THE PLANNING ACT 2008

THE INFRASTRUCTURE PLANNING (EXAMINATION PROCEDURE) RULES 2010

NORFOLK BOREAS OFFSHORE WIND FARM

Planning Inspectorate Reference: EN010087

Deadline 7

Natural England's Updated Ornithology Advice

31st March 2020

Our Ref: NE.NB.D7.06.Ornithology

Contents

Introduction

This document contains Natural England's Updated Ornithology Advice in response to:

- Norfolk Boreas Offshore Ornithology Assessment Update: Project Alone Collision Risk Modelling [as set out in REP5-059 from the Applicant]
- Norfolk Boreas Review of Kittiwake Flight Speed for use in Collision Risk Modelling [as set out in REP5-060 from the Applicant]
- Norfolk Boreas Headroom Position Paper and Examples [as set out in REP6-021].

We have not provided a response to the Position Statement on derogation [REP6-025] as Natural England is currently in the process of reviewing the Hornsea Project 3 and Norfolk Vanguard documents in order to provide our statutory advice to the Secretary of State. We do not wish to prejudice our advice on either project therefore we will provide further advice on this after the respective Deadlines which will be Boreas Deadline 9.

Advice on Norfolk Boreas Offshore Ornithology Assessment Update: Project Alone Collision Risk Modelling

General Comments

Natural England welcomes the additional mitigation measures proposed by Norfolk Boreas in REP5-059 to consider 11.55MW turbines with a minimum draught height of 35m above mean high water springs (MHWS) and 14.7MW turbines with a minimum draught height of 30m above MHWS. We therefore welcome the Applicant's efforts in identifying ways to reduce collision impacts.

We acknowledge that the worst case scenario (WCS) is now based on the 14.7MW turbines as the predicted collisions are greater for this turbine layout than for the 11.55MW, largely due to the larger turbines having a lower minimum draught height. Natural England welcomes that information has been provided in Table 1 of REP5-059 on the numbers of each turbine type and their associated parameters required to run the Band (2012) collision risk model (CRM). We have verified the CRM for the 11.55MW and 14.7MW turbines and agree with the annual collision predictions from the project alone presented in Table 2.1 for EIA and Tables 2.5-2.7 for HRA for these turbine options and draught heights. (NB: that this has been based on using the bird densities from the data presented in the Environmental Statement Technical Appendix 13.1 [APP-566], as the bird densities used are not reproduced in REP5-059).

If the turbine options presented in this document are going to represent the final assessed WCS for CRM for the Norfolk Boreas project, Natural England suggests that, in addition to the turbine parameters and wind farm information, the Applicant also presents all of the other input data required for the CRM (e.g. bird densities, bird biometrics etc.). As was advised at Deadline 5 [REP5-077], we would welcome a mechanism that clearly identifies the revised assessments/technical documents/WCS as those in which a decision will have/has been made.

EIA collision impacts from Norfolk Boreas alone

As shown in Table 1 below, based on the figures for the 14.7MW WCS from REP5-059, all the central CRM predictions (i.e. using mean density, mean avoidance rate, maximum likelihood flight height data and the standard nocturnal activity rates) equate to less than 1% baseline mortality of the largest Biologically Defined Minimum Population Scale (BDMPS) and biogeographic populations for all of the six key species (gannet, kittiwake, LBBG, herring gull, GBBG and little gull). This is also the case for the upper 95% confidence intervals of the bird density for all species. **Therefore, based on these figures we again agree that the collision risk from Norfolk Boreas alone would have no significant adverse impact at the EIA scale for all species.**

Table 1 Percentage of baseline mortality for predicted impact levels for Norfolk Boreas operational collision risk alone for EIA based on WCS using 14.7MW turbines with a minimum draught height of 30m above MHWS, using average across all age class mortality rates, as used by the Applicant

	CRM prediction, Boreas alone from REP5-059	**Largest BDMPS (North Sea) individuals, Furness (2015)**	**% baseline mortality largest BDMPS**	**Biogeographic population individuals (Furness 2015)**	**% baseline mortality biogeographic**
Gannet	31 (9-63)	456,298	0.04 (0.01-0.07)	1,180,000	0.01 (0.00-0.03)
Kittiwake	58 (24-101)	829,937	0.04 (0.02-0.08)	5,100,000	0.01 (0.00-0.01)
LBBG	14 (1-39)	209,007	0.06 (0.01-0.15)	864,000	0.01 (0.00-0.04)
Herring gull	7 (0-21)	466,511	0.01 (0.00-0.03)	1,098,000	0.00 (0.00-0.01)
GBBG	36 (6-77)	91,399	0.27 (0.04-0.59)	235,000	0.11 (0.02-0.23)
Little gull	1 (0-4)	10,000*	0.03 (0.00-0.10)	75,000**	0.01 (0.00-0.03)

* Precautionary estimate based on the surveys conducted across the Greater Wash Area of Search and analysis of those data in Natural England & JNCC (2016), as used by Applicant
** Little gull population with connectivity to the southern North Sea was estimated to be up to 75,000 (Stienen et al. 2007), as used by Applicant in APP-226

HRA collision impacts from Norfolk Boreas alone

Flamborough & Filey Coast (FFC) SPA: Gannet

As noted above, we agree with the annual collision prediction in Table 2.5 of REP5-059 for the 14.7MW turbine of 15 (range: 1-36) gannet collisions from the FFC SPA. These predictions equate to:

- 0.84% (range: 0.06-2.03%) of baseline mortality of the FFC SPA gannet colony based on the colony population size at classification;
- 0.69% (range: 0.05-1.67%) of baseline mortality of the FFC SPA gannet colony based on the colony population size from the 2017 colony count;
- 0.76% (range: 0.06-1.82%) of baseline mortality of the FFC SPA gannet colony based on the colony population size from the mean of the 2012, 2015 and 2017 colony counts.

The central predicted collision impacts for the 14.7MW WCS for gannets from the FFC SPA for the project alone equate to less than 1% of baseline mortality for the colony, although the predicted figures based on the upper 95% confidence interval of the density data exceed 1% of baseline mortality of the colony. However, in our Deadline 4 response [REP4-040] Natural England was able to conclude no adverse effect on integrity (AEOI) of the gannet feature of the FFC SPA from collision risk from the Norfolk Boreas project alone for the previous WCS of 10MW turbines with a 22m draught height (based on consideration of PVA metrics, plausible future growth rates for the gannet FFC SPA colony and the maintain conservation objective for the colony). Therefore, as the predicted collisions for the revised WCS of 14.7MW turbines with a 30m draught height (as presented in REP5-059) have decreased from the previous WCS, **our advice remains that an AEOI of the gannet feature of the FFC SPA can be ruled out for collision impacts from Norfolk Boreas alone**.

The updated collision prediction for the project alone for gannets from the FFC SPA should be added to the previous assessment of displacement of gannet from the FFC SPA. Again, we note that in our Deadline 4 response [REP4-040] Natural England was able to conclude no adverse effect on integrity (AEOI) of the gannet feature of the FFC SPA from collision plus displacement impacts from the Norfolk Boreas project alone when the collision figure for the previous WCS of 10MW turbines with a 22m draught height was included (based on consideration of PVA metrics, plausible future growth rates for the gannet FFC SPA colony and the maintain conservation objective for the colony). Therefore, as the predicted collisions for the revised WCS of 14.7MW turbines with a 30m draught height (as presented in REP5-059) have decreased from the previous WCS, **our advice remains that an AEOI of the gannet feature of the FFC SPA can be ruled out for collision plus displacement impacts from Norfolk Boreas alone**.

Flamborough & Filey Coast (FFC) SPA: Kittiwake

As noted above, we agree with the annual collision prediction in Table 2.6 of REP5-059 for the 14.7MW turbine of 14 (range: 4-28) kittiwake collisions from the FFC SPA based on Natural England's preferred apportionment rates. These predictions equate to:

- 0.11% (range: 0.03-0.21%) of baseline mortality of the FFC SPA kittiwake colony based on the colony population size at classification;

- 0.09% (range: 0.03-0.19%) of baseline mortality of the FFC SPA kittiwake colony based on the colony population size from the mean of the 2016 and 2017 colony counts.

The central predicted collision impacts for the 14.7MW WCS for kittiwakes from the FFC SPA for the project alone equate to less than 1% of baseline mortality for the colony, as do those for the upper 95% confidence interval of the density data. Therefore, based on these figures we again **advise that an adverse effect on integrity (AEOI) of the kittiwake feature of the FFC SPA can be ruled out for collision impacts from Norfolk Boreas alone.**

a) Alde-Ore Estuary SPA: Lesser black-backed gull (LBBG)

As noted above, we agree with the annual collision prediction in Table 2.7 of REP5-059 for the 14.7MW turbine of 2 (range: 0.4-5) LBBG collisions from the Alde-Ore Estuary SPA based on Natural England's preferred apportionment rates. These predictions equate to 0.47% (range: 0.10-1.19%) of baseline mortality of the Alde-Ore Estuary SPA LBBG colony (based on a population of 2,000 pairs).

The central predicted collision impacts for the 14.7MW WCS for LBBGs from the Alde-Ore Estuary SPA for the project alone equate to less than 1% of baseline mortality for the colony, although the predicted figures based on the upper 95% confidence interval of the density data exceed 1% of baseline mortality of the colony. However, in our Deadline 4 response [REP4-040] Natural England was able to conclude no AEOI of the LBBG feature of the Alde-Ore Estuary SPA from collision risk from the Norfolk Boreas project alone for the previous WCS of 10MW turbines with a 22m draught height (based on consideration of PVA metrics and acknowledgement that that a breeding season apportionment rate of 30% is likely to be overly precautionary, see REP4-040). Therefore, as the predicted collisions for the revised WCS of 14.7MW turbines with a 30m draught height (as presented in REP5-059) have decreased from the previous WCS, **our advice remains that an AEOI of the LBBG feature of the Alde-Ore Estuary SPA can be ruled out for collision impacts from Norfolk Boreas alone**.

Detailed Comments

Increases to draught height

We note that in Table 1 of REP5-059, the point of reference to which the draught height is measured for all turbine scenarios included in the document is MHWS. However, we note that the point of reference to which the draught height is measured in the submission documents (see Table 5 of Annex 3 of Appendix 13.1, APP-566) was above Highest Astronomical Tide (HAT). Natural England's understanding is that the hub height entered in the Band (2012) spreadsheet should be referenced to Highest Astronomical Tide (HAT) – Band (2012)[1] states:

[1] Band, W. (2012). *Using a collision risk model to assess bird collision risks for offshore wind farms*. The Crown Estate Strategic Ornithological Support Services (SOSS) report SOSS-02.

'Normally, the hub height of wind turbines is measured from Highest Astronomical Tide (HAT), to help ensure navigational clearance requirements are satisfied. However, bird flight heights are measured relative to sea level, which may be 2-3 metres or more lower. Mean sea level (Z_0) and HAT are normally stated relative to Chart Datum (CD). The calculation allows for a tidal offset to be added to the hub height, to allow for this additional height above mean sea level.'

Also in Table 1 of REP5-059, the Applicant states that the tidal offset parameter (of 0.8m for all turbine sizes considered by Boreas) is the difference between Mean Sea Level (MSL) and MHWS. Natural England's understanding is that the tidal offset used in the Band (2012) spreadsheet should be the difference between MSL and HAT (see Band 2012). The Applicant also states in REP5-059 that:
'In previous submissions the offset was erroneously labelled as the difference between Highest Astronomical Tide (HAT) and Mean High Water Spring (MHWS). This was only an error in labelling (corrected here) and the values used in the modelling are unaffected.'
It will be important that these points of reference are checked and clarified, as they may have an impact on the collision predictions if incorrect reference points have been used in the current assessments. Band (2012) notes that *'the tidal offset can make a substantive difference to the calculated collision risk, reducing the estimate of risk by 25-30% for some species'*. This clarification will also assist our understanding of the scale of the proposed increase in draught height.

Natural England reserves the right to amend the advice given in section 1 above if the resolution of this issue requires an update of the CRM.

Minor Comments

- Paragraph 25 of REP5-059 notes that in order to secure the additional mitigation, it is proposed to revise Requirement 2(1) (e) of the draft DCO (and the corresponding DML conditions), and part e) will be amended to say '*have a draught height which is less than the minimum draught height specified for the relevant wind turbine generator capacity in the table below.'* We note the table given lists wind turbine generator capacity up to 14.6MW and 14.7MW and above. As Norfolk Boreas are in REP5-059 committing to removing the 9MW, 10MW and 11MW options from their design envelope, Natural England suggests that requirement needs to clearly indicate that turbines smaller than 11.55MW turbines cannot be installed. This paragraph also notes the need to transcribe the changes into the DML as well as the draft DCO and Natural England confirms that this is required. Natural England will provide further comment on the updated Draft DCO once submitted.
- We query whether the revised WCS of 14.7MW turbines is now based on a turbine that is not yet available on the market. However, it is recognised that the 14.7MW turbine scenario has higher collision predictions than the 11.55MW turbine scenario, so even if the smaller 11.55MW turbine was constructed, the CRM predictions for this are lower than the WCS assessed.
- We note that in Table 2.6 and in paragraph 21 of REP5-059 the Applicant presents an annual figure of 49.5 collisions of kittiwakes from the FFC SPA based on the Natural England preferred apportionment rates for the previous WCS of 10MW turbines with a 22m draught height. Natural England recommends that the Applicant

checks this figure, as using the full breeding season and adjusted migration seasons together with the upper breeding season apportionment rate of 86% preferred by Natural England, we calculate the annual predicted total collisions to be 45.4.

Advice on Norfolk Boreas Review of Kittiwake Flight Speed for use in Collision Risk Modelling

Introduction

Please see below Natural England's advice on Norfolk Boreas Review of Kittiwake Flight Speed for use in Collision Risk Modelling [as set out in REP5-060 from the Applicant]

General Comments

Natural England acknowledges that bird flight speeds are an important issue in the context of collision risk modelling (CRM). We welcome the review of kittiwake flight speeds undertaken by the Applicant in REP5-060.

The Applicant's review in REP5-060 includes studies covering a range of locations and seasons and also a variety of data collection methods. It does also note some of the limitations associated with the data from studies. However, we note that there are no criteria provided as to how the Applicant has considered studies to include in the review. Additionally, as this review has been submitted during the Norfolk Boreas examination it has not been peer reviewed and therefore has had no formal scrutiny. In addition, Natural England has inevitably only had limited time to review this document due to the Norfolk Boreas examination timetable. We consider that any review of flight speeds for use in collision risk modelling (CRM) therefore needs to be rigorous.

Detailed Comments

Natural England notes that flight speed is used by the Band model twice:

- In the calculation of the total number of birds that may pass through a wind farm over a given time period; and,
- To estimate the probability that any individual bird may collide with the turbine blades (Band 2012; Bowgen & Cook 2018).

As Bowgen & Cook (2018) notes, in order to be consistent with how the Band model is implemented, the point estimate of bird speed should be used to calculate the probability of a bird colliding and the average rate at which it moves through the wind farm should be used to estimate the total number of birds likely to move through the wind farm over a given time period and this therefore needs consideration when calculating mean flight speeds to use in CRM.

We also note that it is not as simple as changing one parameter (i.e. flight speed) in the CRM, there is also a need to consider how this fits in the wider CRM in terms of the other input parameters. As noted in our pre-22nd January 2020 Issue Specific Hearing updated ornithology advice [REP4-039], there is likely to be a relationship between flight speed and height and this also needs to be taken into consideration.

We note that there is an ongoing Marine Scotland Science project on behaviour of seabirds at sea, that we understand will contain analysis of kittiwake flight speeds derived from GPS tag deployments. This is yet to conclude. Therefore, Natural England will wait for the outputs

from this work and then consider this alongside the Norfolk Boreas Applicant's review when considering our advice regarding appropriate flight speeds to use in CRM. However, we note that the currently used kittiwake flight speed figure of 13.1m/s from Alerstam et al. (2007)/Pennycuick (1987) is for air speed rather than ground speed. In the meantime we recommend that as there is uncertainty in the appropriate flight speeds to use, the currently used value from the literature (i.e. 13.1m/s) and the value from the work undertaken by the Norfolk Boreas consultants in REP5-060 are used in the CRM (as is the recommendation for other CRM input parameters where there is uncertainty, such as nocturnal activity). We note that this suggested approach does not quantify the range of flight speeds in a statistical way – i.e. it should not be seen as confidence intervals around a mean, as it is entirely possible that the variability could extend beyond these two values.

We suggest that the mean value calculated by the Applicant in REP5-060 from the range of studies does not include the Masden (2015) study, as the Applicant notes in REP5-060 that the estimate from this study is likely to be unreliable. We also advise that in any mean figure the Applicant calculates from this review that when considering studies to include in the calculation of the mean, the limitations that they have noted regarding the flight speed estimates from the studies (e.g. underestimation of ground speeds from Elliott et al. 2014 and where the Applicant notes that the mean ground speed estimate from Kotzerka et al. 2010 from the assumption of continuous straight line flight over five minute periods is likely to result in underestimation of true ground speed) are considered.

References

Alerstam, T., Rosén, M., Bäckman, J., Ericson, P.G.P. & Hellgren, O. (2007). Flight speeds among bird species: Allometric and phylogenetic effects. *PLoS Biology*, **5**(8): e197.

Band (2012) *Using a collision risk model to assess bird collision risks for offshore wind farms*. The Crown Estate Strategic Ornithological Support Services (SOSS) report SOSS-02.

Bowgen, K. & Cook, A. (2018) *Bird Collision Avoidance: Empirical evidence and impact assessments*. JNCC Report No. 16. Available from: http://data.jncc.gov.uk/data/582298c7-1c78-4130-a115-73d8302013dd/JNCC-Report-614-FINAL-WEB.pdf

Elliott, K.H., Chivers, L.S., Bessey, L., Gaston, A.J., Hatch, S.A., Kato, A., Osborne, O., Ropert-Coudert, Y., Speakman, J.R. & Hare, J.F. (2014). Windscapes shape seabird instantaneous energy costs but adult behaviour buffers impact on offspring. *Movement Ecology*, **2**: 17.

Kotzerka J., Garthe, S. & Hatch, S.A. (2010). GPS tracking devices reveal foraging strategies of black-legged kittiwakes. *Journal of Ornithology*, **151**: 459-467.

Masden, E.A. (2015). Developing an avian collision risk model to incorporate variability and uncertainty. *Scottish Marine and Freshwater Science*, **6**: 14.

Pennycuick, C.J. (1987) Flight of auks (Alcidae) and other northern seabirds compared with southern Procellariiformes: ornithodolite observations. *Journal of Experimental Biology*, **128**: 335-347.

Comments on Norfolk Boreas Headroom Position Paper and Examples

Summary

As the information regarding headroom submitted by the Applicant in REP6-021 is very similar to that submitted by the Applicant in REP4-014 and to that submitted to Natural England by Norfolk Vanguard, we reiterate our advice provided in REP6-049 of the Norfolk Boreas examination.

In summary, whilst Natural England:

a) Acknowledges the work that the Norfolk Boreas Applicant and their consultants have done to consider potential headroom in the in-combination/cumulative collision risk figures by assessing the 'as built' rather than the worst case scenario (WCS);
b) Recognises 'headroom' as an important issue; it is a highly complex one though, and it is important to note that there is not yet an agreed way forward at present. The Applicant's approach has also not been subjected to judicial scrutiny.
c) Does not disagree that there is likely to be some headroom; however, the exact extent of any potential headroom is not agreed.

There are a number of uncertainties/issues with the approach proposed by the Applicant in REP4-014 and in REP6-021, namely:

- Whether consented or as-built scenarios can be considered 'legally secured'.
- Issues with the approach developed by MacArthur Green for The Crown Estate (TCE) to adjust altering the collision figures of planned and consented projects (Trinder 2017) and that Natural England does not advise that it is used.

These uncertainties/issues are set out in detail in our Deadline 6 response [REP6-049] to the Applicant's headroom approach in REP4-014. Therefore, until the uncertainties set out below are addressed and an industry wide approach is agreed we recommend that the default 'standard' approach is appropriate.

Additional comments relating to information provided in REP6-021

a. Projects with revised applications and hence two consents

The Applicant notes that 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. Natural England understands that for such projects the original consents for these projects still stand, and therefore these still represent the WCS and it is these that currently should go into the cumulative/in-combination assessments. Clarification from the Applicant on whether these Applicants retain their original WCS consent would be useful.

b. Impacts on designated sites

Natural England does not agree with the Applicant that no adverse effect on integrity (AEOI) can be ruled out for the qualifying kittiwake feature of the Flamborough and Filey Coast FFC SPA and the qualifying lesser black-backed gull (LBBG) feature of the Alde-Ore Estuary SPA from in-combination collision (Please see our deadline 7 response to the Applicant's updated cumulative/in-combination CRM in REP6-024).

In REP6-021, the Applicant considers that the total headroom they have calculated from Hornsea Project One and Triton Knoll (total of 39.5 collisions) exceeds the revised kittiwake collision risks (using Natural England methods) for Norfolk Boreas (14 collisions) and Norfolk Vanguard (21 collisions) combined, and that if this level of headroom was applied to the Norfolk Boreas project the effect on in-combination kittiwake collision risk would be to reduce the potential impacts on FFC SPA kittiwake to levels that were previously considered acceptable to avoid AEOI (using a building block approach including Norfolk Vanguard but excluding Hornsea Project Three). However, Natural England notes that we have already advised (at Hornsea 2 and East Anglia 3 examinations onwards) that it was not possible to rule out an AEOI on the FFC SPA from operational and consented projects due to the level of annual in-combination collision mortality predicted for kittiwake. There is the potential for Flamborough kittiwakes to be impacted by the Norfolk Boreas proposal during the breeding and non-breeding seasons, and there is therefore the potential for the proposal to make a contribution (WCS prediction of 14 birds) to the overall in-combination kittiwake collision mortality total.

As noted in our response on the Applicant's REP4-014 [REP6-049], even if the Applicant successfully identifies headroom this does not necessarily mean that headroom is the project's to utilise, as there are currently multiple projects ahead of Norfolk Boreas that are not yet consented (Hornsea 3, Norfolk Vanguard, Thanet Extension).

Conclusion

Given the issues detailed in our Deadline 6 response [REP6-049] and above, our position remains that CRM should be re-run in full to generate updated collision figures against any agreed changes to turbine design layouts. Where this is not possible for a project, because original bird density data cannot be obtained, we would need to agree whether correction ratios can be calculated (for example following an approach such as that presented in Trinder (2017)). Natural England would need to see the full calculation details for these correction factors. It is Natural England's advice that simplistic scaling of collision figures based on reductions in turbine numbers from the consented number should not be used, for example due to variation in flight activity at different heights and differences in turbine parameters such as rotor speeds. There are also case-specific issues that need to be addressed: Natural England notes that the Race Bank and Dudgeon assessments didn't use the Band model, and were based on the Folkerts model.

As noted during the Norfolk Boreas Issue Specific Hearing on 22nd January 2020[2], Natural England has been raising the issue of whether as built or consented projects should be considered for in-combination effects with The Crown Estate and we note the need for a strategic approach to this issue. If conducted simply on a project-by-project basis this has significant risks of inconsistency of approach across Applications. Therefore, we consider that this issue needs to be addressed strategically on behalf of the whole sector, including developing consensus on an approach. However we do recognise that this is not possible in timescale for the Norfolk Boreas examination.

[2] Natural England (2020) Norfolk Boreas Offshore Wind Farm: Natural England's Written Summary of Oral Representations made at Issue Specific Hearing 4 on offshore effects including the Draft Development Consent Order. Planning Inspectorate Reference: EN010087. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-001630-DL4%20-%20Natural%20England%20-%20Written%20Representation%20of%20Oral%20Case.pdf