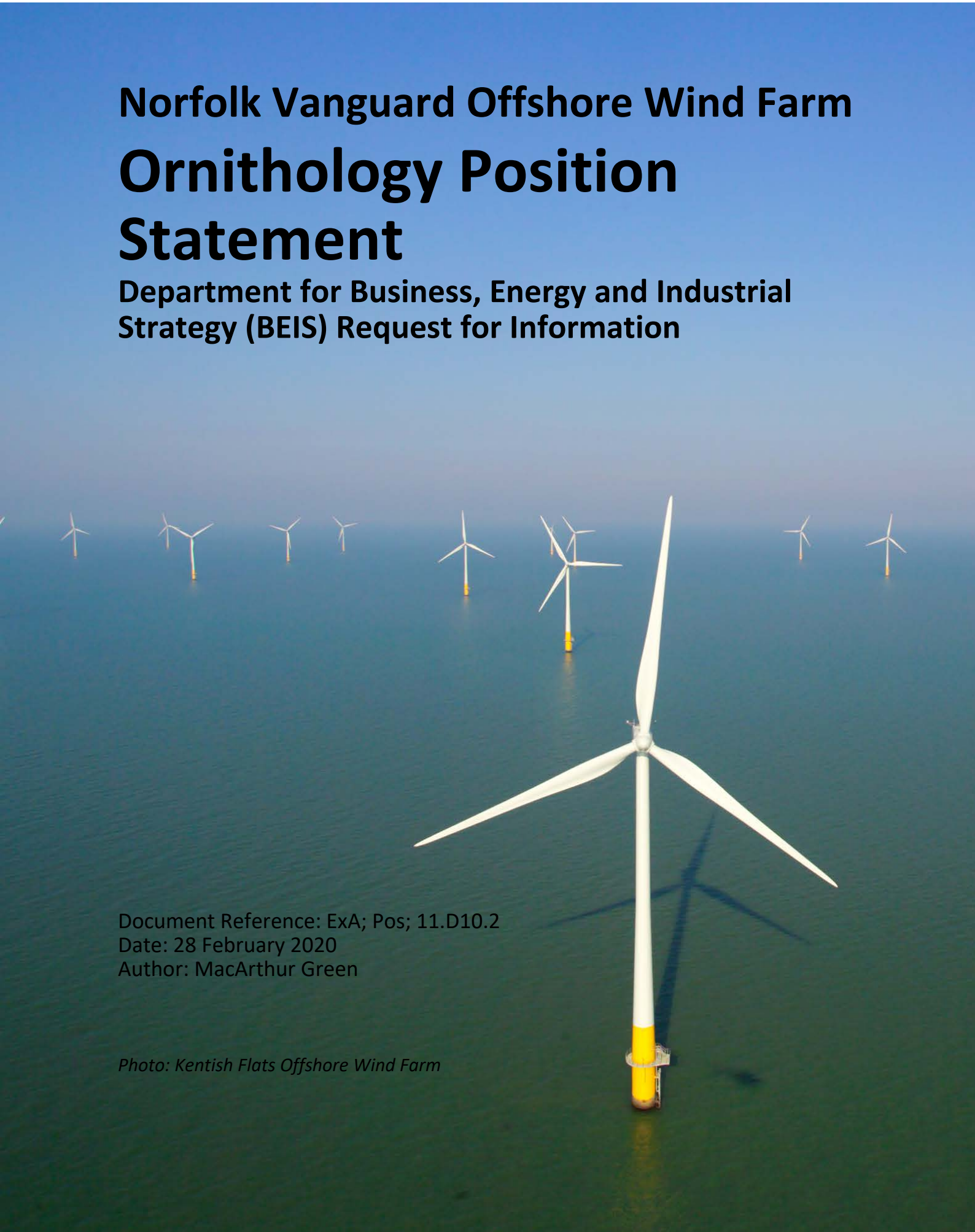
VATTENFALL

Norfolk Vanguard Offshore Wind Farm

Ornithology Position Statement

Department for Business, Energy and Industrial Strategy (BEIS) Request for Information



Document Reference: ExA; Pos; 11.D10.2
Date: 28 February 2020
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Photo: Kentish Flats Offshore Wind Farm

Date	Issue No.	Remarks / Reason for Issue	Author	Checked	Approved
24/02/20	01D	First draft for Norfolk Vanguard Ltd review	MT	RS/VR/JH	RS
28/02/2020	01F	Final	MT	RS	RS

Table of Contents

1 INTRODUCTION

1.1 Purpose of this Document

1. This document provides the Applicant's position regarding the potential effects of Norfolk Vanguard Offshore Wind Farm ('the Project') on the kittiwake feature of the Flamborough and Filey Coast (FFC) Special Protection Area (SPA) and lesser black backed gull (LBBG) feature of the Alde-Ore Estuary (AOE) SPA. This reflects commitments to mitigation made by the Applicant in the Development Consent Order (DCO) application and during the Norfolk Vanguard Examination, combined with further mitigation proposed by the Applicant in response to a letter from the Department for Business, Energy and Industrial Strategy (BEIS) dated 6 December 2019.

   "In relation to in-combination impacts on the qualifying kittiwake feature of the Flamborough and Filey Coast Special Protection Area ("SPA") and the qualifying lesser black-backed gull feature of the Alde-Ore Estuary SPA, the Applicant, in consultation with Natural England as necessary, is invited to provide information on any mitigation, not discussed during the Examination, which could lessen or avoid any adverse effects on the integrity of these sites.

   In addition, or alternatively, the Applicant, in consultation with Natural England as necessary, is invited to provide evidence as to:

   - *whether there are any feasible alternative solutions to the Norfolk Vanguard project which could avoid or lessen any adverse effects on the integrity of these sites;*
   - *any imperative reasons of overriding public interest for the Norfolk Vanguard project to proceed; and*
   - *any in-principle compensatory measures proposed to ensure that the overall coherence of the network of Natura 2000 sites is protected."*

2. Following considerable reductions in the predicted impacts from the Project as a result of additional mitigation (as detailed in Section 1.3), the Applicant firmly maintains the position presented during the Examination, and updated in this document, that in respect of these designated sites, an adverse effect on integrity (AEoI) as a result of the Project alone and in-combination can be ruled out beyond reasonable scientific doubt.

3. However, without prejudice to the Applicant's position regarding no AEoI, the Applicant notes that the letter from BEIS requests consideration of alternative solutions, consideration of Imperative Reasons of Overriding Public Interest (IROPI)

and options for "*in-principle*" compensatory measures for the qualifying kittiwake feature of the Flamborough and Filey Coast SPA and the qualifying lesser black-backed gull feature of the Alde-Ore Estuary SPA . The Applicant has therefore provided an assessment of alternative solutions and IROPI in the HRA Derogation Provision of Evidence (document reference ExA; IROPI; 11.D10.3). In principle compensatory measures in relation to the kittiwake feature of the Flamborough and Filey Coast SPA and lesser black backed gull feature of the Alde-Ore Estuary SPA are provided in Appendices 1 and 2 of the HRA Derogation Provision of Evidence (document references ExA; IROPI; 11.D10.3.App1 and ExA; IROPI; 11.D10.3.App2).

4. These in-principle compensatory measures could be secured and delivered should the Secretary of State (SoS) conclude AEoI on the qualifying kittiwake feature of the FFC SPA or on the qualifying lesser black-backed gull feature of the Alde-Ore Estuary SPA .

5. However, it is the Applicant's firm conclusion that there is no AEoI for these sites as a result of the Project alone and in-combination.

1.2 Consultation

6. Since the release of the letter from BEIS, the Applicant has undertaken extensive consultation with key stakeholders and in particular Natural England and the Marine Management Organisation (MMO), as detailed in the Summary Overview (document reference ExA; Consult; 11.D10.3).

7. The consultation has involved meetings and a number of submissions by the Applicant regarding additional mitigation proposed to reduce ornithology collision risk as well as in-principle compensation proposals.

8. The comments provided by Natural England and the MMO have been used to refine the Applicant's final submissions. This has included provision of further details on the scope for impact mitigation and the commercial and physical constraints within which this mitigation has been developed. Similarly, the in-principle compensation proposals have been refined through this process, to provide additional details on spatial scale, timescales and delivery mechanisms.

9. The Applicant has taken a pro-active approach to consultation and has engaged with other relevant stakeholders in relation to in-principle compensation measures including the RSPB and National Trust. This consultation is detailed in the Consultation Overview (ExA; Consult; 11.D10.3).

1.3 Additional mitigation

10. Additional mitigation proposed by the Applicant is detailed in document reference

ExA; Mit; 11.D10.2 ('Additional Mitigation'). Updated collision risk modelling based on these commitments is provided in Appendix 1 of the Additional Mitigation (document reference ExA; Mit; 11.D10.2.App1).

11. This includes the following measures:

- Reduced maximum number of turbines from 180 to 158 by increasing the minimum turbine size from 10MW to 11.55MW; and
- Increased draught height:
  - Minimum draught height increased from 27m to 35m (above MHWS[1]) for turbine models up to and including 14.6MW capacity; and
  - Minimum draught height increased from 27m to 30m (above MHWS) for turbine models of 14.7MW and above.

12. These design options have been developed following engagement between the Applicant and the supply chain for both turbine manufacturers and construction vessels in order to understand the constraints of what it is feasible to build based on the current supply chain, and in terms of the Project design envelope, considering what is anticipated to be feasible within the Project's construction time frame.

13. Following engagement between the Applicant and the supply chain, it is understood that installation vessels currently available on the market could install turbines with a hub height up to 145 - 150m. The installation capacity of vessels currently available is therefore a key factor in relation to the maximum draught height increase that can be secured; other factors include rotor diameter and turbine weight.

14. As a result of the further mitigation, the Applicant is now progressing a design which is at the limit of current commercial availability both in relation to installation vessel capacity and turbine capacity. The Applicant needs to maintain an option within its envelope that considers current market availability in order to ensure certainty of deliverability. Furthermore, the Applicant must maintain some flexibility as the availability of these largest vessels at the time of construction of the Project cannot be guaranteed, given the number of other offshore wind farms currently in development.

[1] It should be noted that in documents reporting on collision risk modelling submitted for Norfolk Vanguard prior to Deadline 8 (AS-049) rotor draught heights were given in relation to Highest Astronomical Tide (HAT) while subsequent ones were given in relation to Mean High Water Springs (MHWS). As was noted in AS-049, this was an error in labelling only, with HAT mistakenly used in place of MHWS. The tidal offset used in the collision risk modelling to adjust to Mean Sea Level (MSL) was the same throughout and should have been stated as relating to MHWS from the outset. It is important to state that the draught heights presented for the project through the course of the application, examination and in the current submission (i.e. 22m, 27m, 30m and 35m) have at all times been in relation to MHWS.

15. It is also relevant to note that there are various factors which influence draught height including water depths and potential impacts on radar line of sight; draught heights are therefore site specific. Furthermore, when comparing draught heights between projects, the point of reference to which the draught height is measured (i.e. MHWS, Highest Astronomical Tide (HAT) or Lowest Astronomical Tide (LAT)) should also be considered.

16. As a result of the further mitigation committed to by the Applicant, the overall reduction in the total (North Sea scale) predicted collision risks from the estimates submitted in the original assessment as part of the DCO application to those for the worst case in Table 2.1 (the 14.7MW turbine at 30m draught height) is 82% for kittiwake (from an annual EIA total of 318 to 56) and 70% for lesser black-backed gull (from an annual EIA total of 40 to 12).

17. As part of their written feedback, Natural England advised the Applicant to consider other possible design mitigations which could reduce collision risks, including reducing the number of turbines to achieve less than 1 individual kittiwake mortality from the Flamborough and Filey Coast SPA and the potential for seasonal turbine operation restrictions. These other mitigation options have also been considered fully by the Applicant and are presented in Additional Mitigation (ExA; Mit; 11.D10.2) and summarised in section 2.3.

18. Thus, the Applicant considers that the mitigation options have been taken as far as feasible within the confines of commercial viability and meeting the Project's generating aims and the UK Government's environmental targets.

19. Updated assessment (section 2) using the revised Project design has reduced collision impacts to very low levels (mortality of kittiwake from Flamborough and Filey Coast Special Protection Area (SPA) is now 21 and of lesser black-backed gull from Alde-Ore Estuary SPA is 2.6[2]). Consequently, the magnitude of impacts from the Project is now at a comparable, or lower, level to those for previously consented projects for which Natural England and the Secretary of State (SoS) have been able to conclude there was no risk of adverse effects on the integrity of SPA populations. Therefore the Applicant is of the firm opinion that the same conclusion can be made for Norfolk Vanguard.

[2] Note these estimates are those obtained using Natural England's precautionary methods. The Applicant's methods indicate that the equivalent figure for kittiwake is 4.6 and for lesser black-backed gull is 1.6.

2 SUMMARY OF APPLICANT'S POSITION

2.1 Summary of Revised Collision Risk Modelling

2.1.1 Norfolk Vanguard alone

20. At the close of the Project examination the wind farm design comprised 180 x 10MW turbines with a minimum draught height (the gap between the lower rotor tip and the sea level at Mean High Water Springs, MHWS[1]) of 27m, which was a refinement from the DCO submission which was based on 200 x 9MW turbines with a draught height of 22m. The overall reduction in collisions averaged across species for these revisions was 65%.

21. As noted above, following the close of Examination, Norfolk Vanguard has undertaken further investigations into the design envelope and has now committed to additional design restrictions in order to further reduce the predicted collision risks. In summary, this includes an increase in the minimum turbine capacity, with 11.55MW the smallest turbine now being considered within the design envelope and a corresponding reduction in the maximum number of turbines to 158 x 11.55MW. Additionally, the Applicant has committed to a further increase in minimum draught height to 35m (above MHWS) for turbine models up to and including 14.6MW capacity, and to 30m above MHWS for turbine models of 14.7MW and above.

22. At these two draught heights (30m and 35m) the worst case turbine options (with respect to collision risk) are the 14.7MW and 11.55MW respectively, and of these two the overall worst case collision predictions are obtained for the 14.7MW turbine.

2.1.1.1 Flamborough and Filey Coast SPA - kittiwake

23. As a result of the additional mitigation, using Natural England's preferred parameters (which the Applicant considers to be highly precautionary), the annual kittiwake mortality apportioned to the Flamborough and Filey Coast SPA has reduced from 44 individuals (as at the close of Examination) to 21, while using the Applicant's preferred parameters, the reduction is from 9.6 to 4.6 individuals (the Applicant has derived these parameters from a robust analysis of available evidence).

24. Thus the 14.7MW turbine at 30m has predicted collision risks which are over 50% lower for kittiwake compared with the estimate submitted at the close of the project examination for the 10MW turbine at a draught height of 27m (REP7-062) and 85% lower than the figures in the original application.

2.1.1.2 Alde-Ore Estuary SPA – lesser black-backed gull

25. Using Natural England's preferred parameters, the annual lesser black-backed gull mortality apportioned to the Alde-Ore Estuary SPA has reduced from 5 individuals (as at the close of Examination) to 2.6, while using the Applicant's preferred parameters, the reduction is from 3 to 1.6 individuals (again derived from a robust analysis of available evidence).

26. Thus, the 14.7MW turbine at 30m has predicted collision risks which are 46% lower for lesser black-backed gull compared with the estimate submitted at the close of the project examination for the 10MW turbine at a draught height of 27m (REP7-062) and 73% lower than the figures in the original application. The revised collision estimates for all species are now comparable or lower to those for consented projects, and on a per megawatt basis, Norfolk Vanguard's impacts are an order of magnitude lower than those for most North Sea wind farms consented in the last five years.

2.1.2 In combination

2.1.2.1 Flamborough and Filey Coast SPA - kittiwake

27. Using the Applicant's estimate for Norfolk Vanguard of 4.6 individuals, the total in-combination kittiwake collision risk for the Flamborough and Filey Coast SPA population is estimated to be between 677 (including the estimate for Hornsea Project Three which Natural England has advised the Applicant to use[3] and the preliminary estimate for Hornsea Project Four) and 338 when the two Hornsea projects are omitted (as advised by Natural England). If the Natural England estimate of 21 individuals is used (in place of the Applicant's figure of 4.6), these cumulative totals are 693 and 355 respectively (see ExA; Mit; 11.D10.2.App1 for the complete in-combination table).

28. Norfolk Vanguard's contribution to the total using Natural England figures is between 6% (=21/355) and 3% (=21/693) and using the Applicant's figure is therefore between 1.4% (=4.6/338) and 0.6% (=4.6/677). It is clear that this is a very small contribution to the total and would make no material difference to the impact on the SPA population.

29. Outputs from a Population Viability Analysis (PVA) model for this population were presented for the Hornsea Project Three wind farm (MacArthur Green 2018). The outputs from these models for mortality levels of 300, 400, 650 and 700 are provided in Table 1.

[3] These were taken from Hornsea Project 3 Appendix 13 to Deadline 7 submission - Collision Risk Estimates for Mitigation Scenarios, 14th March 2019.

Table 1. Kittiwake FFC SPA population modelling results from MacArthur Green (2018).

Model	Demographic rate set	Adult mortality	Counterfactual metric (after 30 years)		Source table (MacArthur Green 2018)
Density independent	1	300	0.997	0.906	Tables A2_5.1 & A2_5.3
	2		0.997	0.907	Tables A2_7.1 & A2_7.3
Density dependent	1		0.999	0.973	Tables A2_6.1 & A2_6.3
	2		0.999	0.971	Tables A2_8.1 & A2_8.3
Density independent	1	400	0.996	0.877	Tables A2_5.1 & A2_5.3
	2		0.995	0.877	Tables A2_7.1 & A2_7.3
Density dependent	1		0.999	0.963	Tables A2_6.1 & A2_6.3
	2		0.999	0.959	Tables A2_8.1 & A2_8.3
Density independent	1	650	0.993	0.809	Tables A2_5.1 & A2_5.3
	2		0.993	0.809	Tables A2_7.1 & A2_7.3
Density dependent	1		0.999	0.940	Tables A2_6.1 & A2_6.3
	2		0.999	0.936	Tables A2_8.1 & A2_8.3
Density independent	1	700	0.992	0.795	Tables A2_5.1 & A2_5.3
	2		0.992	0.795	Tables A2_7.1 & A2_7.3
Density dependent	1		0.999	0.935	Tables A2_6.1 & A2_6.3
	2		0.998	0.930	Tables A2_8.1 & A2_8.3

30. Although both counterfactual measures (of population size and population growth rate) are presented in Table 1, the Applicant considers that the counterfactuals of population growth rate are more informative and credible for assessment purposes for the following reasons:

- The counterfactual of population growth rate can be compared to recent and longer-term population trends and represents a measure of the population's resilience and ability to regenerate. It is also relatively insensitive to the absolute value for the baseline rate of growth or direction (positive or negative);
- In contrast, the counterfactual of population size is much more sensitive to the predicted population trend (strength of growth and direction). This is particularly true in the absence of density dependence. For example, a population with a positive growth rate will grow exponentially, with the result that very large differences can be obtained in the baseline (unimpacted) population size and impacted population size (neither of which predictions are credible since seabird populations are constrained by factors such as nest site availability, prey availability, etc.).

31. For these reasons the interpretation of PVA outputs focusses on the counterfactuals of population growth rate.

32. The maximum reduction in the population growth rate, at an adult mortality of 700 using the more precautionary density independent model was 0.8% (0.992). Using the more realistic density dependent model the reduction would be 0.2% (0.998).

33. The maximum reduction in growth rate, suggests that even this worst case and unrealistic scenario represents a degree of change which would almost certainly be undetectable.

34. The stated conservation objective for the kittiwake feature of the SPA is to restore the population to the 1987 estimate of 83,700 pairs. The kittiwake breeding numbers at the Flamborough and Filey Coast SPA have remained between 40,000 and 50,000 pairs over the last 20 years, so this target would not appear currently to be being achieved. Furthermore, the Applicant notes that there are several compelling reasons to consider that the apparent population estimate in 1987 was recorded in error and in fact represented the estimate of breeding individuals and not of pairs, with the consequence that the 1987 population estimate was in fact 42,000 pairs (e.g. Coulson 2011, 2017).

35. Therefore, although the kittiwake population has shown a small amount of growth over the last two decades, suggesting that it could be on track to achieving the stated conservation objective, there is robust scientific evidence that the target objective for this population is in fact erroneous. This would suggest that the population is maintaining itself around a size of 40,000-50,000 pairs.

36. On the basis of the more realistic density dependent population model predictions, and the best guide to future trends available (i.e. the recent trend in the population) even the highly precautionary upper estimate of the number of in-combination kittiwake collisions attributed to the Flamborough & Filey Coast SPA (700) is not at a level which would trigger a risk of population decline, but would merely result in a very slight reduction in the growth rate currently seen at this colony.

37. In addition to the very precautionary assumption that 86% of the breeding season collisions (assuming this extends from March to August inclusive) on Norfolk Vanguard are birds from the FFC SPA, the collision total also includes several other sources of precaution, including over-estimated nocturnal activity for the current and other projects and the use of consented collision estimates for projects which have since been constructed to designs which will have much lower collision risks (see section 2.2.1 for further details).

38. It is therefore the Applicant's firm position that it can be concluded that there will be no adverse effect on the integrity of Flamborough & Filey Coast SPA from impacts on

kittiwake due to the proposed Norfolk Vanguard project either alone or in-combination with other plans and projects.

2.1.2.2 Alde-Ore Estuary SPA – lesser black-backed gull

39. Using the Applicant's estimate for Norfolk Vanguard of 1.6 individuals, the total in-combination lesser black-backed gull collision risk for the Alde-Ore Estuary SPA population is estimated to be 52.7. If the Natural England estimate of 2.6 individuals is used, this figure is 53.7. (see ExA; Mit; 11.D10.2.App1 for a complete in-combination table).

40. Norfolk Vanguard's contribution to the total using Natural England figures is therefore 4.8% (=2.6/58), and using the Applicant's figures is 3.0% (=1.6/57).

41. A population model has been developed to provide further interpretation of these potential in-combination impacts (MacArthur Green 2019). This model follows current Natural England guidance, utilising a matched-run approach to generate counterfactuals of population size and counterfactuals of population growth rate and was run for a simulated period of 30 years. Summary results are provided in Table 2.

Table 2. Lesser black-backed gull Alde Ore Estuary SPA population modelling results (see MacArthur Green 2019 for details).

Model	Adult mortality	Counterfactual metric (after 30 years)	
		Growth rate	Population size
Density independent	55	0.986	0.669
Density dependent	55	0.997	0.881

42. As noted above (paragraph 21), the focus of the PVA interpretation is on the counterfactual of population growth rate, as this is considered to provide a more robust and credible measure of population status.

43. Taking the modelled adult mortality of 55 (as the worst case), the population growth rate was predicted to be 1.4% lower (0.986) than the baseline using the precautionary density independent model, and 0.3% lower (0.997) using the density dependent model.

44. Even with the most precautionary combination of methods (see section 2.2), these reductions in growth rate are small (no more than 1.4%) and therefore are not considered likely to result in a population decline. The more realistic collision estimates, accounting for the reduced impacts from built wind farms compared with the consented designs and more appropriate levels of nocturnal activity, predict a growth rate reduction of no more than 0.3% (density independent) or 0.2% (density

dependent), which further reduces any concerns about the impact on the Alde-Ore Estuary SPA population.

45. It should be noted that the in-combination collision total predicted for the consented Galloper Wind Farm was estimated to be 85 (at a 99.5% avoidance rate), which the current total for Norfolk Vanguard (at a worst case of up to 53.7 remains well below, despite the addition of several more wind farms to the total. As noted elsewhere in this submission (ExA; IROPI; 11.D10.3), the SPA population is much smaller than the designated size (and has been since 2001), apparently as a consequence of various factors including changes in farming practice in the region and a shift of rural gull populations to urban locations. Thus, while there is a risk that the in-combination mortality as a result of the Project will delay the time at which the population will achieve the stated aim (to restore the population to 14,000 pairs), the actual contribution to this delay resulting from the in-combination mortality as a result of the Project will be undetectable, and it is other factors which have reduced the population and are likely to continue to be the primary drivers in determining the population status.

46. Given the degree of precaution in collision assessments, it is the Applicant's firm position that it can be concluded that there will be no adverse effect on the integrity of the Alde Ore Estuary SPA due to in-combination collisions of lesser black-backed gull.

2.2 Inherent Over-Precaution

47. The Applicant considers that ornithology impact assessment for offshore wind farms has become highly over-precautionary through the accumulation of individual precautionary elements at different stages of the assessment. It is important to stress that each of these individual elements is justifiable to a degree, however it is the combination of these elements which leads to the over-estimation of impact magnitude and hence over-precautionary predictions.

48. Of relevance to the current focus, the kittiwake collision risk assessment includes the following sources of precaution:

    a. Several of the collision risk modelling parameters are considered to be precautionary, for example:

        i. Nocturnal activity is likely to be half the level currently advised. Adjusting this to realistic levels reduces collision estimates by 10% to 30%;

ii. Advised flight speed (13m/s) is likely to be around 30% higher than realistic values (10m/s). Adjusting this to realistic levels reduces collision risks by around 10%;

b. The months treated as breeding season (March to August) extend into periods when large numbers of migrants are known to be passing through the southern North Sea to colonies further to the north (in March) and early post-breeding movements southwards (in August). Consequently, these peaks of migration movement which represent birds from a great many colonies have all been assigned to the Flamborough and Filey Coast SPA, over-estimating the presence of birds from the SPA.

c. The proportion of birds present on the wind farm during the breeding season is assumed by Natural England to be very high (86%) during all of the breeding months (noted above). This is based on a presumption of connectivity between the SPA and the wind farm derived from a single year of kittiwake tracking conducted at the SPA in late June and July. This study found that towards the end of the period of tracking individuals made trips of sufficient length that they could travel as far as Norfolk Vanguard (although only 3 of 18 individuals entered the Norfolk Vanguard site itself). However, there is no evidence that trips of this length would be undertaken in March, April or May, and indeed such long trip durations would likely be incompatible with successful breeding.

d. The population modelling methods preferred by Natural England are density independent, for the stated reason that there is insufficient understanding of the strength or form of density dependence for it to be included in population models. Thus, while Natural England agree that this is precautionary and unrealistic, these are the only model outputs which are considered.

49. Overall, as can be seen from this extensive list, while each element of precaution on its own does not necessarily result in an overly precautionary conclusion, it is the combined effect which is of primary concern and Natural England gives very little consideration to this accumulation of precaution when reaching conclusions on assessments.

2.2.1 Headroom

50. Cumulative and in-combination collision estimates are made up of the worst case mortality for each contributory wind farm, taken either from the relevant wind farm Environmental Statement (ES) or consent document (i.e. the Development Consent

Order (DCO)). Wind farm applications are submitted at an early stage in the process of the project design, at which time the developers may not know the precise nature and arrangement of turbines and associated infrastructure that make up the proposed development. Assessments are therefore typically presented using a 'Rochdale Envelope' approach to ensure impact assessment encompasses the worst case project design.

51. However, constructed wind farms, particularly more recent ones, rarely use the maximum number, or precise model, of turbines which were used in setting the parameters for the Rochdale Envelope or which are therefore secured in the consent. Technological developments mean that generating capacities can be attained with fewer, larger dimension turbines. This is highly relevant for cumulative collision estimations since collision mortalities are almost always lower for these 'as-built' developments when compared with those for the consented designs. The design revisions made by Norfolk Vanguard provide a prime example of this process, albeit crucially these changes have been made prior to the design being fixed in place as happens when a project is consented. For most recent wind farms, much less project design revision has occurred prior to consent, with the remainder occurring post-consent. The consequence of this is that much of the reduction in impacts which these post-consent design revisions represents is not reflected in the figures used by other wind farms in their cumulative assessments. The use of collision risk estimates based on worst case scenarios is therefore likely to lead to a potential over-estimate. This difference between impact magnitude for a consented design and that for the actually built wind farm is referred to as 'headroom'.

52. When assessing collision risk, the figures used in the collision risk model are either derived from the figures used in the worst case assessment, or the figures relevant to the consented schemes. Therefore there are two tiers to the headroom argument:

- Assessed versus consented; and
- Consented versus as-built.

53. On the matter of assessed versus consented, the Applicant has identified projects where the figures used in the collision risk model are derived from the worst case assessed, as opposed to the final scheme consented. In each case either the original Development Consent Order, or a non-material change, or a section 36 variation has reduced the parameters in the consent from what was originally assessed as the worst case. Therefore as with the East Anglia ONE decision, it must be without doubt that headroom has been created by those projects and that such headroom is "legally secured".

54. On consented versus as-built, there are a number of reasons why the Applicant considers that the as-built scheme (and its associated parameters) is "legally secured". This is partly due to the way in which the deemed marine licence (DML) conditions require approval of final layouts and certification of final layouts on completion of construction. In essence the Applicant's submission is no different to the MMO's and Natural England's recent (draft) advice on cable protection, that new areas of cable protection cannot be installed following certification that construction has completed. This is not least because, in a number of cases which the Applicant has so far considered, the age of the environmental information is now in excess of seven years. As Natural England state in their recent position statement on new areas of cable protection, environmental information which is more than five years old would be considered out of date and updated environmental information would be required. This includes any requirement for a further Habitats Regulation Assessment, which would therefore amount to a material change requiring a new consent.

55. To illustrate this point further, in February 2017, The Crown Estate launched a process to apply for wind farm extensions. Some of the extensions relate to projects which the Applicant has identified as having headroom between the consented and as-built figures. However there is no suggestion that those projects will extend under an existing consent. In fact, the Crown Estate's plan level appropriate assessment noted that a separate appropriate assessment, and therefore a new application, would need to be undertaken for each project.

56. In summary, the Applicant's position is that it is without doubt that there is legally secured headroom between the assessed and consented figures. In addition, the Applicant's position is that further "legally secured" headroom exists between the consented and the as-built projects, and this is supported by the MMO and NE's recent positions and previous advice on deployment of new areas of cable protection.

57. As such, the only remaining question is the extent to which headroom can be modelled and the figures agreed with Natural England, such that it can be taken into account in in-combination assessments to reduce the current level of in-combination impact.

58. Finally, the Applicant has provided a worked example of how headroom can be estimated using Hornsea Project One and Triton Knoll at Appendix 1. This considers the difference between the 'assessed' and 'consented' and between 'consented' and 'as-built' figures.

59. The headroom from these two projects has been calculated and, as shown in Table 3, amounts to 40 collisions at the HRA scale. The current number of collisions for Norfolk Vanguard is 21 using Natural England's preferred methods and 4.6 using the Applicant's preferred methods. If this level of headroom was applied to the Norfolk Vanguard project (using either the Applicant's or Natural England's numbers), the effect on collision risk would be to reduce the potential in-combination impacts on kittiwake to levels that were previously considered acceptable to avoid adverse effect on integrity and consented (using a building block approach without Hornsea Project Three).

Table 3. Assessed versus built Hornsea Project One and Triton Knoll Wind Turbine Generators (WTGs) and impact on kittiwake

Wind Farm	Assessed WTGs	Consented WTGs	Built WTGs	Impact scale	Assessed kittiwake CRM	Consented kittiwake CRM	Built kittiwake CRM	Headroom (reduction from assessed to built), number and percentage
Hornsea Project One	332	240	174	EIA	123	107*	71	52 (43%)
				HRA	41	36*	24	17 (41%)
Triton Knoll	333	90	90	EIA	209	Not available	75	134
				HRA	35.4	Not available	12.7	22.7
EIA Total difference								186
HRA Total difference								39.7

* Estimated as 13% reduction from assessed.

60. Natural England has acknowledged that there are instances of built wind farms which are smaller (for example, in collision risk terms) than the design on which the consent was granted and that there is therefore headroom available.

61. The Applicant has presented worked headroom figures for the two wind farms using the CRM update method developed for The Crown Estate (Trinder 2017). Natural England has agreed that in principle this calculation method is valid, however Natural England has concerns that if the input data are inaccurate then the results will be erroneous. While this concern is reasonable, the method is considered quite robust since there are only three key datasets required, and these can usually be confirmed from public documents. Indeed this is one of the method's key strengths. The only data required are the project's mortality estimates and the turbine parameters used to calculate them in the original application, and the revised turbine parameters. The only critical requirement is that the original turbine parameters and original mortality estimates correspond (i.e. the latter must have been calculated using the former). In most cases where this method could be applied

to update collision estimates it is very likely that these minimal data requirements will be met. It is also relevant that the mortality estimates used in the update method are the same as those already used in the cumulative and in-combination assessments, so there is a presumption that these are appropriate for this purpose.

62. The Crown Estate maintains a database of wind farm designs, consented and actual, and a copy of the tool which automatically updates collision predictions. When this tool was developed it was estimated that cumulative kittiwake collisions were over-estimated by around 17%, which equated to a total headroom of around 500 individuals at the North Sea scale and 40 individuals for Flamborough and Filey Coast SPA, from an in-combination total of 319 (Trinder 2017). For lesser black-backed gull collisions were over-estimated by up to 40% at the North Sea scale, equating to a headroom of 200 individuals (no Alde-Ore Estuary SPA estimate was presented).

63. In addition to revised wind farm designs post-consent, there are now also several wind farms which have submitted revised applications and for which the developers now have two consents (e.g. Inch Cape, Neart Na Gaoithe) with very different impact predictions; the earlier consents are based on wind farm designs with large numbers of small turbines with associated high collision risk estimates, while the later consents have fewer turbines and much lower collision estimates. For example, Inch Cape had a total kittiwake collision estimate of 301 on it original application and on its later one this figure is 72 (a reduction of 229). Neart Na Gaoithe had an original kittiwake collision estimate of 93 and 28 on its later one (a reduction of 65). Thus, these two projects alone represent an over-estimate in kittiwake collisions of almost 300 at the North Sea scale. Their summed (original) contribution to the Flamborough and Filey Coast SPA kittiwake mortality was 20, which is 5 for the second consent designs, a reduction of 15. This reduction alone accounts for 75% of Natural England's precautionary estimate for Norfolk Vanguard (21) and is three times the more realistic estimate of 4.6.

64. However, Natural England has stated that the higher collision estimates must be used for these wind farms, despite the virtual certainty that the earlier consented designs will not be built.

65. In conclusion, the Applicant considers that evidence has been presented in support of both the legal case (as to the parameters that are "legally secured") and the calculation methods (which Natural England has agreed are valid in principle) and that the datasets required are available in many instances and are, to all intents, the same as those currently used in cumulative and in-combination assessment.

66. Whilst the Applicant is in no way reliant on the headroom argument to rule out AEoI for the Project, what this demonstrates is that the current cumulative and in-

combination estimates, which do not account for project updates, are in themselves precautionary (which Natural England has agreed) and that this is an entirely separate and additional source of precaution over and above those other sources of precaution highlighted above (e.g. precautionary collision model parameters and breeding season durations).

67. Natural England has agreed that there is headroom, although the amount is uncertain. However, given the very low predicted impacts for Norfolk Vanguard, it seems highly unlikely that this headroom is not greater than the Project's impacts, and this gives further confidence in the Applicant's position that there will be no AEoI for any SPA population due to the project alone or in-combination.

2.3 Derogation/compensation

68. As noted in section 1.3, the Applicant has given extensive consideration to options for impact mitigation through revision to the Project design envelope. In addition to the increase in minimum draught height and the reduced maximum number of turbines, the Applicant has given consideration to other options for reducing collision risks as requested by NE. This is set out in detail in ExA; Mit;11.D10.2 and is summarised below.

69. Natural England requested that the Applicant provide information on how many turbines would need to be removed in order for kittiwake collisions at the Flamborough and Filey Coast SPA to be less than 1 per year. For the worst case option in the revised design envelope (124 x 14.7MW turbines with a 30m draught height) this was calculated to require removal of 118 turbines, leaving a wind farm with just 6. This is evidently not a viable project, nor would such a development make any meaningful contribution to the de-carbonisation of energy production.

70. Natural England also requested consideration be given to partial turbine shut downs at particularly sensitive times of year. Following a review of the collision predictions for each month the Applicant found that in order to achieve even a modest reduction in kittiwake collisions (of 7 from the precautionary annual total of 21) this would require a complete shutdown of all turbines during March (a cut in annual power generation of approx. 8%). However, it is highly debatable if this measure would achieve even a reduction in mortality of 7 kittiwakes from the SPA, since there will be a large number of migrant birds passing through on route to colonies further north in this month (as noted above). It is therefore evident that on the basis of even the higher mortality estimated using Natural England's methods it would be necessary to shut down all turbine for several months of the year to achieve any meaningful reduction in collisions.

71. The much lower annual lesser black-backed gull collisions (a maximum of 2.6 from the Alde-Ore Estuary SPA) means that achieving meaningful reductions are even less feasible for this species.

72. Thus the Applicant considers that the mitigation options have been taken as far as feasible within the confines of commercial availability and meeting the Project's generating aims and the UK Government's environmental targets.

73. The Project impacts are now reduced to very small levels and the contributions of the Project to in-combination impacts are also very small. Indeed, Norfolk Vanguard's predicted mortality of kittiwake from Flamborough and Filey Coast SPA (using Natural England's precautionary figure of 21) is lower than those consented offshore wind farms including Hornsea Project One (41), Dogger Bank Creyke Beck A and B (84), Dogger Bank Teesside A and B (47) and Triton Knoll (35), and using the Applicant's evidence based estimate is lower than those for East Anglia ONE (12), Hornsea Project Two (14) and East Anglia THREE (6.4).

74. Furthermore, the impacts from the Project are more than offset by the reductions in in-combination totals currently locked up in the available headroom, created by the difference between assessed, consented and as built schemes as discussed in Section 2.2.1.

75. On this basis, the Applicant firmly maintains the position presented during the Examination, as supplemented in this submission, that in respect of these designated sites, an in-combination AEoI can be ruled out beyond reasonable scientific doubt for all relevant designated sites.

76. Nonetheless, as requested by the SoS, the Applicant has given consideration to alternative solutions, Imperative Reasons of Overriding Public Interest (IROPI) and in-principle compensatory measures in respect of the Flamborough and Filey Coast SPA and the Alde-Ore Estuary SPA (the Derogation Case). This is provided in (ExA; IROPI; 11.D10.3), but is presented entirely without prejudice to the Applicant's position that there would be no AEoI in respect of in-combination impacts on the qualifying kittiwake feature of the FFC SPA nor in respect of the qualifying lesser black-backed gull feature of the AOE SPA.

2.4 Conclusion

77. As a result of the further mitigation committed to by the Applicant, the overall reduction in the total (North Sea scale) predicted collision risks from the estimates submitted in the original assessment as part of the DCO application to those for the worst case in Table 2.1 (the 14.7MW turbine at 30m draught height) is 82% for

kittiwake (from an annual EIA total of 318 to 56) and 70% for lesser black-backed gull (from an annual EIA total of 40 to 12).

78. The Project impacts are now reduced to very small levels and the contributions of the Project to in-combination impacts are also very small. Indeed, Norfolk Vanguard's predicted mortality of kittiwake from Flamborough and Filey Coast SPA is lower than those of consented offshore wind farms including Hornsea Project One, Dogger Bank Creyke Beck A and B, Dogger Bank Teesside A and B and Triton Knoll and for lesser black backed gull are considerably lower than the total predicted for the consented Galloper Offshore Wind Farm.

79. Furthermore, the Applicant also notes the inherent levels of over precaution that are applied to ornithology impact assessment for offshore wind farms and the in-combination totals currently locked up in the available headroom.

80. Therefore, in light of the range of evidence presented in the DCO Application and during the Examination, as well as the additional mitigation commitments in response to the BEIS letter, the Applicant firmly maintains that there will be no AEoI in respect of in-combination impacts on the qualifying kittiwake feature of the FFC SPA nor in respect of the qualifying lesser black-backed gull feature of the AOE SPA.

81. It is therefore the Applicant's firm view that there is no requirement for a derogation case to be submitted under Article 6(4) of the Habitats Directive. However, and entirely without prejudice to this position, the Applicant has provided evidence on this matter (in document reference ExA; IROPI; 11.D10.3), including in-principle compensatory measures in relation to kittiwake of FFC SPA and LBBG of AOE SPA in Appendices 1 and 2, respectively to the Habitats Regulations Derogation Provision of Evidence (document references ExA; IROPI; 11.D10.3.App1 and 8.24).

3 REFERENCES

Coulson, J.C. (2011). The Kittiwake. T & AD Poyser, London.
Coulson, J.C. (2017). Productivity of the Black-legged Kittiwake *Rissa tridactyla* required to maintain numbers. Bird Study 64: 84-89.
MacArthur Green (2018). Flamborough and Filey Coast pSPA Seabird PVA Report Supplementary matched run outputs 2018. Submitted as Appendix 9 to Deadline 1 submission – PVA. Hornsea Project Three.
MacArthur Green (2019) Lesser Black-backed Gull Alde Ore Estuary Population Viability Analysis. ExA; AS; 10.D6.17
Trinder, M. (2017) Estimates of Ornithological Headroom in Offshore Wind Farm Collision Mortality(The Crown Estate 2017)