provided to allow a more detailed consideration of the assessment of cumulative effects at the time of finalising the assessment, and this therefore remains as Tier 3 for assessment purposes.

6.2 IMPACTS ASSESSED IN-COMBINATION

289. The potential impacts considered in the in-combination assessment have been described in **Section 3** and summarised in **Table 6-3**.

290. Several assumptions have been made for assessment purposes. These have been detailed in **Table 6-3**.

Table 6-3 Potential impacts considered in the in-combination assessment including assumptions made when undertaking the assessment

Potential Impact	Phase			Description	Summary and Assumptions
	C	O	D		
Impact 1 - Increased underwater noise – pile driving	✓	×	×	A full description of this potential impact can be found in **Section 3.2**	Several projects may be under construction at the same time as the Proposed Offshore Development. The number of projects which will be undertaking pile driving concurrently is likely to be limited by the availability of suitable vessels. It is assumed that at all projects: • noise from pile driving will be intermittent; • instantaneous PTS will be fully mitigated; • the underlying assumptions and conservatism of the modelling approaches used to estimate cumulative PTS lead to over-precautionary estimates. The mitigation measures applied for instantaneous PTS will also reduce the potential for cumulative PTS; and • some animals will continue to use the area during construction (e.g., Graham et al., 2017; Benhemma-Le Gall et al., 2021; Fernandez-Betelu et al., 2021) while animals which have been displaced during noisy activities including pile driving will return to the area either immediately following departure of the vessel (decommissioning of an oil and gas platform in the Moray Firth; Fernandez-Betelu et al., 2024), quickly once activities cease (pile driving in the Solway Firth; Vallejo et al., 2017), or within a few hours (commercial two-dimensional seismic survey in the Moray Firth; Thompson et al., 2013). The in-combination assessment for the 'distribution/disturbance' Conservation Objective has been undertaken using the EDR (rather than the underwater noise modelling and dose-response relationship) approach (see **Section 3.2.1.3**). This is because the EDR approach has been consistently applied across projects and therefore the outcomes are directly comparable. This is not the case for the use of underwater noise modelling and dose-response relationship approach (e.g., different projects have used different underwater noise modelling approaches which can result in very different predictions).

Potential Impact	Phase			Description	Summary and Assumptions
	C	O	D		
Impact 2 - Increased underwater noise – UXO clearance work	✓	×	×	A full description of this potential impact can be found in **Section 3.3**	Other projects may be undertaking UXO clearance work at the same time as the Proposed Offshore Development. It is assumed that at all projects: • mitigation will be put in place e.g., use of low order clearance methods in the first instance; • noise from UXO clearance work will be temporary and intermittent; and • any behavioural responses will be short-term and reversible with suitable alternative habitat being available in the meantime.
Impact 3 - Increases in underwater noise - survey	✓	✓	✓	A full description of this potential impact can be found in **Section 3.4**	Other projects may be undertaking survey work at the same time as the Proposed Offshore Development. It is assumed that at all projects: • mitigation will be implemented for equipment which emits sound within the hearing range of marine mammals at above the SPL threshold for PTS; • noise from survey work will be temporary and intermittent; and • any behavioural responses will be short-term and reversible with suitable alternative habitat being available in the meantime.
Impact 4 - Increased underwater noise – operation (WTGs and moorings)	×	✓	×	A full description of this potential impact can be found in **Section 3.5**	Other projects are likely to be operational at the same time as the Proposed Offshore Development. It is assumed that at all projects: • the risk of auditory injury as a result of either operational WTG or mooring system noise is considered to be negligible; and • while some small-scale behavioural responses may occur, significant disturbance or displacement from Array Areas is unlikely.

Potential Impact	Phase			Description	Summary and Assumptions
	C	O	D		
Impact 5 - Entanglement risk – secondary	✓	✓	✓	A full description of this potential impact can be found in **Section 3.6**	Other projects may be under construction at the same time as the Proposed Offshore Development. Other projects are likely to be operational at the same time as the Proposed Offshore Development. It is assumed that at all projects: • secondary entanglement is not a risk for fixed foundation projects; • will put in place similar mitigation to the Proposed Offshore Development (i.e., development of and adherence to an Entanglement Management Plan, or equivalent (see EM14; • **Table** 4-2); and • for floating projects, the risk of secondary entanglement is low.
Impact 6 - Presence of EMF	×	✓	×	A full description of this potential impact can be found in **Section 3.7**	Other projects are likely to be operational at the same time as the Proposed Offshore Development. It is assumed that at all projects: • will put in place similar mitigation to the Proposed Offshore Development (i.e., development of and adherence to a Cable Plan (see EM9; • **Table** 4-2); • in line with those using fixed foundations, floating projects will not produce EMFs at any significant level; and • annex II marine mammals are unlikely to be affected by power cable EMFs because their high mobility limits their duration of exposure. Should they occur in very close proximity to power cable EMFs, the nature of any potential effects is likely to be limited to small changes in their acoustic activity (Kuznetsov, 1999), orientation, and potentially direction and speed

Potential Impact	Phase			Description	Summary and Assumptions
	C	O	D		
					of travel (Gill *et al*., 2005). Such changes will be small in duration (a few seconds) and extent (a few metres).

6.3 IN-COMBINATION ASSESSMENT

6.3.1 Moray Firth SAC

291. The Moray Firth SAC is 91.9 km from the Proposed Offshore Development at its closest point.

292. The Proposed Offshore Development alone assessment concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Moray Firth SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development alone for all impacts assessed.

6.3.1.1 Assessment of Adverse Effects In-Combination

293. LSE could not be ruled out for the Moray Firth SAC and the following relevant Annex II marine mammal qualifying features in-combination with other plans and projects:

- Bottlenose dolphin (see **Section 2.1**);

294. For the following impacts:

- Impact 1 - Increased underwater noise – Pile Driving[71] (see **Section 3.2**);
- Impact 2 - Increased underwater noise – UXO Clearance Work[72] (see **Section 3.3**); and
- Impact 3 - Increased underwater noise – Survey[73] (see **Section 3.4**).

295. An assessment of these impacts in relation to each relevant Conservation Objective is presented in **Table 6-4**.

It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Moray Firth SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development in-combination with other plans and projects for all impacts assessed.

[71] Relevant to the 'viable component' (2a), 'disturbance' (2b) and 'prey availability' (2c) Conservation Objectives.

[72] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[73] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

Table 6-4 Conclusion Summary of Site Integrity Against the Conservation Objectives of the Qualifying Features at the Moray Firth SAC for the Proposed Offshore Development In-Combination with other Plans and Projects

Assessed Features	Conservation Objectives	Justification	Conclusion
Bottlenose dolphin	2a. The population of bottlenose dolphin is a viable component of the site	See **Section 3** for detail on impacts. It is assumed that bottlenose dolphins from the population which uses the Moray Firth SAC have the potential to interact with all of the plans and projects which may produce underwater noise which overlaps the Moray Firth SAC and the Coastal East Scotland MU (IAMMWG, 2023). These projects, as outlined in **Table 6-2**, are: • Green Volt OWF; • Caledonia OWF; • Salamander OWF; • Muir Mhòr OWF; • Eastern Green Link 2; • Bowdun OWF; • Pentland Floating OWF; • West of Orkney Windfarm; • Cenos OWF; • Seagreen Phase 1a Windfarm; • Inch Cape OWF; • Berwick and Marr Bank Windfarm; • Forthwind OWF; • Broadshore Hub - Scaraben OWF;	Impacts will not impede the achievement of the Conservation Objective 2a for bottlenose dolphin or lead to in-combination adverse effects on site integrity of the Moray Firth SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		• Broadshore Hub - Sinclair OWF; • Broadshore Hub - Broadshore OWF; • Marram Wind OWF; • Stromar OWF; • Ayre OWF; • Westray South tidal array; • Bellrock OWF; • Spittal – Peterhead Subsea Cable Link; • North Connect Cable Installation; • Aspen OWF; • Flora OWF; and • Campion Wind OWF; There will be no impact on the bottlenose dolphin population which uses the Moray Firth SAC from: • Impact 1 - Increased underwater noise – Pile Driving (non-pile driving projects not included[74]); • Impact 2 - Increased underwater noise – UXO Clearance Work; and	

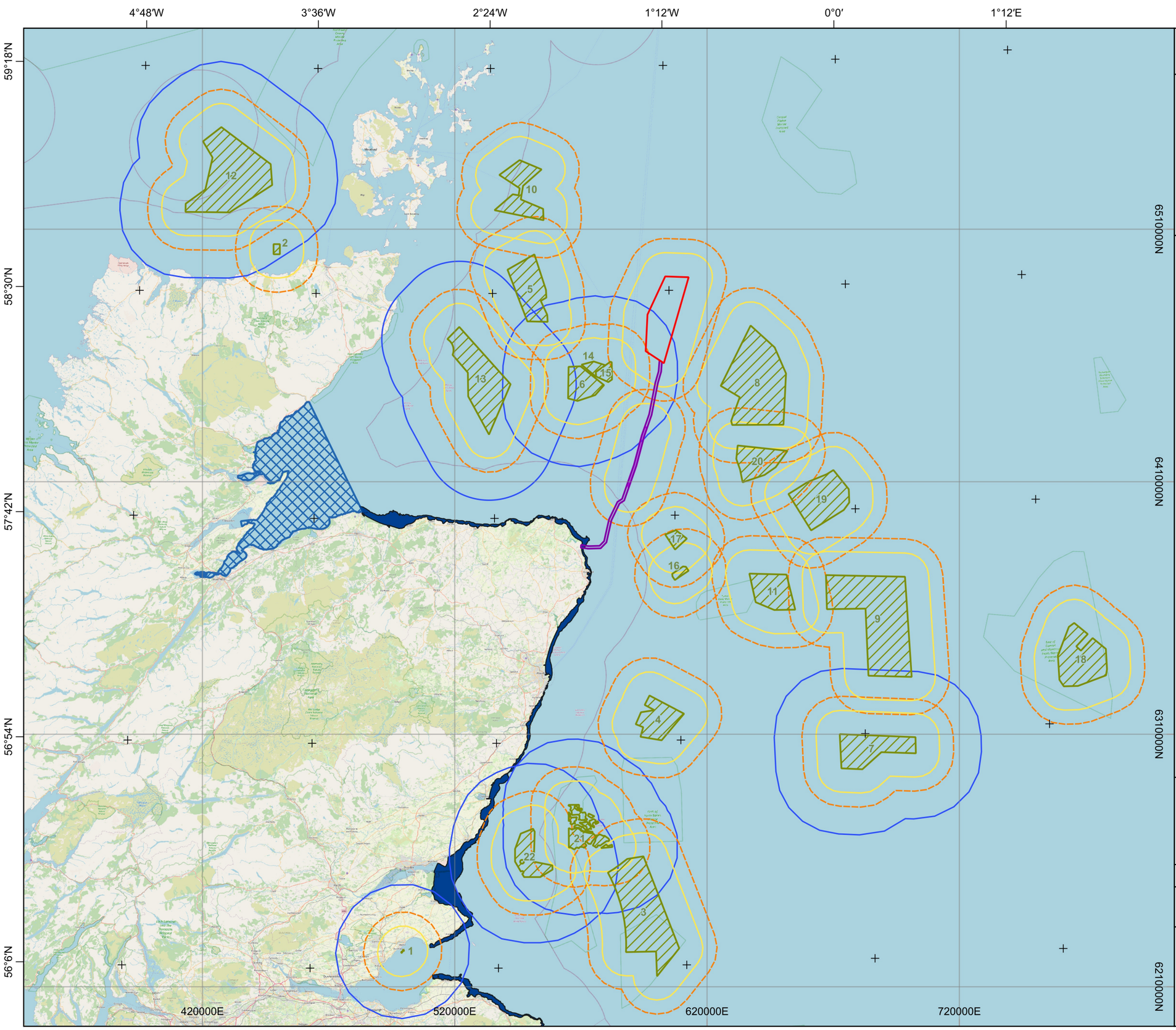
[74] Projects that will not be pile driving include Green Volt OWF, Eastern Green Link 2, Spittal – Peterhead Subsea Cable Link, North Connect Cable Installation and Westray South tidal array.

Assessed Features	Conservation Objectives	Justification	Conclusion
		• Impact 3 - Increased underwater noise – Survey. This is because, with the implementation of mitigation (**Table 6-3**), there is no risk of auditory injury (either instantaneous or cumulative PTS) to bottlenose dolphins as a result of increased underwater noise from pile driving (**Section 3.2.2**), UXO clearance work (**Section 3.3.1.4.1**) or survey work (**Section 3.4.1**) at the Proposed Offshore Development in-combination with other plans and projects. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	2b. The distribution of bottlenose dolphin throughout the site is maintained by avoiding significant disturbance	See **Section 3** for detail on impacts. It is assumed that bottlenose dolphins from the population which uses the Moray Firth SAC have the potential to interact with all of the plans and projects which may produce underwater noise which overlaps the Moray Firth SAC and the Coastal East Scotland MU (IAMMWG, 2023). These projects are the same as those listed for Conservation Objective 2a. For increased underwater noise from pile driving all of these projects have been considered other than the ones which are not piling (i.e. Eastern Green Link 2, Westray South tidal array, Spittal – Peterhead Subsea Cable Link, North Connect Cable Installation). There will be no impact on the distribution of bottlenose dolphin in the Moray Firth SAC from: • Impact 1 - Increased underwater noise – Pile Driving (non-pile driving projects not included); This is because the EDRs for pile driving (9.4 km (Benhemma-Le Gall *et al*., 2024) and 15 km and 26 km (JNCC, 2023a)) (see **Section 3.2.2.3.1**) for the in-combination projects do not overlap the Moray Firth SAC (see **Figure 6-1**). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	Impacts will not impede the achievement of the Conservation Objective 2b for bottlenose dolphin or lead to in-combination adverse effects on site integrity of the Moray Firth SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		• Impact 2 - Increased underwater noise – UXO Clearance Work; and This is because neither the effective deterrence ranges (EDRs; 5 km, 15 km, 26 km) nor the temporary threshold shift (TTS) impact ranges for high frequency cetaceans (0.1 km for low order clearance, 1.2 km for high order clearance for the greatest charge weight) (see **Section 3.3**) for the Proposed Offshore Development in-combination with other plans and projects overlap the Moray Firth SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. This is the case both with and without embedded mitigation. • Impact 3 - Increased underwater noise – Survey. This is because neither the impact range for sub-bottom profilers (SBPs; 2.5 km; BEIS, 2020) nor the EDR for geophysical surveys (5 km; JNCC, 2023a) (see **Section 3.4.3**) for the Proposed Offshore Development in-combination with other plans and projects overlap the Moray Firth SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. Access to the Moray Firth SAC will be maintained for bottlenose dolphin because: • none of the EDRs for pile driving (9.4 km (Benhemma-Le Gall *et al*., 2024) and 15 km (JNCC, 2023a)) (see **Section 3.2.2.3.1**) for the Proposed Offshore Development (for all piled foundations i.e., the WTG anchors, the OSP and the IRC) overlap the inshore bottlenose dolphin coastal strip (see **Figure 6-1**); • none of the EDRs for pile driving (9.4 km (Benhemma-Le Gall *et al*., 2024) and 15 km and 26 km (JNCC, 2023a)) for the local in-combination projects overlap the inshore bottlenose dolphin coastal strip (see **Figure 6-1**); and • although the larger of the pile driving EDRs (15 km and 26 km; JNCC, 2023a) for two of the more distant in-combination projects (Inch Cape OWF and Forthwind OWF) overlap the inshore bottlenose dolphin coastal strip (see **Figure 6-1**), any disturbance will not be significant. This	

Assessed Features	Conservation Objectives	Justification	Conclusion
		is because, in all likelihood, no individuals will be present at a particular location for the majority of the time. This is because bottlenose dolphin is a highly social species which tends to occur in groups rather than singly (Cheney *et al*., 2024) therefore the approach of assuming a uniform distribution when deriving the density surface (**Figure 6-1**) is precautionary). Should individuals be present, any post-mitigation (**Table 6-3**) behavioural responses (including disturbance) as a result of increased underwater noise from pile driving at the Proposed Offshore Development in-combination with other plans and projects are deemed sporadic (due to the nature of the proposed work), short-term and reversible. Furthermore, there is evidence that the east coast of Scotland bottlenose dolphin population shows only short-term behavioural responses (potential vocalisation modifications) to impulsive noise (a two-dimensional seismic survey and piling activity) and that they continue to use impacted areas throughout offshore activity periods (Fernandez-Betelu *et al*., 2021). As such, access to the Moray Firth SAC will be maintained for bottlenose dolphin. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	2c. The supporting habitats and processes relevant to bottlenose dolphin and the availability of prey for bottlenose dolphin are maintained	See **Section 3** for detail on impacts. It is assumed that bottlenose dolphins from the population which uses the Moray Firth SAC have the potential to interact with all of the plans and projects which may produce underwater noise which overlaps the Moray Firth SAC and the Coastal East Scotland MU (IAMMWG, 2023). These projects are the same as those listed for Conservation Objective 2a. There will be no impact on the habitats supporting bottlenose dolphin and the availability of prey in the Moray Firth SAC from:	Impacts will not impede the achievement of the Conservation Objective 2c for bottlenose dolphin or lead to in-combination adverse effects on site integrity of the Moray Firth SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		• Impact 1 - Increased underwater noise – Pile Driving; and • Impact 2 - Increased underwater noise – UXO Clearance Work. This is because, with the implementation of mitigation for pile driving and UXO clearance work at the Proposed Offshore Development in-combination with other plans and projects (**Table 6-3**), it is concluded that the availability of bottlenose dolphin prey species (i.e., fish and cephalopods) will be maintained (see **Volume 2, Chapter 8: Fish and Shellfish Ecology** of the EIAR for assessment of impacts from the Proposed Offshore Development alone). No effects on the supporting habitats or processes relevant to bottlenose dolphin are anticipated as a result of increased underwater noise from pile driving or UXO clearance work at the Proposed Offshore Development in-combination with other plans and projects. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	



Project:

Buchan Offshore Wind EIA

Title:

Figure 6-1: In-Combination Effects of Disturbance From Pile Driving on Bottlenose Dolphins Which Belong to the Population Which Uses the Moray Firth SAC

Key

Proposed offshore development

- Array Area
- Export Cable Corridor (ECC)
- Indicative Intermediate Reactive Compensation (IRC) Area

In-combination developments

- Offshore wind farm

Effective Deterrence Range (EDR)

- 26 km
- 15 km
- 9.4 km
- Bottlenose dolphin coastal strip (20 m depth contour)

Designated site

- Moray Firth Special Area of Conservation (SAC)

In-combination developments

1. Forthwind
2. Pentland
3. Berwick Bank
4. Bowdun
5. Stromar
6. Broadshore
7. Bellrock
8. Marram
9. Campion
10. Ayre
11. Muir Mhor
12. West of Orkney
13. Caledonia
14. Sinclair
15. Scaraben
16. Flora
17. Salamander
18. Cenos
19. Aspen
20. Green Volt
21. Seagreen 1A
22. Inch Cape

Scale @ A3: 1:1,500,000

Coordinate System: WGS 84 UTM Zone 30N
Graticules: WGS84

0 10 20 30 40 km

N

Date: 25-07-25	Prepared by: DH	Checked by: SM

EIA Ref No: BUC-C-MP-NP-0265
Map Ref: GB204095_M_359_A

BUCHAN OFFSHORE WIND

6.3.2 Faray and Holm of Faray SAC

296. The Faray and Holm of Faray SAC is 120 km from the Proposed Offshore Development at its closest point.

297. The Proposed Offshore Development alone assessment concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Faray and Holm of Faray SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development alone for all impacts assessed.

6.3.2.1 Assessment of Adverse Effects In-Combination

298. LSE could not be ruled out for the Faray and Holm of Faray SAC and the following relevant Annex II marine mammal qualifying features in-combination with other plans and projects:

- Grey seal (see **Section 2.3**);

299. For the following impacts:

- Impact 1 - Increased underwater noise – Pile Driving[75] (see **Section 3.2**).
- Impact 2 - Increased underwater noise – UXO Clearance Work[76] (see **Section 3.3**);
- Impact 3 - Increased underwater noise – Survey[77] (see **Section 3.4**);
- Impact 4 - Increased underwater noise – Operation (WTGS and moorings) [78] (see **Section 3.5**);
- Impact 5 - Entanglement risk - Secondary[79] (see **Section 3.6**); and
- Impact 6 - Presence of EMF[80] (**Section 3.7**).

300. An assessment of these impacts in relation to each relevant Conservation Objective is presented in **Table 6-5**.

It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Faray and Holm of Faray SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development in-combination with other plans and projects for all impacts assessed.

[75] Relevant to the 'viable component' (2a), 'disturbance' (2b) and 'prey availability' (2c) Conservation Objectives.

[76] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[77] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[78] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[79] Relevant to the 'viable component' (2a) Conservation Objective.

[80] Relevant to the 'disturbance' (2b) Conservation Objective.

Table 6-5 Conclusion Summary of Site Integrity Against the Conservation Objectives of the Qualifying Features at the Faray and Holm of Faray SAC for the Proposed Offshore Development In-Combination with other Plans and Projects

Assessed Features	Conservation Objectives	Justification	Conclusion
Grey seal	2a. Grey seals are a viable component of the Faray and Holm of Faray SAC	See **Section 3** for detail on impacts. It is assumed that grey seals from the population which uses the Faray and Holm of Faray SAC have the potential to interact with all of the plans and projects screened into the in-combination assessment (**Table 6-2**). There will be no impact on the grey seal population which uses the Faray and Holm of Faray SAC from: • Impact 1 - Increased underwater noise – Pile Driving; • Impact 2 - Increased underwater noise – UXO Clearance Work; • Impact 3 - Increased underwater noise – Survey; • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and • Impact 5 - Entanglement risk – Secondary. This is because with the implementation of mitigation (**Table 6-3**): • There is no risk of auditory injury (either instantaneous or cumulative PTS) to grey seals as a result of increased underwater noise from pile driving (**Section 3.2.2**), UXO clearance work (**Section 3.3.1.4.1**), survey work (**Section 3.4.1**) or operation (**Section 3.5.1**) of the Proposed Offshore Development in-combination with other plans and projects. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI; and • Should marine debris become snagged on the mooring lines and cables associated with infrastructure at either the Proposed Offshore Development or other floating plans and projects, the	Impacts will not impede the achievement of the Conservation Objective 2a for grey seal or lead to adverse effects on site integrity of the Faray and Holm of Faray SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		risk of secondary entanglement is low for grey seals due to their small size and short appendages (**Section 3.6**). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	2b. The distribution of grey seal throughout the site is maintained by avoiding significant disturbance of grey seals	See **Section 3** for detail on impacts. It is assumed that grey seals from the population which uses the Faray and Holm of Faray SAC have the potential to interact with all of the plans and projects screened into the in-combination assessment (**Table 6-2**). There will be no impact on the distribution of grey seal in the Faray and Holm of Faray SAC from: • Impact 1 - Increased underwater noise – Pile Driving; This is because the EDRs for pile driving (9.4 km (Benhemma-Le Gall *et al*., 2024) and 15 km and 26 km (JNCC, 2023a)) (see **Section 3.2.2.3.1**) for the in-combination projects do not overlap the Faray and Holm of Faray SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 2 - Increased underwater noise – UXO Clearance Work; This is because for the Proposed Offshore Development neither the EDRs (5 km, 15 km, 26 km) nor the TTS impact ranges for phocid carnivores in water (0.57 km for low order clearance, 17 km for high order clearance for the greatest charge weight) (see **Section 3.3**) overlap the Faray and Holm of Faray SAC. Some of the impact ranges for some of the local in-combination projects do overlap the Faray and Holm of Faray SAC, however, any disturbance is deemed short-term, sporadic, reversible, and without any likely negative effect on the species. The distribution of grey seal throughout the Faray and Holm of Faray SAC will be maintained therefore	Impacts will not impede the achievement of the Conservation Objective 2b for grey seal or lead to adverse effects on site integrity of the Faray and Holm of Faray SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		there is no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 3 - Increased underwater noise – Survey; This is because for the Proposed Offshore Development the EDR for geophysical surveys (5 km; JNCC, 2023a) (see **Section 3.4.3**) does not overlap the Faray and Holm of Faray SAC. For one local in-combination project the EDR for geophysical surveys does overlap the Faray and Holm of Faray SAC, however, any disturbance is deemed short-term, sporadic, reversible, and without any likely negative effect on the species. The distribution of grey seal throughout the Faray and Holm of Faray SAC will be maintained therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and Although some small-scale behavioural responses may occur as a result of operational noise (see **Section 3.5**), significant disturbance or displacement of grey seals from Array Areas is unlikely. As such, no impact on the distribution of grey seals in the Faray and Holm of Faray SAC is anticipated as a result of the Proposed Offshore Development in-combination with other plans and projects therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 5 - Presence of EMF. Although some small-scale behavioural responses (5 – 10 m) may occur as a result of the presence of EMFs (see **Section 3.7**), significant disturbance or displacement of grey seals from offshore developments is unlikely. As such, no impact on the distribution of grey seals in the Faray and Holm of Faray SAC is anticipated as a result of the Proposed Offshore Development in-	

Assessed Features	Conservation Objectives	Justification	Conclusion
		combination with other plans and projects therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	2c. The supporting habitats and processes relevant to grey seals are maintained	See **Section 3** for detail on impacts. It is assumed that grey seals from the population which uses the Faray and Holm of Faray SAC have the potential to interact with all of the plans and projects screened into the in-combination assessment (**Table 6-2**). There will be no impact on the habitats supporting grey seal and the availability of prey in the Faray and Holm of Faray SAC from: • Impact 1 - Increased underwater noise – Pile Driving; and • Impact 2 - Increased underwater noise – UXO Clearance Work. This is because, with the implementation of mitigation (**Table 6-3**), no effects on the supporting habitats or processes relevant to grey seals (including the availability of prey species i.e., fish and cephalopods; see **Volume 2, Chapter 8: Fish and Shellfish Ecology** of the EIAR for assessment of impacts from the Proposed Offshore Development alone) are anticipated as a result of increased underwater noise from pile driving or UXO clearance work at the Proposed Offshore Development in-combination with other plans and projects. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	Impacts will not impede the achievement of the Conservation Objective 2c for grey seal or lead to adverse effects on site integrity of the Faray and Holm of Faray SAC.

6.3.3 Isle of May SAC

301. The Isle of May SAC is 163.8 km from the Proposed Offshore Development at its closest point.

302. The Proposed Offshore Development alone assessment concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Isle of May SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development alone for all impacts assessed.

6.3.3.1 Assessment of Adverse Effects In-Combination

303. LSE could not be ruled out for the Isle of May SAC and the following relevant Annex II marine mammal qualifying features in-combination with other plans and projects:

- Grey seal (see **Section 2.3**);

304. For the following impacts:

- Impact 1 - Increased underwater noise – Pile Driving[81] (see **Section 3.2**).
- Impact 2 - Increased underwater noise – UXO Clearance Work[82] (see **Section 3.3**);
- Impact 3 - Increased underwater noise – Survey[83] (see **Section 3.4**);
- Impact 4 - Increased underwater noise – Operation (WTGS and moorings) [84] (see **Section 3.5**);
- Impact 5 - Entanglement risk - Secondary[85] (see **Section 3.6**); and
- Impact 6 - Presence of EMF[86] (**Section 3.7**).

305. An assessment of these impacts in relation to each relevant Conservation Objective is presented in **Table 6-6**.

It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Isle of May SAC during construction, operation and maintenance, and decommissioning of the Project in-combination with other plans and projects for all impacts assessed.

[81] Relevant to the 'viable component' (2a), 'disturbance' (2b) and 'prey availability' (2c) Conservation Objectives.

[82] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[83] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[84] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[85] Relevant to the 'viable component' (2a) Conservation Objective.

[86] Relevant to the 'disturbance' (2b) Conservation Objective.

Table 6-6 Conclusion Summary of Site Integrity Against the Conservation Objectives of the Qualifying Features at the Isle of May SAC for the Project In-Combination with other Plans and Projects

Assessed Features	Conservation Objectives	Justification	Conclusion
Grey seal	2a. Grey seals are a viable component of the Isle of May SAC	See **Section 3** for detail on impacts. It is assumed that grey seals from the population which uses the Isle of May SAC have the potential to interact with all of the plans and projects screened into the in-combination assessment (**Table 6-2**). There will be no impact on the grey seal population which uses the Isle of May SAC from: • Impact 1 - Increased underwater noise – Pile Driving; • Impact 2 - Increased underwater noise – UXO Clearance Work; • Impact 3 - Increased underwater noise – Survey; • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and • Impact 5 - Entanglement risk – Secondary. This is because with the implementation of mitigation (**Table 6-3**): • There is no risk of auditory injury (either instantaneous or cumulative PTS) to grey seals as a result of increased underwater noise from pile driving (**Section 3.2.2**), UXO clearance work (**Section 3.3.1.4.1**), survey work (**Section 3.4.1**) or operation (**Section 3.5.1**) of the Proposed Offshore Development in-combination with other plans and projects. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI; and • Should marine debris become snagged on the mooring lines and cables associated with infrastructure at either the Proposed Offshore Development or other floating plans and	Impacts will not impede the achievement of the Conservation Objective 2a for grey seal or lead to adverse effects on site integrity of the Isle of May SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		projects, the risk of secondary entanglement is low for grey seals due to their small size and short appendages (**Section 3.6**). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	2b. The distribution of grey seal throughout the site is maintained by avoiding significant disturbance of grey seals	See **Section 3** for detail on impacts. It is assumed that grey seals from the population which uses the Isle of May SAC have the potential to interact with all of the plans and projects screened into the in-combination assessment (**Table 6-2**). There will be no impact on the distribution of grey seal in the Isle of May SAC from: • Impact 1 - Increased underwater noise – Pile Driving; This is because the EDRs for pile driving (9.4 km (Benhemma-Le Gall *et al*., 2024) and 15 km and 26 km (JNCC, 2023a)) (see **Section 3.2.2.3.1**) for the in-combination projects do not overlap the Isle of May SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 2 - Increased underwater noise – UXO Clearance Work; This is because for the Proposed Offshore Development neither the EDRs (5 km, 15 km, 26 km) nor the TTS impact ranges for phocid carnivores in water (0.57 km for low order clearance, 17 km for high order clearance for the greatest charge weight) (see **Section 3.3**) overlap the Isle of May SAC. Some of the impact ranges for some of the local in-combination projects do overlap the Isle of May SAC, however, any disturbance is deemed short-term, sporadic, reversible, and without any likely negative effect on the species. The distribution of grey seal throughout the Isle of May SAC will be maintained therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI.	Impacts will not impede the achievement of the Conservation Objective 2b for grey seal or lead to adverse effects on site integrity of the Isle of May SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		• Impact 3 - Increased underwater noise – Survey; This is because for the Proposed Offshore Development the EDR for geophysical surveys (5 km; JNCC, 2023a) (see **Section 3.4.3**) does not overlap the Isle of May SAC. For one local in-combination project the EDR for geophysical surveys does overlap the Isle of May SAC, however, any disturbance is deemed short-term, sporadic, reversible, and without any likely negative effect on the species. The distribution of grey seal throughout the Isle of May SAC will be maintained therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and Although some small-scale behavioural responses may occur as a result of operational noise (see **Section 3.5**), significant disturbance or displacement of grey seals from Array Areas is unlikely. As such, no impact on the distribution of grey seals in the Isle of May SAC is anticipated as a result of the Proposed Offshore Development in-combination with other plans and projects therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 6 - Presence of EMF. Although some small-scale behavioural responses (5 – 10 m) may occur as a result of the presence of EMFs (see **Section 3.7**), significant disturbance or displacement of grey seals from offshore developments is unlikely. As such, no impact on the distribution of grey seals in the Isle of May SAC is anticipated as a result of the Proposed Offshore Development in-combination with other plans and projects therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI.	

Assessed Features	Conservation Objectives	Justification	Conclusion
	2c. The supporting habitats relevant to grey seal are maintained	See **Section 3** for detail on impacts. It is assumed that grey seals from the population which uses the Isle of May SAC have the potential to interact with all of the plans and projects screened into the in-combination assessment (**Table 6-2**). There will be no impact on the habitats supporting grey seal and the availability of prey in the Isle of May SAC from: • Impact 1 - Increased underwater noise – Pile Driving; and • Impact 2 - Increased underwater noise – UXO Clearance Work. This is because, with the implementation of mitigation (**Table 6-3**), no effects on the supporting habitats or processes relevant to grey seals (including the availability of prey species i.e., fish and cephalopods; see **Volume 2, Chapter 8: Fish and Shellfish Ecology** of the EIAR for assessment of impacts from the Proposed Offshore Development alone) are anticipated as a result of increased underwater noise from pile driving or UXO clearance work at the Proposed Offshore Development in-combination with other plans and projects. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	Impacts will not impede the achievement of the Conservation Objective 2c for grey seal or lead to adverse effects on site integrity of the Isle of May SAC.

6.3.4 Berwickshire and North Northumberland Coast SAC

306. The Berwickshire and North Northumberland Coast SAC is 184.6 km from the Proposed Offshore Development at its closest point.

307. The Proposed Offshore Development alone assessment concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Berwickshire and North Northumberland Coast SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development alone for all impacts assessed.

6.3.4.1 Assessment of Adverse Effects In-Combination

308. LSE could not be ruled out for the Berwickshire and North Northumberland Coast SAC and the following relevant Annex II marine mammal qualifying features in-combination with other plans and projects:

- grey seal (see **Section 2.3**);

309. For the following impacts:

- Impact 1 - Increased underwater noise – Pile Driving[87] (see **Section 3.2**).
- Impact 2 - Increased underwater noise – UXO Clearance Work[88] (see **Section 3.3**);
- Impact 3- Increased underwater noise – Survey[89] (see **Section 3.4**);
- Impact 4 - Increased underwater noise – Operation (WTGS and moorings) [90] (see **Section 3.5**);
- Impact 5 - Entanglement risk - Secondary[91] (see **Section 3.6**); and
- Impact 6 - Presence of EMF[92] (**Section 3.7**).

310. An assessment of these impacts in relation to each relevant Conservation Objective is presented in **Table 6-7**.

It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Berwickshire and North Northumberland Coast SAC during construction, operation and maintenance, and decommissioning of the Project in-combination with other plans and projects for all impacts assessed.

[87] Relevant to the 'viable component' (2a), 'disturbance' (2b) and 'prey availability' (2c) Conservation Objectives.

[88] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[89] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[90] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[91] Relevant to the 'viable component' (2a) Conservation Objective.

[92] Relevant to the 'disturbance' (2b) Conservation Objective.

Table 6-7 Conclusion Summary of Site Integrity Against the Conservation Objectives of the Qualifying Features at the Berwickshire and North Northumberland Coast SAC for the Project In-Combination with other Plans and Projects

Assessed Features	Conservation Objectives	Justification	Conclusion
Grey seal	Maintain or restore the populations of qualifying species Relevant attributes and targets (as per the Supplementary Advice on Conservation Objectives) presented in **Table 5-5** and **Table 5-6**	See **Section 3** for detail on impacts. It is assumed that grey seals from the population which uses the Berwickshire and North Northumberland Coast SAC have the potential to interact with all of the plans and projects screened into the in-combination assessment (**Table 6-2**). There will be no impact on the grey seal population which uses the Berwickshire and North Northumberland Coast SAC from: • Impact 1 - Increased underwater noise – Pile Driving; • Impact 2 - Increased underwater noise – UXO Clearance Work; • Impact 3 - Increased underwater noise – Survey; • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and • Impact 5 - Entanglement risk – Secondary. This is because with the implementation of mitigation (**Table 6-3**): • there is no risk of auditory injury (either instantaneous or cumulative PTS) to grey seals as a result of increased underwater noise from pile driving (**Section 3.2.2**), UXO clearance work (**Section 3.3.1.4.1**), survey work (**Section 3.4.1**) or operation (**Section 3.5.1**) of the Proposed Offshore Development in-combination with other plans and projects. There is therefore no risk of hindering the	Impacts will not impede the achievement of this Conservation Objective or lead to adverse effects on site integrity of the Berwickshire and North Northumberland Coast SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		Conservation Objective, and no potential for AEoSI; and • should marine debris become snagged on the mooring lines and cables associated with infrastructure at either the Proposed Offshore Development or other floating plans and projects, the risk of secondary entanglement is low for grey seals due to their small size and short appendages (**Section 3.6**). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	Maintain or restore the distribution of qualifying species within the site Relevant attributes and targets (as per the Supplementary Advice on Conservation Objectives) presented in **Table 5-5** and **Table 5-6**	See **Section 3** for detail on impacts. It is assumed that grey seals from the population which uses the Berwickshire and North Northumberland Coast SAC have the potential to interact with all of the plans and projects screened into the in-combination assessment (**Table 6-2**). There will be no impact on the distribution of grey seal in the Berwickshire and North Northumberland Coast SAC from: • Impact 1 - Increased underwater noise – Pile Driving; This is because the EDRs for pile driving (9.4 km (Benhemma-Le Gall *et al*., 2024) and 15 km and 26 km (JNCC, 2023a)) (see **Section 3.2.2.3.1**) for the in-combination projects do not overlap the Berwickshire and North Northumberland Coast SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	Impacts will not impede the achievement of this Conservation Objective or lead to adverse effects on site integrity of the Berwickshire and North Northumberland Coast SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		• Impact 2 - Increased underwater noise – UXO Clearance Work; This is because for the Proposed Offshore Development neither the EDRs (5 km, 15 km, 26 km) nor the TTS impact ranges for phocid carnivores in water (0.57 km for low order clearance, 17 km for high order clearance for the greatest charge weight) (see **Section 3.3**) overlap the Berwickshire and North Northumberland Coast SAC. Some of the impact ranges for some of the local in-combination projects do overlap the Berwickshire and North Northumberland Coast SAC, however, any disturbance is deemed short-term, sporadic, reversible, and without any likely negative effect on the species. The distribution of grey seal throughout the Berwickshire and North Northumberland Coast SAC will be maintained therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 3 - Increased underwater noise – Survey; This is because for the Proposed Offshore Development the EDR for geophysical surveys (5 km; JNCC, 2023a) (see **Section 3.4.3**) does not overlap the Berwickshire and North Northumberland Coast SAC. For some local in-combination projects the EDR for geophysical surveys does overlap the Berwickshire and North Northumberland Coast SAC, however, any disturbance is deemed short-term, sporadic, reversible, and without any likely negative effect on the species. The distribution of grey seal throughout the Berwickshire and North Northumberland Coast SAC will be maintained therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI.	

Assessed Features	Conservation Objectives	Justification	Conclusion
		• Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and Although some small-scale behavioural responses may occur as a result of operational noise (see **Section 3.5**), significant disturbance or displacement of grey seals from array areas is unlikely. As such, no impact on the distribution of grey seals in the Berwickshire and North Northumberland Coast SAC is anticipated as a result of the Proposed Offshore Development in-combination with other plans and projects therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 6 - Presence of EMF. Although some small-scale behavioural responses (5 – 10 m) may occur as a result of the presence of EMFs (see **Section 3.7**), significant disturbance or displacement of grey seals from offshore developments is unlikely. As such, no impact on the distribution of grey seals in the Berwickshire and North Northumberland Coast SAC is anticipated as a result of the Proposed Offshore Development in-combination with other plans and projects therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	Maintain or restore the extent and distribution of qualifying natural habitats and habitats of qualifying species Maintain or restore the structure and function (including typical species) of qualifying natural habitats	See **Section 3** for detail on impacts. It is assumed that grey seals from the population which uses the Berwickshire and North Northumberland Coast SAC have the potential to interact with all of the plans and projects screened into the in-combination assessment (**Table 6-2**).	Impacts will not impede the achievement of these Conservation Objectives or lead to adverse effects on site integrity of the Berwickshire and North Northumberland Coast SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
	Maintain or restore the structure and function of the habitats of qualifying species Maintain or restore the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely Relevant attributes and targets (as per the Supplementary Advice on Conservation Objectives) presented in **Table 5-5** and **Table 5-6**	There will be no impact on the habitats supporting grey seal and the availability of prey in the Berwickshire and North Northumberland Coast SAC from: • Impact 1 - Increased underwater noise – Pile Driving; and • Impact 2 - Increased underwater noise – UXO Clearance Work. This is because, with the implementation of mitigation (**Table 6-3**), no effects on the supporting habitats or processes relevant to grey seals (including the availability of prey species i.e., fish and cephalopods; see **Volume 2, Chapter 8: Fish and Shellfish Ecology** of the EIAR for assessment of impacts from the Proposed Offshore Development alone) are anticipated as a result of increased underwater noise from pile driving or UXO clearance work at the Proposed Offshore Development in-combination with other plans and projects. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	

6.3.5 North Rona SAC

311. The North Rona SAC is 269.1 km from the Proposed Offshore Development at its closest point.

312. The Proposed Offshore Development alone assessment concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the North Rona SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development alone for all impacts assessed.

6.3.5.1 Assessment of Adverse Effects In-Combination

313. LSE could not be ruled out for the North Rona SAC and the following relevant Annex II marine mammal qualifying features in-combination with other plans and projects:

- grey seal (see **Section 2.3**);

314. For the following impacts:

- Impact 1 - Increased underwater noise – Pile Driving[93] (see **Section 3.2**).
- Impact 2 - Increased underwater noise – UXO Clearance Work[94] (see **Section 3.3**);
- Impact 3 - Increased underwater noise – Survey[95] (see **Section 3.4**);
- Impact 4 - Increased underwater noise – Operation (WTGS and moorings) [96] (see **Section 3.5**);
- Impact 5 - Entanglement risk - Secondary[97] (see **Section 3.6**); and
- Impact 6 - Presence of EMF[98] (**Section 3.7**).

315. An assessment of these impacts in relation to each relevant Conservation Objective is presented in **Table 6-8**.

It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the North Rona SAC during construction, operation and maintenance, and decommissioning of the Project in-combination with other plans and projects for all impacts assessed.

[93] Relevant to the 'viable component' (2a), 'disturbance' (2b) and 'prey availability' (2c) Conservation Objectives.

[94] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[95] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[96] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[97] Relevant to the 'viable component' (2a) Conservation Objective.

[98] Relevant to the 'disturbance' (2b) Conservation Objective.

Table 6-8 Conclusion Summary of Site Integrity Against the Conservation Objectives of the Qualifying Features at the North Rona SAC for the Project In-Combination with other Plans and Projects

Assessed Features	Conservation Objectives	Justification	Conclusion
Grey seal	2a. Grey seals are a viable component of the North Rona SAC	See **Section 3** for detail on impacts. It is assumed that grey seals from the population which uses the North Rona SAC have the potential to interact with all of the plans and projects screened into the in-combination assessment (**Table 6-2**). There will be no impact on the grey seal population which uses the North Rona SAC from: • Impact 1 - Increased underwater noise – Pile Driving; • Impact 2 - Increased underwater noise – UXO Clearance Work; • Impact 3 - Increased underwater noise – Survey; • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and • Impact 5 - Entanglement risk – Secondary. This is because with the implementation of mitigation (**Table 6-3**): • There is no risk of auditory injury (either instantaneous or cumulative PTS) to grey seals as a result of increased underwater noise from pile driving (**Section 3.2.2**), UXO clearance work (**Section 3.3.1.4.1**), survey work (**Section 3.4.1**) or operation (**Section 3.5.1**) of the Proposed Offshore Development in-combination with other plans and projects. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI; and • Should marine debris become snagged on the mooring lines and cables associated with infrastructure at either the Proposed Offshore Development or other floating plans and projects, the	Impacts will not impede the achievement of the Conservation Objective 2a for grey seal or lead to adverse effects on site integrity of the North Rona SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		risk of secondary entanglement is low for grey seals due to their small size and short appendages (**Section 3.6**). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	2b. The distribution of grey seals throughout the site is maintained by avoiding significant disturbance	See **Section 3** for detail on impacts. It is assumed that grey seals from the population which uses the North Rona SAC have the potential to interact with all of the plans and projects screened into the in-combination assessment (**Table 6-2**). There will be no impact on the distribution of grey seal in the North Rona SAC from: • Impact 1 - Increased underwater noise – Pile Driving; This is because the EDRs for pile driving (9.4 km (Benhemma-Le Gall *et al*., 2024) and 15 km and 26 km (JNCC, 2023a)) (see **Section 3.2.2.3.1**) for the in-combination projects do not overlap North Rona SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 2 - Increased underwater noise – UXO Clearance Work; This is because for the Proposed Offshore Development neither the EDRs (5 km, 15 km, 26 km) nor the TTS impact ranges for phocid carnivores in water (0.57 km for low order clearance, 17 km for high order clearance for the greatest charge weight) (see **Section 3.3**) overlap the North Rona SAC. Some of the impact ranges for one of the local in-combination projects do overlap the North Rona SAC, however, any disturbance is deemed short-term, sporadic, reversible, and without any likely negative effect on the species. The distribution of grey seal throughout the North Rona SAC will be maintained therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI.	Impacts will not impede the achievement of the Conservation Objective 2b for grey seal or lead to adverse effects on site integrity of the North Rona SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		• Impact 3 - Increased underwater noise – Survey; This is because neither the impact range for SBPs (2.5 km; BEIS, 2020) nor the EDR for geophysical surveys (5 km; JNCC, 2023a) (see **Section 3.4.3**) for the Proposed Offshore Development in-combination with other plans and projects overlap the North Rona SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and Although some small-scale behavioural responses may occur as a result of operational noise (see **Section 3.5**), significant disturbance or displacement of grey seals from Array Areas is unlikely. As such, no impact on the distribution of grey seals in the North Rona SAC is anticipated as a result of the Proposed Offshore Development in-combination with other plans and projects therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 6 - Presence of EMF. Although some small-scale behavioural responses (5 – 10 m) may occur as a result of the presence of EMFs (see **Section 3.7**), significant disturbance or displacement of grey seals from offshore developments is unlikely. As such, no impact on the distribution of grey seals in the North Rona SAC is anticipated as a result of the Proposed Offshore Development in-combination with other plans and projects therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	2c. The supporting habitats and processes relevant to grey seals are maintained	See **Section 3** for detail on impacts. It is assumed that grey seals from the population which uses the North Rona SAC have the potential to interact with all of the plans and projects screened into the in-combination assessment (**Table 6-2**).	Impacts will not impede the achievement of the Conservation Objective 2c for grey seal or lead to adverse effects on site

Assessed Features	Conservation Objectives	Justification	Conclusion
		There will be no impact on the habitats supporting grey seal and the availability of prey in the North Rona SAC from: • Impact 1 - Increased underwater noise – Pile Driving; and • Impact 2 - Increased underwater noise – UXO Clearance Work. This is because, with the implementation of mitigation (**Table 6-3**), no effects on the supporting habitats or processes relevant to grey seals (including the availability of prey species i.e., fish and cephalopods; see **Volume 2, Chapter 8: Fish and Shellfish Ecology** of the EIAR for assessment of impacts from the Proposed Offshore Development alone) are anticipated as a result of increased underwater noise from pile driving or UXO clearance work at the Proposed Offshore Development in-combination with other plans and projects. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	integrity of the North Rona SAC.

6.3.6 Southern North Sea SAC

316. The Southern North Sea SAC is 278.8 km from the Proposed Offshore Development at its closest point.

317. The Proposed Offshore Development alone assessment concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Southern North Sea SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development alone for all impacts assessed.

6.3.6.1 Assessment of Adverse Effects In-Combination

318. LSE could not be ruled out for the Southern North Sea SAC and the following relevant Annex II marine mammal qualifying features in-combination with other plans and projects:

- harbour porpoise (see **Section 2.2**);

319. For the following impacts:

- Impact 1 - Increased underwater noise – Pile Driving[99] (see **Section 3.2**).
- Impact 2 - Increased underwater noise – UXO Clearance Work[100] (see **Section 3.3**);
- Impact 3 - Increased underwater noise – Survey[101] (see **Section 3.4**);
- Impact 4 - Increased underwater noise – Operation (WTGS and moorings) [102] (see **Section 3.5**);
- Impact 5 - Entanglement risk - Secondary[103] (see **Section 3.6**); and
- Impact 6 - Presence of EMF[104] (**Section 3.7**).

320. An assessment of these impacts in relation to each relevant Conservation Objective is presented in **Table 6-9**.

It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Southern North Sea SAC during construction, operation and maintenance, and decommissioning of the Project in-combination with other plans and projects for all impacts assessed.

[99] Relevant to the 'viable component' (2a), 'disturbance' (2b) and 'prey availability' (2c) Conservation Objectives.

[100] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[101] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[102] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[103] Relevant to the 'viable component' (2a) Conservation Objective.

[104] Relevant to the 'disturbance' (2b) Conservation Objective.

Table 6-9 Conclusion Summary of Site Integrity Against the Conservation Objectives of the Qualifying Features at the Southern North Sea SAC for the Project In-Combination with other Plans and Projects

Assessed Features	Conservation Objectives	Justification	Conclusion
Harbour porpoise	1. Harbour porpoise is a viable component of the site	See **Section 3** for detail on impacts. It is assumed that harbour porpoise from the population which uses the Southern North Sea SAC have the potential to interact with all of the plans and projects screened into the in-combination assessment (**Table 6-2**). There will be no impact on the harbour porpoise population which uses the Southern North Sea SAC from: • Impact 1 - Increased underwater noise – Pile Driving; • Impact 2 - Increased underwater noise – UXO Clearance Work; • Impact 3 - Increased underwater noise – Survey; • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and • Impact 5 - Entanglement risk – Secondary. This is because with the implementation of mitigation (**Table 6-3**): • there is no risk of auditory injury (instantaneous PTS) to harbour porpoise as a result of increased underwater noise from pile driving (**Section 3.2.2.1**) at the Proposed Offshore Development in-combination with other plans and projects. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI; • the cumulative PTS contours (**Section 3.2.2.2**) from the Proposed Offshore Development in-combination with other plans and projects are unlikely to overlap the Southern North Sea SAC. The risk of auditory injury (cumulative PTS) to harbour porpoise as a	Impacts will not impede the achievement of the Conservation Objective for harbour porpoise or lead to adverse effects on site integrity of the Southern North Sea SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		result of increased underwater noise from pile driving is unlikely to result in long term effects at the population level and will not affect the viability of the harbour porpoise population within the UK portion of the North Sea MU in the long term (**Section 3.2.2.4.2**). As such, cumulative PTS as a result of pile driving at the Proposed Offshore Development in-combination with other plans and projects will not lead to a long-term decline of the feature within the Southern North Sea SAC. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI; • there is no risk of auditory injury (either instantaneous or cumulative PTS) to harbour porpoise as a result of increased underwater noise from UXO clearance work (**Section 3.3.1.4.1**), survey work (**Section 3.4.1**) or operation (**Section 3.5.1**) of the Proposed Offshore Development in-combination with other plans and projects. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI; and • should marine debris become snagged on the mooring lines and cables associated with infrastructure at either the Proposed Offshore Development or other floating plans and projects, the risk of secondary entanglement is low for harbour porpoises due to their small size and short appendages (**Section 3.6**). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	2. There is no significant disturbance of the species	See **Section 3** for detail on impacts. It is assumed that harbour porpoise from the population which uses the Southern North Sea SAC have the potential to interact with all of the plans and projects screened into the in-combination assessment (**Table 6-2**).	Impacts will not impede the achievement of the Conservation Objective for harbour porpoise or lead to adverse effects on site integrity of the Southern North Sea SAC.

Assessed Features	Conservation Objectives	Justification	Conclusion
		There will be no significant disturbance of harbour porpoise in the Southern North Sea SAC from: • Impact 1 - Increased underwater noise – Pile Driving; This is because although the EDRs for pile driving (9.4 km (Benhemma-Le Gall *et al*., 2024) and 15 km and 26 km (JNCC, 2023a)) (see **Section 3.2.2.3.1**) for some of the local in-combination projects overlap the Southern North Sea SAC, this is not the case for the Proposed Offshore Development. Also, evidence suggests that some animals will continue to use the area during construction (e.g., Graham *et al*., 2017; Benhemma-Le Gall *et al*., 2021; Fernandez-Betelu *et al*., 2021) while animals which may have been displaced during noisy activities including pile driving will return to the area either immediately following departure of the vessel (decommissioning of an oil and gas platform in the Moray Firth; Fernandez-Betelu *et al*., 2024), quickly once activities cease (pile driving in the Solway Firth; Vallejo *et al*., 2017), or within a few hours (commercial two-dimensional seismic survey in the Moray Firth; Thompson *et al*., 2013). As such, disturbance as a result of pile driving noise from some of the local in-combination projects will not be significant and the distribution of harbour porpoise throughout the Southern North Sea SAC will be maintained therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 2 - Increased underwater noise – UXO Clearance Work; This is because for the Proposed Offshore Development neither the EDRs (5 km, 15 km, 26 km) nor the TTS impact ranges for very high frequency cetaceans (1.8 km for low order clearance, 20 km for high order clearance for the greatest charge weight) (see **Section 3.3**) overlap the Southern North Sea SAC. Some of the impact ranges for some of the local in-combination projects do overlap the Southern North Sea SAC, however, any disturbance is deemed short-term, sporadic, reversible, and without any likely negative effect on the species. The distribution of harbour porpoise throughout the	

Assessed Features	Conservation Objectives	Justification	Conclusion
		Southern North Sea SAC will be maintained therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 3 - Increased underwater noise – Survey; This is because for the Proposed Offshore Development the EDR for geophysical surveys (5 km; JNCC, 2023a) (see **Section 3.4.3**) does not overlap the Southern North Sea SAC. For some local in-combination project the EDR for geophysical surveys does overlap the Southern North Sea SAC, however, any disturbance is deemed short-term, sporadic, reversible, and without any likely negative effect on the species. The distribution of harbour porpoise throughout the Southern North Sea SAC will be maintained therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and Although some small-scale behavioural responses may occur as a result of operational noise (see **Section 3.5**), significant disturbance or displacement of harbour porpoise from Array Areas is unlikely. As such, no impact on the distribution of harbour porpoise in the Southern North Sea SAC is anticipated as a result of the Proposed Offshore Development in-combination with other plans and projects therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 5 - Presence of EMF. Although some small-scale behavioural responses (5 – 10 m) may occur as a result of the presence of EMFs (see **Section 3.7**), significant disturbance or displacement of harbour porpoise from offshore developments is unlikely. As such, no impact on the distribution of harbour porpoise in the Southern North Sea SAC is anticipated as a result of the Proposed Offshore Development in-combination with other plans and projects therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI.	

Assessed Features	Conservation Objectives	Justification	Conclusion
	3. The condition of supporting habitats and processes, and the availability of prey is maintained	See **Section 3** for detail on impacts. It is assumed that harbour porpoise from the population which uses the Southern North Sea SAC have the potential to interact with all of the plans and projects screened into the in-combination assessment (**Table 6-2**). There will be no impact on the habitats supporting harbour porpoise and the availability of prey in the Southern North Sea SAC from: • Impact 1 - Increased underwater noise – Pile Driving; and • Impact 2 - Increased underwater noise – UXO Clearance Work. This is because, with the implementation of mitigation for pile driving and UXO clearance work at the Proposed Offshore Development in-combination with other plans and projects (**Table 6-3**), it is concluded that the availability of harbour porpoise prey species (i.e., fish and cephalopods) will be maintained (see **Volume 2, Chapter 8: Fish and Shellfish Ecology** of the EIAR for assessment of impacts from the Proposed Offshore Development alone). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. No effects on the supporting habitats or processes relevant to harbour porpoise are anticipated as a result of increased underwater noise from pile driving or UXO clearance work at the Proposed Offshore Development in-combination with other plans and projects. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	Impacts will not impede the achievement of the Conservation Objective for harbour porpoise or lead to adverse effects on site integrity of the Southern North Sea SAC.

6.3.7 Non-UK SACs

321. The non-UK SACs are >380 km from the Proposed Offshore Development at their closest point.

322. The Proposed Offshore Development alone assessment concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of any non-UK SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development alone for all impacts assessed.

6.3.7.1 Assessment of Adverse Effects In-Combination

323. LSE could not be ruled out for all 32 non-UK SACs and the following relevant Annex II marine mammal qualifying features in-combination with other plans and projects:

- Harbour porpoise (see Section 2.2);

324. For the following impacts:

- Impact 1 - Increased underwater noise – Pile Driving[105] (see **Section 3.2**).
- Impact 2 - Increased underwater noise – UXO Clearance Work[106] (see **Section 3.3**);
- Impact 3 - Increased underwater noise – Survey[107] (see **Section 3.4**);
- Impact 4 - Increased underwater noise – Operation (WTGS and moorings) [108] (see **Section 3.5**);
- Impact 5 - Entanglement risk - Secondary[109] (see **Section 3.6**); and
- Impact 6 - Presence of EMF[110] (**Section 3.7**).

325. An assessment of these impacts in relation to each relevant Conservation Objective is presented in **Table 6-10**.

It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of any non-UK SAC during construction, operation and maintenance, and decommissioning of the Project in-combination with other plans and projects for all impacts assessed.

[105] Relevant to the 'viable component' (2a), 'disturbance' (2b) and 'prey availability' (2c) Conservation Objectives.

[106] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[107] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[108] Relevant to the 'viable component' (2a) and 'disturbance' (2b) Conservation Objectives.

[109] Relevant to the 'viable component' (2a) Conservation Objective.

[110] Relevant to the 'disturbance' (2b) Conservation Objective.

Table 6-10 Conclusion Summary of Site Integrity Against the Conservation Objectives of the Qualifying Features at non-UK SACs for the Project In-Combination with other Plans and Projects

Assessed Features	Conservation Objectives	Justification	Conclusion
Harbour porpoise	1. Harbour porpoise is a viable component of the site	See **Section 3** for detail on impacts. It is assumed that harbour porpoise from the population which uses any of the non-UK SACs have the potential to interact with all of the plans and projects screened into the in-combination assessment (**Table 6-2**). There will be no impact on the harbour porpoise populations which use any of the non-UK SACs from: • Impact 1 - Increased underwater noise – Pile Driving; • Impact 2 - Increased underwater noise – UXO Clearance Work; • Impact 3 - Increased underwater noise – Survey; • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and • Impact 5 - Entanglement risk – Secondary. This is because with the implementation of mitigation (**Table 6-3**): • there is no risk of auditory injury (instantaneous PTS) to harbour porpoise as a result of increased underwater noise from pile driving **Section 3.2.2.1**) at the Proposed Offshore Development in-combination with other plans and projects. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI; • the cumulative PTS contours (**Section 3.2.2.2**) from the Proposed Offshore Development in-combination with other plans and projects are unlikely to overlap the non-UK SACs. The risk of auditory injury (cumulative PTS) to harbour porpoise as a result of increased underwater noise from pile driving is unlikely	Impacts will not impede the achievement of the Conservation Objective 2a for harbour porpoise or lead to adverse effects on site integrity for any of the non-UK SACs.

		to result in long term effects at the population level and will not affect the viability of the harbour porpoise population within the UK portion of the North Sea MU in the long term (**Section 3.2.2.4.2**). As such, cumulative PTS as a result of pile driving at the Proposed Offshore Development in-combination with other plans and projects will not lead to a long-term decline of the feature within the non-UK SACs. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI; • there is no risk of auditory injury (either instantaneous or cumulative PTS) to harbour porpoise as a result of increased underwater noise from UXO clearance work (**Section 3.3.1.4.1**), survey work (**Section 3.4.1**) or operation (**Section 3.5.1**) of the Proposed Offshore Development in-combination with other plans and projects. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI; and • should marine debris become snagged on the mooring lines and cables associated with infrastructure at either the Proposed Offshore Development or other floating plans and projects, the risk of secondary entanglement is low for harbour porpoises due to their small size and short appendages (**Section 3.6**). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	2. There is no significant disturbance of the species	See **Section 3** for detail on impacts. It is assumed that harbour porpoise from the population which uses any of the non-UK SACs have the potential to interact with all of the plans and projects screened into the in-combination assessment (**Table 6-2**). There will be no significant disturbance of harbour porpoise in any of the non-UK SACs from:	Impacts will not impede the achievement of the Conservation Objective 2b for harbour porpoise or lead to adverse effects on site integrity for any of the non-UK SACs.

		• Impact 1 - Increased underwater noise – Pile Driving; This is because although the EDRs for pile driving (9.4 km (Benhemma-Le Gall *et al*., 2024) and 15 km and 26 km (JNCC, 2023a)) (see **Section 3.2.2.3.1**) for some of the local in-combination projects overlap the non-UK SACs, this is not the case for the Proposed Offshore Development. Also, evidence suggests that some animals will continue to use the area during construction (e.g., Graham *et al*., 2017; Benhemma-Le Gall *et al*., 2021; Fernandez-Betelu *et al*., 2021) while animals which may have been displaced during noisy activities including pile driving will return to the area either immediately following departure of the vessel (decommissioning of an oil and gas platform in the Moray Firth; Fernandez-Betelu *et al*., 2024), quickly once activities cease (pile driving in the Solway Firth; Vallejo *et al*., 2017), or within a few hours (commercial two-dimensional seismic survey in the Moray Firth; Thompson *et al*., 2013). As such, disturbance as a result of pile driving noise from some of the local in-combination projects will not be significant and the distribution of harbour porpoise throughout the non-UK SACs will be maintained therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 2 - Increased underwater noise – UXO Clearance Work; This is because for the Proposed Offshore Development neither the EDRs (5 km, 15 km, 26 km) nor the TTS impact ranges for very high frequency cetaceans (1.8 km for low order clearance, 20 km for high order clearance for the greatest charge weight) (see **Section 3.3**) overlap the non-UK SACs. Some of the impact ranges for some of the local in-combination projects do overlap the non-UK SACs, however, any disturbance is deemed short-term, sporadic, reversible, and without any likely negative effect on the species. The distribution of harbour porpoise throughout the non-UK SACs will be maintained therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 3 - Increased underwater noise – Survey;	

		This is because for the Proposed Offshore Development the EDR for geophysical surveys (5 km; JNCC, 2023a) (see **Section 3.4.3**) does not overlap the non-UK SACs. For some local in-combination project the EDR for geophysical surveys does overlap the non-UK SACs, however, any disturbance is deemed short-term, sporadic, reversible, and without any likely negative effect on the species. The distribution of harbour porpoise throughout the Southern North Sea SAC will be maintained therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 4 - Increased underwater noise – Operation (WTGS and moorings); and Although some small-scale behavioural responses may occur as a result of operational noise (see **Section 3.5**), significant disturbance or displacement of harbour porpoise from Array Areas is unlikely. As such, no impact on the distribution of harbour porpoise in the non-UK SACs is anticipated as a result of the Proposed Offshore Development in-combination with other plans and projects therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI. • Impact 6 - Presence of EMF. Although some small-scale behavioural responses (5 – 10 m) may occur as a result of the presence of EMFs (see **Section 3.7**), significant disturbance or displacement of harbour porpoise from offshore developments is unlikely. As such, no impact on the distribution of harbour porpoise in the non-UK SACs is anticipated as a result of the Proposed Offshore Development in-combination with other plans and projects therefore there is no risk of hindering the Conservation Objective, and no potential for AEoSI.	
	3. The condition of supporting habitats and processes, and the availability of prey is maintained	See **Section 3** for detail on impacts.	Impacts will not impede the achievement of the Conservation Objective 2c for harbour porpoise or

		It is assumed that harbour porpoise from the population which uses any of the non-UK SACs have the potential to interact with all of the plans and projects screened into the in-combination assessment (**Table 6-2**). There will be no impact on the habitats supporting harbour porpoise and the availability of prey in any of the non-UK SACs from: • Impact 1 - Increased underwater noise – Pile Driving; and • Impact 2 - Increased underwater noise – UXO Clearance Work. This is because, with the implementation of embedded mitigation for pile driving and UXO clearance work at the Proposed Offshore Development in-combination with other plans and projects (**Table 6-3**), it is concluded that the availability of harbour porpoise prey species (i.e., fish and cephalopods) will be maintained (see **Volume 2, Chapter 8: Fish and Shellfish Ecology** of the EIAR for assessment of impacts from the Proposed Offshore Development alone). There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI. No effects on the supporting habitats or processes relevant to harbour porpoise are anticipated as a result of increased underwater noise from pile driving or UXO clearance work at the Proposed Offshore Development in-combination with other plans and projects. There is therefore no risk of hindering the Conservation Objective, and no potential for AEoSI.	lead to adverse effects on site integrity for any of the non-UK SACs.

7 SUMMARY OF APPRAISAL OF ADVERSE EFFECTS ON INTEGRITY: ANNEX II MARINE MAMMALS

326. A summary of the assessments presented in this RIAA, considering the relevant SACs, is provided in **Table 7-1** below. This table presents the conclusions of Adverse Effects on Integrity in relation to the Proposed Offshore Development alone and in-combination with other plans and projects.

Table 7-1 Summary of Conclusions for Annex II Marine Mammals

Site Name	Site ID	Relevant Qualifying Features	Potential Impact	Conclusion for the Assessment of the Project Alone	Conclusion for the Assessment of the Project In-Combination with other Plans and Projects
Moray Firth SAC	UK0019808	Bottlenose dolphin	• Impact 1 - Increased underwater noise – pile driving • Impact 2 - Increased underwater noise – UXO clearance work • Impact 3 - Increases in underwater noise - survey	It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Moray Firth SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development alone for all impacts assessed.	It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Moray Firth SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development in-combination with other plans and projects for all impacts assessed.
Faray and Holm of Faray SAC	UK0017096	Grey seal	• Impact 1 - Increased underwater noise – pile driving • Impact 2 - Increased underwater noise – UXO clearance work • Impact 3 - Increases in underwater noise - survey • Impact 4 - Increased underwater noise – operation (WTGs and moorings) • Impact 5 - Entanglement risk – secondary • Impact 6 - Presence of EMF	It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Faray and Holm of Faray SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development alone for all impacts assessed.	It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Faray and Holm of Faray SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development in-combination with other plans and projects for all impacts assessed.
Isle of May SAC	UK0030172	Grey seal	• Impact 1 - Increased underwater noise – pile driving • Impact 2 - Increased underwater noise – UXO clearance work • Impact 3 - Increases in underwater noise - survey • Impact 4 - Increased underwater noise – operation (WTGs and moorings) • Impact 5 - Entanglement risk – secondary • Impact 6 - Presence of EMF	It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Isle of May SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development alone for all impacts assessed.	It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Isle of May SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development in-combination with other plans and projects for all impacts assessed.
Berwickshire and North Northumberland Coast SAC	UK0017072	Grey seal	• Impact 1 - Increased underwater noise – pile driving	It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Berwickshire and North Northumberland Coast SAC	It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Berwickshire and North Northumberland Coast SAC

Site Name	Site ID	Relevant Qualifying Features	Potential Impact	Conclusion for the Assessment of the Project Alone	Conclusion for the Assessment of the Project In-Combination with other Plans and Projects
			• Impact 2 - Increased underwater noise – UXO clearance work • Impact 3 - Increases in underwater noise - survey • Impact 4 - Increased underwater noise – operation (WTGs and moorings) • Impact 5 - Entanglement risk – secondary • Impact 6 - Presence of EMF	during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development alone for all impacts assessed.	during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development in-combination with other plans and projects for all impacts assessed.
North Rona SAC	UK0012696	Grey seal	• Impact 1 - Increased underwater noise – pile driving • Impact 2 - Increased underwater noise – UXO clearance work • Impact 3 - Increases in underwater noise - survey • Impact 4 - Increased underwater noise – operation (WTGs and moorings) • Impact 5 - Entanglement risk – secondary • Impact 6 - Presence of EMF	It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the North Rona SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development alone for all impacts assessed.	It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the North Rona SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development in-combination with other plans and projects for all impacts assessed.
Southern North Sea SAC	UK0030395	Harbour porpoise	• Impact 1 - Increased underwater noise – pile driving • Impact 2 - Increased underwater noise – UXO clearance work • Impact 3 - Increases in underwater noise - survey • Impact 4 - Increased underwater noise – operation (WTGs and moorings) • Impact 5 - Entanglement risk – secondary • Impact 6 - Presence of EMF	It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Southern North Sea SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development alone for all impacts assessed.	It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on the integrity of the Southern North Sea SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development in-combination with other plans and projects for all impacts assessed.
Non-UK SACs	Non-UK SACs	Harbour porpoise	• Impact 1 - Increased underwater noise – pile driving	It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on	It can be concluded, beyond reasonable scientific doubt, that there is no risk of adverse effects on

Site Name	Site ID	Relevant Qualifying Features	Potential Impact	Conclusion for the Assessment of the Project Alone	Conclusion for the Assessment of the Project In-Combination with other Plans and Projects
			• Impact 2 - Increased underwater noise – UXO clearance work • Impact 3 - Increases in underwater noise - survey • Impact 4 - Increased underwater noise – operation (WTGs and moorings) • Impact 5 - Entanglement risk – secondary • Impact 6 - Presence of EMF	the integrity of any non-UK SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development alone for all impacts assessed.	the integrity of any non-UK SAC during construction, operation and maintenance, and decommissioning of the Proposed Offshore Development in-combination with other plans and projects for all impacts assessed.

8 REFERENCES

6 Alpha Associates. (2023). Unexploded Ordnance Threat and Risk Assessment: Buchan OWF. Report by 6 Alpha Associates Ltd. for Atkins under Project No.: 50013. Report reference: 50013_UXOTARA_Buchan OWF_Atkins_V1.0, 20th March 2023.

Bailey, H. and Thompson, P. (2006). Quantitative analysis of bottlenose dolphin movement patterns and their relationship with foraging. Journal of Animal Ecology 75: 456-465.

BEIS (2020). Record of the Habitats Regulations Assessment undertaken under Regulation 65 of the Conservation of Habitats and Species 2017, and Regulation 33 of the Conservation of Offshore Marine Habitats and Species Regulations 2017. Review of Consented Offshore Wind Farms in the Southern North Sea Harbour Porpoise SAC. September 2020. Department for Business, Energy and Industrial Strategy.

Bejder, L., Samuels, A.M.Y., Whitehead, H., Finn, H. and Allen, S. (2009). Impact assessment research: use and misuse of habituation, sensitisation and tolerance in describing wildlife responses to anthropogenic stimuli. Marine Ecology Progress Series 395: 177-185.

Benhemma-Le Gall, A., Graham, I.M., Merchant, N.D. and Thompson, P.M. (2021). Broad-scale responses of harbour porpoises to pile-driving and vessel activities during offshore windfarm construction. Frontiers in Marine Science 8: 664724. doi: 10.3389/fmars.2021.664724.

Benhemma-Le Gall, A., Hastie, G.D., Brown, A.M., Booth, C.G., Graham, I.M., Fernandez-Betelu, O., Iorio-Merlo, V., Bashford, R., Swanson, H., Cheney, B.J., Abad Oliva, N. and Thompson, P.M. (2024). Harbour porpoise responses to the installation of XXL monopiles without noise abatement; implications for noise management in the Southern North Sea. PrePARED Report, No. 004. August 2024.

Benhemma-Le Gall, A., Thompson, P., Merchant, N., and Graham, I. (2023). Vessel noise prior to pile driving at offshore windfarm sites deters harbour porpoises from potential injury zones. Environmental Impact Assessment Review 103: 107271.

Benjamins, S., Harnois, V., Smith, H.C.M., Johanning, L., Greenhill, L., Carter, C. and Wilson, B. (2014). Understanding the potential for marine megafauna entanglement risk from renewable marine energy developments. Scottish Natural Heritage Commissioned Report No. 791.

Buchan Offshore Wind Ltd. (2025a). PMP 1 - Proposed Environmental Management Plan (pEMP). Available online at: https://buchanoffshorewind.com/document-library.

Buchan Offshore Wind Ltd. (2025b). PMP 9 - Proposed Marine Pollution Contingency Plan (pMPCP) Available online at: https://buchanoffshorewind.com/document-library

Buchan Offshore Wind Ltd. (2025c). PMP 6 - Proposed Invasive Non Native Species Management Plan (pINNSMP) Available online at: https://buchanoffshorewind.com/document-library.

Buchan Offshore Wind Ltd. (2025d). PMP 2 - Proposed Marine Mammal Mitigation Protocol (pMMMP). Available online at: https://buchanoffshorewind.com/document-library.

Buchan Offshore Wind Ltd. (2025e). PMP 3 - Proposed Navigational Safety and Vessel Management Plan (pNSVMP) Available online at: https://buchanoffshorewind.com/document-library.

Carter, M.I., Boehme, L., Cronin, M.A., Duck, C.D., Grecian, W.J., Hastie, G.D., Jessopp, M., Matthiopoulos, J., McConnell, B.J., Miller, D.L. and Morris, C.D. (2022). Sympatric seals, satellite tracking and protected areas: habitat-based distribution estimates for conservation and management. Frontiers in Marine Science 9: 875869.

Cheney, B., Thompson, P.M., Ingram, S.N., Hammond, P.S., Stevick, P.T., Durban, J.W., Culloch, R.M., Elwen, S.H., Mandleberg, L., Janik, V.M. and Quick, N.J. (2013). Integrating multiple data sources to assess the distribution and abundance of bottlenose dolphins *Tursiops truncatus* in Scottish waters. Mammal Review 43(1): 71-88.

Cheney, B.J., Arso Civil, M., Hammond, P.S. and Thompson, P.M. (2024). Site Condition Monitoring of bottlenose dolphins within the Moray Firth Special Area of Conservation 2017-2022. NatureScot Research Report 1360. Available from https://www.nature.scot/doc/naturescot-research-report-1360-site-condition-monitoring-bottlenose-dolphins-within-moray-firth

COME3T. (2023). Can floating offshore wind farms pose a risk of entanglement and injury to marine megafauna? Bulletin No. 9 – Risk of entanglement. Available from https://tethys.pnnl.gov/sites/default/files/publications/FEM-COME3T-Bulletin-9-Entanglement.pdf

Culloch, R.M. and Robinson, K.P. (2008). Bottlenose dolphins using coastal regions adjacent to a Special Area of Conservation in north-east Scotland. Journal of the Marine Biological Association of the UK 88(6): 1237-1243.

Czech-Damal, N.U., Liebschner, A., Miersch, L., Klauer, G., Hanke, F.D., Marshall, C., Dehnhardt, G. and Hanke, W. (2012). Electroreception in the Guiana dolphin (*Sotalia guianensis*). Proceedings of the Royal Society B 279: 663-668.

Darias-O'Hara, A.K. and Sinclair, R.R. (2020). Baseline marine mammal data at ScotWind DPO site NE8. Report number SMRUC-TCE-2020-019 provided to ITPEnergised and BayWa r.e. October 2020 (unpublished).

Department for Energy Security and Net Zero (Defra), Department for Energy Security and Net Zero (DESNZ), Marine Management Organisation (MMO), Scottish Government, Welsh Government, Natural Resources Wales, Department of Agriculture Environment and Rural Affairs (DAERA), JNCC, Natural England, NatureScot, Ministry of Defence (2025). Policy paper: Marine environment: unexploded ordnance clearance Joint Position Statement. Available from Marine environment: unexploded ordnance clearance Joint Position Statement - GOV.UK [Accessed 28/02/2025].

Donovan, C.R., Harris, C.M., Milazzo, L., Harwood, J., Marshall, L. and Williams, R. (2017). A simulation approach to assessing environmental risk of sound exposure to marine mammals. Ecology and Evolution 7(7): 2101-2111.

Ellis, G., Arso Civil, M., Cheney, B., Sinclair, R., Humphrey, O., Hammond, P.S. and Sparling, C.E. (2024). Towards improved conservation of the east coast of Scotland bottlenose dolphin population:

quantifying and understanding a major range expansion into northeast England. Poster session presented at The UK & Ireland Regional Student Chapter of The Society of Marine Mammalogy.

Fernandez-Betelu, O., Graham, I.M., Brookes, K.L., Cheney, B.J., Barton, T.R. and Thompson, P.M. (2021). Far-field effects of impulsive noise on coastal bottlenose dolphins. Front. Mar. Sci. 8: 664230. doi: 10.3389/fmars.2021.664230.

Fernandez-Betelu, O., Graham, I.M., Malcher, F., Webster, E., Cheong, S.H., Wang, L., Iorio-Merlo, V., Robinson, S. and Thompson, P.M. (2024). Characterising underwater noise and changes in harbour porpoise behaviour during the decommissioning of an oil and gas platform. Marine Pollution Bulletin, 200, p.116083.

Finneran, J.J. (2015). Noise-induced hearing loss in marine mammals: A review of temporary threshold shift studies from 1996 to 2015. Journal of the Acoustical Society of America 138(3): 1702-1726.

Finneran, J.J., Carder, D.A., Schlundt, C.E. and Dear, R.L. (2010). Temporary threshold shift in a bottlenose dolphin (Tursiops truncatus) exposed to intermittent tones. Journal of the Acoustical Society of America 127(5): 3267-3272.

Finneran, J.J., Carder, D.A., Schlundt, C.E. and Ridgway, S.H. (2005). Temporary threshold shift in bottlenose dolphins (Tursiops truncatus) exposed to mid-frequency tones. Journal of the Acoustical Society of America 118(4): 2696-2705.

Gill, A. B., I. Gloyne-Phillips, K. J. Neal, and J. A. Kimber. (2005). The potential effects of electromagnetic fields generated by sub-sea power cables associated with offshore wind farm developments on electrically and magnetically sensitive marine organisms - a review. Collaborative Offshore Wind Research into the Environment (COWRIE), Ltd, UK. 128 pp.

Gilles, A., Authier, M., Ramirez-Martinez, N.C., Araújo, H., Blanchard, A., Carlström, J., Eira, C., Dorémus, G., Fernández-Maldonado, C., Geelhoed, S.G.V., Kyhn, L., Laran, S., Nachtsheim, D., Panigada, S., Pigeault, R., Sequeira, M., Sveegaard, S., Taylor, N.L., Owen, K., Saavedra, C., Vázquez-Bonales, J.A., Unger, B. and Hammond, P.S. (2023). Estimates of cetacean abundance in European Atlantic waters in summer 2022 from the SCANS-IV aerial and shipboard surveys. Final report published 29 September 2023. 64 pp. Available from: https://tinyurl.com/3ynt6swa

Graham, I.M., Merchant, N.D., Farcas, A., Barton, T.R., Cheney, B., Bono, S. and Thompson, P.M. (2019). Harbour porpoise responses to pile-driving diminish over time. Royal Society Open Science 6(6): 190335.

Graham, I.M., Pirotta, E., Merchant, N.D., Farcas, A., Barton, T.R., Cheney, B., Hastie, G.D. and Thompson, P.M. (2017). Responses of bottlenose dolphins and harbour porpoises to impact and vibration piling noise during harbour construction. Ecosphere 8(5):e01793. 10.1002/ecs2.1793.

Harwood, J., King, S., Schick, R., Donovan, C. and Booth, C. (2014). A protocol for implementing the interim Population Consequences of Disturbance (PCoD) approach: Quantifying and assessing the effects of UK offshore renewable energy developments on marine mammal populations. Report number SMRUL-TCE-2013-014. Scottish Marine and Freshwater Science 5(2).

Hastie, G., Merchant, N.D., Götz, T., Russell, D.J., Thompson, P. and Janik, V.M. (2019). Effects of impulsive noise on marine mammals: investigating range-dependent risk. Ecological Applications 29(5): e01906.

Hüttner, T., von Fersen, L., Miersch, L., Czech Guido Dehnhardt, N.U. (2021). Behavioral and anatomical evidence for electroreception in the bottlenose dolphin (Tursiops truncatus). The Anatomical Record 305: 592-608.

IAMMWG. (2023). Review of Management Unit boundaries for cetaceans in UK waters (2023). JNCC Report 734, JNCC, Peterborough, ISSN 0963-8091.

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

JNCC and Natural England (2019). Harbour Porpoise (*Phocoena phocoena*) Special Area of Conservation: Southern North Sea Conservation Objectives and Advice on Operations. Available at: https://data.jncc.gov.uk/data/206f2222-5c2b-4312-99ba-d59dfd1dec1d/SouthernNorthSea-conservation-advice.pdf [Accessed on 24/04/2025].

JNCC. (2017). JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys. JNCC, Peterborough. https://hub.jncc.gov.uk/assets/e2a46de5-43d4-43f0-b296-c62134397ce4

JNCC. (2020). Guidance for assessing the significance of noise disturbance against Conservation Objectives of harbour porpoise SACs (England, Wales & Northern Ireland). JNCC Report No. 654, JNCC, Peterborough, ISSN 0963-8091.

JNCC. (2023a). UK Marine Noise Registry Disturbance Tool: Description and Output Generation. Annex 1 in Marine Noise Registry Help and Guidance, Version 1.1. Last updated: 23 November 2023.

JNCC. (2023b). JNCC guidance for the use of Passive Acoustic Monitoring in UK waters for minimising the risk of injury to marine mammals from offshore activities. JNCC, Peterborough. https://hub.jncc.gov.uk/assets/fb7d345b-ec24-4c60-aba2-894e50375e33

JNCC. (2025). JNCC guidelines for minimising the risk of injury to marine mammals from unexploded ordnance (UXO) clearance in the marine environment. JNCC, Aberdeen.

Kastelein, R.A., Hoek, L., Gransier, R., Rambags, M. and Claeys, N. (2014). Effect of level, duration, and inter-pulikely significant effects interval of 1–2 kHz sonar signal exposures on harbour porpoise hearing. Journal of the Acoustical Society of America 136(1): 412-422.

Kastelein, R.A., Gransier, R., Schop, J. and Hoek, L. (2015). Effects of exposure to intermittent and continuous 6–7 kHz sonar sweeps on harbour porpoise (Phocoena phocoena) hearing. Journal of the Acoustical Society of America 137(4): 1623-1633.

Kastelein, R.A., van de Voorde, S. and Jennings, N. (2018). Swimming speed of a harbour porpoise (Phocoena phocoena) during playbacks of offshore pile driving sounds. Aquatic Mammals 44(1): 92-99. DOI 10.1578/AM.44.1.2018.92.

Kuznetsov, V.B. (1999). Vegetative reactions of dolphins to a change in the permanent magnetic field. Biofizika 44(3): 496-502.

Leemans, J.J. and Fijn, R.C. (2023). Observations of harbour porpoises in offshore wind farms. Final report. Report 23-495. Waardenburg Ecology, Culemborg.

Martin, B., MacDonnell, J., Vallarta, J., Lumsden, E. and Burns, R. (2011). HYWIND acoustic measurement report: Ambient levels and HYWIND signature. Technical report for Statoil by Jasco Applied Sciences.

Matei, M., Chudzińska, M., Remmers, P., Bellman, M., Darias-O'Hara, A.K., Verfuss, U., Wood, J., Hardy, N., Wilder, F. and Booth, C. (2024). Range dependent nature of impulsive noise (RaDIN). Report for the Offshore Renewables Joint Industry Programme (ORJIP) Project, Phase 2. Prepared on behalf of the Carbon Trust.

McConnell, B., Fedak, M., Lovell, P. and Hammond, P. (1999). Movements and foraging areas of grey seals in the North Sea. Journal of Applied Ecology 36: 573-590.

McGarry, T., De Silva, R., Canning, S., Mendes, S., Prior, A., Stephenson, S. and Wilson, J. (2020). Evidence base for application of Acoustic Deterrent Devices (ADDs) as marine mammal mitigation (Version 3). JNCC Report No. 615, JNCC, Peterborough. ISSN 0963-8091.

Mooney, T.A., Nachtigall, P.E. and Vlachos, S. (2009). Sonar-induced temporary hearing loss in dolphins. Biology Letters 5(4): 565-567.

Morris, C.D., Duck, C., Riddoch, N.G. and Thompson, D. (2022a). The status of UK harbour seal populations in 2021 including summer counts of grey seals. SCOS-BP 22/04. Scientific Advice on Matters Related to the Management of Seal Populations: 2022. Natural Environment Research Council Special Committee on Seals.

Morris, C.D., Thompson, D. and Duck, C. (2022b). Provisional Regional PBR values for Scottish seals in 2023. SCOS-BP 22/07. Scientific Advice on Matters Related to the Management of Seal Populations: 2022. Natural Environment Research Council Special Committee on Seals.

Natural England. (2018) European Site Conservation Objectives for Berwickshire & Northumberland Coast SAC. Available at: https://publications.naturalengland.org.uk/publication/5920077534724096 [Accessed 25/04/2025].

Natural England. (2021). Offshore wind marine environment assessments: Best practice advice for evidence and data standards – Phase III: Expectations for data analysis and presentation at examination for offshore wind applications. Version 1. Department for Environment, Food & Rural Affairs.

NatureScot. (2024a). Conservation and Management Advice. Moray Firth SAC. August 2024. Available at:https://www.nature.scot/sites/default/files/special-area-conservation/8327/conservation-and-management-advice.pdf [Accessed 29/10/2025].

NatureScot. (2024b). Conservation and Management Advice. Faray And Holm Of Faray SAC. October 2024. Available at: https://www.nature.scot/sites/default/files/special-area-conservation/8254/conservation-and-management-advice.pdf [Accessed 23/04/2025].

NatureScot. (2024c). Conservation and Management Advice. Isle of May SAC. June 2024. Available at: https://www.nature.scot/sites/default/files/special-area-conservation/8278/conservation-and-management-advice.pdf [Accessed 29/10/2025].

NatureScot. (2024d). Conservation and Management Advice. North Rona SAC. February 2024. Available at: https://www.nature.scot/sites/default/files/special-area-conservation/8340/conservation-and-management-advice.pdf [Accessed 24/04/2025].

Quick, N., Arso, M., Cheney, B., Islas, V., Janik, V., Thompson, P.M. and Hammond, P.S. (2014). The east coast of Scotland bottlenose dolphin population: Improving understanding of ecology outside the Moray Firth SAC. Document 14D/086 which was produced as part of the UK Department of Energy and Climate Change's offshore energy Strategic Environmental Assessment programme.

Rayner, J., Embling, C.B., Ryan, C. and Hartny-Mills, L. (2024). Minke whale entanglement in static fishing gear: identifying consistent areas of high risk in Western Scotland. Journal of the Marine Biological Association of the United Kingdom 104, e15, 1–12. https://doi.org/10.1017/S0025315423000930.

Risch, D., Favill, G., Marmo, B., van Geel, N., Benjamins, S., Thompson, P., Wittich, A. and Wilson, B. (2023). Characterisation of underwater operational noise of two types of floating offshore wind turbines. 'Fortune' report by the Scottish Association for Marine Science (SAMS) for the Supergen Offshore Renewable Energy Hub.

Robinson, K.P., Baumgartner, N., Eisfeld, S.M., Clark, N.M., Culloch, R.M., Haskins, G.N., Zapponi, L., Whaley, A.R., Weare, J.S. and Tetley, M.J. (2007). The summer distribution and occurrence of cetaceans in the coastal waters of the outer southern Moray Firth in northeast Scotland (UK). Lutra 50(1): 19-30.

Robinson, R.A., Crick, H.Q., Learmonth, J.A., Maclean, I.M., Thomas, C.D., Bairlein, F., Forchhammer, M.C., Francis, C.M., Gill, J.A., Godley, B.J. and Harwood, J. (2009). Travelling through a warming world: climate change and migratory species. Endangered species research 7(2): 87-99.

Robinson, S.P., Lepper, P.A., Hazelwood, R.A. (2014). Good practice guide for underwater noise measurement. National Measurement Office, Marine Scotland, The Crown Estate. NPL Good Practice Guide No. 133, ISSNL 1368-6550.

Russell, D.J.F., McConnell, B.J., Thompson, D., Duck, C.D., Morris, C., Harwood, J. and Matthiopoulos, J. (2013). Uncovering the links between foraging and breeding regions in a highly mobile mammal. Journal of Applied Ecology DOI: 10.1111/1365-2664.12048

Russell, D.J.F., Brasseur, S.M.J.M., Thompson, D., Hastie, G.D., Janik, V.M., Aarts, G., McClintock, B.T., Matthiopoulos, J., Moss, S.E.W. and McConnell, B. (2014). Marine mammals trace anthropogenic structures at sea. Current Biology 24(14): 638-639. ISSN 0960-9822. https://doi.org/10.1016/j.cub.2014.06.033

Russell, D.J.F., Hastie, G.D., Thompson, D., Janik, V.M., Hammond, P.S., Scott-Hayward, L.A.S., Matthiopoulos, J., Jones, E.L. and McConnell, B.J. (2016). Avoidance of wind farms by harbour seals is limited to pile driving activities. Journal of Applied Ecology 53: 1642–1652.

Russell, D.J.F and Carter, M.I.D. (2021). Grey seal independent estimate scalar: converting counts to population estimates. SCOS-BP 21/02. Scientific Advice on Matters Related to the Management of Seal Populations: 2021. Natural Environment Research Council Special Committee on Seals.

SCOS. (2022). Scientific advice on matters related to the management of seal populations: 2022. Available at: http://www.smru.st-andrews.ac.uk/scos/scos-reports/ [Accessed on: 14/11/2023].

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

Sinclair, R.R. and Verfuss, U.K. (2021). Awel y Mor Marine Mammal Quantitative Noise Impact Assessment - Assumptions, Limitations and Uncertainties. SMRU Consulting Report No. SMRUC-GOB-2022-002.

Sinclair, R.R., Stevens, A. and Klementisova, K. (2023). West of Orkney Wind Farm: Pre-construction and Construction Marine Mammal Underwater Noise Impact Assessment. West of Orkney Offshore EIA Report. SMRU Consulting Report No. SMRUC-HID-2022-005.

SNH. (2017). The Scottish Marine Wildlife Watching Code. Scottish Natural Heritage, Inverness.

Southall, B.L. (2021). Evolutions in marine mammal noise exposure criteria. Acoustics Today 17(2): 52-60.

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

Southall, B.L., Finneran, J.J., Reichmuth, C., Nachtigall, P.E., Ketten, D.R., Bowles, A.E., Ellison, W.T., Nowacek, D.P. and Tyack, P.L. (2019). Marine mammal noise exposure criteria: Updated scientific recommendations for residual hearing effects. Aquatic Mammals 45(2): 125-232.

Southall, B.L., Nowacek, D.P., Bowles, A.E., Senigaglia, V., Bejder, L. and Tyack, P.L. (2021). Marine mammal noise exposure criteria: assessing the severity of marine mammal behavioural responses to human noise. Aquatic Mammals 47(5): 421-464.

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

Tyack, P.L. and Thomas, L. (2019). Using dose–response functions to improve calculations of the impact of anthropogenic noise. Aquatic Conservation: Marine and Freshwater Ecosystems 29: 242-253.

Vallejo, G.C., Grellier, K., Nelson, E.J., McGregor, R.M., Canning, S.J., Caryl, F.M. and McLean, N. (2017). Responses of two marine top predators to an offshore wind farm. Ecology and Evolution 7(21): 8698-8708.

van Beest, F.M., Teilmann, J., Hermannsen, L., Galatius, A., Mikkelikely significant effectsn, L., Sveegaard, S., Balle, J.D., Dietz, R. and Nabe-Nielikely significant effectsn, J. (2018). Fine-scale movement responses of free-ranging harbour porpoises to capture, tagging and short-term noise pulikely significant effectss from a single airgun. Royal Society Open Science 5:170110.

Verfuss, U.K., Sinclair, R.R. and Sparling, C.E. (2019). A review of noise abatement systems for offshore wind farm construction noise, and the potential for their application in Scottish waters. Scottish Natural Heritage Research Report No. 1070.

Verfuss, U.K., Remmers, P., Ryder, M., Palmer, K., Wood, J. and Bellmann, M. (2023). Reducing Uncertainty in Underwater Noise Assessments (ReCon). SMRUC-TCT-2022-014. The Offshore Renewables Joint Industry Programme (ORJIP).

von Benda-Beckmann, A.M., Aarts, G., Sertlek, H.Ö., Lucke, K., Verboom, W.C., Kastelein, R.A., Ketten, D.R., van Bemmelen, R., Lam, F.P.A., Kirkwood, R.J. and Ainslie, M.A. (2015). Assessing the impact of underwater clearance of unexploded ordnance on harbour porpoises (*Phocoena phocoena*) in the Southern North Sea. Aquatic Mammals 41(4): 503-523.

Whyte, K.F., Russell, D.J., Sparling, C.E., Binnerts, B. and Hastie, G.D. (2020). Estimating the effects of pile driving sounds on seals: Pitfalls and possibilities. Journal of the Acoustical Society of America 147(6): 3948-3958.

Xodus. (2015). Technical note on underwater noise. A-100142-S20-TECH-001.