REPORT

Dogger Bank Teesside A Non-Material Change Application: Appendix 1 Ornithological Technical Report

Client: Dogger Bank Wind Farms

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Acronyms

CRM	Collision Risk Modelling
CRH	Collision Risk Height
DCO	Development Consent Order
EIA	Environmental Impact Assessment
ES	Environmental Statement
HAT	Highest Astronomical Tide
HRA	Habitats Regulations Assessment
OWF	Offshore Wind Farm
SNCB	Statutory Nature Conservation Body
SOSS	Strategic Ornithological Support Service
SPA	Special Protection Area
WTG	Wind Turbine Generator

Executive Summary

The Dogger Bank Teesside A Offshore Wind Farm was granted development consent in 2015 under The Dogger Bank Teesside A and B Offshore Wind Farm Order 2015. This prescribes a number of parameters including maximum number of turbines, overall generating capacity, rotor diameter, total rotor-swept area, maximum tip height and lower tip height; these are set out in detail in Section 2 of this report.

Since the consent was granted, advancements in technology mean that larger turbines have become available which would require an increase to the maximum permitted rotor diameter, from up to 215m to up to 280m. As a result, the Teesside A Project Team is seeking to make a non-material change to the consent to permit the use of a larger rotor diameter, with respect to the Teesside A Offshore Wind Farm only.

The effect of the proposed change could be to allow a smaller number of larger rotor turbines than is currently permitted. This is because the (unchanged) total swept area constrains the total number of turbines which can be installed: this is the key parameter. Currently the maximum number of turbines (with a rotor diameter of 215m) which can be installed utilising the full consented swept area is 119; the proposed increase in rotor diameter would reduce this number to 70, assuming a maximum rotor diameter of 280m is used.

The Environmental Statement assesses four potential impacts on ornithology: disturbance and displacement; barrier effects; habitat loss and change; and collision risk. For every one of these, this report demonstrates that the worst case scenario as originally assessed would remain unchanged. In other words, the increase in maximum rotor diameter does not affect or alter the ornithology assessments already carried out.

It is recognised that of these four ornithology impacts, collision risk is potentially the most sensitive to changes to turbine parameters. Therefore, this report has a particular focus on collision impacts. The worst case identified for the existing ornithology assessments in relation to collision impact was the largest number of smallest rotor diameter turbines, being 200 turbines with a 167m rotor diameter. It was therefore anticipated that fewer, larger turbines would not affect the worst case assessed in the existing ornithology assessment, and indeed would result in lower collision estimates.

To confirm that the proposed increase in maximum allowable rotor diameter would reduce modelled collision impacts, collision risk modelling was carried out on a ‘like for like’ basis with the existing assessment (i.e. using the same Band collision risk model options and avoidance rates and keeping all data the same as that underpinning the Development Consent Order, except the parameters relating to the use of turbines with a larger rotor diameter). Four sensitive species of seabird: northern gannet, black-legged kittiwake, lesser black-backed gull and great black-backed gull were remodelled in full. Using ‘like for like’ collision risk modelling and the updated turbine parameters the predicted collision estimates for all species decreased. This confirmed that the use of fewer, larger turbines would reduce collision impacts compared to those predicted in the existing assessment for the project alone and cumulatively with all other projects. As a result of fewer collisions in total, effects on European sites would also be reduced.

In summary, this report confirms that the impact of the proposed increase in maximum rotor diameter on ornithological receptors is that there are no new or materially different likely significant effects compared to the consented design. Using larger, fewer turbines results in a reduction in collision risk. The conclusions of the Environmental Statement that ornithology impacts are not significant for the project alone and cumulatively with other projects are not affected. Similarly, the conclusions of the Department of Energy

and Climate Change (DECC) Habitats Regulations Assessment of no adverse effects on the integrity of any European site arising from the project alone and in-combination with all other sites are not affected. The worst case position remains the same and no further assessment is required for ornithology in support of the proposed increase in maximum rotor diameter.

As the proposed change would not give rise to any new or materially different likely significant effects on any receptor and the conclusions of the Environmental Statement and the DECC HRA are not affected, it is therefore appropriate for the application to amend the maximum rotor diameter to be consented as a non-material change to the Development Consent Order.

1 Introduction

Dogger Bank Teesside A is an offshore wind farm project, consented in 2015, located in the North Sea 196km from the East Yorkshire Coast (herein referred to as the Project) and connecting to the national grid at the existing Lackenby substation in Teesside. The Project was granted development consent in 2015 under The Dogger Bank Teesside A and B Offshore Wind Farm Order 2015 (the DCO), having been originally developed by the Forewind Limited consortium, which split following the grant of the DCO. A Joint Venture between SSE and Equinor, known as 'The Dogger Bank Wind Farms' (herein referred to as the Project Team), has now been set up to deliver the development of Dogger Bank Teesside A[1].

In the four years since the DCO was granted there have been a number of advancements in technology that would make the wind farm more efficient and cost effective. These advances are based on the size of wind turbine generators that are available, or that are likely to become available during the course of the development programme. The advances require an increase in the maximum allowable rotor diameter and therefore the Project Team is looking to make a non-material change (NMC) to the DCO to enable the Project to be developed in the most efficient and cost-effective manner.

This technical report describes how the proposed increase in the maximum allowable rotor diameter would affect the ornithology assessment presented in the Environmental Statement (ES) and its associated documents (Burton *et al*., 2014; Forewind, 2014a) and the DECC Habitats Regulations Assessment (HRA) (DECC, 2015).

[1] Innogy now owns 100% of Dogger Bank Teesside B under a new subsidiary, the Sofia Offshore Wind Farm Limited and has renamed Teesside B as Sofia Offshore Wind Farm. This technical report and the associated non-material change application only concern changes to Dogger Bank Teesside A.

2 Summary of the Consented Project and Proposed Design Changes

2.1 The Consented Project

The DCO for the Dogger Bank Teesside A and B OWFs (Secretary of State, 2015) states that no wind turbine generator (WTG) may:

- Exceed a height of 315m when measured from Highest Astronomical Tide (HAT) to the tip of the vertical blade;
- Have a rotor diameter exceeding 215m;
- Be less than a multiple of six times the rotor diameter from the nearest WTG in any direction being not less than 750m measured between WTGs; and
- Have a distance of less than 26m between the lowest point of the rotating blade of the WTG and HAT.

In addition, the DCO also states that the total rotor swept area of either project must not exceed 4.35km^2.

2.2 Changes to the Consented Project

A non-material change to the DCO for the Teesside A OWF has been submitted to enable an increase in the maximum rotor diameter allowed under the DCO from 215m to 280m. The highest and lowest rotor tip heights, distance to other turbines and total rotor swept area will all still be subject to the existing limits set out in the DCO. The air gap of 26m will be retained between the consented design and the proposed amendment.

As there is an overall limit on the total rotor swept area, an increase in the rotor swept area of an individual turbine will result in the reduction in the maximum number of turbines that can be installed. This would reduce from the maximum of 200 turbines as assessed (167m rotor diameter) to 70 turbines with the proposed amendment (280m rotor diameter). It would however be possible to construct turbines with a rotor diameter of less than 280m, though all other conditions in the DCO (including the total rotor swept area) would remain the same. The Project Team may still deliver a 200 turbine scheme, and whilst the maximum number of turbines that could be delivered with a 280m rotor diameter would be 70, the Project Team needs to retain the flexibility within the existing DCO alongside the increased rotor diameter.

Further details on the consented design and the proposed amendment are provided in relation to the input parameters for the Collision Risk Assessment, as set out in Section 4.2.5.

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3 Review of Impacts of the Consented Project

The original assessment (Burton *et al*., 2014; Forewind, 2014a) assessed in detail four impacts of the consented design on seabirds: disturbance and displacement; collision risk; barrier effects; and indirect effects.

The following sections consider whether the proposed amendment has the potential to affect the original impact assessment conclusions for the consented design.

3.1 Disturbance and Displacement

The original assessment considered disturbance and displacement impacts on seabirds during construction, operation and decommissioning.

Disturbance and displacement during construction and decommissioning is related largely to vessel movements and construction activities. The proposed amendment would allow between 70 and 200 turbines rather than between 119 and 200 turbines as considered for the consented design (Section 4.2.5), depending on the rotor diameter that is selected. As a result, it can be assumed that the potential magnitude of construction effects of the proposed amendment will be at worst the same, and in practice almost certainly smaller, than the consented design. This impact has therefore been screened out of further assessment.

During the operational phase, the potential for operational disturbance and displacement of seabirds is largely determined by the total area of subtidal habitat containing wind turbines. The original assessment (Burton *et al*., 2014; Forewind, 2014a) presented the disturbance and displacement impact assumed to occur across the entire wind farm lease area. As a worst case, the assumption remains that the proposed amendment will still involve the development of the entire lease area. As a result, the conclusions of the original assessment are unchanged and this impact has therefore been screened out of further assessment.

3.2 Collision Risk

The original Teesside A OWF assessment (Burton *et al*., 2014; Forewind, 2014a) predicted collision mortality using a deterministic Collision Risk Model (CRM) ('the Band Model'), which was published as part of the Strategic Ornithology Support Services (SOSS) Project in 2012 (Band, 2012).

As an increase is being proposed to the maximum allowable rotor diameter of the turbines, it is considered necessary to calculate new predictions of collision mortality using the updated turbine parameters (see Table 4 below). The use of fewer, larger turbines is expected to result in decreased impacts on birds (Innogy Renewables UK, 2018; Royal HaskoningDHV, 2018), but updated modelling has been provided to confirm this. Collision impacts have therefore been screened in for reassessment.

3.3 Barrier Effects

Barrier effects on seabirds may occur due to the presence of OWFs either daily (e.g. if the wind farm is located between a colony and a foraging location) or seasonally (e.g. if the wind farm lies on a migration route). With regard to the proposed amendment, it is not considered that there is potential for barrier effects to differ from those originally assessed for the consented design (Burton *et al*., 2014; Forewind, 2014a). This is because the total footprint of the Teesside A OWF is assumed to remain unchanged. The conclusions of the original assessment are therefore unaffected, and this impact has been screened out of further assessment.

3.4 Indirect Effects

Seabirds can be at risk of indirect effects due to OWFs if construction or operation of the project affects their prey species. With regard to the proposed amendment versus the consented design, the potential for these effects will not differ from those originally assessed (Burton *et al*., 2014; Forewind, 2014a) since the worst case scenario would remain unchanged. Consequently, the conclusions of the original assessment are unaffected, and this impact has been screened out of further assessment.

3.5 Summary of Assessment Revisions Required

The only ornithological impact for which it is considered necessary to undertake reassessment is collision risk. Collision risk predictions in the original assessment (Burton *et al*., 2014; Forewind, 2014a) were presented for 11 species which were recorded at the wind farm site in sufficient numbers to enable prediction to be carried out. Of these species, the number of collisions predicted for fulmar, Arctic skua, great skua, guillemot, razorbill, little auk and puffin were low. Natural England's written representations for the Teesside A and B OWFs examination (Natural England, 2014) agreed that there would be no significant collision mortality impacts for these species.

The ES stated that the project-alone effects of Teesside A on the four remaining species due to collision risk was minor adverse. The same impact significance for cumulative collision were predicted for gannet, lesser black-backed gull and great black-backed gull, whilst the impact significance of cumulative collision for kittiwake was assessed as moderate (Forewind, 2014).

During the subsequent examination process, gannet, kittiwake, lesser black-backed gull and great black-backed gull were identified as the only species for which the predicted levels of collision mortality raised concern, the first two species with respect to both EIA and HRA for European sites, and the second two for EIA only (Natural England, 2014). The Record of Appropriate Assessment for the project (DECC, 2015) ultimately recorded no adverse effect on integrity for any European site.

Collision risk for these four species is reassessed in Section 4 in order to confirm that the proposed increase in maximum rotor diameter would reduce the previously modelled collision impacts.

4 Updated Collision Risk Assessment

4.1 Objective

The objective of this section, as set out in Section 3.5, is to assess differences in predicted collision risk for four species (gannet, kittiwake, lesser black-backed gull and great black-backed gull) between the consented design and the proposed amendment. In order to achieve this, the assessment for the consented design has been recreated, followed by the assessment of the proposed amendment.

The key outcome for this assessment is to understand how the predicted collision impacts for the four species to be assessed are altered by the proposed change, as opposed to reassessing the significance of the impacts themselves.

During the examination, Natural England applied their own precautionary adjustments to CRM outputs presented by the applicant, in order to test the sensitivity of the outcomes to assumptions made. As a consequence of this approach there have been multiple versions of CRM outputs presented and it is not clear which CRM outputs were used by Natural England to reach their final position. The collision estimates for the consented design are taken from the applicant's position set out in their Statement of Common Ground with Natural England (Forewind, 2014b). Whilst these are slightly lower than some of the Natural England collision estimates, the key focus of this assessment is to understand how the impacts are altered by the proposed amendment. Since the proportional magnitude of change will be consistent, changes to the applicant's figures would equally apply to those estimated elsewhere in the examination process.

4.2 Input Parameters

4.2.1 Model Type

The original Teesside A OWF assessment (Burton *et al*., 2014; Forewind, 2014a) used the Band Model CRM (Band, 2012). This model was also used to calculate the updated collision risk predictions for the four species re-examined.

Within the Band Model, there are four options with respect to how the 'number of flying birds at collision risk height' parameter is calculated. The original assessment (Burton *et al*., 2014; Forewind, 2014a) used Option 3. This is a function of the "Extended" Band Model and uses a heterogeneous flight height distribution derived from a generic dataset (Section 4.2.2). However, since the original assessment was carried out, guidance has been issued on the use of the four Band Model options (UK SNCBs, 2014). This guidance states that it is not appropriate to use the Extended Band model for predicting collision risk of gannet and kittiwake due to a lack of reliable data on flight height distributions. During the examination, collision estimates using Option 2 (the "Basic" Band Model, uniform flight height distribution, with proportion of birds at collision risk height derived from a generic dataset) were also presented (Forewind, 2014b).

Option 2 of the Band Model has therefore been used to assess the differences in collision risk between the consented design and the proposed amendment to ensure the outputs are compatible with current guidance, and that a like for like comparison of the collision estimates from the consented design and the proposed amendment can be undertaken.

4.2.2 Bird Parameters

The biometric data for the species of interest that was used in the CRM for the original assessment (Table 4.16 of Burton *et al.* (2014)) is presented in Table 1. No parameters from Table 1 were altered in the updated CRM.

Table 1. Bird data included in the CRM of the original assessment and the updated CRM.

Species	Length (m)	Wingspan (m)	Flight Speed (m/s)	Nocturnal Activity (1-5)	Flight Type	Flights Upwind / Downwind	Proportion of Birds at Collision Risk Height (CRH) Observed (>20m)
Kittiwake	0.39	1.08	13.10	3	Flapping	50%	0.2
Gannet	0.94	1.72	14.90	2	Flapping	50%	0.16
Lesser black-backed gull	0.58	1.42	9.95	3	Flapping	50%	0.36
Great black-backed gull	0.71	1.58	13.00	3	Flapping	50%	0.32

In addition to the parameters listed in Table 1, species-specific parameters are also required as an input into the ‘Flight height’ section of the CRM spreadsheet, which model the relative frequency of bird flights at 1m intervals. The flight height distribution datasets that enabled the original collision rates to be replicated were used to enable a like for like comparison between the consented design and the proposed amendment.

As the proposed amendment incorporates turbines that are taller than the consented design (rotor swept height of 26m to 306m versus 26m to 193m), the proportion of each species to be assessed as present at CRH according to the modelled flight height distribution data (Cook *et al*., 2012; Johnston *et al*., 2014a, 2014b) was examined to assess whether omitting the higher height bands (i.e. those above 155m) from the updated CRM could result in the underestimation of collision risk (Table 2).

Table 2. Proportions of birds flying at different flight height ranges representing the rotor swept area of the consented design and the proposed amendment according to the modelled flight height distribution datasets used in the updated CRM.

Species	Dataset	Proportion of birds at different height ranges				
		0-26m	26-155m	26-193m	>26m	>194m
Gannet	Cook *et al*. (2012)	0.972	0.028	0.028	0.028	0.000
Kittiwake	Cook *et al*. (2012)	0.929	0.070	0.070	0.071	0.000
Lesser black-backed gull	Johnston *et al*. (2014)	0.807	0.193	0.193	0.193	0.000
Great black-backed gull	Johnston *et al*. (2014)	0.767	0.233	0.233	0.233	0.000

Two key conclusions are apparent from the data presented in Table 2.

1. The modelled flight height distributions indicate that the vast majority of bird flight activity occurs below 26m for all four species under consideration. For gannet, the proportion of birds flying below 26m is 97.2%, for kittiwake it is 92.9%, for lesser black-backed gull it is 80.7%, and for great black-backed gull the value is 76.7%. The fact that the larger turbines that would be allowed by the proposed amendment have the same air gap as those included in the consented design (26m) means that the vast majority of bird flight activity for the four species under consideration will still be below CRH.

2. There are either no birds, or only a very small number of birds allocated to flight heights in excess of 155m for any of the four species under consideration (0.1% of kittiwakes according to Cook *et al*. (2012), zero for all other species and datasets). This means that the proposed amendment, with turbines of a maximum height of 306m, will not cause increases in collision risk due to large numbers of birds colliding with turbine blades at high altitude, regardless of whether flight height distribution data above 155m is included in the CRM calculations.

4.2.3 Avoidance Rates

The original assessment (Burton *et al*., 2014; Forewind, 2014a) predicted collision mortality estimates using an avoidance rate of 0.990 for gannet and kittiwake, and 0.995 for great black-backed gull and lesser black-backed gull (when used with Band Model Options 1 and 2). At the time, and following the publication of a report commissioned by Marine Scotland (Cook *et al*., 2014), these avoidance rates were accepted by Natural England.

After the original EIA submission (Burton *et al*., 2014; Forewind, 2014a), guidance was issued by the UK SNCBs (UK SNCBs, 2014) which advised that the avoidance rate for gannet and kittiwake should be reduced from 0.990 to 0.989 for Band Model Options 1 and 2. At the time of writing (August 2019) this remains the recommended avoidance rate for these species. The same guidance recommended Band Model Options 1 and 2 avoidance rates for great black-backed gull and lesser black-backed gull continues to be 0.995. These avoidance rates are used in the updated assessment. For gannet and kittiwake CRM, outputs for an avoidance rate of 0.990 (i.e. that used for the original assessment) are also presented to enable direct comparisons between the consented design and the proposed amendment.

4.2.4 Bird Survey Parameters

CRM outputs for the original assessment were presented for each survey year (Tables A6.2, A6.5, A6.6 and A6.7 in Burton *et al*. (2014)). It is assumed that the flying bird densities presented in Tables 4.14a, 4.14b and 4.14c of Burton *et al*. (2014) are the input values that were used for the original CRM.

For the updated CRM, to avoid the need to run multiple annual models for each species, the monthly mean flying bird density, calculated from data for all three survey years, were used as input values. These monthly mean density values are presented in Table 3.

Table 3. Monthly mean flying seabird densities (birds per km^2) across all Teesside A OWF survey years used in updated CRM.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Kittiwake	0.600	1.373	2.353	0.627	0.633	0.453	0.237	0.143	0.177	0.487	0.427	0.717
Gannet	0.037	0.087	0.270	0.127	0.167	0.097	0.063	0.073	0.100	0.170	0.060	0.067
Lesser black-backed gull	0.007	0.010	0.027	0.050	0.053	0.043	0.030	0.010	0.003	0.003	0.003	0.003

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Great black-backed gull	0.060	0.060	0.053	0.060	0.037	0.020	0.010	0.010	0.017	0.017	0.027	0.067

4.2.5 Wind Farm Parameters

The wind farm CRM parameters used for the original assessment (Table 4.17 of Burton *et al*. (2014)) are presented along with the parameters used for the assessment of the proposed amendment in Table 4.

Table 4. Turbine parameters as assessed in the ES and as used for updated collision risk modelling.

Parameter (unit)	Existing worst case scenario parameters assessed in the ES	Updated parameters assessed
Number of turbines	200	70
Number of blades	3	3
Rotation speed (rpm)	8.84	9
Rotor diameter (m)	167*	280
Rotor radius (m)	83.5	140
Total rotor swept area (km^2)	4.35	4.35
Maximum blade width (m)	5.5	10
Hub height (m above HAT)	109.5	166
Surface clearance at HAT (m)	26	26
Blade pitch (degrees)	10	10
Tidal offset (m)	Unknown	1.5 (assumed)
Wind farm latitude (decimal degrees)	Unknown	55.04

* A rotor diameter of up to 215m was consented but 167m constitutes the worst case scenario for CRM.

The monthly proportions of time for which the turbines are predicted to be operational that were used in the original assessment (Table 4.18 of Burton *et al*. (2014)) are presented in Table 5. These were also used in the updated assessment.

Table 5. Estimates of the monthly proportion of time that wind turbines will be operational used in original and updated CRM assessments.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Operational time (%)	97	97	97	94	93	92	92	92	95	96	97	96

4.3 Results

4.3.1 Comparison between Consented Design and Proposed Amendment

Using the data presented in Table 1, Table 3, Table 4 and Table 5, monthly collision mortality estimates for the consented design and the proposed amendment by species are presented in Table 6, Table 7, Table 8 and Table 9. The outputs for the proposed amendment enable a like-for-like comparison of collision risk for the two designs for gannet and kittiwake by presenting the avoidance rate of 0.990 used in the original assessment (Burton *et al*., 2014; Forewind, 2014a), along with the updated avoidance rate of 0.998 published after the original assessment (UK SNCBs, 2014).

As per the Band *et al*. (2012) spreadsheets, collision estimates are rounded to the nearest whole number.

Table 6. Monthly mean collisions for the consented design and proposed amendment using Band Model Option 2 for gannet.

Species	OWF Design	Avoidance Rate	J	F	M	A	M	J	J	A	S	O	N	D	Total
Gannet	Consented	0.990	0	1	3	1	2	1	1	1	1	2	1	1	14
	Proposed amendment	0.990	0	1	2	1	1	1	1	1	1	1	0	0	10
	Proposed amendment	0.998	0	1	2	1	2	1	1	1	1	1	0	0	11

Table 7. Monthly mean collisions for the consented design and proposed amendment using Band Model Option 2 for kittiwake.

Species	OWF Design	Avoidance Rate	J	F	M	A	M	J	J	A	S	O	N	D	Total
Kittiwake	Consented	0.990	11	24	49	13	14	10	5	3	4	10	8	13	163
	Proposed amendment	0.990	8	17	34	9	10	7	4	2	2	7	5	9	112
	Proposed amendment	0.998	8	18	37	10	11	8	4	2	3	7	6	10	124

Table 8. Monthly mean collisions for the consented design and proposed amendment using Band Model Option 2 for lesser black-backed gull.

Species	OWF Design	Avoidance Rate	J	F	M	A	M	J	J	A	S	O	N	D	Total
Lesser black-backed gull	Consented	0.995	0	0	1	1	2	1	1	0	0	0	0	0	7
	Proposed amendment	0.995	0	0	1	1	1	1	1	0	0	0	0	0	5

Table 9. Monthly mean collisions for the consented design and proposed amendment using Band Model Option 2 for great black-backed gull.

Species	OWF Design	Avoidance Rate	J	F	M	A	M	J	J	A	S	O	N	D	Total
Great black-backed gull	Consented	0.995	2	2	2	3	2	1	0	0	1	1	1	3	19
	Proposed amendment	0.995	2	1	2	2	1	1	0	0	0	0	1	2	12

The values obtained for the consented design are slightly different from the mean of the annual values published for the original assessment and agreed with Natural England (Forewind, 2014b). These were 15 (90% confidence intervals 12-17) for gannet, 159 (90% confidence intervals 141-181) for kittiwake, 6 (90% confidence intervals 4-10) for lesser black-backed gull and 18 (90% confidence intervals 12-27) for great black-backed gull. As the recalculated values fall within the 90% confidence intervals for these species, it is assumed that these minor differences are due either to rounding processes occurring within the Band (2012) spreadsheet, which are not visible to the user, or a difference in the tidal offset and/or wind farm latitude values used here and in the original assessment (which were unknown).

The recalculated collision mortalities for the proposed amendment are all lower than those for the consented design, with reductions of 21% for gannet, 24% for kittiwake, 29% for lesser black-backed gull and 37% for great black-backed gull in annual predicted collision mortality. This includes allowance for the slightly lower avoidance rate of 0.998 now recommended for gannet and kittiwake (UK SNCBs, 2014).

As stated in Section 2.2, as there is an overall limit on the total rotor swept area, an increase in the rotor swept area of an individual turbine will result in a reduction in the maximum number of turbines that can be installed. Collision estimates have been made for turbines with the largest rotor diameter of 280m so that they can be compared to the worst case scenario of the original assessment where the rotor diameter was 167m. Any turbine with an intermediate rotor diameter i.e. between 280m and 167m, will give collision estimates which are intermediate to those given here because the number of turbines will remain constrained by the key consent parameter, being the total rotor swept area of 4.35km^2. The results presented in this section demonstrate that the use of fewer, larger turbines whilst retaining the same air gap, results in a reduction of collision risk for all four species examined. Therefore, regardless of the exact nature of the final design, collision risk will be reduced relative to the consented design.

4.3.2 Comparisons with Updated Collision Estimates for Sofia OWF

A summary of the consented design annual collision mortalities, along with the updated annual estimates due to the changes in designs at both Teesside A OWF and Sofia OWF (according to its worst case scenario), along with guidance on avoidance rates (UK SNCBs, 2014), is presented in Table 10.

Table 10. Summary of consented and updated annual collision mortalities for Teesside A (proposed amendment) and Teesside B (now Sofia) OWFs.

Species	Avoidance Rate	Consented (Worst Case Scenario)			Updated		
		Teesside A	Teesside B (now Sofia)	Combined	Teesside A	Sofia	Combined
Gannet	0.990	15	18	33	10	13	23
	0.989	-	-	-	11	14	25
Kittiwake	0.990	159	245	404	112	181	293
	0.989	-	-	-	124	199	323
Lesser black-backed gull	0.995	6	6	12	5	5	10
Great black-backed gull	0.995	18	19	37	12	14	26

Using the same apportioning rate as the original assessment (Burton *et al*., 2014; Forewind, 2014a), the proposed amendment would exert a reduced effect on the breeding kittiwake qualifying interest feature at the Flamborough and Filey Coast Special Protection Area (SPA) and Farne Islands SPA, and the breeding gannet qualifying interest feature at the Flamborough and Filey Coast SPA. As a result, the findings of DECC (2015) are maintained; that the collision risk for kittiwake and gannet from the project both alone and in combination with other projects will not have an adverse effect upon the integrity of any European site.

5 Conclusions

This report reviews the impacts on birds which could arise from an increase in the maximum rotor diameter of the Teesside A OWF and examines the differences between the impacts predicted for the consented design and the proposed amendment.

An increase to the maximum rotor diameter will not change the previously assessed worst case scenario displacement impacts considered when granting the DCO, therefore this impact was screened out of further assessment (Section 3.1). The same conclusion also applies to the consideration of potential barrier and indirect effects (Sections 3.3 and 3.4). However, collision risk was assessed as an impact that could potentially be changed as a consequence of the proposed amendment (Section 3.2).

To understand how the proposed amendment would affect predictions of collision mortality relative to the consented design, updated CRM was undertaken. To ensure that collision predictions comply with current guidance and comparisons could be made on a like-for-like basis, updated modelling was undertaken for both the consented design and the proposed amendment (Section 4.2 and Section 4.3).

For all species examined, collision risk modelling showed that the use of fewer larger turbines would reduce collision estimates from the project alone and cumulatively with other projects, indicating that fewer, larger turbines with the same air gap result in reductions in collision risk. Consequently, effects on European sites were also lower than the worst case scenario presented in the ES and the DECC HRA (Forewind, 2014; DECC, 2015).

It is therefore concluded that, as for all other ornithology impacts, the worst case scenario for collision risk as assessed in the ES i.e. 200 turbines with a rotor diameter of 167m, would not be changed by the proposed amendment. This means that the conclusions of the ES and its associated documents are not affected and that the recommendations of the Examining Authority and the conclusions of the DECC HRA which underpin the DCO are not affected and that the worst case scenario in respect of collision risk is as assessed within the ES. As such no further assessment is required for ornithology in support of the proposed amendment to the DCO.

It is therefore concluded that the proposed amendment would not give rise to any new or materially different likely significant effects on any receptor and that the conclusions of the ES and the DECC HRA (Burton *et al.,* 2014; Forewind, 2014a; DECC, 2015) are not affected. Therefore, it is appropriate for the application to amend the maximum rotor diameter be consented as an NMC to the DCO.

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