DBS Offshore Wind

RWE Renewables UK Dogger Bank South (West) Limited

RWE Renewables UK Dogger Bank South (East) Limited

Dogger Bank South Offshore Wind Farms

Appendix C Marine Mammal Report to Inform Appropriate Assessment (RIAA) Habitats Regulations Assessment (HRA) Update

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Term	Definition
Array Areas	The DBS East and DBS West offshore Array Areas, where the wind turbines, offshore platforms and array cables would be located. The Array Areas do not include the Offshore Export Cable Corridor or the Inter-Platform Cable Corridor within which no wind turbines are proposed. Each area is referred to separately as an Array Area.
Concurrent	Installation of monopiles or pin piles happening at the same time at the DBS Projects.
Concurrent Scenario	A potential construction scenario for the Projects where DBS East and DBS West are both constructed at the same time.
Cumulative effects	The combined effect of the Projects in combination with the effects of a number of different (defined cumulative) schemes, on the same single receptor / resource.
Cumulative Effects Assessment (CEA)	The assessment of the combined effect of the Projects in combination with the effects of a number of different (defined cumulative) schemes, on the same single receptor/resource.
Development Scenario	Description of how the DBS East and / or DBS West Projects would be constructed either in isolation, sequentially or concurrently.
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for one or more Nationally Significant Infrastructure Project (NSIP).
Dogger Bank South (DBS) Offshore Wind Farms	The collective name for the two Projects, DBS East and DBS West.
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of the impact with the value, or sensitivity, of the receptor or resource in accordance with defined significance criteria.
Electrical Switching Platform (ESP)	The Electrical Switching Platform (ESP), if required would be located either within one of the Array Areas (alongside an Offshore Converter Platform (OCP)) or the Export Cable Platform Search Area.
Environmental Statement (ES)	A document reporting the findings of the EIA and produced in accordance with the EIA Directive as transposed into UK law by the EIA Regulations.

Term	Definition
Habitats Regulations Assessment (HRA)	The process that determines whether or not a plan or project may have an adverse effect on the integrity of a European Site or European Offshore Marine Site.
Impact	Used to describe a change resulting from an activity via the Projects, i.e. increased suspended sediments / increased noise.
In Isolation Scenario	A potential construction scenario for one Project which includes either the DBS East or DBS West array, associated offshore and onshore cabling and only the eastern Onshore Converter Station within the Onshore Substation Zone and only the northern route of the onward cable route to the proposed Birkhill Wood National Grid Substation.
Management Unit	Management units provide an indication of the spatial scales at which impacts of plans and projects alone, cumulatively and in-combination, need to be assessed for the key cetacean species in UK waters, with consistency across the UK.
Offshore Development Area	The Offshore Development Area for ES encompasses both the DBS East and West Array Areas, the Inter-Platform Cable Corridor, the Offshore Export Cable Corridor, plus the associated Construction Buffer Zones.
Offshore Export Cable Corridor	This is the area which will contain the offshore export cables (and potentially the ESP) between the Offshore Converter Platforms and Transition Joint Bays at the landfall.
Offshore platforms	Collective term which refers to all potential offshore platforms found within the Projects' Offshore Development Area (i.e. OCPs, CPs, ESP and Accommodation Platform).
Project Change Request 1	The proposed changes to the DCO application for the Projects set out in Project Change Request 1 - Offshore & Intertidal Works [document reference 10.49].
Projects Design (or Rochdale) Envelope	A concept that ensures the EIA is based on assessing the realistic worst case scenario where flexibility or a range of options is sought as part of the consent application.
Sequential Scenario	A potential construction scenario for the Projects where DBS East and DBS West are constructed with a lag between the commencement of construction activities. Either Project could be built first.
Special Area of Conservation (SAC)	Strictly protected sites designated pursuant to Article 3 of the Habitats Directive (via the Habitats Regulations) for habitats listed on Annex I and species listed on Annex II of the Directive.

Term	Definition
The Applicants	The Applicants for the Projects are RWE Renewables UK Dogger Bank South (East) Limited and RWE Renewables UK Dogger Bank South (West) Limited. The Applicants are themselves jointly owned by the RWE Group of companies (51% stake) and Masdar (49% stake).
The Projects	DBS East and DBS West (collectively referred to as the Dogger Bank South Offshore Wind Farms).

Acronyms

Acronym	Definition
BNNC	Berwickshire and North Northumberland Coast
CEA	Cumulative Effects Assessment
DBS	Dogger Bank South
DCO	Development Consent Order
EDR	Effective Deterrence Range
ES	Environmental Statement
ESP	Electrical Switching Platform
ExA	Examining Authority
GBS	Gravity Based Structure
HRA	Habitats Regulations Assessment
iPCoD	Interim Population of Consequences of Disturbance
JNCC	Joint Nature Conservation Committee
MMMP	Marine Mammal Mitigation Protocol
MU	Management Unit
NRW	Natural Resources Wales
NS	North Sea
OWF	Offshore Wind Farm
PTS	Permanent Threshold Shift
RIAA	Report to Inform Appropriate Assessment
RR	Relevant Representation
SAC	Special Area of Conservation
SCOS	Special Committee on Seals

Acronym	Definition
SEL_{cum}	Sound Exposure Level from cumulative exposure
SIP	Site Integrity Plan
SNS	Southern North Sea

1 Introduction

1. The Development Consent Order (DCO) application for the Dogger Bank South (DBS) East and DBS West Offshore Wind Farms (hereafter referred to as 'the Projects') was accepted by the Secretary of State for examination on 10th July 2024. RWE Renewables UK Dogger Bank South (East) Limited and RWE Renewables UK Dogger Bank South (West) Limited ('the Applicants') have been engaging with Interested Parties to seek to resolve concerns or comments ahead of the examination commencing. This engagement and further refinement of the Projects' Design Envelope has resulted in the Applicants deciding to seek a small number of changes to their application. The acceptability of any change is to be determined by the Examining Authority (ExA). The proposed changes taken alone or together would not materially change the nature of the Projects.

2. The proposed changes to the Projects' Design Envelope are as follows:

- Removal of Gravity Based Structure (GBS) foundations;
- Removal of the Electrical Switching Platform (ESP) within the Offshore Export Cable Corridor;
- Reduction in number of offshore platforms in the Projects' Design Envelope from eight to three within the Array Areas;
- Reduction of cabling within the Array Areas, plus associated seabed preparation and cable protection; and
- Removal of the short trenchless crossing option at landfall.

3. To aid the ExA in determining the acceptability of the proposed changes, a **Project Change Request 1 – Offshore and Intertidal Works** [document reference: 10.49] was submitted for consultation with key technical stakeholders to seek their views on the proposed changes. That report summarises all proposed changes to the assessments detailed in the Environmental Statement (ES) and Report to Inform Appropriate Assessment (RIAA).

4. The targeted non-statutory consultation period ran from the 15th November 2024 to the 16th December 2024, at which point all responses were reviewed by the Applicants with updates to the documents made as necessary (see section 5 of **Project Change Request 1 – Offshore and Intertidal Works** [document reference: 10.49], which details the stakeholder comments received and the Applicants' responses to each). No material changes to this appendix were required on receipt of stakeholder comments.

2 Purpose of this Document

5. This **Appendix C Marine Mammal Report to Inform Appropriate Assessment (RIAA) Habitats Regulations Assessment (HRA) Update** [document reference: 10.52] has been produced to provide additional detail regarding the proposed changes to the marine mammal assessment summarised in the **Project Change Request 1 – Offshore and Intertidal Works** [document reference: 10.49]. The methodology used within this appendix is detailed within the original RIAA (**RIAA HRA Part 3 of 4** [APP-047]), which should be read alongside this document to contextualise assessments made.

6. Any construction or operational effects assessed in the original assessment (**RIAA HRA Part 3 of 4** [APP-047]) which would not be affected by the proposed changes are not considered in this appendix, as conclusions reached for those effects would remain the same.

7. The assessment originally undertaken in the **RIAA HRA Part 3 of 4** [APP-047] for impact pile driving to marine mammals was carried out for DBS East Array Area, DBS West Array Area and for the Offshore Export Cable Corridor. However, following the proposed removal of the ESP in the Offshore Export Cable Corridor from the Projects' Design Envelope all impact piling would be removed from the Offshore Export Cable Corridor.

8. Due to the proposed reduction in number of offshore platforms and the removal of the ESP in the Offshore Export Cable Corridor, the underwater noise modelling for the Projects has been updated (**Appendix 11-3 Underwater Noise Modelling Report (Revision 2)** [document reference: 7.11.11.3]). Based on these proposed changes, there will no longer be three concurrent (12 sequential) jacket pin piles installed. Therefore, the updated underwater noise modelling presents impact ranges for two concurrent (four sequential) jacket pin piles in the Array Areas only. The effects of the updated underwater noise modelling on marine mammals are presented in this document.

9. In addition, the number of monopiles at the Projects in isolation would be reduced from 104 to 102 monopiles, and if the Projects were constructed together the number of monopiles would be reduced from 208 to 203 (**Table 2-1**). The total number of jacket pin piles would be reduced from 432 to 416 for the Projects in isolation and 864 to 824 for the Projects together. All piling would be removed from the Offshore Export Cable Corridor with the removal of the ESP (**Table 2-1**).

10. These alterations in the Projects' design would result in no change when assessing the impacts of piling (i.e. Permanent Threshold Shift (PTS) and disturbance). However, with the reduction of monopiles through the proposed reduction in number of offshore platforms and the removal of the ESP in the Offshore Export Cable Corridor, there is a reduction in disturbance days; therefore, updated population modelling has been undertaken based on the proposed changes to the Projects' Design Envelope.

Table 2-1 Changes to the number of monopile and jacket pin pile installations within the Projects' Design Envelope due to the proposed changes (*assessed in the RIAA in grey*).

Location	Number assessed in the RIAA	Number assessed in this Appendix
Monopiles		
DBS East	104	102
DBS West	104	102
DBS East and DBS West	208	203
Offshore Export Cable Corridor	1	0
Jacket pin-piles		
DBS East	432	416
DBS West	432	416
DBS East and DBS West	864	824
Offshore Export Cable Corridor	8	0

11. The updated assessments based on the proposed removal of the ESP in the Offshore Export Cable Corridor and the reduction in piling (disturbance) days due to the proposed reduction in number of offshore platforms for each Special Area of Conservation (SAC) can be found in the following sections:

- Southern North Sea (SNS) SAC (section 3);
- Humber Estuary SAC (section 4);
- The Wash and North Norfolk Coast SAC (section 5); and
- Berwickshire and North Northumberland Coast (BNNC) SAC (section 6).

12. In addition, updates to numbers for the in-combination assessment on grey seal in the Humber Estuary SAC are presented. The updates are due to an error presented in Table 8-89 in the **RIAA HRA Part 3 of 4** [APP-047] where the worst case numbers for grey seal of the Humber Estuary SAC were not used for DBS West. This has been corrected and presented in section 4.3.

3 Southern North Sea SAC

13. The assessment of construction activities for the SNS SAC is presented in section 8.3.5.2 in the **RIAA HRA Part 3 of 4** [APP-047].

14. This section provides an updated assessment based on the proposed removal of the ESP in the Offshore Export Cable Corridor and the reduction in piling days due to the proposed reduction in number of offshore platforms.

3.1 Removal of the ESP in the Offshore Export Cable Corridor

3.1.1 Permanent Threshold Shift

15. The only change to section 8.3.5.2 in the **RIAA HRA Part 3 of 4** [APP-047], based on the proposed removal of the ESP in the Offshore Export Cable Corridor, is a reduction to the concurrent piling of the jacket pin piles from three concurrent pin pile installations (four sequential at DBS East Array Area at the same time as four sequential at DBS West Array Area and four sequential at the Offshore Export Cable Corridor) to two concurrent pin pile installations (four sequential at DBS East Array Area at the same time as four sequential at DBS West Array Area) (**Table 3-1**) (see section 8.3.5.2.1.3 of the **RIAA HRA Part 3 of 4** [APP-047]).

16. Updated underwater noise modelling for the concurrent piling of the jacket pin piles (**Appendix 11-3 Underwater Noise Modelling Report (Revision 2)** [document reference: 7.11.11.3]) shows that there is a reduction in the potential impact range for harbour porpoise. In the **RIAA HRA Part 3 of 4** [APP-047] the impact range used for the assessment was 3,700km², with the proposed removal of the ESP in the Offshore Export Cable Corridor, the impact range would be reduced to 1,800km² (**Table 3-1**).

Table 3-1 Summary of the Impact Areas for the Concurrent Installation of Jacket Pin pile foundations at multiple locations across DBS Array Areas, for Harbour Porpoise using the Impulsive Southall *et al.* (2019) criteria assuming a fleeing animal, (*assessed in the RIAA in grey*) (Amendments to Table 8-13 of the RIAA HRA Part 3 of 4 [APP-047])]

Location	Potential effect areas for PTS (weighted cumulative sound exposure level (SEL_{cum})	
	Impact range assessed in the RIAA	Impact range assessed in this Appendix
	PTS from three concurrent pin pile installations (four sequential at DBS East Array Area at the same time as four sequential at DBS West Array Area & four sequential at the Offshore Export Cable Corridor)	PTS from two concurrent pin pile installations (four sequential at DBS East Array Area at the same time as four sequential at DBS West Array Area)
DBS East and DBS West	3,700km²	1,800km²

17. An assessment of the maximum number of harbour porpoise that could be at risk of instantaneous PTS, due to a sequential piling event for jacket pin piles, is presented in **Table 3-2**.

18. For jacket pin piles, the maximum number of harbour porpoise that could potentially be exposed to the risk of PTS would be reduced from 2,442 individuals (0.7% of the North Sea (NS) Management Unit (MU)) (as presented in Table 8-14 of the **RIAA HRA Part 3 of 4** [APP-047]) to 792 individuals (0.23% of the NS MU) (**Table 3-2**).

Table 3-2 Assessment of the Potential for PTS due to the Cumulative Exposure of Sequential Jacket Pin Piles in a 24 hour Period (Amendments to Table 8-14 of the RIAA HRA Part 3 of 4 [APP-047]) (*Grey assessed in the RIAA*).

Location	Maximum number of individuals (% of reference population)	Potential adverse effect on site integrity
Three concurrent installations at DBS East, DBS West Array Areas, and Offshore Export Cable Corridor, with four sequential jacket pin piles at each location (total of 12 jacket pin piles installed in one day)	2442.0 (0.704% of the NS MU)	**No** Less than 1% of the population will be affected. Marine Mammal Mitigation Protocol (MMMP) would reduce risk of PTS

Location	Maximum number of individuals (% of reference population)	Potential adverse effect on site integrity
Two concurrent jacket pin piles at DBS East and DBS West Array Areas with four sequential jacket pin piles at each location (total of 8 jacket pin piles installed in one day)	792.0 (0.23% of the NS MU)	**No** Less than 1% of the population will be affected. MMMP would reduce risk of PTS

19. The effective implementation of the MMMP and the In Principle Site Integrity Plan (SIP) for piling will reduce the risk of PTS to harbour porpoise during piling at the Projects. This mitigation alongside less than 1% of the population being affected, means there would be **no adverse effect on the integrity of the SNS SAC in relation to the conservation objectives for harbour porpoise due to auditory injury (PTS) from underwater noise during construction (piling) of the Projects together.**

20. There is no change to the conclusion of the assessment as presented in section 8.3.5.2.1.3 of the **RIAA HRA Part 3 of 4** [APP-047], although it should be noted that the proposed removal of the ESP in the Offshore Export Cable Corridor would substantially reduce the maximum number of individuals affected.

3.1.2 Disturbance or behavioural effects from underwater noise during piling

21. The range of possible behavioural reactions that may occur as a result of exposure to noise include orientation or attraction to a noise source, increased alertness, modification of characteristics of their own sounds, cessation of feeding or social interaction, alteration of movement / diving behaviour, temporary or permanent habitat abandonment and, in severe cases, panic, or stranding, sometimes resulting in injury or death (Southall *et al.* 2007).

22. The proposed removal of the ESP would make no difference to harbour porpoise in the SNS SAC assessed in section 8.3.5.2.2 of the **RIAA HRA Part 3 of 4** [APP-047] in relation to disturbance or behavioural effects, therefore only updated assessments for SACs where grey seal or harbour seal are a qualifying feature are included in this document.

23. The population effected by disturbance from underwater noise at the Projects remains less than 5%. Therefore, there would be **no adverse effect on the integrity of the SNS SAC in relation to the conservation objectives for harbour porpoise due to disturbance or behaviour effects from increased underwater noise during construction (piling) for the Projects alone or the Projects together.**

3.2 Reduction of Piling Days

24. In order to assess for potential disturbance, the population modelling was redone for the Projects alone and in-combination assessments based on the proposed removal of the ESP in the Offshore Export Cable Corridor and the slight reduction in the number of monopiles at the Projects due to the proposed reduction in number of offshore platforms in the Array Areas.

3.2.1 Projects Alone

25. Population modelling has been carried out for harbour porpoise using the interim Population Consequences of Disturbance (iPCoD) model using the numbers presented in Table 11-4-5 of **Appendix 11-4 iPCoD Modelling (Revision 2)** [document reference: 7.11.11.4]. The harbour porpoise NS MU was used to look at the worst case scenario of DBS East and DBS West constructed sequentially, based on there being more piling days, therefore more disturbance days.

26. The population modelling resulted in no significant impact to the harbour porpoise population, as by the end of 2032 (two years after piling ends, and six years after the onset of the disturbance) the median population size for the impacted population is predicted to be 99.77% of the unimpacted population. Beyond 2032, the impacted population is expected to maintain the same stable trajectory as the un-impacted population as far as 2052 which is the end point of the modelling, with less than 1% annual decline over the first six years (Natural Resources Wales (NRW) 2023). Therefore, piling has very little impact to the population of harbour porpoise in the North Sea (Table 3-1 and Plate 3-1 of **Appendix B Marine Mammal Environmental Statement Update** [document reference: 10.51].

27. The results from the population modelling show that there would be **no adverse effect on the integrity of the SNS SAC in relation to the conservation objectives for harbour porpoise due to disturbance or behaviour effects from increased underwater noise during construction (piling) for the Projects constructed alone**.

28. Therefore, there is no change to the conclusion of the assessment, as presented in section 8.3.5.2.2 of the **RIAA HRA** [APP-047].

3.2.2 In-Combination

29. For the in-combination scenario assessed (see Table 11-4-6 and Table 11-4-7 in **Appendix 11-4 iPCoD Modelling (Revision 2)** [document reference: 7.11.11.4] for details of the schemes considered, and their parameters) for the harbour porpoise NS MU population, the iPCoD model predicts no change in the harbour porpoise NS MU size over time, as the median population size was predicted to be 99.67% of the un-impacted population size at the end of 2028 (one year after the piling has commenced). By the end of 2032, the median ratio for the impacted population is predicted to be 98.72% of the un-impacted population size. Beyond 2032, the impacted population is expected to maintain the same stable trajectory as the un-impacted population (as far as 2052 which is the end point of the modelling, at which point the median impacted to un-impacted ratio remains 98.76%. Therefore, there is less than 1% annual decline over the first six years and over the 25 year period, which is not significant (NRW, 2023). See Table 3-9 and Plate 3-8 in **Appendix B Marine Mammal Environmental Statement Update** [document reference: 10.51].

30. The results from the population modelling show that there would be **no adverse effect on the integrity of the SNS SAC in relation to the conservation objectives for harbour porpoise due to disturbance or behaviour effects from increased underwater noise during construction (piling) for the Projects constructed in-combination with other offshore wind farms (OWF)s**.

31. Therefore, there is no change to the conclusion of the assessment, as presented in section 8.3.5.5.1.1 of the **RIAA HRA** [APP-047].

3.2.3 Potential In-combination Effects

32. The CEA screening (**Appendix 11-5 CEA Screening** [APP-101]) identified five UK OWFs with the potential for construction to take place at the same time as the construction of DBS East and / or DBS West within the SNS SAC summer area, taking into account the relevant spatial areas for each species.

33. With the reduction in piling days due to the proposed removal of the ESP in the Offshore Export Cable Corridor and reduction in number of monopiles due to the proposed reduction in number of offshore platforms, there would be a slight change to the seasonal effect on the SNS SAC. The seasonal averages have been calculated by multiplying the average effect on any given day in each season by the proportion of days within the season on which piling could occur (i.e. taking into account the average of effect / area of overlap with the SNS SAC and number of days piling per season). Therefore, calculations for estimates of seasonal average of effect is presented in **Table 3-4**.

34. This has been put into the context of the maximum number of piling days for DBS East and / or DBS West per season:

- Up to 51 days for the monopile scenario at DBS East or DBS West in isolation; or
- Up to 102 days for the monopile scenario at DBS East and DBS West together.

35. As a worst-case, no allowance has been made for downtime as a result of technical issues and no assumptions have been made for reloading of piling vessels with foundations. The assessment assumes that all piling will be undertaken on the same days as piling at DBS East and / or DBS West, therefore this is the maximum number of days on which it is possible for in-combination piling to include DBS East and / or DBS West with the maximum spatial overlap of all schemes.

36. The tables in this section are colour coded for each project scenario to make the results easier to understand (**Table 3-3**).

Table 3-3 Project scenario colour code

With DBS East	**Green**
With DBS West	**Blue**
Projects (DBS East and DBS West) together	**Dark blue**
Without the Projects	**Orange**

Table 3-4 Estimated seasonal averages for the SNS SAC Summer Area from single piling at other OWF schemes which could be piling on the same date as DBS East and / or DBS West (*assessed in the RIAA in grey*) (Amendments to Table 8-44 of the RIAA HRA Part 3 of 4 [APP-047])

In-combination assessment scenario	Maximum Number of Days assessed in the RIAA	Maximum Number of Days based on Proposed Changes to Projects' Design	Average overlap with the season (%)
DBS East	52	51	2.11
DBS West	52	51	2.11
Dudgeon Extension Project	34	34	0.12
East Anglian One North	160	160	2.38
Hornsea Project Three	58	58	1.06
Hornsea Project Four	92	92	3.42

In-combination assessment scenario	Maximum Number of Days assessed in the RIAA	Maximum Number of Days based on Proposed Changes to Projects' Design	Average overlap with the season (%)
Outer Dowsing	47	47	0.89
Total number of days with DBS East	**443**	**442**	**9.98**
Total number of days with DBS West	**443**	**442**	**9.98**
Total number of days with the Projects together	**495**	**493**	**12.09**
Total for summer area without the Projects	**391**	**391**	**7.87**

37. The assessment indicates that based on the worst case scenarios, the 10% seasonal average threshold would not be exceeded for the summer area for the construction of DBS East or DBS West in isolation in-combination with other schemes. The assessment also indicates based on the worst case scenarios, the 10% seasonal average threshold could likely be exceeded for the summer area for DBS East and DBS West together in combination with other schemes. Based on this, there is no change to the conclusion of the assessment as presented in section 8.3.5.5.1.1 of the **RIAA HRA Part 3 of 4** [APP-047].

38. Mitigation measures for DBS East and / or DBS West are presented in the **In Principle SIP for the SNS SAC (Revision 2)** [AS-102 and AS-103] and the **Outline MMMP (Revision 2)** [AS-100 and AS-101] submitted with the DCO application. These will be reviewed and updated based on the final design of the Projects prior to construction commencing.

39. With the implementation of the final SIP there would be **no adverse effect on the integrity of the SNS SAC in relation to the conservation objectives for harbour porpoise as a result of DBS East and / or DBS West in-combination with other schemes**.

4 Humber Estuary SAC

40. The assessment of construction activities for the Humber Estuary SAC is presented in section 8.3.6.3 of the **RIAA HRA Part 3 of 4** [APP-047].

41. This section provides an update to that assessment based on the proposed removal of the ESP in the Offshore Export Cable Corridor and the reduction in piling days due to the proposed reduction in number of offshore platforms.

42. In addition, updates to numbers for the in-combination assessment on grey seal in the Humber Estuary SAC are provided due to an error presented in Table 8-89 in the **RIAA HRA Part 3 of 4** [APP-047] where the worst case numbers for grey seal were not used for DBS West. These have been corrected and presented in section 4.3.

4.1 Removal of the ESP in the Offshore Export Cable Corridor

4.1.1 Permanent Threshold Shift

43. The only change to section 8.3.6.3 of the **RIAA HRA Part 3 of 4** [APP-047] based on the proposed removal of the ESP in the Offshore Export Cable Corridor, is a reduction to the concurrent piling of the jacket pin piles from three concurrent pin pile installations (four sequential at DBS East Array Area at the same time as four sequential at DBS West Array Area and four sequential at the Offshore Export Cable Corridor) to two concurrent pin pile installations (four sequential at DBS East Array Area at the same time as four sequential at DBS West Array Area) (see section 8.3.6.3.1.2 of the **RIAA HRA Part 3 of 4** [APP-047]).

44. Updated underwater noise modelling for the concurrent piling of the jacket pin piles (**Appendix 11-3 Underwater Noise Modelling Report (Revision 2)** [document reference: 7.11.11.3]) shows that there is a reduction in the potential impact range for grey seal. In the RIAA the impact range used for the assessment was 240km², with the proposed removal of the ESP in the Offshore Export Cable Corridor, the impact range would be reduced to 230km² (see **Table 4-1**).

Table 4-1 Summary of the Impact Areas for the Concurrent Installation of Jacket Pin pile foundations at multiple locations across DBS Array Areas, for seals using the Impulsive Southall *et al.* (2019) criteria assuming a fleeing animal, (*assessed in the RIAA in grey*) (Amendments to Table 8-63 of the RIAA HRA Part 3 of 4 [APP-047])]

Location	Potential effect areas for PTS (weighted cumulative sound exposure level (SEL_{cum}))	
	Impact range assessed in the RIAA	Impact range assessed in this Appendix
	PTS from three concurrent pin pile installations (four sequential at DBS East Array Area at the same time as four sequential at DBS West Array Area & four sequential at the Offshore Export Cable Corridor)	PTS from two concurrent pin pile installations (four sequential at DBS East Array Area at the same time as four sequential at DBS West Array Area)
DBS East and DBS West	240km²	230km²

45. With the slight reduction of the impact area and using the highest density from the Array Areas (0.089 per km²) rather than the density estimate for the Offshore Export Cable Corridor (0.728 per km²) (Carter *et al.* 2022), (as described in paragraph 449 in the **RIAA HRA Part 3 of 4** [APP-047], the maximum number of individuals at risk of PTS would be reduced from 42.3 individuals to 20.5 individuals (**Table 4-2**).

Table 4-2 Assessment of the Potential for PTS due to the Cumulative Exposure of Sequential Jacket Pin Piles in a 24 hour Period (Amendments to Table 8-64 of the RIAA HRA Part 3 of 4 [APP-047]) (*Grey assessed in the RIAA*)

Location	Maximum number of individuals (% of reference population)	Potential adverse effect on site integrity
Three concurrent installations at DBS East, DBS West Array Area, and Offshore Export Cable Corridor, with four sequential jacket pin piles at each location (total of 12 jacket pin piles installed in one day)	42.3 (0.27% of Humber Estuary SAC)	**No** Less than 1% of the population at risk. MMMP would reduce risk of PTS
Two concurrent installations at DBS East Array Area and DBS West Array Area with four	20.5 (0.132% of Humber Estuary SAC)	**No** Less than 1% of the population at risk.

Location	Maximum number of individuals (% of reference population)	Potential adverse effect on site integrity
sequential jacket pin piles at each location (total of 8 jacket pin piles installed in one day)		MMMP would reduce risk of PTS

46. The effective implementation of the MMMP for piling will reduce the risk of PTS to grey seal during piling as a result of construction of the Projects. This mitigation alongside less than 1% of the population being affected, means there would be **no adverse effect on the integrity of the Humber Estuary SAC in relation to the conservation objectives for grey seal due to auditory injury (PTS) from underwater noise during construction (piling) for the Projects together**.

47. There is no change to the conclusion of the **RIAA HRA Part 3 of 4** [APP-047] presented in section 8.3.6.3.1.2, although it should be noted that proposed removal of the ESP in the Offshore Export Cable Corridor would substantially reduce the maximum number of individuals affected.

4.1.2 Disturbance or behavioural effects from underwater noise during piling

48. In section 8.3.6.3.2 of the **RIAA HRA Part 3 of 4** [APP-047], piling in the Offshore Export Cable Corridor resulted in high numbers of seal being potentially disturbed. With the proposed removal of the ESP in the Offshore Export Cable Corridor, this would result in a significant reduction in number of seals to be potentially disturbed, in particular grey seal.

4.1.2.1 Projects Alone

49. For the Projects in isolation, using the 25km disturbance range for grey seal, up to 1,430 individuals (9.23% of the Humber Estuary SAC) could be potentially disturbed from piling in the Offshore Export Cable Corridor (Table 8-65 of the **RIAA HRA Part 3 of 4** [APP-047]). However, with the proposed removal of the ESP in the Offshore Export Cable Corridor there is only the potential that the following animals would be disturbed:

- DBS East; up to 106.0 individuals to be disturbed (0.68% of the Humber Estuary SAC); and
- DBS West; up to 174.7 individuals to be disturbed (1.67% of the Humber Estuary SAC).

50. The numbers of grey seal of the Humber Estuary SAC to be potentially disturbed from piling in the Array Areas compared to piling in the Offshore Export Cable Corridor is significantly less. However, the worst case has been carried forward to the population modelling and the updates with the proposed removal of the ESP in the Offshore Export Cable Corridor are presented in section 4.2.

51. For the Projects in isolation using the dose response curve assessment for grey seal in the Humber Estuary SAC, up 648 individuals (4.1% of the Humber Estuary SAC) have the potential to be disturbed (Table 8-66 of the **RIAA HRA Part 3 of 4** [APP-047]). However, with the proposed removal of the ESP in the Offshore Export Cable Corridor there is the potential that the following animals would be disturbed:

- DBS East; up to 48.6 individuals to be disturbed (0.31% of the Humber Estuary SAC); and
- DBS West; up 279.0 individuals to be disturbed (1.8% of the Humber Estuary SAC).

52. With the proposed removal of the ESP in the Offshore Export Cable Corridor, the potential number of grey seal that could be disturbed is greatly reduced.

4.1.2.2 Projects Together

53. For the Projects together, with the proposed removal of the ESP in the Offshore Export Cable Corridor, for piling of jacket pin piles; disturbance was assessed with piling occurring concurrently in both Array Areas as the worst case using a 15km Effective Deterrent Range (EDR), (recommended for harbour porpoise (JNCC *et al.* 2020)).

54. In Table 8-69 of the **RIAA HRA Part 3 of 4** [APP-047] an assessment was carried out using a 15km disturbance range for the installation of three concurrent jacket pin piles. With the proposed removal of the ESP in the Offshore Export Cable Corridor, the maximum number of jacket pin piles to be installed at the same time would be two (concurrent installation of one jacket pin pile in DBS East Array Area and one in DBS West Array Area). **Table 4-3** presents the updated assessment and shows that there would be a significant decrease in the potential numbers of grey seal to be disturbed.

Table 4-3 Assessment of the Potential for Disturbance to Grey Seal in the Humber Estuary SAC Based on a Disturbance Range of 15km for the installation of concurrent Jacket Pin Piles at the Projects (Updates to Table 8-69 in RIAA HRA Part 3 of 4 [APP-047]) (*Grey was assessed in the RIAA*)

Maximum number of individuals (% of reference population) Jacket pin piles at three concurrent locations (EDR – 15km, with a disturbance area of 2,120.8km²)	Potential adverse effect on site integrity	Maximum number of individuals (% of reference population) Jacket pin piles at two concurrent locations (EDR – 15km, with a disturbance area of 1,413.72km²)	Potential adverse effect on site integrity
615.7 (3.98% of the Humber Estuary SAC)	No Less than 5% of the population affected	125.8 (0.8% of the Humber Estuary SAC)	No Less than 5% of the population affected

4.2 Reduction of Piling Days

55. In order to assess for potential disturbance, the population modelling was redone to include the proposed removal of the ESP in the Offshore Export Cable Corridor and the reduction of monopiles due to the proposed reduction in number of offshore platforms for both the Projects alone and in-combination assessments.

4.2.1 Projects Alone

56. The updated population modelling for grey seal is based on:

- A worst case of up to 385 grey seal disturbed; reduced from 1,814.4 in the RIAA:
  - Based on the EDR assessment of 106 at DBS East (Table 8-65 of the **RIAA HRA Part 3 of 4** [APP-047]).
  - Based on the dose response curve for 279.0 individuals at DBS West (Table 8-66 of the **RIAA HRA Part 3 of 4** [APP-047]).
- A worst case of one individual at risk of PTS at DBS East and DBS West (combined total from both locations, Table 8-62 in the **RIAA HRA Part 3 of 4** [APP-047]):

- DBS East - 0.3; and
- DBS West - 0.4.

57. For the Humber Estuary SAC population, the results of the population modelling predict that by the end of 2032 (two years after piling ends and six years after the onset of the disturbance), the median ratio for the unimpacted: impacted population is predicted to be 100% of the unimpacted population. Beyond 2032, the impacted population remains stable as far as 2052 which is the end point of the modelling (**Table 4-4**). Therefore, there is less than 1% annual decline over the first six years and over the 25 year period, which is not significant (NRW 2023).

Table 4-4 Results of the iPCoD modelling for DBS East and DBS West sequentially scenario, giving the mean population size of grey seal population (Humber SAC population) for years up to 2052 for both impacted and un-impacted population (Amendments to Table 8-67 of the RIAA HRA Part 3 of 4 [APP-047])

Time period	Un-impacted population mean	Impacted population mean	Median impacted as % of unimpacted
Start	15,495	15,495	100.00%
End 2028	15,574	15,574	100.00%
End 2029	15,708	15,707	99.99%
End 2032	15,992	15,994	100.02%
End 2037	16,555	16,557	100.05%
End 2047	17,615	17,617	100.02%
End 2052	18,164	18,167	100.01%

58. **Plate 4-1** shows the mean unimpacted and the mean impacted population of grey seal within the Humber Estuary SAC population. The graph shows that with piling at DBS East and DBS West, there is no significant impact on the population of grey seal.

59. Therefore, the results from the population modelling show that there would be **no adverse effect on the integrity of the Humber Estuary SAC in relation to the conservation objectives for grey seal due to disturbance or behaviour effects from increased underwater noise during construction (piling) for the Projects alone.**

60. There is no change to the conclusion of the assessment, as presented in section 8.3.6.3.2.1.1 of the **RIAA HRA** [APP-047].

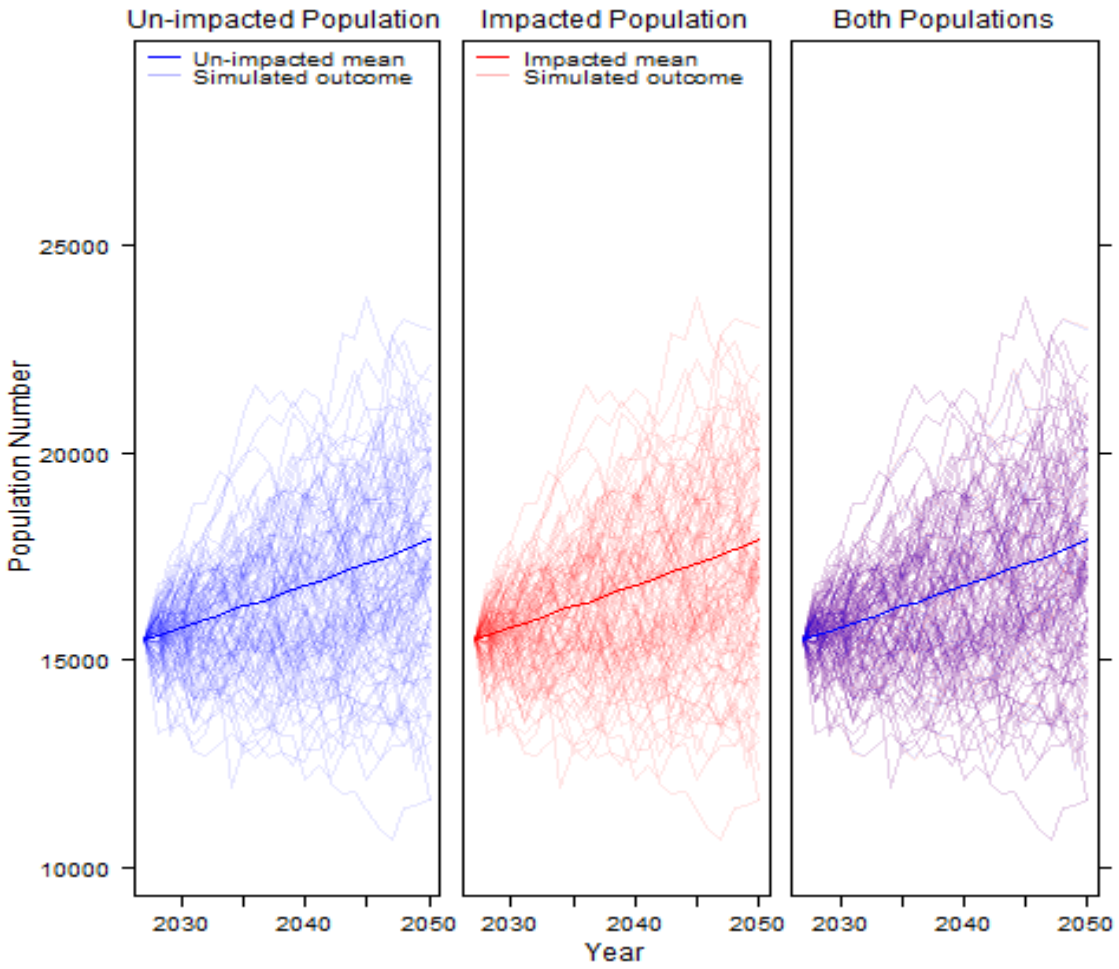

Plate 4-1 Simulated worst case grey seal population sizes (Humber SAC population) for both the unimpacted and the impacted populations for the Projects Alone (Amendments to Plate 8-5 of the RIAA HRA Part 3 of 4 [APP-047])

4.2.2 In-Combination

61. For the in-combination scenario assessed (see Table 11-4-8 in **Appendix 11-4 iPCoD Modelling (Revision 2)** [document reference: 7.11.11.4] for details of the schemes considered, and their parameters) within the Humber Estuary SAC population, the iPCoD model predicts no change in the grey seal population size over time (**Table 4-5**; **Plate 4-2**).

62. The median population size was predicted to be 100% of the ratio of the un-impacted: impacted population size at the end of 2028 (one year after the piling has commenced). By the end of 2052, which is the end point of the modelling, the median impacted to un-impacted ratio remains 100%. Therefore, there is less than 1% annual decline over the first six years and over the 25 year period, which is not significant (NRW 2023); (**Table 4-5**; **Plate 4-2**).

Table 4-5 Results of the iPCoD modelling for the in-combination assessment, giving the mean population size of the Humber Estuary SAC grey seal population (for years up to 2052 for both impacted and un-impacted populations in addition to the median ratio between their population sizes) (Amendments to Table 8-90 in the RIAA HRA Part 3 of 4 [APP-047])

Time period	Un-impacted population mean	Impacted population mean	Median impacted
Start	15,494	15,494	100.00%
End 2028	15,596	15,596	100.00%
End 2029	15,693	15,691	99.98%
End 2032	16,001	15,999	99.98%
End 2037	16,466	16,466	100.00%
End 2047	17,467	17,466	99.99%
End 2052	17,947	17,947	100.00%

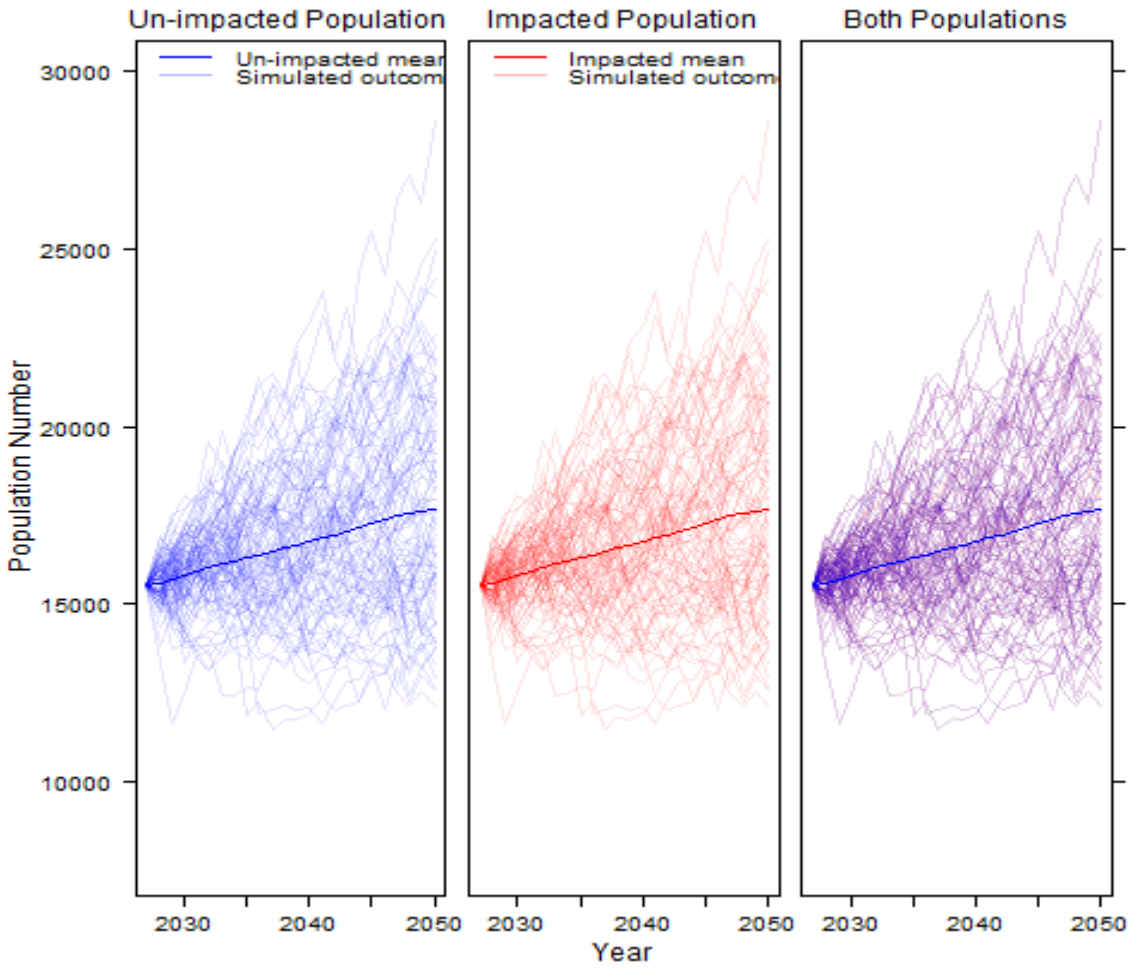

Plate 4-2 Simulated worst case Humber Estuary SAC grey seal population sizes for both the un-impacted and the impacted populations for the Projects in-combination with other OWF projects. (Amendments to Plate 8-6 of the RIAA HRA Part 3 of 4 [APP-047])

63. The results from the population modelling are the same as those presented in section 8.3.6.6.1.1 of the **RIAA HRA Part 3 of 4** [APP-047] and therefore the proposed changes to the Projects' Design Envelope would not change the conclusion of the assessment.

64. Therefore, the results from the population modelling show that there would be **no adverse effect on the integrity of the Humber Estuary SAC in relation to the conservation objectives for grey seal due to disturbance or behaviour effects from increased underwater noise during construction (piling) for the Projects in-combination.**

4.3 Correction to Section 8.3.6.6.1.1 In-combination Impact 1a: Assessment of Underwater Noise from Piling at Other OWFs

65. Updates to numbers for the in-combination assessment on grey seal in the Humber Estuary SAC are provided due to an error presented in Table 8-89 in the **RIAA HRA Part 3 of 4** [APP-047] where the worst case numbers for grey seal were not used for DBS West. These have been corrected and presented in **Table 4-6**.

66. The list of UK and European OWF schemes that have the potential for overlapping piling with the Projects is provided in **Appendix 11-5 CEA Screening** [APP-101] and has been used to inform the assessment for in-combination effects due to piling at other OWF schemes presented in **Table 4-6**, which is the same as that presented in section 8.3.6.6.1.1 of the **RIAA HRA Part 3 of 4** [APP-047]. Of these, all are shown to have grey seal associated with the Humber Estuary SAC present within the OWF areas (**Table 4-6**).

67. The only differences in **Table 4-6** in comparison to the RIAA are the proposed removal of the ESP in the Offshore Export Cable Corridor and the maximum number of grey seal potentially disturbed at DBS West only. In the RIAA, the EDR assessments were used, where there was an estimated of 178.4 individuals that could potentially be disturbed. This was used in error as the dose response assessment was the actual worst case with 279 individuals. Therefore, updates to Table 8-89 of the **RIAA HRA Part 3 of 4** [APP-047] have been presented in **Table 4-6**.

68. As presented in **Table 4-6** below, the Projects if constructed in isolation or together represents only a small proportion of grey seal that may be disturbed due to piling. For piling at the Projects and other OWFs, up to 14.4% of the Humber Estuary SAC population could be disturbed and up to 12% of the Humber Estuary SAC population without the Projects.

69. The correction of the maximum numbers of grey seal potentially disturbed at DBS West has caused no significant change to the numbers that were presented in Table 8-89 of the **RIAA HRA Part 3 of 4** [APP-047].

Table 4-6 Quantitative assessment for in-combination disturbance for grey seal from piling at other OWFs (Amendments to Table 8-89 in the RIAA HRA Part 3 of 4 [APP-047])

Project	Grey seal density (/km²)	Impact area (25km EDR)	Maximum number of individuals potentially disturbed during single piling
DBS East	0.054	1,963.5	106.0
DBS West	0.089	Dose response assessment	279.0

Project	Grey seal density (/km²)	Impact area (25km EDR)	Maximum number of individuals potentially disturbed during single piling
Dudgeon Extension	Dose response assessment (Equinor New Energy Limited, 2022)		166
East Anglia Hub	0.02	2,124	42.5
	(East Anglia TWO Limited, 2019)		
Five Estuaries	Dose response assessment (Five Estuaries Offshore Wind Farm Ltd, 2023)		168
Hornsea Project Three	Dose response assessment (Orsted Power (UK) Ltd, 2018)		53
Hornsea Project Four	Dose response curve assessment, with 39% apportioned to the Humber SAC (Orsted Hornsea Project Four Ltd, 2022)		580.7
North Falls	0.018	3,927	70.7
	(North Falls Offshore Wind Farm Ltd, 2023)		
Outer Dowsing	0.29	2,124	615.0
	(Outer Dowsing Offshore Wind, 2023)		
Sheringham Shoal Extension	Dose response assessment (Equinor New Energy Limited, 2022)		157
Total number of grey seal with DBS East			**1,958.9 (12.6% of the Humber SAC)**
Total number of grey seal with DBS West			**2,131.9 (13.7% of the Humber SAC)**
Total number of grey seal with the Projects together			**2,237.9 (14.4% of the Humber SAC)**
Total number of grey seal without the Projects			**1,852.9 (12.0% of the Humber SAC)**

70. **Table 4-6** and Table 8-89 of the **RIAA HRA Part 3 of 4** [APP-047] show a proportion of the Humber Estuary SAC grey seal population are at risk of disturbance therefore, population modelling was carried out using the iPCoD model (section 4.2.2), using the worst case numbers presented in **Table 4-6**. The methodology is described in **Appendix 11-4 iPCoD Modelling (Revision 2)** [application ref: 7.11.11.4].

71. Based on both the EDRs and dose response curve assessment, up to 13.7% of the Humber Estuary SAC population are at risk of disturbance from an in-combination perspective at DBS West, 12.6% at DBS East and 14.4% if the Projects were constructed together. Without the Projects, up to 12% of the Humber Estuary SAC population are at risk of disturbance from in-combination effects from underwater noise due to piling (**Table 4-6**). This shows that the Projects only account for a small percentage.

72. However, this is very precautionary as not all OWF schemes would be piling at the same time. Another factor is that the 25km disturbance range for grey seal could be considered over precautionary because it stems from a single study on harbour seal response to OWFs and considers that all seals will be disturbed within 25km from piling, which is unlikely. This study did not account for variations in piling characteristics or the effects of bathymetry on sound propagation. Consequently, the displacement distance of grey seal could vary significantly across sites (Madsen *et al.* 2006, Russel *et al.* 2016).

73. Results from the population modelling (section 4.2.2) show that there is no population consequence, with no change in the Humber Estuary SAC grey seal population. The Applicants still consider the iPCoD to be the best approach for determining the impact. The model requires detailed demographic information and an understanding of the relationship between days of disturbance and individual survival and reproduction rates (Sinclair *et al.* 2020) by taking the worst case numbers of disturbance, models a thousand scenarios, and looks at population effects on an annual and longer term basis. Therefore, it is considered to be the most appropriate tool to assess cumulative disturbance.

74. Therefore, based on the population modelling there is **no potential for adverse effect on integrity of the Humber Estuary SAC in relation to the conservation objectives for grey seal in-combination with piling at the Projects and other OWF schemes**. This results in no change to the conclusions presented in section 8.3.6.6.1 of the **RIAA HRA Part 3 of 4** [APP-047].

5 The Wash and North Norfolk Coast SAC

75. The assessment of construction activities for the Wash and North Norfolk SAC is presented in section 8.3.7.3 of the **RIAA HRA Part 3 of 4** [APP-047].

76. This section updates the assessment to take into account the proposed removal of the ESP in the Offshore Export Cable Corridor and the reduction of piling days due to the proposed reduction in number of offshore platforms.

5.1 Removal of the ESP in the Offshore Export Cable Corridor

5.1.1 Permanent Threshold Shift

77. The only change to section 8.3.7.3 in the **RIAA HRA Part 3 of 4** [APP-047], based on the proposed removal of the ESP in the Offshore Export Cable Corridor, is a reduction to the concurrent piling of the jacket pin piles from three concurrent pin pile installations (four sequential at DBS East Array Area at the same time as four sequential at DBS West Array Area and four sequential at the Offshore Export Cable Corridor) to two concurrent pin pile installations (four sequential at DBS East Array Area at the same time as four sequential at DBS West Array Area) (see section 8.3.7.3.1.2 of the **RIAA HRA Part 3 of 4** [APP-047]).

78. Updated underwater noise modelling for the concurrent piling of the jacket pin piles (**Appendix 11-3 Underwater Noise Modelling Report (Revision 2)** [document reference: 7.11.11.3]) shows that there is a reduction in the potential impact range for harbour seal. In the RIAA the impact range used for the assessment was 240km², with the proposed removal of the ESP in the Offshore Export Cable Corridor, the impact range would be reduced to 230km² (**Table 4-1**).

79. With the slight reduction of the impact area and using the highest density from the Array Areas (0.0015 per km²) (Carter *et al.* 2022),(as described in paragraph 718 in the **RIAA HRA Part 3 of 4** [APP-047]), the maximum number would be reduced from 0.01% of the harbour seal population at the Wash and North Norfolk Coast SAC to 0.008% of the Wash and North Norfolk Coast SAC population (**Table 5-1**).

Table 5-1 Assessment of the potential for instantaneous PTS due to a single strike of the maximum hammer energy for Jacket Pin Pile, and Cumulative Exposure of Sequential Jacket Pin Piles in a 24 hour Period for the Projects together (Amendment to Table 8-101 in the RIAA HRA Part 3 of 4 [APP-047])

Location	Maximum number (% of reference population)	Potential adverse effect on site integrity
Three concurrent installations at DBS East, DBS West Array Area, and Offshore Export Cable Corridor, with four sequential jacket pin piles at each location (total of 12 jacket pin piles installed in one day)	0.43 (0.01% of Wash and North Norfolk Coast SAC)	**No** Less than 1% of the population would be at risk from PTS MMMP would reduce risk of PTS
Two concurrent jacket pin piles at DBS East Array Area and DBS West Array Area, with four sequential jacket pin piles at each location (total of 8 jacket pin piles installed in one day)	0.35 (0.008% of Wash and North Norfolk Coast SAC)	**No** Less than 1% of the population would be at risk from PTS MMMP would reduce risk of PTS

80. The effective implementation of the MMMP for piling will reduce the risk of permanent auditory injury (PTS) to harbour seal during piling at the Projects. This mitigation alongside less than 1% of the population being affected, means there would be **no adverse effect on the integrity of the Wash and North Norfolk Coast SAC in relation to the conservation objectives for harbour seal due to auditory injury (PTS) from underwater noise during construction (piling) for the Projects together**.

81. Therefore, the proposed removal of the ESP in the Offshore Export Cable Corridor results in no change to the conclusion of the **RIAA HRA Part 3 of 4** [APP-047] presented in section 8.3.7.3.1.2.

5.1.2 Disturbance or behavioural effects from underwater noise during piling

82. In section 8.3.7.3.2 of the **RIAA HRA Part 3 of 4** [APP-047], piling in the Offshore Export Cable Corridor resulted in higher numbers of harbour seal being potentially disturbed. With the proposed removal of the ESP in the Offshore Export Cable Corridor, this would result in a reduction in number of harbour seals to be potentially disturbed.

5.1.2.1 Projects Alone

83. For the Projects in isolation, using the 25km disturbance range for harbour seal, up to 24 individuals (0.6% of the Wash and North Norfolk Coast SAC) could be potentially disturbed from piling in the Offshore Export Cable Corridor (Table 8-102 in the **RIAA HRA Part 3 of 4** [APP-047]). However, with the proposed removal of the ESP in the Offshore Export Cable Corridor there is only the potential that the following animals would be disturbed:

- DBS East; up to 3.5 individuals to be disturbed (0.09% of the Wash and North Norfolk Coast SAC); and
- DBS West; up to 2.9 individuals to be disturbed (0.07% of the Wash and North Norfolk Coast SAC).

84. These numbers of harbour seal of the Wash and North Norfolk Coast SAC represent the worst case and have been carried forward to the population modelling and the updates with the proposed removal of the ESP in the Offshore Export Cable Corridor are presented in section 5.2.

85. For the Projects in isolation using the dose response curve assessment for harbour seal in the Wash and North Norfolk Coast SAC, up to four individuals (0.1% of the Wash and North Norfolk Coast SAC) have the potential to be disturbed (Table 8-103 of the **RIAA HRA Part 3 of 4** [APP-047]). However, with the proposed removal of the ESP in the Offshore Export Cable Corridor there is the potential that the following animals would be disturbed:

- DBS East; up to 0.7 individual to be disturbed (0.01% of the Wash and North Norfolk Coast SAC); and
- DBS West; up 0.6 individual to be disturbed (0.02% of the Wash and North Norfolk Coast SAC.

86. With the proposed removal of the ESP in the Offshore Export Cable Corridor, the potential number of harbour seal that could be disturbed is reduced.

5.1.2.2 The Projects Together

87. For the Projects together, with the proposed removal of the ESP in the Offshore Export Cable Corridor, for piling of jacket pin piles; disturbance was assessed with piling occurring concurrently in both Array Areas as the worst case using a 15km EDR, (recommended for harbour porpoise (JNCC *et al.* 2020)).

88. In Table 8-105 of the **RIAA HRA Part 3 of 4** [APP-047] an assessment was carried out using a 15km disturbance range for the installation of three concurrent jacket pin piles. With the proposed removal of the ESP in the Offshore Export Cable Corridor, the maximum number of jacket pin piles to be installed at the same time would be two (concurrent installation of one jacket pin pile in DBS East Array Area and one in DBS West Array Area). **Table 5-2** presents the updated assessment and shows that there is a significant decrease in the potential numbers of grey seal to be disturbed.

Table 5-2 Assessment of the Potential for Disturbance to Harbour Seal in the Wash and North Norfolk Coast SAC Based on a Disturbance Range of 15km for the installation of concurrent Jacket Pin Piles at the Projects (Updates to Table 8-105 in RIAA HRA Part 3 of 4 [APP-047]) (*Grey was assessed in the RIAA*)

Maximum number of individuals (% of reference population) Jacket pin piles at three concurrent locations (EDR – 15km, with a disturbance area of 2,120.8km²)	Potential adverse effect on site integrity	Maximum number of individuals (% of reference population) Jacket pin piles at two concurrent locations (EDR – 15km, with a disturbance area of 1,413.72km²)	Potential adverse effect on site integrity
25.4 (0.64% of the Wash and North Norfolk Coast SAC)	No Less than 5% of the population affected	2.5 (0.06% of the Wash and North Norfolk Coast SAC)	No Less than 5% of the population affected

5.2 Reduction of Piling Days

89. In order to assess for potential disturbance, the population modelling was redone to include the small reduction in number of monopiles due to the proposed reduction in number of offshore platforms and the proposed removal of the ESP in the Offshore Export Cable Corridor for the Projects' alone and in-combination assessments.

5.2.1 Projects Alone

90. Although there is a very small impact of potential disturbance to harbour seal (less than 1% of the population affected (**Table 5-2**)), in light of the declining population of the Wash and North Norfolk Coast SAC, population modelling has been carried out to show what the long term effects would be, based on the proposed changes to the Projects' Design Envelope.

91. Population modelling has been undertaken to determine whether the number of animals disturbed would cause a population level effect for both DBS East and DBS West sequentially as the worst case for a declining harbour seal population.

92. The updated population modelling for harbour seal is based on:

- A worst case of up to 6.4 harbour seal disturbed; reduced from 30 modelled in the RIAA: based on the 25km disturbance assessments presented in Table 8-102 in the **RIAA HRA Part 3 of 4** [APP-047]:
  - DBS East - 3.5; and
  - DBS West - 3.0.
- Up to one individual could be at risk of PTS at DBS East and DBS West (combined total from both Array Areas) (same as in the RIAA (Table 8-100 in the **RIAA HRA Part 3 of 4** [APP-047]):
  - DBS East - 0.01; and
  - DBS West - 0.004.

93. Due to Special Committee on Seals (SCOS) (2022) reports stating that the harbour seal population is in decline in the Wash and North Norfolk Coast SAC, the population modelling was also undertaken with the parameters for a declining population as described in **Appendix 11-4 iPCoD Modelling (Revision 2)** [document reference: 7.11.11.4] (based on Sinclair *et al.* 2020).

94. For the Wash and North Norfolk Coast SAC population, the results of the modelling predict that by the end of 2032 (two years after piling ends and six years after the onset of the disturbance), the median population size for the impacted population is predicted to be 100% of the unimpacted population. Beyond 2032, the impacted population maintains as relatively stable as the un-impacted population, remaining at 100% as far as 2052, which is the end point of the modelling. Therefore, there is less than 1% annual decline over the first six years and over the 25 year period, which is not significant (NRW, 2023) (**Table 5-3**).

Table 5-3 Results of the iPCoD modelling for DBS East and DBS West sequentially scenario, giving the mean population size of a declining harbour seal population (Wash SAC population) for years up to 2052 for both impacted and un-impacted population (Amendments to Table 8-107 in the RIAA HRA Part 3 of 4 [APP-047])

Time period	Un-impacted population mean	Impacted population mean	Median impacted as % of unimpacted
Start	3,956	3,956	100.00%
End 2028	3,541	3,541	100.00%
End 2029	3,170	3,170	100.00%
End 2032	2,284	2,284	100.00%
End 2037	1,319	1,319	100.00%
End 2047	441	441	100.00%

Time period	Un-impacted population mean	Impacted population mean	Median impacted as % of unimpacted
End 2052	253	253	100.00%

95. **Plate 5-1** shows the mean unimpacted and the mean impacted population of harbour seal within the Wash and North Norfolk Coast SAC population. The graph shows that piling at the Projects have no significant impact on the harbour seal population in the Wash and North Norfolk Coast SAC.

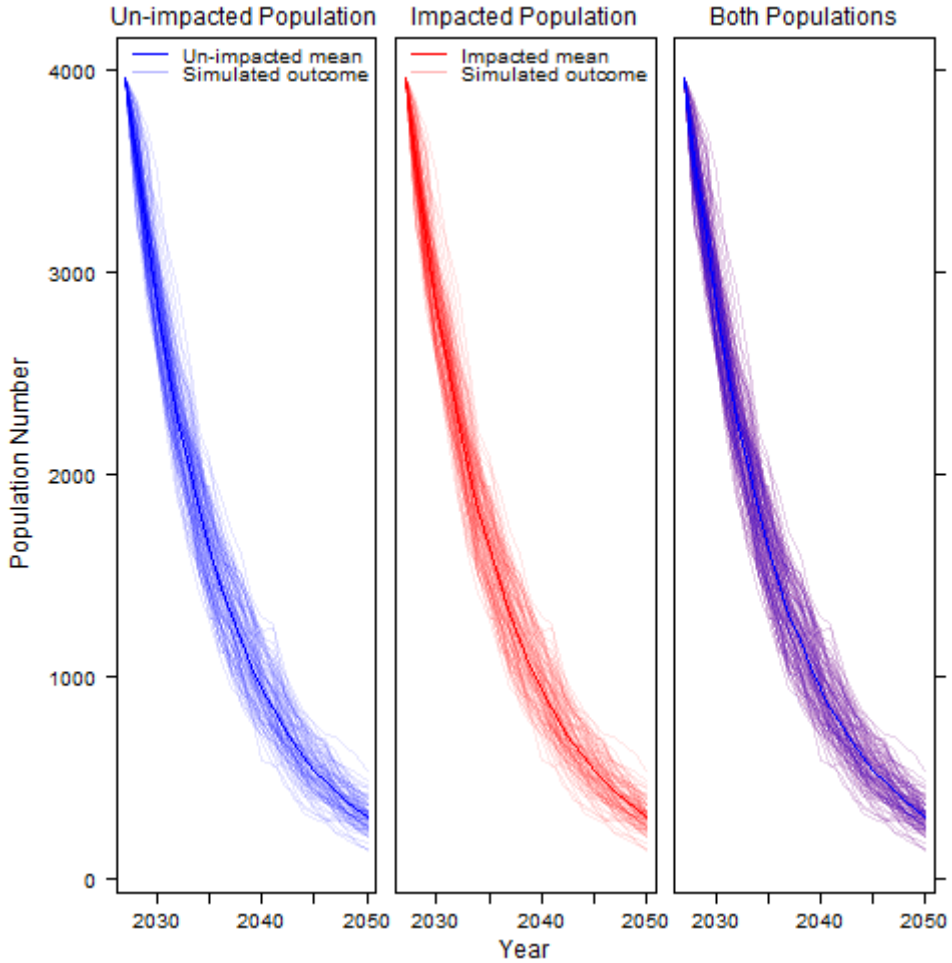

Plate 5-1 Simulated worst case for declining harbour seal population sizes (The Wash and North Norfolk Coast SAC population) for both the unimpacted and the impacted populations for the Projects Alone. (Amendments to Plate 8-7 of the RIAA HRA Part 3 of 4 [APP-047])

96. Therefore, the results from the population modelling show that there would be **no adverse effect on the integrity of the Wash and Norfolk Coast SAC in relation to the conservation objectives for harbour seal due to disturbance or behaviour effects from increased underwater noise during construction (piling) for the Projects alone.**

97. There is no change to the conclusion of the assessment, as presented in section 8.3.7.3.2.2.1 of the **RIAA HRA Part 3 of 4** [APP-047].

5.2.2 In-Combination Scenario

98. For the in-combination scenario assessed (see Table 11-4-8 in **Appendix 11-4 iPCoD Modelling (Revision 2)** [document reference: 7.11.11.4]) for details of the schemes considered) within the Wash and North Norfolk Coast SAC population, the iPCoD model predicts no change in the harbour seal population size over time (**Table 5-4, Plate 5-2**).

99. The median ratio of the unimpacted: impact population remains stable at 100% at the end of 2028 (one year after the piling has commenced). By the end of 2052, which is the end point of the modelling, the median impacted to un-impacted ratio remains 100% (**Table 5-4, Plate 5-2**).

100. For the Wash and North Norfolk Coast SAC harbour seal population, the potential magnitude of the in-combination scenario for disturbance from underwater noise from piling is assessed as not significant due to there being less than 1% population level impact over both the first six years and 25 year modelled periods. Therefore, there is less than 1% annual decline over the first six years and over the 25 year period, which is not significant (NRW, 2023); (**Table 5-4, Plate 5-2**).

Table 5-4 Results of the iPCoD modelling for the in-combination assessment, giving the mean population size of the Wash and North Norfolk Coast SAC harbour seal population (for years up to 2052 for both impacted and un-impacted populations in addition to the median ratio between their population sizes (Amendments to Table 8-126 of the RIAA HRA Part 3 of 4 [APP-047])

Year	Un-impacted pop mean	Impacted pop mean	Median
Start	3,956	3,956	100.00%
End 2028	3,539	3,539	100.00%
End 2029	3,170	3,172	100.01%
End 2032	2,274	2,278	100.17%
End 2037	1,311	1,314	100.22%
End 2047	432	433	100.23%

Year	Un-impacted pop mean	Impacted pop mean	Median
End 2052	247	248	100.40%

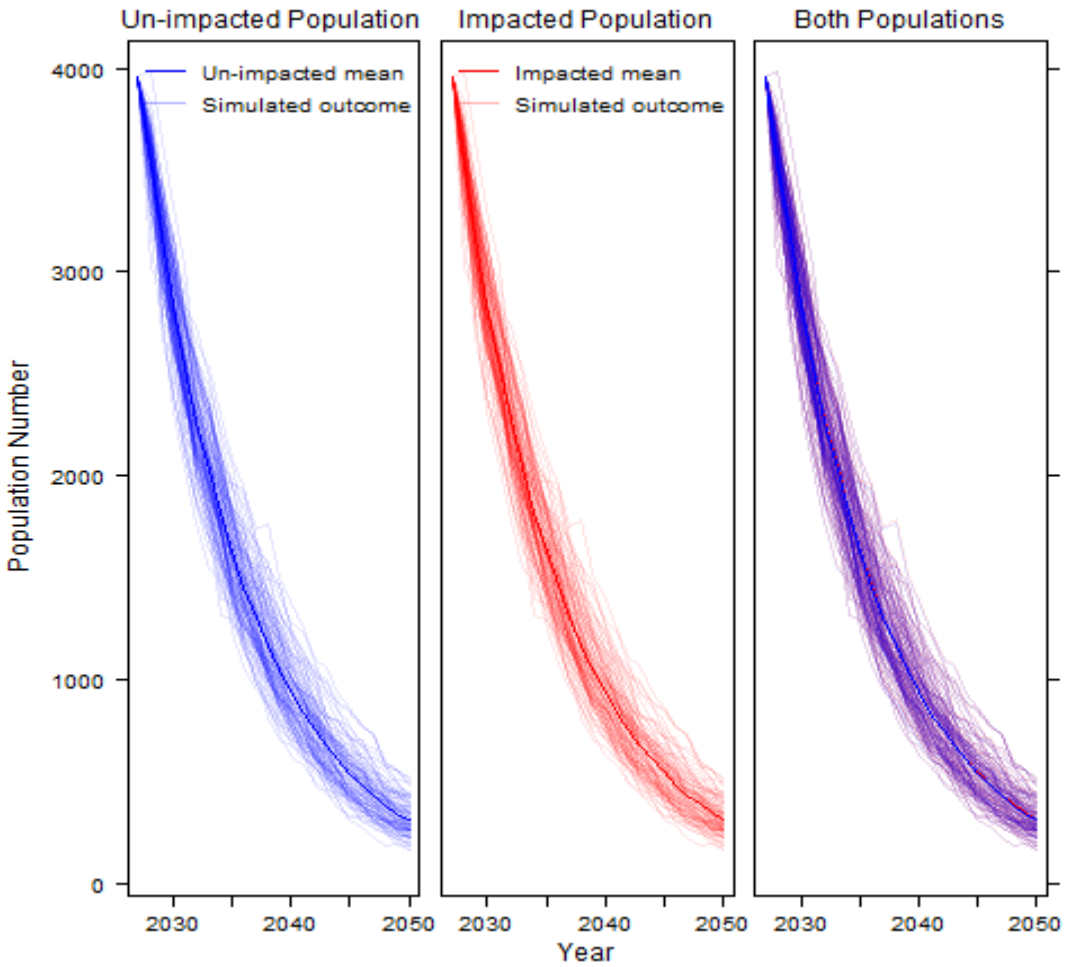

Plate 5-2 Simulated worst case of the Wash and North Norfolk Coast SAC harbour seal (declining) population sizes for both the un-impacted and the impacted populations for the Projects in-combination with other OWF projects (Amendments to Plate 8-8 of the RIAA HRA Part 3 of 4 [APP-047])

101. The results from the population modelling are the same as those presented in section 8.3.7.6.1.1 of the **RIAA HRA Part 3 of 4** [APP-047] and therefore the proposed changes to the Projects' Design Envelope would not change the conclusion of the assessment.

102. Therefore, the results from the population modelling show that there would be **no adverse effect on the integrity of the Wash and Norfolk Coast SAC in relation to the conservation objectives for harbour seal due to disturbance or behaviour effects from increased underwater noise during construction (piling) for the Projects in-combination.**

6 Berwickshire & North Northumberland Coast SAC

103. The assessment of construction activities for the Berwickshire and North Northumberland Coast SAC is presented in section 8.3.8.3 of the **RIAA HRA Part 3 of 4** [APP-047].

104. This section provides an update to the assessment based on the proposed removal of the ESP in the Offshore Export Cable Corridor and the slight reduction in number of piling days due to the proposed reduction in number of offshore platforms, along with the in-combination assessment of underwater noise from piling at other OWF schemes.

6.1 Removal of the ESP in the Offshore Export Cable Corridor

6.1.1 Permanent Threshold Shift

105. The only change to section 8.3.8.3 of the **RIAA HRA Part 3 of 4** [APP-047], based on the proposed changes removal of the ESP in the Offshore Export Cable Corridor, is a reduction to concurrent piling of the jacket pin piles from three concurrent pin pile installations (four sequential at DBS East Array Area at the same time as four sequential at DBS West Array Area and four sequential at the Offshore Export Cable Corridor) to two concurrent pin pile installations (four sequential at DBS East Array Area at the same time as four sequential at DBS West Array Area) (see section 8.3.8.3.1.2 of the **RIAA HRA Part 3 of 4** [APP-047]).

106. Updated underwater noise modelling for the concurrent piling of the jacket pin piles (**Appendix 11-3 Underwater Noise Modelling Report (Revision 2)** [document reference: 7.11.11.3]) shows that there is a reduction in the potential impact range for grey seal. In the RIAA the impact range used for the assessment was 240km², with the proposed removal of the ESP in the Offshore Export Cable Corridor, the impact range would be reduced to 230km² (**Table 4-1**).

107. With the slight reduction of the impact area and using the highest density from the Array Areas (0.054 per km²) (Carter *et al.* 2022),(as described in paragraph 941 of the **RIAA HRA Part 3 of 4** [APP-047]) the maximum number would be reduced from 13 individuals to 12.4 individuals (**Table 6-1**).

Table 6-1 Assessment of the Potential for PTS due to the Cumulative Exposure of Sequential Jacket Pin Piles in a 24 hour Period (Amendments to Table 8-137 of the RIAA HRA Part 3 of 4 [APP-047])

Location	Maximum number of individuals (% of reference population	Potential adverse effect on site integrity
Three concurrent installations at DBS East, DBS West Array Area, and Offshore Export Cable Corridor, with four sequential jacket pin piles at each location (total of 12 jacket pin piles installed in one day)	13.0 (0.08% of the BNNC SAC) [based on the worst case density at DBS West]	No Less than 1% of the population at risk. MMMP would reduce risk of PTS.
Two concurrent installations at DBS East Array Area and DBS West Array Area with four sequential jacket pin piles at each location (total of 8 jacket pin piles installed in one day)	12.4 (0.07% of the BNNC SAC) [based on the worst case density at DBS West]	**No** Less than 1% of the population at risk. MMMP would reduce risk of PTS.

108. The effective implementation of the MMMP for piling will reduce the risk of PTS to grey seal during piling at the Projects. There would be **no adverse effect on the integrity of the Berwickshire and North Northumberland Coast SAC in relation to the conservation objectives for grey seal due to auditory injury (PTS) from underwater noise during construction (piling) for the Projects together**.

109. There is no change to the conclusion of the **RIAA HRA Part 3 of 4** [APP-047] in section 8.3.8.3.1.2.

6.1.2 Disturbance or behavioural effects from underwater noise during piling

110. In section 8.3.8.3.2 of the **RIAA HRA Part 3 of 4** [APP-047], piling in the Offshore Export Cable Corridor resulted in high numbers of grey seal being potentially disturbed. With the proposed removal of the ESP in the Offshore Export Cable Corridor, this would result in a significant reduction in number of grey seals to be potentially disturbed.

6.1.2.1 Projects Alone

111. For the Projects in isolation, using the 25km disturbance range for grey seal, up to 81 individuals (0.48% of the Berwickshire and North Northumberland Coast SAC) could be potentially disturbed from piling in the Offshore Export Cable Corridor (Table 8-138 in the **RIAA HRA Part 3 of 4** [APP-047]). However, with the proposed removal of the ESP in the Offshore Export Cable Corridor there is only the potential that the following animals would be disturbed:

- DBS East; up to 62.8 individuals to be disturbed (0.37% of the Berwickshire and North Northumberland Coast SAC); and
- DBS West; up to 106.0 individuals to be disturbed (0.63% of the Berwickshire and North Northumberland Coast SAC).

112. These numbers of grey seal of the Berwickshire and North Northumberland Coast SAC represent the worst case and have been carried forward to the population modelling and the updates with the proposed removal of the ESP in the Offshore Export Cable Corridor are presented in section 6.2.

113. For the Projects in isolation using the dose response curve assessment for grey seal in the Berwickshire and North Northumberland Coast SAC, up 2,355.9 individuals (13.9% of the Berwickshire and North Northumberland Coast SAC) have the potential to be disturbed (Table 8-139 of the **RIAA HRA Part 3 of 4** [APP-047]). However, with the proposed removal of the ESP in the Offshore Export Cable Corridor there is the potential that the following animals would be disturbed:

- DBS East; up to 281.0 individuals to be disturbed (1.7% of the Berwickshire and North Northumberland Coast SAC); and
- DBS West; up 1,154.8 individuals to be disturbed (6.8% of the Berwickshire and North Northumberland Coast SAC).

114. With the proposed removal of the ESP in the Offshore Export Cable Corridor, the potential numbers of grey seal that could be disturbed is greatly reduced.

6.1.2.2 The Projects Together

115. For the Projects together, with the proposed removal of the ESP in the Offshore Export Cable Corridor, for piling of jacket pin piles; disturbance was assessed with piling occurring concurrently in both Array Areas as the worst case using a 15km EDR, (recommended for harbour porpoise (JNCC *et al.* 2020).

116. In Table 8-142 of the **RIAA HRA Part 3 of 4** [APP-047] an assessment was carried out using a 15km disturbance range for the installation of three concurrent jacket pin piles. With the proposed removal of the ESP in the Offshore Export Cable Corridor, the maximum number of jacket pin piles to be installed at the same time would be two (concurrent installation of one jacket pin pile in DBS East Array Area and one in DBS West Array Area). **Table 6-2** presents the updated assessment and shows that there is a significant decrease in the potential numbers of grey seal to be disturbed.

Table 6-2 Assessment of the Potential for Disturbance to Grey Seal in the Berwickshire and North Northumberland Coast SAC Based on a Disturbance Range of 15km for the installation of concurrent Jacket Pin Piles at the Projects (Updates to Table 8-142 in RIAA HRA Part 3 of 4 [APP-047]) (*Grey was assessed in the RIAA*)

Maximum number of individuals (% of reference population) Jacket pin piles at three concurrent locations (EDR – 15km, with a disturbance area of 2,120.8km²)	Potential adverse effect on site integrity	Maximum number of individuals (% of reference population) Jacket pin piles at two concurrent locations (EDR – 15km, with a disturbance area of 1,413.72km²)	Potential adverse effect on site integrity
89.8 (0.49% of the Berwickshire and North Northumberland Coast SAC)	No Less than 5% of the population affected	52.3 (0.3% of the Berwickshire and North Northumberland Coast SAC)	No Less than 5% of the population affected

6.2 Reduction of Piling Days

117. In order to assess for potential disturbance, the population modelling was redone to include the reduction in the number of monopiles due to the proposed reduction in number of offshore platforms and the proposed removal of the ESP in the Offshore Export Cable Corridor for the Projects alone and in-combination assessments.

6.2.1 Projects Alone

118. The updated population modelling for grey seal is based on:

- A worst case of up to 1,435.8 grey seal disturbed; reduced from 3,791.7 modelled in the RIAA; based on the dose response curve assessments presented in Table 8-139 of the **RIAA HRA Part 3 of 4** [APP-047]:
  - DBS East - 281.0; and
  - DBS West - 1,154.8.

- Up to one individual could be at risk of PTS at DBS East and DBS West (combined total from both locations, Table 8-136 of the **RIAA HRA Part 3 of 4** [APP-047]):
  - DBS East - 0.2; and
  - DBS West - 0.2.

119. For the Berwickshire and North Northumberland Coast SAC grey seal population, the modelling predicts that by the end of 2032 (two years after piling ends and six years after the onset of the disturbance), the median ratio for the unimpacted: impacted population is predicted to be 100% of the unimpacted population. Beyond 2032, the impacted population maintains relatively stable as far as 2052, which is the end point of the modelling. Therefore, there is less than 1% annual decline over the first six years and over the 25 year period, which is not significant (NRW 2023); (**Table 6-3**).

Table 6-3 Results of the iPCoD modelling for DBS East and DBS West sequentially scenario, giving the mean population size of grey seal population (BNNC SAC population) for years up to 2052 for both impacted and un-impacted population (Amendments to Table 8-140 of the RIAA HRA Part 3 of 4 [APP-047])

Time period	Un-impacted population mean	Impacted population mean	Median impacted as % of unimpacted
Start	16,903	16,903	100.00%
End 2028	17,023	17,023	100.00%
End 2029	17,167	17,168	100.00%
End 2032	17,463	17,465	100.01%
End 2037	18,095	18,098	100.00%
End 2047	19,295	19,299	99.98%
End 2052	19,738	19,742	100.03%

120. **Plate 6-1** shows the mean unimpacted and the mean impacted population of grey seal within the Berwickshire and North Northumberland Coast SAC population. The figure shows that with piling at DBS East and DBS West, there is no significant impact on the population of grey seal.

121. Therefore, the results from the population modelling show that there would be **no adverse effect on the integrity of the Berwickshire and North Northumberland Coast SAC in relation to the conservation objectives for grey seal due to disturbance or behaviour effects from increased underwater noise during construction (piling) for the Projects alone.**

122. There is no change to the conclusion of the assessment as presented in section 8.3.8.3.2.1.1 of the **RIAA HRA Part 3 of 4** [APP-047].

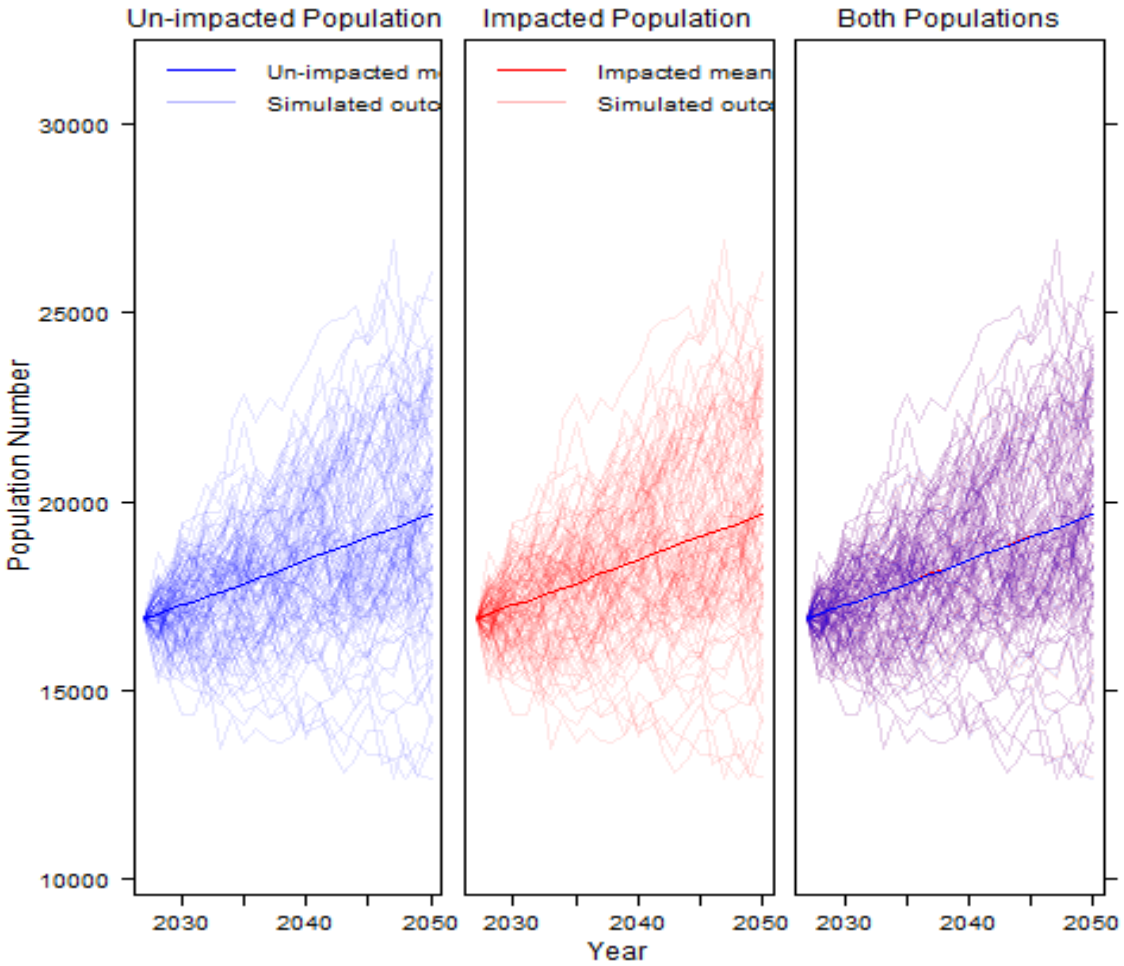

Plate 6-1 Simulated worst case grey seal population sizes (BNNC SAC population) for both the unimpacted and the impacted populations in the Projects Alone (Amendments to Plate 8-9 of the RIAA HRA Part 3 of 4 [APP-047]).

6.2.2 In-Combination

123. For the in-combination scenario assessed (see Table 11-4-8 in **Appendix 11-4 iPCoD Modelling (Revision 2)** [document reference: 7.11.11.4] for details of the schemes considered, and their parameters) within the Berwickshire and North Northumberland Coast SAC population, the iPCoD model predicts no change in the grey seal population size over time (**Table 6-4; Plate 6-2**).

124. The median population size was predicted to be almost 100% of the ratio of the un-impacted: impacted population size at the end of 2028 (one year after the piling has commenced). By the end of 2052, which is the end point of the modelling, the median impacted to un-impacted ratio is at almost 100% and has remained at a stable level after 2032. Therefore, there is less than 1% annual decline over the first six years and over the 25 year period, which is not significant (NRW, 2023); (**Table 6-4; Plate 6-2**).

Table 6-4 Results of the iPCoD Modelling for the In-combination Assessment, Giving the Mean Population Size of the BNNC SAC Grey Seal Population (for years up to 2052 for Both Impacted and Un-Impacted Populations in Addition to the Median Ratio between their Population Sizes (Amendments to Table 8-161 of the RIAA HRA Part 3 of 4 [APP-047])

Time period	Un-impacted population mean	Impacted population mean	Median impacted as % of unimpacted
Start	16,906	16,906	100.00%
End 2028	17,006	17,004	99.98%
End 2029	17,151	17,145	99.97%
End 2032	17,478	17,465	99.98%
End 2037	18,101	18,086	99.89%
End 2047	19,311	19,295	99.95%
End 2052	19,963	19,946	99.89%

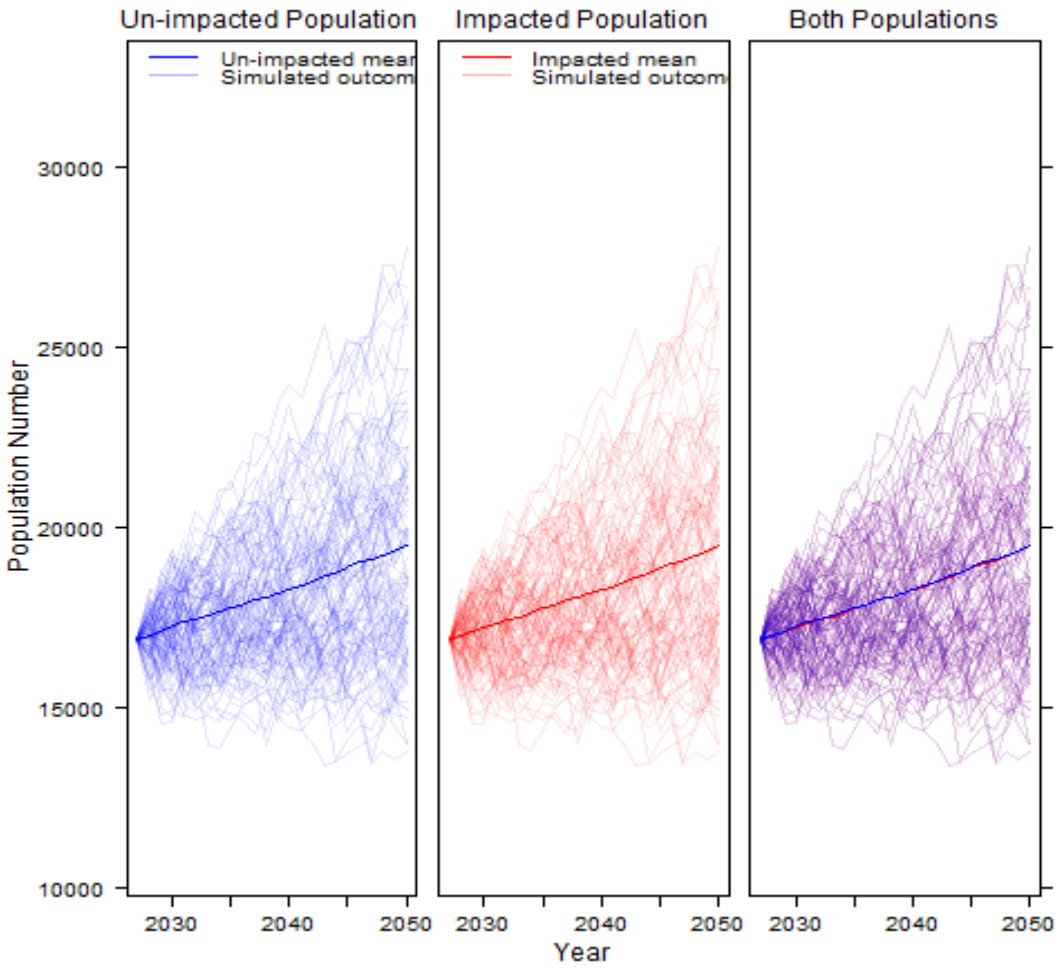

Plate 6-2 Simulated Worst case Berwickshire and North Northumberland Coast SAC Grey Seal Population Sizes for Both the Un-Impacted and the Impacted Populations (Amendments to Plate 8-10 of the RIAA HRA Part 3 of 4 [APP-047]).

125. The results from the population modelling are the same as those presented in section 8.3.8.6.1.1 in the **RIAA HRA Part 3 of 4** [APP-047] and therefore the proposed changes to the Projects' Design Envelope would not change the conclusion of the assessment.

126. Therefore, the results from the population modelling show that there would be **no adverse effect on the integrity of the Berwickshire and North Northumberland Coast SAC in relation to the conservation objectives for grey seal due to disturbance or behaviour effects from increased underwater noise during construction (piling) for the Projects in-combination.**

7 Conclusion

127. The proposed removal of the ESP in the Offshore Export Cable Corridor significantly reduces the numbers of grey seal to be disturbed, in particular within the Humber Estuary SAC population. However, the proposed removal of the ESP in the Offshore Export Cable Corridor does not change the conclusions of no adverse of effect of the site integrity on the SACs as presented in the **RIAA HRA Part 3 of 4** [APP-047].

128. The proposed reduction of piling days would not cause any significant changes to the original results from the population modelling with in the **RIAA HRA Part 3 of 4** [APP-047]. However, the proposed reduction of piling days would result in the in-combination assessment of disturbance from piling at other OWF schemes being reduced to below the seasonal threshold of 10% for the SNS SAC.

129. For the in-combination assessment of disturbance due to underwater noise from other piling projects for the Humber Estuary SAC, an error was corrected to use the worst case numbers for DBS West. The conclusion presented in paragraph 659 in **RIAA HRA Part 3 of 4** [APP-047] still remains valid. Based on the population modelling there is no potential for adverse effect on integrity of the Humber Estuary SAC in relation to the conservation objectives for grey seal for in-combination with piling at the Projects and other OWFs.

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