THE PLANNING ACT 2008

THE INFRASTRUCTURE PLANNING (EXAMINATION PROCEDURE) RULES 2010

East Anglia ONE North Offshore Wind Farm

Planning Inspectorate Reference: EN010077

Secretary of State 2nd Additional Information Request

(30 December 2021)

Appendix 1: Offshore Ornithology EIA Impacts from East Anglia ONE North and East Anglia TWO Cumulatively with other Plans and Projects

31st January 2022

Appendix 1   Offshore Ornithology EIA Impacts from East Anglia ONE North and East Anglia TWO Cumulatively with other Plans and Projects

Summary

1. This document is a technical document submitted to the Secretary of State to provide scientific justification for Natural England's advice regarding the significance of the potential cumulative (EIA scale) impacts of East Anglia ONE North (EA1N) and East Anglia TWO (EA2), as summarised within each section.

2. This advice is based on the updated cumulative collision and displacement totals submitted by the Applicants in response to the Part 6 of the Secretary of State (SoS) letter dated 2 November 2021 and presented in MacArthur Green & Royal Haskoning DHV *et al.* (2021). Therefore, this advice updates that previously provided during the EA1N and EA2 examinations at Deadline 8 [REP8-159] regarding cumulative collision and displacement impacts. Our advice considers all projects up to and including Hornsea Project 3, Norfolk Vanguard, Norfolk Boreas, EA1N and EA2, and excluding the Hornsea Project 4, and Dudgeon and Sheringham extension projects (DEP & SEP), as per the SoS request to the Applicants.

3. Our advice is based on best available evidence at the time of writing and is subject to change in the future should further evidence be presented.

4. Since the close of the examinations for East Anglia One North and East Anglia Two, no further updates have been made in relation to draught heights and the collision risk modelling (CRM) for the East Anglia One North and East Anglia Two projects remains based on a draught height of a minimum of 24m above Mean High Water Springs (MHWS). The projects continue to make a meaningful contribution to cumulative effects on several seabirds at the EIA scale, particularly with respect to North Sea populations of great black-backed gull, gannet and kittiwake (see summary Table 1 in the cover letter).

5. We largely agree with the updated cumulative predicted collision impact totals of gannet, kittiwake, lesser black-backed gull (LBBG), herring gull, great black-backed gull (GBBG) and the updated cumulative abundances at risk of displacement of gannet and guillemot presented by the Applicants in Tables 1-7 of MacArthur Green & Royal Haskoning DHV et al. (2021) for all projects up to and including Hornsea

Project 3, Norfolk Boreas, Norfolk Vanguard, East Anglia ONE North (EA1N) and East Anglia TWO (EA2) and excluding Hornsea Project 4 and Dudgeon (DEP) and Sheringham (SEP) Extensions (as request by the Secretary of State 20 December 21) . However, we note a minor discrepancy between the cumulative razorbill abundance at risk of displacement of 4 birds between Natural England's total for all projects excluding Hornsea Project 4, DEP and SEP (123,852) and the Applicants' total (123,848) in Table 8 of MacArthur Green & Royal Haskoning DHV (2021). This minor discrepancy is likely due to rounding differences in the annual totals for some projects going into the cumulative total, but does not make a material difference to the predicted cumulative razorbill mortalities across the recommended range of 30-70% displacement and 1-10% mortality.

6. We note that the Hornsea Project 4 application has now been accepted by PINS and the Environmental Statement (ES) is now in the public domain. Natural England has reviewed this submission. More generally, Natural England highlights that collision and displacement assessments tend to go through multiple iterations during the Examination phase, and therefore are also subject to change. Accordingly, there remains significant uncertainty regarding the contribution of Hornsea Project 4 to the in-combination totals.

Detailed Comments

1) **EIA Impacts from Operational Collision Risk from East Anglia ONE North and East Anglia TWO Cumulatively with other Plans and Projects**

7. Table 1 shows the cumulative collision risk total predictions for all relevant projects excluding Hornsea Project 4 and Norfolk Vanguard and for all projects including Hornsea Project 4 and Norfolk Vanguard. This is based on the figures presented by the Applicants in REP4-042 for all species except herring gull, which is based on that presented in REP1-047. The shaded cells of the table indicate where the predicted cumulative totals exceed 1% of baseline mortality of the largest BDMPS or biogeographic population.

Table 1 Percentage of baseline mortality for cumulative CRM for EIA for all projects excluding and including Hornsea 4, DEP and SEP. (Using average across all age class mortality rates, as used by the Applicants in APP-060)

	Cumulative collision prediction*		Largest BDMPS (North Sea) individuals, Furness (2015)	% baseline mortality largest BDMPS		Biogeographic population individuals (Furness 2015)	% baseline mortality biogeographic	
	Excl. H4, DEP & SEP	ALL projects		Excl. H4, DEP & SEP	ALL projects		Excl. H4, DEP & SEP	ALL projects
Gannet	2,940	3,012	456,298	3.37	3.46	1,180,000	1.30	1.34
Kittiwake	4,015	4,243	839,456**	3.07	3.24	5,100,000	0.50	0.53
LBBG	530	533	209,007	2.01	2.02	864,000	0.49	0.49
Herring gull	763	766	466,511	0.95	0.95	1,098,000	0.40	0.41
GBBG	979	1,003	91,399	5.79	5.93	235,000	2.25	2.31

* Based on the Applicants' cumulative figures presented in MacArthur Green & Royal Haskoning DHV (2021)
** Population estimate for all UK colonies within North Sea BDMPS scale (from Furness 2015)

2) Gannet Cumulative Impacts

a) Operational Collision Risk:

8. The Applicants' updated cumulative collision totals for gannet of 2,940 birds excluding Hornsea Project 4, DEP and SEP and of 3,012 including all projects exceed 1% of baseline mortality of the North Sea BDMPS scale and the biogeographic population (Furness 2015). The figure excluding Hornsea Project 4, DEP and SEP equates to 3.37% of baseline mortality of the BDMPS and 1.30% of baseline mortality of the biogeographic population, and the figure including all projects equates to 3.46% of the BDMPS and 1.34% of the biogeographic population baseline mortality (Table 1 above). **These levels are significant and require further consideration.**

9. No further updates have been made regarding EIA scale PVAs and so we have again utilised the PVA metrics from the EIA scale (BDMPS and biogeographic scale) gannet PVAs undertaken by Norfolk Boreas (MacArthur Green 2019), which used the 'Seabird PVA Tool'. We highlight that we raised some issues with these PVAs during the Boreas examination and that no changes were made to the models. However, these models nevertheless currently represent the best available evidence on which to base an assessment, though this should not be taken as a Natural England endorsement or 'acceptance' of the model outputs.

10. Using the PVA models undertaken by Boreas, if the additional mortality from the offshore wind farms is 3,000-3,100 per annum (closest PVA outputs to the

cumulative collision mortality figures of 2,940 excluding Hornsea Project 4, DEP and SEP and of 3,012 including all projects) then:

- The BDMPS population after 30 years will be 21.33-21.95% lower than it would have been in the absence of the additional mortality using the density independent model and 21.15-21.76% lower using the density dependent model. The population growth rate would be reduced by 0.77-0.80% using the density independent model and by 0.76-0.79% using the density dependent model (Table 2).

- The biogeographic population after 30 years will be 8.84-9.13% lower than it would have been in the absence of the additional mortality using the density independent model and 8.75-9.03% lower using the density dependent model. The population growth rate would be reduced by 0.30-0.31% using the density independent model and by 0.29-0.30% using the density dependent model (Table 2).

Table 2 Predicted Population impacts on the gannet BDMPS and biogeographic population for the range of mortality impacts predicted for cumulative collision. PVA Impact Metrics are as provided in Table 3.2 of MacArthur Green (2019). The range of predicted figures are indicated in purple. The darker shaded cells represent the level of impact closest to the combined cumulative collision predictions

GANNET, EIA CUMULATIVE COLLISIONS – DENSITY INDEPENDENT PVA MODELS						
Additional mortality	% baseline mortality largest BDMPS as used by Applicants	Counterfactual of Final Population Size (CPS), BDMPS	Counterfactual of Growth Rate (CGR), BDMPS	% baseline mortality biogeographic, as used by Applicants	Counterfactual of Final Population Size (CPS), biogeographic	Counterfactual of Growth Rate (CGR), biogeographic
3,000	3.44	0.7867	0.9923	1.33	0.9116	0.9970
3,100	3.56	0.7805	0.9920	1.38	0.9087	0.9969
3,200	3.67	0.7744	0.9918	1.42	0.9059	0.9968
GANNET, EIA CUMULATIVE COLLISIONS – DENSITY DEPENDENT PVA MODELS						
Additional mortality	% baseline mortality largest BDMPS as used by Applicants	Counterfactual of Final Population Size (CPS), BDMPS	Counterfactual of Growth Rate (CGR), BDMPS	% baseline mortality biogeographic, as used by Applicants	Counterfactual of Final Population Size (CPS), biogeographic	Counterfactual of Growth Rate (CGR), biogeographic
3,000	3.44	0.7885	0.9924	1.33	0.9125	0.9971
3,100	3.56	0.7824	0.9921	1.38	0.9097	0.9970
3,200	3.67	0.7761	0.9919	1.42	0.9070	0.9969

11. The northern gannet is classified as 'Least Concern' with respect to the potential for global extinction (BirdLife International 2018). However, at the UK scale the species is Amber listed in Birds of Conservation Concern (BoCC) 5 (Stanbury *et al*. 2021). The BoCC Amber listing is due to:

- Localisation of breeding population within Important Bird Areas (IBAs)/Special Protection Areas (SPAs) – more than 50% of the UK population found at ten or fewer sites (SPAs/IBAs) in the breeding season (Stanbury *et al.* 2021).

- International importance of UK population – threshold of 20% of European population (Stanbury *et al*. 2021). It has been estimated that the UK holds 55.6% of the global population (JNCC 2021).

12. Based on current UK gannet population growth rates of ~2-3% per annum and using the PVA model outputs, then the level of additional cumulative mortality from collisions from the offshore wind farms would still allow the population to grow. However, it is not known what the growth rate of the UK gannet population will be over the next 30 years and this should therefore be considered when judging the significance of predicted impacts and whether a 0.8% reduction in annual growth rate would be significant. It is considered likely that the level of predicted cumulative impact would not be significant for a population growing at 2-3% per annum. However, if the population does not grow at that level for the next 30 years (say if the growth rate was around 1% per annum), we consider that it is uncertain that a 0.8% reduction in growth rate would not be significant.

13. Based on consideration of the PVA metrics presented, the above conservation assessment, and given the UK's particular responsibility for gannet because of supporting over half of the global population, the predicted impacts at the North Sea population scale have the potential to give rise to significant effects. **Therefore, we are unable to rule out a significant adverse impact on gannet from cumulative collision mortality at an EIA scale irrespective of whether the Hornsea Project 4, DEP and SEP projects are included in the cumulative totals or not**.

b) Operational Displacement

14. Based on the updated in-combination abundance totals presented by the Applicants in Table 6 of MacArthur Green & Royal Haskoning DHV (2021), the annual in-combination total number of gannets to be at risk of displacement for all projects **excluding** Hornsea Project 4, SEP and DEP is estimated to be 45,922.

15. For the rates considered by the Applicants of 60-80% displacement and 1% mortality, the number of predicted additional cumulative mortalities **excluding** Hornsea Project 4, DEP and SEP is between 276 (60% displacement and 1% mortality) and 367 (80% displacement and 1% mortality) gannets. This equates to 0.32-0.42% of baseline mortality for the largest BDMPS.

16. Based on the updated in-combination abundance totals presented by the Applicants in Table 6 of MacArthur Green & Royal Haskoning DHV (2021), the annual in-combination total number of gannets to be at risk of displacement for all projects **including** Hornsea Project 4, SEP and DEP is estimated to be 50,751.

17. <u>For the rates considered by the Applicants of 60-80% displacement and 1% mortality, the number of predicted additional cumulative mortalities **including** Hornsea Project 4, DEP and SEP is between 305 (60% displacement and 1% mortality) and 406 (80% displacement and 1% mortality) gannets</u>. This equates to 0.35-0.47% of baseline mortality for the largest BDMPS.

18. Based on the above, **we therefore advise no significant adverse impact to gannet from cumulative operational displacement at an EIA scale if the Hornsea Project 4, DEP and SEP projects are excluded from the cumulative totals.**

19. **However, due to the inevitable uncertainty associated with the figures for Hornsea Project 4 being from a recently submitted application, and those from DEP and SEP being from the PEIRs and are hence subject to change, Natural England therefore is not in a position to advise that significant impact can be ruled out for gannet for cumulative displacement impacts when these projects are included in the cumulative totals.**

c) Operational Collision Risk Plus Displacement

20. As noted previously, the SNCBs regard the two impacts (collision and displacement) as additive and advise that they should be summed. However, we acknowledge that this simplistic approach will incorporate a degree of precaution (SNCBs 2017).

21. The combined cumulative impact **excluding** Hornsea Project 4, DEP and SEP of collision plus displacement to gannet equals:

- 2,940 mortalities per annum from collisions plus up to 367 mortalities per annum from displacement = up to 3,307 mortalities.
  This combined cumulative impact equates to 3.79% of baseline mortality of the largest BDMPS and to 1.47% of the biogeographic population.

22. The combined cumulative impact **including** all projects of collision plus displacement to gannet equals:

- 3,012 mortalities per annum from collisions plus up to 406 mortalities per annum from displacement = up to 3,418 mortalities.
  This combined cumulative impact equates to 3.92% of baseline mortality of the largest BDMPS and to 1.52% of the biogeographic population.
  These predicted levels of impacts are significant and require further consideration.

23. As with gannet cumulative collision impacts, Natural England has again utilised the PVA metrics from the EIA scale (BDMPS and biogeographic scale) gannet PVAs undertaken by Norfolk Boreas (MacArthur Green 2019), which used the 'Seabird PVA Tool'. We highlight that we raised some issues with these PVAs during the Boreas examination and that no changes were made to the models. However, these models nevertheless currently represent the best available evidence on which to base an assessment, though this should not be taken as a Natural England endorsement or 'acceptance' of the model outputs.

24. Using the PVA models undertaken by Boreas, if the additional mortality from the offshore wind farms is 3,400-3,500 per annum (closest PVA outputs to the cumulative collision + displacement mortality figures of 3,307 excluding Hornsea 4, DEP and SEP and of 3,418 including all projects) then:

- The BDMPS population after 30 years will be 23.82-24.43% lower than it would have been in the absence of the additional mortality using the density independent model and 23.59-24.22% lower using the density dependent model. The population growth rate would be reduced by 0.87-0.90% using the density independent model and by 0.86-0.89% using the density dependent model (Table 3).
- The biogeographic population after 30 years will be 9.96-10.25% lower than it would have been in the absence of the additional mortality using the density independent model and 9.86-10.14% lower using the density dependent model. The population growth rate would be reduced by 0.34-0.35% using the density independent model and by 0.33-0.34% using the density dependent model (Table 3).

Table 3 Predicted Population impacts on the gannet BDMPS and biogeographic population for the range of mortality impacts predicted for cumulative collision + displacement. PVA Impact Metrics are as provided in Table 4.22 of MacArthur Green (2019). The range of predicted figures are indicated in purple. The darker shaded cells represent the level of impact closest to the combined cumulative collision predictions

GANNET, EIA CUMULATIVE COLLISIONS – DENSITY INDEPENDENT PVA MODELS						
Additional mortality	% baseline mortality largest BDMPS as used by Applicants	Counterfactual of Final Population Size (CPS), BDMPS	Counterfactual of Growth Rate (CGR), BDMPS	% baseline mortality biogeographic, used by Applicants	Counterfactual of Final Population Size (CPS), biogeographic	Counterfactual of Growth Rate (CGR), biogeographic
3,400	3.90	0.7618	0.9913	1.51	0.9004	0.9966
3,500	4.02	0.7557	0.9910	1.55	0.8975	0.9965
3,600	4.13	0.7495	0.9907	1.60	0.8949	0.9964
GANNET, EIA CUMULATIVE COLLISIONS – DENSITY DEPENDENT PVA MODELS						
Additional mortality	% baseline mortality largest BDMPS as used by Applicants	Counterfactual of Final Population Size (CPS), BDMPS	Counterfactual of Growth Rate (CGR), BDMPS	% baseline mortality biogeographic, as used by Applicants	Counterfactual of Final Population Size (CPS), biogeographic	Counterfactual of Growth Rate (CGR), biogeographic
3,400	3.90	0.7641	0.9914	1.51	0.9014	0.9967
3,500	4.02	0.7578	0.9911	1.55	0.8986	0.9966
3,600	4.13	0.7517	0.9908	1.60	0.8958	0.9965

25. The northern gannet is classified as 'Least Concern' with respect to the potential for global extinction (BirdLife International 2018). However, at the UK scale the species is Amber listed in Birds of Conservation Concern (BoCC) 5 (Stanbury *et al.* 2021). The BoCC Amber listing is due to:

- Localisation of breeding population within Important Bird Areas (IBAs)/Special Protection Areas (SPAs) – more than 50% of the UK population found at ten or fewer sites (SPAs/IBAs) in the breeding season (Stanbury *et al.* 2021).

- International importance of UK population – threshold of 20% of European population (Stanbury *et al.* 2021). It has been estimated that the UK holds 55.6% of the global population (JNCC 2021).

26. As noted for gannet cumulative collisions above, based on current UK gannet population growth rates of ~2-3% per annum and using the PVA model outputs, then the level of additional cumulative mortality from collisions from the offshore wind farms would still allow the population to grow. However, it is not known what the growth rate of the UK gannet population will be over the next 30 years, and this should therefore be considered when judging the significance of predicted impacts and whether a 0.9% reduction in annual growth rate would be significant. It is considered likely that the level of predicted cumulative impact would not be significant for a population growing at 2-3% per annum. However, if the population does not grow at that level for the next 30 years (say if the growth rate was around

1% per annum), we consider that it is uncertain that a 0.9% reduction in growth rate would not be significant.

27. Based on consideration of the PVA metrics presented, the above conservation assessment, and given the UK's particular responsibility for gannet because of supporting over half of the global population, the predicted impacts at the North Sea population scale have the potential to give rise to significant effects. **Therefore, we are unable to rule out a significant adverse impact on gannet from cumulative collision + displacement mortality at an EIA scale irrespective of whether the Hornsea Project 4, DEP and SEP projects are included in the cumulative totals or not**.

3) Kittiwake Cumulative Operational Collision Risk

28. The Applicants' updated cumulative collision totals for kittiwake of 4,015 birds excluding Hornsea Project 4, DEP and SEP and of 4,243 including all projects exceeds 1% of baseline mortality of all UK kittiwake colonies within the North Sea BDMPS scale (Furness 2015) – the figure excluding Hornsea Project 4, DEP and SEP equates to 3.07% of baseline mortality, and the figure including all projects equates to 3.24% (Table 1 above). This is significant and requires further consideration.

29. No further updates have been made regarding EIA scale PVAs and so we have again utilised the PVA metrics from the EIA scale (BDMPS and biogeographic scale) kittiwake PVAs undertaken by Norfolk Boreas (MacArthur Green 2019), which used the 'Seabird PVA Tool'. We highlight that we raised some issues with these PVAs during the Boreas examination and that no changes were made to the models. However, these models nevertheless currently represent the best available evidence on which to base an assessment, though this should not be taken as a Natural England endorsement or 'acceptance' of the model outputs.

30. Using the density independent PVA models undertaken by Norfolk Boreas in MacArthur Green (2019), if the additional mortality from the offshore wind farms is 4,100-4,300 per annum (closest PVA outputs to the cumulative collision mortality figures of 4,015 excluding Hornsea Project 4, DEP and SEP and of 4,243 including all projects) then:

- The BDMPS population after 30 years will be 16.65-17.32% lower than it would have been in the absence of the additional mortality and the population growth rate would be reduced by 0.59-0.61% (Table 4).

- The biogeographic population after 30 years will be 2.89-3.03% lower than it would have been in the absence of the additional mortality and the population growth rate would be reduced by 0.10% (Table 4).

Table 4 Predicted Population impacts on the kittiwake BDMPS and biogeographic population for the range of mortality impacts predicted for cumulative collision. PVA Impact Metrics are as provided in Table 3.6 of MacArthur Green (2019). The range of predicted figures are indicated in purple. The darker shaded cells represent the level of impact closest to the combined cumulative collision predictions

KITTIWAKE, EIA CUMULATIVE COLLISIONS – DENSITY INDEPENDENT PVA MODELS						
Additional mortality	% baseline mortality largest BDMPS as used by Applicants	Counterfactual of Final Population Size (CPS), BDMPS	Counterfactual of Growth Rate (CGR), BDMPS	% baseline mortality biogeographic, as used by Applicants	Counterfactual of Final Population Size (CPS), biogeographic	Counterfactual of Growth Rate (CGR), biogeographic
3,900	3.01	0.8410	0.9944	0.49	0.9723	0.9991
4,000	3.09	0.8376	0.9943	0.50	0.9717	0.9991
4,100	3.17	0.8335	0.9941	0.52	0.9711	0.9990
4,200	3.24	0.8302	0.9940	0.53	0.9703	0.9990
4,300	3.32	0.8268	0.9939	0.54	0.9697	0.9990
4,400	3.40	0.8229	0.9937	0.55	0.9688	0.9989

31. Kittiwake are listed as 'Vulnerable' to global extinction on the IUCN Red List (raised from Least Concern to Vulnerable in 2017) as a result of breeding population declines in Europe of >40% over 39 years (BirdLife International 2018). The European regional assessment has listed the species as 'Vulnerable', due to the population trend appearing to be declining at a rapid rate (Birdlife International 2021). In Europe, the population size is estimated to have decreased by 42% (best estimate) over the past 29 years (three generations), is expected to decline at the same rate between 1993-2021 and is projected to decline by 31% over the next three generations (BirdLife International 2021). Kittiwake is also listed as Red on BoCC5 (Stanbury *et al.* 2021) as a result of severe population declines in the UK.

32. Based on consideration of the PVA metrics as currently presented, the above conservation assessment and particularly given the population declines at a UK and wider scale for the species, the predicted impacts at the North Sea population scale have the potential to give rise to significant effects. **Therefore, we are unable to rule out a significant adverse impact on kittiwake from cumulative collision mortality at an EIA scale irrespective of whether the Hornsea Project 4, DEP and SEP projects are included in the cumulative totals or not**.

4) Lesser Black-Backed Gull (LBBG) Cumulative Operational Collision Risk

33. The Applicants' updated cumulative collision totals for LBBG of 530 birds excluding Hornsea Project 4, DEP and SEP and of 533 including all projects exceeds 1% of baseline mortality of the North Sea BDMPS scale (Furness 2015) – the figure excluding Hornsea Project 4, DEP and SEP equates to 2.01% of baseline mortality, and the figure including all projects equates to 2.02% (Table 1 above). This is not insignificant and requires further consideration.

34. No further updates have been made regarding EIA scale PVAs and so we have again utilised the PVA metrics from the EIA scale (BDMPS) LBBG PVA undertaken by Norfolk Boreas (MacArthur Green 2019), which used the 'Seabird PVA Tool'. We highlight that we raised some issues with these PVAs during the Boreas examination and that no changes were made to the models. However, these models nevertheless currently represent the best available evidence on which to base an assessment, though this should not be taken as a Natural England endorsement or 'acceptance' of the model outputs.

35. Using the density independent PVA model undertaken by Norfolk Boreas in MacArthur Green (2019), if the additional mortality from the offshore wind farms is 600 per annum (closest PVA output to the cumulative collision mortality figures of 530 excluding Hornsea Project 4, DEP and SEP and of 533 including all projects) then:

- The BDMPS population after 30 years will be 9.65% lower than it would have been in the absence of the additional mortality and the population growth rate would be reduced by 0.33% (Table 5).

Table 5 Predicted Population impacts on the LBBG BDMPS for the range of mortality impacts predicted for cumulative collision. PVA Impact Metrics are as provided in Table 3.11 of MacArthur Green (2019). The range of predicted figures are indicated in purple. The darker shaded cells represent the level of impact closest to the combined cumulative collision predictions

LBBG, EIA CUMULATIVE COLLISIONS – DENSITY INDEPENDENT PVA MODEL			
Additional mortality	% baseline mortality largest BDMPS as used by Applicant	Counterfactual of Final Population Size (CPS), BDMPS	Counterfactual of Growth Rate (CGR), BDMPS
500	1.90	0.9191	0.9973
600	2.28	0.9035	0.9967

36. The LBBG is classified as 'Least Concern' (BirdLife International 2018). The overall population trend across its range is increasing, although it has experienced recent

declines at a UK level (Balmer et al. 2013). The species is Amber listed in BoCC 5 (Stanbury *et al.* 2021) due to:

- Localisation of breeding population within Important Bird Areas (IBAs)/Special Protection Areas (SPAs) – more than 50% of the UK population found at ten or fewer sites (SPAs/IBAs) in the breeding season (Stanbury *et al.* 2021).

- International importance of UK population – threshold of 20% of European population (Stanbury *et al.* 2021).

We note that quite a high proportion of birds in the largest BDMPS of 209,007 will be UK breeding birds (Furness 2015).

37. Between the 1969-70 and 1998-2002 censuses the UK LBBG population increased by 81% (only UK wide estimates considered reliable; JNCC 2019), which represents an annual average growth rate of approximately 1.8% per annum. Based on this and using the PVA model outputs, then the level of additional cumulative mortality from collisions from the offshore wind farms would still allow the population to grow. However, it is not known what the growth rate of the UK LBBG population will be over the next 30 years, and this should therefore be considered when judging the significance of predicted impacts and whether a 0.3% reduction in annual growth rate would be significant. It is considered likely that the level of predicted cumulative impact would not be significant for a population growing at 1-2% per annum. It should also be noted there is uncertainty in the predicted collision figures due the uncertainty/variability in the input parameters and some degree of precaution in the cumulative total regarding the nocturnal activity rate and build out scenarios. It is also worth noting that there is limited evidence and therefore some uncertainty around baseline mortality rates.

38. Based on consideration of the above, the PVA metrics presented and the above conservation assessment, **we therefore advise a conclusion of no significant adverse impact from cumulative collision to LBBG at an EIA scale if the Hornsea Project 4, DEP and SEP projects are excluded from the cumulative total**.

39. **However, due to the inevitable uncertainty associated with the figures for Hornsea Project 4 being from a recently submitted application, and those from DEP and SEP being from the PEIRs and are hence subject to change, Natural England therefore is not in a position to advise that significant impact can be**

ruled out for LBBG for cumulative collision impacts when these projects are included in the cumulative totals.

5) Herring Gull Cumulative Operational Collision Risk

40. The Applicants' updated cumulative collision totals for herring gull of 763 birds excluding Hornsea Project 4, DEP and SEP and of 766 including all projects equates to 0.95% (excluding or including Hornsea Project 4, DEP and SEP) of baseline mortality of the largest BDMPS and to 0.40% (excluding Hornsea Project 4, DEP and SEP) and 0.41% (including all projects) of baseline mortality of the biogeographic population (Table 1 above).

41. On the basis that the EA1N contribution to the cumulative collision total is 0 (see Table 4 of MacArthur Green & Royal Haskoning DHV 2021), Natural England considers that EA1N is unlikely to make any contribution to the cumulative collision totals irrespective of whether the Hornsea Project 4, DEP and SEP projects are included in the total. **Therefore, we advise that no significant cumulative collision risk impact at the EIA scale for herring gull for EA1N irrespective of whether these projects are included or excluded from the cumulative total.**

42. EA2 contributes and mean collision prediction on 0.5 collisions to the cumulative total (see Table 4 of MacArthur Green & Royal Haskoning DHV 2021). However, we note that the range of predictions based on the 95% confidence intervals of the density data (to account for uncertainty/variability in the input data) have not been provided by the Applicants.

43. The European herring gull is classified as 'Least Concern' on the IUCN Red List (BirdLife International 2021). However, the species is also Red listed on BoCC 5 (Stanbury *et al.* 2021) as a result of population declines in the UK. The Applicants' cumulative collision totals for including and excluding the Hornsea Project 4, DEP and SEP projects equate to just under 1% of baseline mortality of the largest BDMPS and to less than 1% of baseline mortality of the biogeographic population. **Therefore, for EA2 cumulatively with other plans and projects we advise no significant cumulative collision risk impact at the EIA scale for herring gull when the Hornsea Project 4, DEP and SEP projects are excluded from the cumulative total.** We note that the cumulative total is now approaching 1% of baseline mortality of the largest BDMPS, reinforcing the need for herring gull CRM to have been carried

out, and the need for all future offshore wind farm projects in the North Sea to do similar.

44. **However, due to the inevitable uncertainty associated with the figures for Hornsea Project 4 being from a recently submitted application, and those from DEP and SEP being from the PEIRs and are hence subject to change, Natural England therefore is not in a position to advise that significant impact can be ruled out for EA2 for herring gull for cumulative collision impacts when these projects are included in the cumulative totals.**

6) Great Black-Backed Gull (GBBG) Cumulative Operational Collision Risk

45. The Applicants' updated cumulative collision totals for GBBG of 979 birds excluding Hornsea Project 4, DEP and SEP and of 1,003 including all projects exceed 1% of baseline mortality of the North Sea BDMPS scale and the biogeographic population (Furness 2015). The figure excluding Hornsea Project 4, DEP and SEP equates to 5.79% of baseline mortality of the BDMPS and 2.25% of baseline mortality of the biogeographic population, and the figure including all projects equates to 5.93% of the BDMPS and 2.31% of the biogeographic population baseline mortality (Table 1 above). These levels are not insignificant and require further consideration.

46. No further updates have been made regarding EIA scale PVAs and so we have again utilised the PVA metrics from the EIA scale (BDMPS and biogeographic scale) GBBG PVAs undertaken by Norfolk Boreas (MacArthur Green 2019), which used the 'Seabird PVA Tool'. We highlight that we raised some issues with these PVAs during the Boreas examination and that no changes were made to the models. However, these models nevertheless currently represent the best available evidence on which to base an assessment, though this should not be taken as a Natural England endorsement or 'acceptance' of the model outputs.

47. Using the PVA models undertaken by Norfolk Boreas in MacArthur Green (2019), if the additional mortality from the offshore wind farms is 1,000-1,100 per annum (closest PVA outputs to the cumulative collision mortality figures of 979 excluding Hornsea Project 4, DEP and SEP and of 1,003 including all projects) then:

- The BDMPS population after 30 years will be 30.70-33.23% lower than it would have been in the absence of the additional mortality using the density independent model and 25.54-27.75% lower using the density dependent model. The population growth

rate would be reduced by 1.18-1.30% using the density independent model and by 0.95-1.04% using the density dependent model (Table 6).

- The biogeographic population after 30 years will be 13.26-14.48% lower than it would have been in the absence of the additional mortality using the density independent model and 10.56-11.55% lower using the density dependent model. The population growth rate would be reduced by 0.46-0.50% using the density independent model and by 0.36-0.40% using the density dependent model (Table 6).

Table 6 Predicted Population impacts on the GBBG BDMPS and biogeographic population for the range of mortality impacts predicted for cumulative collision. PVA Impact Metrics are as provided in Table 3.18 of MacArthur Green (2019). The range of predicted figures are indicated in purple. The darker shaded cells represent the level of impact closest to the combined cumulative collision predictions

GBBG, EIA CUMULATIVE COLLISIONS – DENSITY INDEPENDENT PVA MODELS						
Additional mortality	% baseline mortality largest BDMPS as used by Applicant	Counterfactual of Final Population Size (CPS), BDMPS	Counterfactual of Growth Rate (CGR), BDMPS	% baseline mortality biogeographic, as used by Applicant	Counterfactual of Final Population Size (CPS), biogeographic	Counterfactual of Growth Rate (CGR), biogeographic
1,000	5.91	0.6930	0.9882	2.30	0.8674	0.9954
1,100	6.51	0.6677	0.9870	2.53	0.8552	0.9950
1,200	7.10	0.6437	0.9859	2.76	0.8432	0.9945
GBBG, EIA CUMULATIVE COLLISIONS – DENSITY DEPENDENT PVA MODELS						
Additional mortality	% baseline mortality largest BDMPS as used by Applicant	Counterfactual of Final Population Size (CPS), BDMPS	Counterfactual of Growth Rate (CGR), BDMPS	% baseline mortality biogeographic, as used by Applicant	Counterfactual of Final Population Size (CPS), biogeographic	Counterfactual of Growth Rate (CGR), biogeographic
1,000	5.91	0.7446	0.9905	2.30	0.8944	0.9964
1,100	6.51	0.7225	0.9896	2.53	0.8845	0.9960
1,200	7.10	0.7014	0.9886	2.76	0.8746	0.9957

48. GBBG is classed as 'Least Concern' of global extinction by IUCN. The overall population trend across its range is stable, although at a UK level the species is Amber listed in BoCC 5 (Stanbury *et al.* 2021) due to moderate declines in both the breeding and non-breeding populations.

49. Based on consideration of the PVA metrics presented, the above conservation assessment and particularly that the GBBG population is stable to possibly declining and that we are not aware of any evidence to suggest that the population is going to start increasing, the predicted impacts at the North Sea population scale have the potential to give rise to significant effects. **Therefore, we are unable to rule out a significant adverse impact on GBBG from cumulative collision mortality at an**

EIA scale irrespective of whether the Hornsea Project 4, DEP and SEP projects are included in the cumulative totals or not.

7) Guillemot Cumulative Operational Displacement

50. Based on the Applicants' updated figures presented in Table 7 of MacArthur Green & Royal Haskoning DHV (2021), the annual total cumulative number of guillemots to be at risk of displacement for all projects **excluding** Hornsea Project 4, DEP and SEP is estimated to be 341,495.

51. For the Natural England recommended rate ranges of 30-70% displacement and 1-10% mortality, the number of predicted additional cumulative mortalities **excluding** Hornsea Project 4, DEP and SEP is between 1,024 (30% displacement and 1% mortality) and 23,905 (70% displacement and 10% mortality) guillemots. This equates to 0.36-8.35% of baseline mortality for the largest BDMPS (Table 7). This is significant towards the upper level of the displacement/mortality range that the SNCBs advise for auks (30-70% displacement and 1-10% mortality) and therefore requires further consideration.

52. Based on the Applicants' updated figures presented in Table 7 of MacArthur Green & Royal Haskoning DHV (2021), the annual total cumulative number of guillemots to be at risk of displacement for all projects **including** Hornsea Project 4, DEP and SEP is estimated to be 438,542.

53. For the Natural England recommended rate ranges of 30-70% displacement and 1-10% mortality, the number of predicted additional cumulative mortalities **including** Hornsea Project 4, DEP and SEP is between 1,316 (30% displacement and 1% mortality) and 30,698 (70% displacement and 10% mortality) guillemots. This equates to 0.46-10.72% of baseline mortality for the largest BDMPS (Table 7). Again, this is significant towards the upper level of the displacement/mortality range that the SNCBs advise for auks (30-70% displacement and 1-10% mortality) and therefore requires further consideration.

54. Table 7 below indicates that when considering the cumulative totals, either excluding or including Hornsea Project 4, DEP and SEP, for the Natural England recommended range of 30-70% displacement and 1-10% mortality and the predicted impacts against baseline mortality for the largest BDMPS:

- 1% of baseline mortality of the largest BDMPS is only exceeded for displacement at 70% or above and 1% mortality when Hornsea Project 4, DEP and SEP are included in the cumulative total, but not for any displacement scenario (30-70%) at 1% mortality when these projects are excluded from the cumulative total. When a 2% mortality rate is used, 1% of baseline mortality is exceeded when displacement exceeds 30% including Hornsea Project 4, DEP and SEP, or when it exceeds 40% when these projects are excluded.

- At 4% mortality and above, 1% of baseline mortality is exceeded at all displacement rates from 30-70% including or excluding Hornsea Project 4, DEP and SEP.

Table 7 Percent of baseline mortality (using 14% average across all age class mortality rates, as used by the Applicants) that predicted guillemot cumulative operational displacement impacts equate to of largest BDMPS for Natural England preferred range of 30-70% displacement and 1-10% mortality for calculated cumulative totals excluding and including Hornsea 4, DEP and SEP. Shaded cells are those where 1% of baseline mortality is exceeded

EXCLUDING HORNSEA 4, DEP & SEP							
Displacement (%)	% Baseline mortality of largest BDMPS*						
	Mortality rate (%)						
	1	2	4	5	6	8	10
30	0.36	0.72	1.43	1.79	2.15	2.86	3.58
40	0.48	0.95	1.91	2.39	2.86	3.82	4.77
50	0.60	1.19	2.39	2.98	3.58	4.77	5.96
60	0.72	1.43	2.86	3.58	4.29	5.73	7.16
70	0.83	1.67	3.34	4.17	5.01	6.68	8.35
INCLUDING HORNSEA 4, DEP & SEP							
Displacement (%)	% Baseline mortality of largest BDMPS*						
	Mortality rate (%)						
	1	2	4	5	6	8	10
30	0.46	0.92	1.84	2.30	2.76	3.68	4.60
40	0.61	1.23	2.45	3.06	3.68	4.90	6.13
50	0.77	1.53	3.06	3.83	4.60	6.13	7.66
60	0.92	1.84	3.68	4.60	5.51	7.35	9.19
70	1.07	2.14	4.29	5.36	6.43	8.58	10.72

* 2,045,078 individuals for largest North Sea Population scale (from Furness 2015)

55. Guillemot are listed as 'least concern' on the IUCN Red List (Birdlife International 2018). It is listed as Amber on BoCC 5 (Stanbury *et al.* 2021) due to:

- Localisation of breeding population within Important Bird Areas (IBAs)/Special Protection Areas (SPAs) – more than 50% of the UK population found at ten or fewer sites (SPAs/IBAs) in the breeding season (Stanbury *et al.* 2021).
- International importance of UK population – threshold of 20% of European population (Stanbury *et al.* 2021).

56. While there is some empirical evidence to support the displacement levels for auks, we do not know what the likely mortality impacts of displacement are. We therefore consider it appropriate to consider a range of mortalities from 1-10%. However, on the basis that the projects that have been scoped into the assessment lie in areas of the North Sea that represent low to medium levels of guillemot density during both the breeding (where relevant) and non-breeding seasons (Seabird Sensitivity Mapping Tool), it is assumed that areas of low/medium density will be less important/desirable feeding areas and therefore mortality impacts of displacement from less good areas would be lower than displacement from optimal/important areas. Therefore, we do not expect mortality rates to be at the top of the range considered.

57. Predicted cumulative mortality predictions exceed 1% of baseline mortality of the largest BDMPS at a 2% mortality rate and when displacement rates fall between 30% and 50%, the specific displacement rate depending on whether Hornsea Project 4, DEP and SEP are included in the cumulative total or not. **Therefore, we advise a significant adverse impact to guillemot from cumulative operational displacement cannot be ruled out at an EIA scale irrespective of whether the Hornsea Project 4, DEP and SEP projects are included in the cumulative totals or not.**

8) Razorbill Cumulative Operational Displacement

58. As noted in Section 1 above, there is a minor discrepancy between the cumulative razorbill abundance at risk of displacement of 4 birds between Natural England's total for all projects excluding Hornsea Project 4, DEP and SEP (123,852) and the Applicants' total (123,848) in Table 8 of MacArthur Green & Royal Haskoning DHV (2021). This is also the case for the totals for all projects including the Hornsea4, DEP and SEP projects. This minor discrepancy is likely due to rounding differences in the annual totals for some projects going into the cumulative total, but does not

make a material difference to the predicted cumulative razorbill mortalities across the recommended range of 30-70% displacement and 1-10% mortality.

59. Based on Natural England's calculated totals, the annual total cumulative number of razorbills to be at risk of displacement for all projects **excluding** Hornsea Project 4, DEP and SEP is estimated to be 123,852 (compared to 123,848 calculated by the Applicants).

60. For the Natural England recommended rates of 30-70% displacement and 1-10% mortality, the number of predicted additional cumulative mortalities **excluding** Hornsea Project 4, DEP and SEP is between 372 (30% displacement and 1% mortality) and 8,670 (70% displacement and 10% mortality) razorbills. This equates to 0.36-8.42% of baseline mortality for the largest BDMPS (Table 8). This is significant towards the upper level of the displacement/mortality range that the SNCBs advise for auks (30-70% displacement and 1-10% mortality) and therefore requires further consideration.

61. Based on Natural England's calculated totals, the annual total cumulative number of razorbills to be at risk of displacement for all projects **including** Hornsea Project 4, DEP and SEP is estimated to be 139,527 (compared to 139,523 calculated by the Applicants).

62. For the Natural England recommended rates of 30-70% displacement and 1-10% mortality, the number of predicted additional cumulative mortalities **including** Hornsea Project 4, DEP and SEP is between 419 (30% displacement and 1% mortality) and 9,767 (70% displacement and 10% mortality) razorbills. This equates to 0.41-9.48% of baseline mortality for the largest BDMPS (Table 8). Again, this is significant at the upper level of the displacement/mortality range that the SNCBs advise for auks (30-70% displacement and 1-10% mortality) and therefore requires further consideration.

63. Table 8 below indicates that when considering the cumulative totals, including or excluding Hornsea Project 4, DEP and SEP for the Natural England recommended range of 30-70% displacement and 1-10% mortality and the predicted impacts against baseline mortality for the largest BDMPS:

- 1% of baseline mortality of the largest BDMPS is not exceed for any displacement scenario (30-70%) at 1% mortality;

- At 4%-10% mortality, 1% of baseline mortality is exceeded at all displacement rates from 30-70%.

Table 8 Percent of baseline mortality (using 17.4% average across all age class mortality rates, as used by the Applicants) that predicted razorbill cumulative operational displacement impacts equate to of largest BDMPS for Natural England preferred range of 30-70% displacement and 1-10% mortality for calculated cumulative totals excluding and including Hornsea 4, DEP and SEP. Shaded cells are those where 1% of baseline mortality is exceeded

EXCLUDING HORNSEA 4, DEP & SEP							
Displacement (%)	% Baseline mortality of largest BDMPS*						
	Mortality rate (%)						
	1	2	4	5	6	8	10
30	0.36	0.72	1.44	1.80	2.16	2.89	3.61
40	0.48	0.96	1.92	2.41	2.89	3.85	4.81
50	0.60	1.20	2.41	3.01	3.61	4.81	6.01
60	0.72	1.44	2.89	3.61	4.33	5.77	7.22
70	0.84	1.68	3.37	4.21	5.05	6.73	8.42
INCLUDING HORNSEA 4, DEP & SEP							
Displacement (%)	% Baseline mortality of largest BDMPS*						
	Mortality rate (%)						
	1	2	4	5	6	8	10
30	0.41	0.81	1.63	2.03	2.44	3.25	4.06
40	0.54	1.08	2.17	2.71	3.25	4.34	5.42
50	0.68	1.35	2.71	3.39	4.06	5.42	6.77
60	0.81	1.63	3.25	4.06	4.88	6.50	8.13
70	0.95	1.90	3.79	4.74	5.69	7.59	9.48

* 591,874 individuals for largest North Sea Population scale (from Furness 2015)

64. Razorbill are listed as 'near threatened' on the IUCN Red List (Birdlife International 2021). It is listed as Amber on BoCC 5 (Stanbury *et al.* 2021) due to:

- Localisation of breeding population within Important Bird Areas (IBAs)/Special Protection Areas (SPAs) – more than 50% of the UK population found at ten or fewer sites (SPAs/IBAs) in the breeding season (Stanbury *et al.* 2021).

- International importance of UK population – threshold of 20% of European population (Stanbury *et al.* 2021).

65. While there is some empirical evidence to support the displacement levels for auks, we do not know what the likely mortality impacts of displacement are. We therefore consider it appropriate to consider a range of mortalities from 1-10%. However, on the basis that the projects that have been scoped into the assessment lie in areas of the North Sea that represent low to medium levels of razorbill density during both the breeding (where relevant) and non-breeding seasons (Seabird Sensitivity Mapping Tool), it is assumed that areas of low/medium density will be less important/desirable feeding areas and therefore mortality impacts of displacement from lower quality areas would be lower than displacement from optimal/important areas. Therefore, we do not expect mortality rates to be at the top of the range considered.

66. Predicted cumulative mortality predictions exceed 1% of baseline mortality of the largest BDMPS at a 2% mortality rate and between 40 and 50% displacement. **Therefore, we advise that a significant adverse impact to razorbill from cumulative operational displacement cannot be ruled out at an EIA scale irrespective of whether the Hornsea Project 4, DEP and SEP projects are included in the cumulative totals or not**.

REFERENCES

Balmer, D., Gillings, S., Caffrey, B., Swann, R., Downie, I. & Fuller, R. (2013) *Bird Atlas 2007–11: the breeding and wintering birds of Britain and Ireland.* BTO Books, Thetford.

BirdLife International (2018) *The IUCN Red List of Threatened Species 2018.*

BirdLife International (2021) *The IUCN Red List of Threatened Species 2021.*

Furness, R.W. (2015) *Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS)*. Natural England Commissioned Report Number 164. 389 pp.

JNCC (2021) *Seabird Population Trends and Causes of Change: 1986-2019 Report* ██████████████████████████████. Joint Nature Conservation Committee. Updated May 2021.

MacArthur Green (2019) Norfolk Boreas Offshore Wind Farm: Deadline 2 Offshore Ornithology Assessment Update. Document Reference ExA; AS-1.D2.V1. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-001420-Offshore%20Ornithology%20Assessment%20Update.pdf

MacArthur Green & Royal Haskoning DHV (2021) *East Anglia Two and East Anglia One North Offshore Windfarms Updated Offshore Ornithology Cumulative and In-Combination Collision Risk and Displacement Assessment.* Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010077/EN010077-007519-ExA.AS-3.SoSQ.V1%20Updated%20Offshore%20Ornithology%20Cumulative%20and%20In%20Combination%20Collision%20Risk%20and%20Displacement%20Assessment.pdf

SNCBs (JNCC, NE, NIEA, NRW, SNH) (2017) *Joint SNCB Interim Displacement Advice Note: Advice on how to present assessment information on the extent and potential consequences of seabird displacement from Offshore Wind Farm (OWF) developments, January 2017*.

Stanbury, A., Eaton, M., Aebischer, N., Balmer, D., Brown, A., Douse, A., Lindley, P., McCulloch, N., Noble, D. & Win, I. (2021) The status of our bird populations: the fifth Birds of Conservation Concern in the United Kingdom, Channel Islands and Isle of Man and second IUCN Red List assessment of extinction risk for Great Britain. *British Birds*, 114: 723-747.