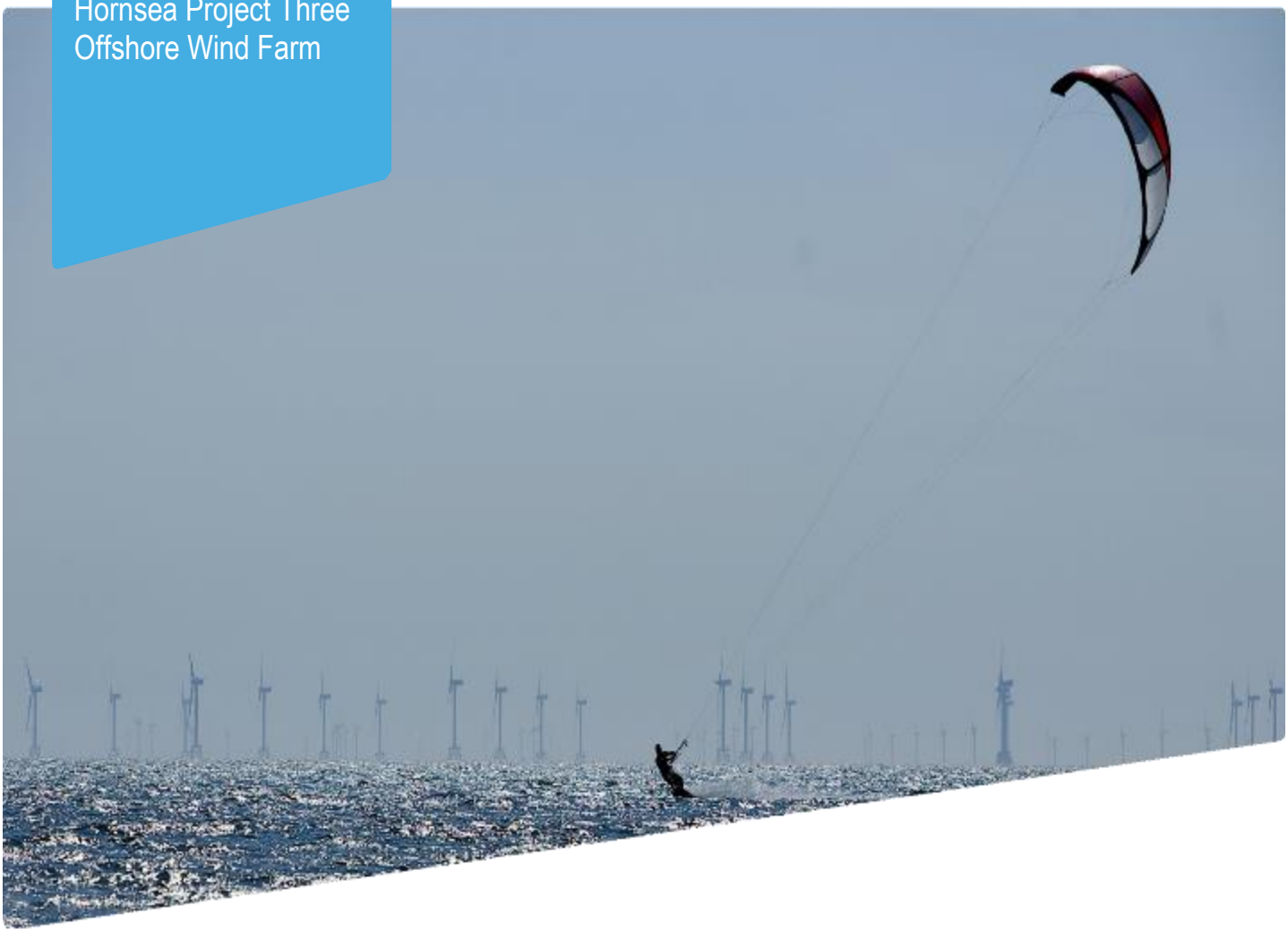
Hornsea Project Three
Offshore Wind Farm



Hornsea Project Three

Offshore Wind Farm

Written summary of Applicant's oral case put at Issue Specific Hearing 7 (6th Mar 2019)

Date: 14th March 2019

Hornsea 3
Offshore Wind Farm

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1. INTRODUCTORY REMARKS

1.1 Issue Specific Hearing 7 ("**ISH**") on Offshore Ecology was held at 09:30am on 6 March 2019 at the Mercure Norwich Hotel, 121-131 Boundary Road, Norwich, NR3 2BA.

1.2 The ISH took the form of running through items listed in the agenda published by the ExA on 27 February 2019 (the "**Agenda**"). The format of this note follows that of the Agenda. The Applicant's substantive oral submissions commenced at item 3 of the Agenda, therefore this note does not cover items 1 and 2 which were procedural and administrative in nature.

2. AGENDA ITEM 1 – INTRODUCTION OF THE PARTICIPATING PARTIES

2.1 The ExA: - David Prentis (Lead Panel Member), Guy Rigby, David Cliff and Dr Roger Catchpole.

2.2 The Applicant:

2.2.1 Speaking on behalf of the Applicant: - Richard Turney (Counsel at Landmark Chambers) and Gary McGovern (Partner at Pinsent Masons LLP).

2.2.2 Present from the Applicant: - Felicity Browner (Lead Offshore Environment Manager for Hornsea Three) and Gareth Parker (Electrical Project Manager).

2.2.3 The Applicant's legal advisors:- Claire Brodrick (Pinsent Masons LLP) and Peter Cole (Pinsent Masons LLP).

2.2.4 The Applicant's environmental consultants (listed alongside their relevant environmental topic area):

(a) Offshore Ornithology – Dr Tim Norman (Managing Director at NIRAS Consulting Ltd) and Matthew Hazleton (Senior Ornithologist at NIRAS Consulting Ltd);

(b) Benthic Ecology – Dr Kevin Linnane (Principal Marine Ecologist at RPS Group plc); and

(c) Marine Mammals – Peter Gaches (GoBe Consultants Ltd)

2.3 The following parties were present at the ISH:

2.3.1 Mulbarton Parish Council

3. AGENDA ITEM 3 – STATEMENTS OF COMMON GROUND

3.1 Following a request from the ExA for an update, Felicity Browner advised that statements of common ground ("**SoCGs**") on benthic ecology and marine processes between Natural England ("**NE**") and the Applicant had been developed over the course of the examination. Ms Browner confirmed that a call had taken place on 27 February to discuss how best to present the information to provide maximum clarity to the ExA on the respective position of each party. During this call NE advised that it is working on a summary of this position to be submitted for Deadline 7. Ms Browner reported that NE had stated its preference to focus on this document rather than the SoCG so the Applicant had agreed to withhold SoCG discussions until after Deadline 7, with an aim to provide a final SoCG for Deadline 9.

3.2 Regarding ornithology, Ms Browner advised the ExA that both NE and the Applicant had commented on a SoCG a number of times but with limited progress made to resolve the issues outstanding. Ms Browner confirmed that the Applicant has therefore aimed to present the document in a format with binary positions. She advised that this document is with NE for approval, and that the Applicant hopes to submit it at as soon as possible.

3.3 Ms Browner added that the Applicant had asked to meet with NE ahead of ISH 7 to discuss mitigation options, but NE had stated that due to their position on the sufficiency of information to quantify the impact, they would not be able to advise on the level of mitigation required. Ms Browner relayed that the Applicant had told NE in response that engagement would still be beneficial, and had asked to discuss generic benefits of different mitigation options, suggesting an outline meeting agenda. Ms Browner advised that NE had not yet responded to such.

3.4 Responding to an ExA clarification question, Ms Browner confirmed that the Applicant hoped to submit a SoCG on benthic ecology by Deadline 9, and a SoCG on ornithology by Deadline 7, but this timetable would depend on NE's resources.

3.5 In response to a question from the ExA, Ms Browner confirmed that in the context of the ornithology SoCG, binary meant that positions would be set out as either agreed or not agreed, rather than setting out copious amounts of text or identifying points as still “under discussion”. The Applicant hopes that given the late stage of the examination, this will provide the ExA with clarity on where no further movement can be made.

3.6 Responding to an ExA request for an update on the feasibility of micro-siting for reef areas, Dr Kevin Linnane confirmed that the Applicant had submitted at Deadline 6 a note that looked at implications of using the proposed temporary working areas for micro-siting [REP6-038]. He advised that a specific DML condition would not be required, rather an amendment to the Works Plans referred to in the DCO.

4. AGENDA ITEM 4 – BENTHIC ECOLOGY

4.1 **a) General Issues**

4.2 The ExA raised a query regarding an MMO suggestion that swath bathymetry monitoring of scour pits should be used at sites with high mud fractions to offset uncertainty at deeper locations, with this being secured either in the deemed marine licence ("**DML**") or in the in principle monitoring plan ("**IPMP**"). Dr Linnane responded that the Applicant had discussed this with the MMO and agreed to update both the IPMP and DML accordingly and this will also be recorded in the next version of the statement of common ground ("**SoCG**"). Dr Linnane confirmed that an updated SoCG and updated IPMP would be provided at Deadline 7. Peter Cole confirmed that an updated draft DCO would be provided at Deadline 7 with amended wording on this point.

4.3 **b) Cable Specification Installation Plan**

4.4 Responding to an ExA question on mitigation of inter array cables within Markham's Triangle rMCZ, Dr Linnane confirmed that Markham’s Triangle was not specifically cited within the cable specification and installation plan (“**CSIP**”) as most of the concerns raised by Natural England related to the offshore cable corridor and the overlap with the SACs and the Cromer Shoal MCZ. Dr Linnane agreed though to take this point away for further consideration. He added that one element of the CSIP was to clearly define the maximum design envelope within each of the designated

sites. Dr Linnane highlighted that a condition of each DML (Schedules 11 and 12, latest version REP6-004) already covers the maximum design envelope for Markham's Triangle. Therefore, there were elements of the CSIP captured within the DMLs. Dr Linnane agreed to review and further consider the need to update the CSIP ahead of Deadline 7 to include Markham's Triangle, in addition to other updates which will be made to address comments made by the MMO and Natural England ("**NE**") at Deadline 6 and to more clearly define the maximum design parameters for sandwave clearance volume, cable protection volumes and footprint for each designated site.

4.5 The Applicant clarified that the CSIP is a standard post consent document produced for all offshore wind farm projects that covers all cable installation and burial activity. In the case of Hornsea Project Three, the Applicant has expanded the content of the standard CSIP to present specific detail in relation to key designated sites where concerns have been raised by the statutory nature conservation body ("**SNCB**") and the activities of most concern to SNCBs (i.e. sandwave clearance and cable protection). In this regard, it is important for the ExA to note that although the Markham's Triangle was not specifically referred to within the first draft of the outline CSIP (REP5-011), as was the case for the other designated sites, detail of cable installation activity within Markham's Triangle rMCZ would be covered by the terms of the CSIP.

4.6 The updated outline CSIP has been provided at Appendix 4 to the Applicant's response to Deadline 7.

4.7 **c) Cable Trenching Assessment**

4.8 Dr Linnane addressed a question from the ExA regarding a NE query on whether supplementary information could be provided such as highlighting areas of relative cable burial risk on different plans within the cable trenching assessment. Dr Linnane confirmed that the main purpose of the cable trenching assessment was to demonstrate, based on the ground conditions, that the tools within the project description would be sufficient to allow cable burial in the ground types present in the cable corridor. He advised that the Applicant was not planning to update the trenching assessment, but that clarifications would be provided at Deadline 7 to respond to the comments from Natural England on this document (as set out in REP6-048). These clarifications are provided in the Applicant's comments on Written Representations and Responses submitted by Interested Parties at Deadline 6.

4.9 With regard to the NE suggestion to update the assessment to include high, medium and low risk areas for cable burial, Dr Linnane advised that there are many reasons why cable may be insufficiently buried, and these reasons are not limited to ground conditions. Therefore, Dr Linnane stated that such an approach would not reflect the actual risk of burial failure as it would relate only to ground conditions and could be misleading and give an impression of false accuracy.

4.10 Gareth Parker replied to an ExA question on the other reasons (other than ground conditions) for not achieving target burial highlighting that this had been discussed at previous Issue Specific Hearings but would include factors such as tool breakdown due to excessive chain wear, or it may be necessary to change tool type between different soil types to optimise burial spread, in which case there may be a standing bite on the cable and remedial burial techniques would be needed to protect the cable. Dr Linnane added that the main finding of the preliminary trenching assessment was that with the correct installation tools cable burial is possible, but that it remains necessary for cable protection to be included in the project envelope to cover an eventuality of an unplanned event occurring that would prevent burial such as outlined by Mr Parker.

4.11 In response to a question from the ExA, Mr Parker advised that in the planning for cable burial, the seabed mobility would be taken into account. He advised that a reference seabed level would be set at the outset, below the minimum trough of the sandwave expected over the cable's lifetime. He confirmed that a shallower depth in a stiffer soil may afford a similar level of protection to a deeper burial in a softer soil, so the trenching depth would depend on the different substrate. Mr Parker added that the same would apply when target burial is not achieved, when a site specific assessment would be required.

4.12 Richard Turney confirmed that the Applicant would review typographical errors highlighted by the ExA in paragraph 3.3 of the CSIP. As outlined in paragraph 4.6 above, the updated outline CSIP is

presented at Appendix 4 to the Applicant's response to Deadline 7, which includes correction of these errors.

4.13 Dr Linnane responded to comments by NE [REP6-048] which stated that an area of cobble reefs would be a significant cable trenching impediment by clarifying that this is an area which would in any event be avoided. Dr Linnane advised that the Applicant had contacted the Eastern Inshore Fisheries Conservation Authority ("**IFCA**") regarding their recent survey of the north Norfolk coast, with an initial review that data having identified one area of reef close to the edge of the Hornsea Three boundary. He stated that the Applicant was aware of this area of reef and the Eastern IFCA's observations aligned with an area of circalittoral and infralittoral rock to the west of the cable land fall, within the temporary working area (see Seasearch Dive Survey records in Figure 4.29 of Volume 5, Annex 2.1: Benthic Ecology Technical Report). Dr Linnane confirmed that as these are Annex 1 reefs within the SAC, these areas would be avoided and no cable would be installed there as they are within the temporary working area, not the cable corridor. He advised, in terms of how far the area extends, that the Benthic Ecology Technical report [APP-102] sets out a lot of detail on drop down video surveys and geophysical surveys within the nearshore area, and no evidence of cobble reef was found. However, in any event the area identified will be avoided. With respect to coarse and mixed sediments representing an impediment to cable installation, see paragraph 4.17 below.

4.14 The ExA requested clarification on the relative strength of the benthic sampling tool as compared to the tools used for burial. Dr Linnane advised that for benthic sampling a grab sampler would be used which would sample the surface sediments, i.e. just a few tens of centimetres, as these target surface sediments and associated ecology (which occur the first 10s of centimetres of sediment). He stated within the preliminary trenching assessment that the geotechnical sampling (e.g. bore holes and cone penetration test (CPT) samplers) go much deeper. Mr Parker supplemented these comments, stating that the purpose of the sampling is to understand the ground conditions and build a ground model, therefore sampling would be to a deeper depth. He advised that boreholes would go to depths beyond that which cable burial would be expected to be achieved within. Thus borehole sampling could be up to 6 metres as noted by the ExA, but burial depth would be expected to be in the order of 2 to 3 metres for the majority of tools. Mr Parker confirmed that based on the sampling, the Applicant is satisfied that the tools proposed within the project envelope would be perfectly able to penetrate the sediments found.

4.15 To clarify, Ørsted is in agreement with the examiners' observation that if the Vibrocore (VC) samples performed in the chalk were able to penetrate to the target depth then this is evidence to support the fact that the target burial depth can be achieved at Hornsea Three when trenching in similar soils. Of the VC's undertaken (as part of the Hornsea Three 2018 geotechnical campaign), six vibrocores penetrated into the chalk. During these tests, as part of the field measurements, vibration time is routinely measured which is considered to be a good indicator of the intact soil strength. Where vibration time was recorded, the time varied between 2 and 10 seconds. To provide some context to these vibration times; at another Ørsted windfarm where the ground conditions were observed to be very stiff clays (more competent than a weathered chalk) vibration time varied between 5 and 10 minutes. In these soils burial was successfully achieved to a depth of approximately 1.5m below seabed using a cable plough.

4.16 Ms Browner added that the cable trenching assessment is intended to be an engineering document to provide greater comfort that burial tools are adequate having regard to the ground conditions in view of issues raised by NE regarding burial concerns, and is not intended to be a benthic ecology assessment document and there appeared to be some conflation of these matters in NE's comments in its Deadline 6 submission.

4.17 The ExA highlighted a point made by NE in its Deadline 6 submission that there is apparently a lack of substantiated evidence of the similarity of sediments and geology of Sheringham and Dudgeon cable routes, and that drop down video surveys show mixed sediments similar to Race Bank. Dr Linnane responded stating that this NE comment speaks to the point made by Ms Browner, the cable trenching document being an engineering document to show the tools are applicable for the ground conditions. In terms of the ability to install cables within mixed and course sediments, he advised that the Applicant's geotechnical specialists had considered the particle size distribution data collected in the cable corridor and could see no issues with cable burial, based on the

proportion of gravels in the tests based on there being a greater proportion of sands in the majority of samples. Dr Linnane highlighted that offshore wind farms off the Holderness coast, for example Westermost Rough and Humber Gateway, had been able to install cables in much coarser sediments than those found at the Hornsea Three application site; the Holderness coast being an environment which is much coarser in terms of sediment composition (i.e. presence of boulders, cobbles and gravels) than the North Norfolk coast. Therefore the Applicant does not consider the sediments within the Hornsea Three cable corridor to be a significant challenge to cable installation. Turning to the comparability of mixed sediment areas within the Hornsea Three cable corridor to mixed sediment areas near Sheringham and Dudgeon or Race Bank, Dr Linnane advised that it was not unusual that surface sediments are similar, as this is broad scale habitat features across the southern North Sea, so it is not unusual to find mixed sediments within the cable corridors for both Hornsea Three and Race Bank. He added that within the Cromer MCZ one of the main habitat features is subtidal mixed sediment. In relation to the communities, Dr Linnane stated that the similarity of Hornsea Three and Race Bank is not unusual as communities recorded on the drop down video footage are generally quite ubiquitous species within mixed core sediment across the southern North Sea. In relation to ground conditions, Dr Linnane confirmed that particle size data that the Applicant has collected indicates that cable burial will not be a problem in those mixed and coarse sediment areas.

4.18 Dr Linnane confirmed that the Applicant would provide evidence at Deadline 7 to show that the seabed along the Sheringham and Dudgeon export cables is more similar than Race Bank, beyond being nearer to Hornsea Three's cable corridor. He stated that Natural England had noted that cutting tools had been used for Sheringham to cut through sub cropping chalk. He confirmed that Hornsea Three also has sub cropping chalk within the ground types. Dr Linnane stated that whilst the Applicant doesn't have all of the ground condition information for Sheringham or Dudgeon if it did encounter sub cropping chalk, given that Hornsea Three's corridor is only a few kilometres from Sheringham, it would be sensible to assume that the chalk is more similar to Sheringham Shoal than the chalk at Race Bank, which is much further away. Dr Linnane reiterated that the preliminary cable trenching assessment is based on the conditions in the Hornsea Three cable corridor, and these do not present an issue for the cable installation tools proposed in the project description.

4.19 The Applicant has provided at Appendix 33 to the Applicant's response to Deadline 7 a paper (Le *et al*., 2014) discussing the characteristics of the chalk found within the Sheringham Shoal offshore wind farm. The chalk in this area is known to be Upper Cretaceous (or chalk) with a thickness of >200 m. The chalk in Sheringham Shoal has a high porosity which is conducive to the formation of 'putty' chalk by weathering and freeze thaw cycles, explaining the presence of weathered chalk within Sheringham Shoal. The thickness of this structureless chalk is between 10-15m (Le *et al*., 2014). This interpretation is consistent with British Geological Survey records of Upper Cretaceous off the North Norfolk coast, which is shown in the figure in Appendix 34 to the Applicant's response to Deadline 7 extending from the Hornsea Three landfall, to the Sheringham and Dudgeon offshore wind farm array areas (British Geological Survey, 1992[1]).

4.20 As outlined in Le *et al.* (2014), using the chalk classification system suggested by Lord et al. (2002), the weathered chalk at Sheringham Shoal is graded as Dm (i.e. structureless chalk with >35% chalk matrix) and Dc (i.e. structureless chalk with <35% chalk matrix. As per section 4.5 of Preliminary Trenching Assessment (REP5-010; see also Table 4.2 and Table 4.3), the chalk Hornsea Three export cable corridor chalk is also classified as grade Dm or Dc.

4.21 In addition, the Applicant has provided a geophysical survey report for the Dudgeon export cable route at Appendix 32 to the Applicant's response to Deadline 7. The Applicant would direct the ExA to section 3.4 of that report and the accompanying table on page 17 of that report, which states that the chalk present in the nearshore section of the Dudgeon offshore cable corridor is "weathered" and "weak and structureless", which aligns with the description of the chalk within the Hornsea Three offshore cable corridor (see sections 4.5 and 4.33 and Table 4.3 of the Preliminary Trenching Assessment; REP5-010).

[1] British Geological Survey (1992) The Geology of the southern North Sea. UK Offshore Regional Report.

4.22 Dr Linnane advised that the Applicant's position is still that the maximum design scenario would be 10% cable protection within any one MPA if operation and construction phases are taken together.

4.23 **d) Cable Protection Decommissioning**

4.24 The ExA sought clarification of figures for long term and permanent habitat loss in the absence of cable decommissioning within the marine protected areas and equivalence of figures in Table 1.1 of the Markham's Triangle Lifetime Effects Assessment [REP3-023], which is stated to be 540,038 square metres, compared to column 3 of Table 2.1 of the Cable Protection Clarification Note [REP1-138] and, assuming comparability of the figures, if the ExA has understood correctly that the habitat loss is less than 1% for all MPAs. Dr Linnane confirmed that the long term/permanent habitat loss at all sites would be less than 1% of each individual MPA area and less than 1% of each feature of those MPAs. In relation to Table 1.1 of REP3-023, he advised that the figures for long term habitat loss and permanent habitat loss were not additive, but the permanent habitat loss was a subset of long term habitat loss (i.e. if cable/scour protection is not decommissioned, it becomes permanent habitat loss). He explained that the reason the long term and permanent habitat loss numbers were different in the table was because foundations (with a footprint of approximately 61,000 m^2) would be removed during decommissioning, but for the purposes of the MCZ Assessment, it was assumed that scour and cable protection would not be decommissioned (therefore being permanent habitat loss). Dr Linnane confirmed that the figures in the third column of Table 2.1 were correct, advising that the footprints would be included in the updated outline CSIP together with volumes for designated sites (see Appendix 4 to the Applicant's response to Deadline 7).

4.25 In response to an ExA request for clarification, Dr Linnane confirmed that cable protection could be removed using either a backhoe dredger or trailing suction hopper dredger in all marine protected areas except Markham's Triangle MCZ, and some deeper areas of North Norfolk Sandbanks SAC. In these areas, the greater water depths would render backhoe dredging unfeasible, however a trailing suction hopper dredger would be able to operate within these depths.

4.26 Dr Linnane confirmed that the Applicant would clarify in the hearing summary how much of the seabed below the point of rock protection would be removed with a backhoe dredger. The Applicant is currently investigating this and will report back to the ExA at Deadline 8, although it is likely to be within a similar range as trailing suction hopper dredger (i.e. 10s of centimetres). The ExA also asked for a view from the Applicant on which method would be more environmentally damaging, which Dr Linnane confirmed would be clarified in the hearing summary.

4.27 The Applicant clarifies that the purpose of the REP6-018 was to demonstrate that there are methods currently available which can remove rock protection. The precise methodology to be used to decommission rock protection will be determined as part of the decommissioning plan to be signed off by the MMO prior to decommissioning. The Applicant would note that based on the methodologies proposed, the width of disturbance from decommissioning of rock protection will be within the maximum design scenario for construction phase impacts (i.e. a width of disturbance of up to 30 m) and the effects, including recovery rates, following decommissioning would be similar to those associated with the construction phase. It would not be appropriate to comment on which of the two methodologies presented would be more or less environmentally damaging, as both methods would be within the envelope assessed. Furthermore, technological advances in the decades between now and Hornsea Three decommissioning would be expected to make decommissioning more efficient.

4.28 For example, as outlined in previous examination submissions (e.g. Cable Protection Clarification Note; REP1-138) it would be expected that sediment (i.e. sand and mud) would accumulate within spaces in the cable protection and as noted by NE that decommissioning may remove this material and some sediment beneath the cable protection. During dredging operations, it is not unusual for fine sediments (e.g. sand and mud) to be lost in suspension and return to the seabed over time. One potential mechanism by which these losses could be minimised (i.e. sediment returned to the seabed) is via screening, which is used in the aggregates industry to remove finer grained sediment from coarse aggregate, and return this material to the sea. However, it should be noted that the volumes of sand removed from the seabed via such a pathway would be extremely small in the context of the overall sediment budgets within the wider MPAs. This is supported by evidence from

the aggregates industry, where considerable volumes of sand and gravels are removed entirely and the seabed recovers over a period of years (discussed further below).

4.29 In response to an ExA question, Dr Linnane advised that within the Benthic Ecology Environmental Statement chapter [APP-062] there is information on the recovery of sand and gravel sediments and associated communities following aggregate extraction activities. He noted that methods proposed had been used in aggregate extraction, so the evidence is directly applicable. Dr Linnane reported that depending on where the sediment is removed and the level of mobility in the area, recovery would be achieved within 5 years within sand and gravel communities. Dr Linnane confirmed that the ES chapter referred to various papers for the aggregates industry, and that the Applicant would submit those to the ExA.

4.30 The Applicant has provided references to relevant studies from the aggregate extraction industry, as referenced in Volume 2, Chapter 2: Benthic Ecology of the Environmental Statement (paragraphs 2.11.1.25 and 2.11.1.28). These are provided at Appendices 16, 17, 18 and 19 to the Applicant's response to Deadline 7. While these studies have been used to inform the assessments within the Environmental Statement and the RIAA, it should be noted that aggregate extraction typically extracts sediment to metres below the seabed, as opposed to 10s of cm assumed for removal of cable protection. This activity therefore represents a much greater impact than that assumed for decommissioning of rock protection.

4.31 Dr Linnane stated that the Applicant would provide more detail at Deadline 7 responding to NE comments on issues experienced with decommissioning at Thanet offshore wind farm. In summary, Thanet had used a remotely operated vehicle ("ROV") to relocate rocks from an existing rock berm onto a new section of cable. That method was not successful due to local currents and visibility which limited the ROV's ability to navigate and orientate the equipment to remove rock protection. Dr Linnane confirmed that within the Applicant's decommissioning note, a very different method would be used, which would not be limited by environmental conditions to the same degree as a relatively small ROV, therefore, he set out his view that this example was not a valid comparison to Hornsea Three. Further detail is provided in the Applicant's comments on Written Representations and Responses submitted by Interested Parties at Deadline 6.

4.32 Dr Linnane also reiterated that the Applicant's position is that cable protection decommissioning is not necessary to (a) avoid adverse effects on the integrity of the SAC (b) in other respects ensure that adverse environmental effects are minimised, but it has been proposed to allay NE concerns about permanent habitat loss effects. This has also been proposed as NE had previously advised Vanguard that this would be expected for remedial rock protection.

4.33 **e) North Norfolk Sandbanks and Saturn Reef SAC**

4.34 The Applicant will supply a higher resolution version of REP4-097 (Appendix 5 to the Applicant's response to Deadline 7) and a copy of Jenkins et al (2015) (Appendix 6 to the Applicant's response to Deadline 7).

4.35 **f) The Wash and North Norfolk Coast SAC ("WNNC SAC")**

4.36 Dr Linnane confirmed that the revised in combination assessment submitted at Deadline 3 (REP3-024) supersedes the assessment within the ES and the Report to Inform Appropriate Assessment ("**RIAA**"), and was based on information not available at the time those documents were drafted.

4.37 Dr Linnane advised that although NE stated that the Large Shallow Inlets and Bays feature is not geographically limited to The Wash embayment, it was screened out of the assessment as the relevant DEFRA figure presented during the hearing (which will be submitted at Deadline 7) shows that this feature does not extend to the part of the coast which coincides with the Hornsea Three offshore cable corridor. He further stated that the Applicant's position was that the part of the North Norfolk Coast that coincides with the export cable corridor is in open coastline and cannot be described as an inlet or bay when following JNCC and European Nature Information System (EUNIS) definition, i.e. large indentations of the coast, generally more sheltered from wave action than the open coast. Dr Linnane confirmed that it had been agreed in a meeting on 4 December 2017 for the Evidence Plan that this could be screened out of the RIAA. Further detail of this,

including the figure presented and discussed during the hearing, is provided in the Applicant's comments on the RIES

4.38 In response to an ExA question, Dr Linnane advised that the 25% replenishment is inherent in the assessment in the same way as in the RIAA. He advised that this would not add any additional footprint and therefore there is no additional habitat loss as it would be placed on top of existing cable protection.

4.39 Dr Linnane advised that NE commented that one marine licence was not included in the in combination assessment. He stated this would be explained further in a Deadline 7 submission, but that the missing marine licence was for cable protection to be placed outside the Wash and North Norfolk Coast SAC, so the Applicant is of the view that there is no in-combination effect (see Applicant's comments on Written Representations and Responses submitted by Interested Parties at Deadline 6).

4.40 **g) Cromer Shoal Chalk Beds MCZ**

4.41 Mr Turney advised in response to an ExA question that it was correct that under section 126 of the Marine and Coastal Access Act 2009 ("**MCAA**") that authorisation should not be granted where subsection (7) applies unless three tests are met including arrangements for measures of equivalent environmental benefit ("**MEEB**"). He confirmed that whilst he agreed that subsection (9) required conditions to be added to secure MEEB where subsection (7) applies, it was the Applicant's position that subsection 126(6) applies (i.e. no significant risk of the act hindering the achievement of the conservation objectives stated for the MCZ) so subsection 126(7) is not engaged and therefore such conditions should not apply.

4.42 The Applicant would add that subsection 126(7) is only engaged where first, the proposal is capable of affecting (other than insignificantly) the protected features of an MCZ or any ecological or geomorphological process on which the conservation of any protected feature of an MCZ is (wholly or in part) dependent (s 126(1)) and there is a significant risk of the proposal hindering the achievement of the conservation objectives stated for the MCZ (s 126(6)).

4.43 Mr Turney confirmed that MEEB could be secured in principle via a condition under the DMLs. The detail of the delivery of the MEEB would be subsequent to the consent.

4.44 Answering an ExA question, Mr Turney advised that no wording for a condition to secure MEEB had been provided given that the Applicant's position is that this is not required. He confirmed that the Applicant had proposed at Deadline 4 that if MEEB was necessary, it would take the approach outlined in the Applicant's response to ExA's further written question 2.2.46, namely that there should be an in principle commitment with the full detail of the MEEB would to be secured later. He advised that there was no discussion yet on the wording with the MMO, but if directed to do so by the ExA this could be discussed with the MMO without prejudice to the Applicant's position that it is not required

4.45 **h) Markham's Triangle rMCZ**

4.46 Mr Turney confirmed that any condition wording discussed regarding MEEB would also cover Markham's Triangle, not withstanding that it had yet to be designated.

4.47 **i) Any Other Matters**

4.48 Mr Turney stated that it was in the nature of the examination process to focus on outstanding issues but the Applicant wished to highlight that there was a substantial offshore export cable re-route following the consultation on the preliminary environmental information report (PEIR) as explained in the site selection chapter of the ES [APP-059]. This was in response to observations by NE and was undertaken by the Applicant at substantial additional cost to avoid some of the most sensitive interest features. Mr Turney asked that this should be in the ExA's mind when considering the impacts on the SAC.

4.49 Dr Linnane added to this, advising that there had been two pre-application reroutes. The offshore reroute reduced the total cable length in the North Norfolk Sandbanks and Saturn Reef SAC by 78 kilometres. He stated that the more substantial reroute was in the nearshore area to avoid more sensitive features of the Cromer Shoal Chalk Beds MCZ including clay exposures and chalk reef habitat. NE's advice on the PEIR was that marine interest features of the Wash and North Norfolk Coast SAC near to Weybourne are less sensitive to those within the Cromer MCZ, which would have been affected by the previous cable corridor route. Dr Linnane confirmed that upon receiving this advice from NE, the Applicant had undertaken a comparison exercise of the two routes in terms of impact on the SAC, MCZ and the two designations as a whole. This comparison confirmed that there were benefits in terms of volume and footprint of cable protection (largely due to removal of asset crossings from the two designated sites) and length of cable across the two designates sites and accepted NE's view that there was merit in rerouting the cable corridor through the SAC. Dr Linnane added that the key benefit was the avoidance of direct impacts to more sensitive habitats such as clay exposure, which once crossed would have no chance of recovery. In contrast the habitats in the eastern area of the SAC would recover following cable installation.

5. AGENDA ITEM 5 – MARINE MAMMALS

5.1 **a) Site Integrity Plan**

5.2 Responding to an ExA question on an MMO recommendation submission of the final Site Integrity Plan ("**SIP**") six months prior to commencement (the Applicant maintains that a four month period is adequate), Peter Gaches advised that under the outline SIP, section 2.2, there would be an iterative process and there were a number of consultation steps to be undertaken before and leading up to seeking agreement for the final SIP. These would commence following award of a contract for difference, the second falling six to nine months before construction, then subsequent to this the document would be submitted to the MMO for approval. Mr Gaches highlighted that therefore there would be an ongoing discussion with the MMO on successive drafts of the document and that the Applicant therefore considers four months would be adequate for sign off of the final version. He emphasised that all of the material and detail of the SIP would be discussed and agreed during the consultation process, so the final document submitted to the MMO would have gone through a number of rounds of consultation and all matters would be either agreed or positions clear by that point. Mr Gaches added that as this was a high risk document for the Applicant, containing mitigation, it would not be in the interests of the Applicant to leave any substantive issues on mitigation or content outstanding and submit the final draft blind.

6. AGENDA ITEM 6 – OFFSHORE ORNITHOLOGY

6.1 **a) General Issues**

6.2 Ms Browner confirmed that the Applicant has been considering the list of data requested by NE in REP4-130 and will provide to NE the relevant information that it can as soon as possible. Regarding the roadmap, Ms Browner stated that the Applicant had sought a meeting with NE following the last ISH, but they had been unable to commit to that. Ms Browner stated that an updated roadmap could be provided at Deadline 7.

6.3 Replying to an ExA question, Ms Browner confirmed that there had been weekly calls held with NE's Emma Brown, however the Applicant had not been able to have a meeting with NE's ornithological specialist.

6.4 Mr Turney emphasised that the Applicant had made a request for a specific meeting with NE to discuss mitigation measures, firstly on a project specific basis. Once this was rejected due to NE's concerns on data, Mr Turney confirmed that the Applicant had renewed that request to discuss mitigation generically but that had no response had been received to that.

6.5 **b) Collision Risk Model**

6.6 Dr Tim Norman confirmed that a presentation had been prepared to summarise and show as transparently as possible the different positions for collision risk modelling with reference to kittiwake, what they were and where they derive from (the slides and accompanying speaker note

are attached to this hearing summary an Annex A). He stated that the differences with NE relate to six issues: (i) flight speeds, which is a bird characteristic input variable model assumption; (ii) avoidance rate, which is a correction for model errors and the behaviour of birds; (iii) apportioning of the collisions back to the SPA; (iv) the percentage of the collisions to attribute to the SPA; (v) biological seasons, which is linked to the previous issue as different apportionments are applied in different seasons; and (vi) nocturnal activities, because birds behave differently in night and day, but the model requires a 24 hour risk.

6.7 Dr Norman explained that, as requested in previous hearings, the Applicant had produced numbers based on NE's assumed position as a high water mark for predicted collision rates. The Applicant has then provided refinements to that position so that it gradually reaches the Applicant's. Dr Norman highlighted that in some instances it had been difficult to pin down NE's position, as either there was a range or they had no view, so the upper value was taken where there is a range. Therefore, Dr Norman advised that the figures may not be NE's position. He confirmed that the data related to kittiwakes, and that the Applicant had only used mean densities from digital aerial surveys, not the meta analysis or boat based data. Mr Turney clarified that the information was available in Appendix 29 to the Applicant's Deadline 6 submission [REP6-043].

6.8 Dr Norman advised that the collision rates were shown in the slides, with the predicted annual collision rate. He confirmed that the top of the table set out the value, with the six issues of difference set out. Dr Norman confirmed that if all of NE's values were included, then the predicted collision rate is shown, for the project alone with the mean value highlighted and a range of values depending on the confidence value for the data. He advised that the suggested NE inputs would be a flight speed of 13.1 metres per second, avoidance rate of 98.9%, use of model option 2, apportioning rate back to the SPA during the breeding season of 93.1% (being the highest in the range interpreted as NE's position). Dr Norman added that the biological seasons advocated by NE had been used, and a nocturnal activity factor of 3, which was the upper value in a range. He noted that these values were changed progressively as the table moved to the right, initially flight speed, and then avoidance rate, and so on so as to provide a sequential change from the Applicant's position to NE's.

6.9 In response to a question from the ExA, Dr Norman confirmed that the Applicant's position was largely the same as at the time the Application was made; the only key difference was the avoidance rate and flight speed which has evolved based on new evidence. He advised that the Applicant's position had evolved in light of the emergence of evidence on flight speed and the recommendations in the JNCC report to use a rate of 99.0% for kittiwake when using the basic version of the Band (2012) collision risk model. Dr Norman also highlighted that different nocturnal activity factors were being used based on information from Furness et al. (2018; REP1-143).

6.10 Replying to an ExA question, Dr Norman confirmed that the conclusions in the ES and RIAA would be the same for the range of inputs described in paragraph 6.8, and that there is no indication from the evidence of an adverse effect arising from this predicted mortality rate for kittiwake as a feature of the Flamborough and Filey Coast SPA. He stated that the numbers are indicative of an effect so small as to be a non material, or de minimis, contribution, being an extremely small proportion of a total breeding population, which recent counts indicate to be more than 51,000 pairs.

6.11 In response to a request by the ExA, Dr Norman confirmed that the Applicant would provide a table for each of the species and a table for baseline mortality analogous to tables 7.13 and 7.17 in the RIAA. Also, the Applicant will provide a summary of the preferred parametrisation as per ES Tables 5.26 and 5.27 [APP-065] (this is provided as Appendix 15 of the Applicant's Deadline 7 submission). Finally, Dr Norman agreed that the ExA would be able to compare tables 5.28 and 5.29 in the ES for lesser black backed gull and great black backed gull.

6.12 Dr Norman advised that the presentation included an in combination element for the calculated mortality of other projects. He stated that the baseline is 250 mortalities deriving from other projects in the list provided at Deadline 1 [REP1-005], which included projects flagged by NE for inclusion.

6.13 In response to an ExA question on slide 7 of the presentation, Dr Norman stated that the population size relates to the time the assessment was made, this was assessed against an assumed size for the conservation objective of the SPA and the current population based on the most recent

monitoring data. So for the Flamborough and Filey Coast SPA this was cited as 44,520 pairs, but in 2017, the most recent data was 51,535 pairs. Dr Norman advised that this was included to indicate the trajectory of the population, as a consideration in the PVA is whether the population is increasing. With respect to kittiwake at Flamborough and Filey Coast SPA, there is a modest increase. Dr Norman stated that latest population figures were from readily available sources.

6.14 Dr Norman confirmed that the PVA model was updated and submitted at Deadline 4 to reflect comments from NE relating to two matched runs. He clarified that the model is produced in two formats, a density dependant model and a density independent model. Dr Norman stated that the independent model is the more precautionary approach, as it does not include any density dependent compensation, although some birds show a reaction to changes in population that can buffer the effect of mortality, for example, as there are fewer adults there is less competition. Dr Norman stated that the mechanism by how this occurs, and how applicable this is to the kittiwake population at the Flamborough and Filey Coast is a matter of debate so the Applicant has presented the independent model, which shows a stark response to population change, which Dr Norman, and the author of the model, considered unlikely. Dr Norman outlined that there is an effect on this model, as there is different data available on bird survivorship, and two sets of data was modelled, namely demographic data set 1 and 2. Dr Norman confirmed rate set 1 had been used as it is the most similar to the recent demographics data of this population, which is a point NE had raised. In response to the ExA observation that NE maintain the most recent rate set be used, Dr Norman stated that the Applicant had confirmed with the model author, Dr Mark Trinder, that contrary to NE's opinion, it was better to use older but longer term data sets as this would show trends over a longer period of time without being affected by inter-annual variability. Dr Norman stated that this advice is set out in REP4-092. Dr Norman clarified that the PVA modelling the Applicant was not trying to simulate population, rather try to understand its resilience to mortality.

6.15 Ms Browner advised in response to an ExA query that the Applicant had asked NE ahead of ISH7 if it agreed with the Applicant's interpretation of their position on the parameterisation, but no response had been given.

6.16 Dr Norman added that the Applicant was not aware of any specific divergences of opinion, as there is no mileage for the Applicant in presenting anything which NE would immediately disagree with. He considered that the Applicant had gone the extra mile to present the position of another party in an open and transparent way, and was not aware of any specific disagreement. Dr Norman added though that on the PVA he did not know NE's position.

6.17 In responding to an ExA question, Dr Norman advised that colony specific data for gannet and kittiwake had been used for the purpose of setting out NE's position in the Deadline 4 and 6 submissions.

6.18 Regarding a question from the ExA, Dr Norman confirmed that Table 2.1 of REP6-043 Johnston et al (2014) was the source.

6.19 Dr Norman answered an ExA question regarding the number of tracks and samples in table 7.11 of Skov (2018), that the data was obtained using a laser range finder. Regarding the sample size, Dr Norman advised that the survey had been undertaken over two years so there had been lots of observation of individual birds – 790 for large gulls and 287 for kittiwake. He advised there could be multiple laser range finders for multiple birds, but the Applicant would need to clarify what was presented in that table.

6.20 Subsequent to the hearing, the Applicant has contacted Dr Henrik Skov who is the lead author of Skov et al. (2018) who has confirmed that the figures provided in Table 5.1 and Table 7.11 of Skov et al. (2018) refer to the number of rangefinder tracks but the numbers presented represent different subsamples as not all tracks were used for the calculations conducted for flight speed or the macro empirical avoidance rate calculations.

6.21 Regarding the Applicant's Deadline 2 representation REP2-004, which stated that the boat based surveys were representative of bird behaviour in the array area, Dr Norman advised that the Lidar survey in August 2018 had been limited, and undertaken over a short time period and had been submitted for context and not used for flight heights in the impact assessment. The boat based

data, he confirmed, provided a good set of information which exceeded the threshold used previously for determining a site specific flight height, which has typically been 100 individuals. The Boat based data, Dr Norman stated, yielded more than that for the Hornsea Three area so the Applicant was confident in the flight height derived from it. The Lidar was illustrating a similar distribution, which although not identical, was more similar to the boat based data than the generic data. Dr Norman stated this is why option 1 is preferred by the Applicant, as it gives a better reflection of the risk at the site, as it is based on site specific data.

6.22 Responding to an ExA query on the number of gannet and kittiwake measured during LiDAR surveys, Matthew Hazleton advised that 34 kittiwakes were identified to species level, and 91 additional grey backed gull species, which more than likely were kittiwake given the location, and that common gull would not likely be present as it is not really a marine species.

6.23 Regarding NE concerns over using different platforms for density and height Dr Norman advised that he doesn't understand NE's contention that you can't source different parameters from different platforms and his view is the most appropriate method available should be used when measuring two variables. He highlighted that the Johnston data is based on the results of boat based surveys, but processed and presented as flight height distribution, so if option 2 is used, this would therefore be based on boat based data and would be subject to the same criticism. Dr Norman commented that boat based data was considered sufficient for the assessment of previous projects and was the standard approach until digital and LiDAR came along. Mr Hazleton added that East Anglia One and Walney Extension offshore wind farms had used aerial and boat based data.

6.24 Dr Norman confirmed that, when presenting NE's position, this used Option 2, and therefore generic data from Johnston.

6.25 Regarding REP1-188, further to a request by the ExA, the Applicant confirms that the flight speed data presented in Alerstam et al. (2007) was sourced from two datasets as described in the Materials and Methods of the Alerstam et al. (2007) paper. These datasets were:

- Tracking radar measurements collected in Sweden and the Arctic between 1979-1999 consisting of 1,399 tracks of 102 identified species; and
- Equivalent airspeeds of identified birds obtained by similar tracking techniques published from the work of Bruno Bruderer and his research group from birds in natural migratory flight. This dataset comprises data from 64 species.

6.26 The dataset collected by radar in Sweden and the Arctic is described by the authors as the main dataset providing the bulk of records.

6.27 The number of tracks obtained for each species is provided in Protocol S1 which accompanies the main paper. This was not included as part of REP6-033 but is now included as Appendix 20 in the Applicant's submission at Deadline 7. In summary, the tracks recorded for key species of interest in this assessment, are:

- Kittiwake – 2 tracks
- Lesser black-backed gull – 11 tracks
- Herring gull – 18 tracks
- Great black-backed gull – 4 tracks

6.28 Dr Norman advised that the avoidance rates used were from Cook et al (2014) which provided the appropriate rates to be used in offshore situations. He confirmed that the evidence base was terrestrial based and the only point of difference relates to kittiwake. He stated that the recommendation of Angus Cook of 92.1% is based on data available for kittiwake and other small gulls. He commented that NE's view was to include kittiwake with large gulls and use a more precautionary value of 98.9%. Dr Norman stated that the Applicant's point is that the result of the ORJIP study, which was a better data set, was pointing to higher avoidance rates but now Bowden and Cook provided a more detailed analysis of the results of that study.

6.29 Mr Hazleton advised that the gannet and kittiwake nocturnal activity factors for the first collision risk model were based on data presented in Annex 5.3 [APP-109], much of the data from which was presented in a review by McArthur Green (2015). The data, he advised, came from many studies for each species, which are listed in APP-109.

6.30 Mr Hazleton advised that the nocturnal activity factors for kittiwake used in the Applicant's Deadline 6 submissions are from the McArthur Green (2018) report, but they are taken from a Furness report which is yet to be submitted. He stated that he thought that this would not be published during the examination, although the results are reported in McArthur Green. Mr Hazleton added that the application figures were based on the review set out in APP-109, and stated that he thought that the Deadline 6 figures were higher than in the application. In summary, the Deadline 6 submission did not affect the conclusions of the environmental statement.

6.31 Mr Hazleton agreed to provide a table showing all the parameters used to run the collision risk model for the Applicant's and NE's position. This is provided at Appendix 13 to Deadline 7.

6.32 To provide context before presenting mitigation options outlined on slides 10 and 11, Mr Turney advised that there is usually a degree of negotiation between the particular applicant and the relevant statutory nature conservation body over the form and type of mitigation, but that had not happened in this case. He advised that the Applicant's approach has been to look at the way mitigation could be addressed, albeit from a starting point that the Applicant considers that impacts are so minimal that there would be no proper basis for further mitigation. Mr Turney confirmed that the Applicant does not propose to reduce the ability of the project to produce energy by reducing its size or scale. He advised that the approach was to look at increasing the height of the rotor, so that the lower tip height is higher than the parameters modelled in the collision risk model, to see what difference that would make. He stated that this would be presented to the ExA by Dr Norman, with two potential changes considered. The first is to increase the lower tip height to 37.5 metres MSL, from that modelled in the Application (33.17 metres MSL). The second is to increase further to 40 metres MSL.

6.33 Mr Turney stated that more explanation could be provided (see Appendix 12 to Deadline 7 submission), but it should be noted that the changes outlined would have an impact on the project in that it would need more steel, as the tower is higher, and there would be technical issues with the vessels that can erect the turbines. Mr Turney stated that these therefore were proposals that required serious consideration before being offered. On this basis, with those caveats, he stated that the impacts with further mitigation would be presented by Dr Norman.

6.34 Dr Norman responded to an ExA query as to whether a conclusion of adverse effect on integrity for the SPA would arise if the NE's parameterisation is used, accepting that is at the extreme end of the spectrum. Dr Norman advised that he did not think you can make that leap and that is not necessarily the case that an adverse effect on integrity would arise. He clarified that it depends on the view taken of the in combination effect and the interpretation of PVA – for example, even the highest number on the table in slide 9 of the presentation, of 0.848, is actually higher than a number consented in Scotland, where the population of kittiwake is in a less favourable condition, and no adverse effect was concluded. Dr Norman stated that as there is a lack of a hard threshold for determining effect, as this will not be provided by statutory nature conservation bodies, it is not clear that it has been exceeded on any reading of the numbers. The colourisation on the charts was just a benchmark against other consented projects, not stating that this leads to a conclusion of adverse effects.

6.35 Dr Norman stated that the Applicant had not checked whether the parameterisation takes the figures over the 1% mortality rate for regional population effects but this would come out in the comparative tables to be provided (see Appendix 15 to the Applicant's response to Deadline 7). He clarified that the 1% criterion is used an indicator, on the basis that anything below that is almost by definition not significant.

6.36 Dr Norman stated that the summary of the collision rates that the cells in green have either absolute numbers of counter-factuals of numbers that exceed those associated with East Anglia Three. He confirmed that the cells in blue are lower than those in the decision, but it does not follow that they represent an adverse effect on integrity.

6.37 Regarding options for mitigation, Dr Norman stated that because of the distribution of birds over a vertical space, with a strong skew towards the sea surface, there will be a big change in the collision risk predicted by raising the swept area up. He stated that a raise of the lower tip height to 37.5 metres lowers collision rates by c. 34% for a small distance change. Mr Hazleton advised that this reduction was using the same numbers and assumptions as previously. Dr Norman added that if NE's parameters are used, the numbers change from 181 per annum to 119 with this mitigation. He stated that further height increases would give a diminishing return, getting to the point where there is no further gain, noting that the reduction for a 40 metre lower tip height is 48% (compared to that predicted with a lower tip height of 33.17m), meaning that virtually all the values would sit nested within those from previous decisions and only NE's extreme position, in combination, would exceed the East Anglia Three example.

6.38 Mr Turney stated that the Applicant's position is that the 40 metre level is beyond what is necessary to address any potential effects in this case, illustrated by the fact that on the Applicant's numbers, the difference between this height and 37.5 metres is less than one bird. He made the point that to conclude that a marginally worse PVA than that in the mind of the decision maker at East Anglia Three by 0.1, you would have to reject the refinement of the in combination calculations and accept all of NE's assumptions in the parameterisation of the model, and reject each aspect of the Applicant's approach on the six parameters identified. Mr Turney stated that the Applicant did not accept even that PVA scenario should be regarded as an adverse effect on integrity at the site. He added that the Applicant was aiming to give the ExA something to work with in terms of mitigation should it be against the Applicant on various points. Mr Turney reiterated that the test for a DCO requirement was one of necessity and the need to have regard to whether the mitigation is having a difference on the collision risk modelling, which would depend on the parameters that can be supported. The Applicant's position is that it is a long way from necessary to raise the tip height to 40 metres, given the cost and risk of doing so. Mr Turney agreed that the Applicant would submit a note on the project effects of this, including on the amount of renewable energy that could be generated.

6.39 Dr Norman confirmed that although kittiwake effects were presented, there were meaningful changes for other species too, gulls and gannets in particular.

6.40 Mr Turney, responding to an ExA question, confirmed that if the lower tip height was raised, this would not affect the other project envelope parameters and the project would stay within the other parameters. He clarified that this mitigation could be secured by an additional requirement added in the DCO.

6.41 **c) Cumulative Assessment Headroom**

6.42 Dr Norman responded to an ExA query stating that if all worst case 'as consented' scenarios are considered, there would be an overestimate of effects. He confirmed that the McArthur Green analysis for the Crown Estate was a substantive attempt to resolve the uncertainty over how to deal with this generally acknowledged issue. Dr Norman stated that the methodology was clear and transparent and understood to be an appropriate way to calculate what the difference in effects would be. He advised that the approach was to simply follow that methodological pathway and incorporate the calculations that flow through from the McArthur Green process. Dr Norman advised that the Applicant had sought to be clear where changes were needed and the rationale and substance of changes, where a project had made a change and set out what that entails. There was no other methodology, and the discussion was only whether the projects and parameters had been properly identified and realistic. He stressed that if this was not considered, there was a risk of overestimating the effects on these populations.

6.43 Mr Hazleton added that in the Applicant's submission on as built scenarios [REP1-148], the assumptions on the "as built" are presented in Appendix A of that report. He confirmed those were the only parameters changed. Dr Norman added that although other parameters could be changed, the only changes that were made were where there was verifiable evidence of difference at the project, which documented and publicly available, such as through a modification application, rather than assuming those changes.

6.44 **d) Biological seasons**

6.45 Regarding NE's proposals regarding breeding seasons, Dr Norman advised that evidence in the Applicant's response deals with occurrence of birds, and it was not in dispute that birds associate with colonies often early in the year. He stated that NE did not give information on when the onset of breeding activity starts. Dr Norman pointed out that there is not one date when that would start. The Applicant, he stated, understood NE's position and had sought to reflect this as best it could but was not looking for further justification on this. The Applicant had been seeking a reason for a change in position by NE from previous projects.

6.46 **e) Any Other Matters**

6.47 The ExA flagged NE's agreement to the revised auk apportioning but noted NE's statement that 100% of immature birds should be assigned to the Flambourgh and Filey Coast SPA and asked what difference that would make to the RIAA and ES conclusions. Mr Hazleton advised that the Applicant did not agree with this, as it did not match with its understanding of distribution of birds in the North Sea from papers such as Furness, that state that birds mix. However, in terms of the RIAA and ES conclusions, Mr Hazleton advised that it would make no change as the Applicant had assumed a worst case, looked at the PVA modelling and assumed an impact would be 1600 birds, meaning an equivalent of 1200 immature birds, and impact over and above in combination. This assessment concluded no adverse effects so there would be no changes to the conclusion. Dr Norman added that it did not fit the evidence as far as the assumption goes. He stated that the PVA model takes adult mortality and cascades it through an age structure, so that it assumes a corresponding mortality for each age class below adult, therefore immature birds had been considered. He argued that even with all adults being used in the model, there would not be an adverse effect.

7. ANNEX 1

Collision slides

Introduction
The purpose of the presentation (presented by NIRAS to the ExA on 06/03/2018) is to explain the differences between Natural England and the Applicant in the assessment of the potential impact on the breeding kittiwake population of the Flamborough & Filey SPA (FFC SPA). The starting point is Natural England's position as understood by the Applicant from their submissions during the Examination. The presentation then sets out how incrementally adjusting the assumptions in Natural England's position, to those advocated by the Applicant, reduces the collision rate.

The presentation presents the collision rates for a range of positions between Natural England and the Applicant, alone and in-combination, and puts them into context both with respect to previous relevant consent decisions and population viability analysis (PVA) modelling.

Finally, options for mitigation have been explored and the reduction in collision rate that can be achieved through mitigation is presented.

These slides were presented on a without prejudice basis to the Applicant's position.

Slide 2 – Summary of key differences between NE and the Applicant
This slide sets out six points of difference between Natural England and the Applicant, relating to:

1. The assumed flight speed of birds
2. The appropriate avoidance rate to apply
3. Which option of the Band (2012) to use
4. The apportioning rate to apply during the breeding season
5. The definition of biological seasons and particularly the breeding season
6. The degree of nocturnal activity that should be assumed

Slide 3 – Quantifying the differences between Natural England and the Applicant
Natural England and the Applicant have set out, in submissions, their positions on each of these points. In some cases Natural England has not indicated a specific position, pointing instead to a range. In these instances, the upper value in the assumed range has been assumed.

Starting with Natural England's position, each point of difference is then switched to the Applicant's assumptions progressively (1-6) and cumulatively until the Applicant's position is fully reached.

For each scenario, the collision rate is calculated using the mean density of birds in flight as observed during digital aerial surveys only. In addition, the rate is also calculated for the upper and lower confidence intervals of the density of birds in flight. For other parameters, including, for example, avoidance rate, for which confidence intervals can be calculated, only the mean value is used. This is to simplify presentation.

Slides 4, 5 and 6 – predicted collision rates for the Project alone and in-combination
The upper part of the table shown in each of these slides indicates which assumptions have been made for Hornsea Three. The column headed 'NE' represents our understanding of Natural England's position and each of the six issues, flight speed, avoidance rate etc. is set to the values Natural England prefers. Working across the table, each of those issues is progressively changed to the Applicant's position, starting with flight speed (column '1'); then flight speed together with avoidance rate (column '2'); flight speed, avoidance rate and model option (column '3') and so on. In the final column ('Applicant') all the issues are set to the preferred position of the Applicant.

The lower part of the table shows the annual collision rates calculated using the assumptions in the upper part of the table. The collision rate has been calculated using the mean density of birds in flight together with the upper ('UCL') and lower ('LCL') confidence intervals around this mean.

The collision rates are calculated for the project alone (slide 4) and then for the following in-combination scenarios (slides 5 and 6):

- Inclusion of all projects as indicated in the Applicant's submission at Deadline 1 (REP1-005). This includes additional projects to those considered in the Application as requested by the Examining Authority. Note that no adjustment is made to the predicted collision rate for other projects and the predicted collision rates are the worst case scenarios assessed in each case (except those projects where the consent has changed as explained in APP-051, APP-065 and REP1-148). The total additional collision rate contributed by these projects is approximately 250 birds per annum.
- Inclusion of all projects as indicated in the Applicant's submission at Deadline 1 (REP1-005) but the predicted collision rates for those projects have been corrected to account for:
    - The final design of those projects which may no longer reflect the worst case scenario assessed (as indicated in REP1-148);
    - Nocturnal activity factors (REP4-049); and,
    - Flight speeds (REP4-049)

  The total additional collision rate contributed by these projects is approximately 170 birds per annum.

In slides 5 and 6 the upper part of the table is repeated from slide 4. The lower part of the table shown has been updated to include the additional in-combination mortality (250 and 170 respectively).

Slide 7 – previous advice and decisions
To place the predicted collision rates into context they are compared to those considered in recent consent decisions. For the Flamborough and Filey Coast SPA, there are two relevant decisions (Hornsea Two and East Anglia Three) where there was specific consideration of the potential for an adverse effect on the breeding kittiwake interest feature of that SPA. In addition, the Scottish Government has recently consented Neart na Gaoithe offshore wind farm in the Firth of Forth and, in doing so, considered the potential for an adverse effect on two breeding kittiwake populations that are, respectively, interest features of the Forth Islands SPA and Fowlsheugh SPA. Slide 7 summarises information about those projects, SPAs and impacts that were considered when approval was granted.

With respect to the magnitude of the impact on the population, each of these decisions involved consideration of the total predicted collision rate as well as the likely effect of that rate on the population using Population Viability Analysis (PVA) models.

Slide 8 – previous predictions
The PVA model used by the Applicant to explore the effects of predicted mortality on the breeding kittiwake population of the Flamborough & Filey Coast SPA is described in REP4-092 and its results for kittiwake are summarised in slide 8. This version of the model uses a matched pairs approach and assumes a project life of 35 years. The results of the density independent version of the model are used; this is more precautionary because it does not assume any compensatory response of the population to a reduction in breeding population size caused by additional mortality. The model was also run using two different demographic rate sets and the results for demographic rate set 1 are shown, which is considered to the be the most similar to the current status of the population.

The model was originally run at 50 bird impact increments, but, on the advice of the model author, these have been interpolated to single bird increments so that the likely response to specific impact levels can be seen.

To PVA model metric outputs are shown:

- Counterfactual of Population Size (after 35 years) – referred to as CPS35 – which is the ratio of the predictions of impacted to unimpacted population size. A CPS35 of 0.92, for example, indicates that the impacted population will be 92% of the size that the unimpacted population will likely be after 35 years. The higher the value for CPS35, the lower the predicted effect on the population.
- Counterfactual of Growth Rate (CGR) – which is the ratio of the predicted impacted growth rare to unimpacted growth rate. The higher the value for CGR, the lower the predicted effect on the population.

Slide 9 - Results
This slide summarises the outcomes of collision risk modelling and the implications for the kittiwake population of FFC SPA. There are three parts to it.

The upper table summarises the predicted collision rates from slides 4, 5 and 6. The lower tables show the equivalent CPS35 and CGR values taken from the interpolated PVA model. The collision rates and CPS35 values are colour coded to indicate their correspondence with the impacts considered at East Anglia Three. Green indicating that the collision rate is lower or CPS35 value is higher than that which was considered in consenting East Anglia Three.

Slides 10 and 11 – mitigation, raising lower tip height

The Applicant has considered options for mitigation, to reduce predicted collision rates. On the Applicant's position, this mitigation is not necessary, as the predicted impact is sufficiently low that it is considered that Hornsea Three makes no material contribution to any in-combination effect.

Raising the lower tip height of the turbines reduces the swept area that intersects with the distribution of kittiwakes and reduces the predicted collision rate. The worst case scenario assessed in the application assumed a lower tip height of 33.17m (in relation to mean sea level) and the effect of increasing this to 37.5m and 40m has been explored (slides 10 and 11 respectively).

Raising the lower tip height to 37.5m reduces the collision rate by approximately 34%, increasing lower tip height to 40m reduces the collision rate by approximately 48%.

Hornsea Three

Summary of kittiwake CRM

ISH 7, 6TH MARCH 2019

Collision risk for kittiwake (FFC SPA)

Summary of key differences between NE and Applicant

Issue	Applicant	Natural England
1. Flight speed	Prefers evidence presented in Skov et al. (2018) **8.71 m/s**	Prefers Alerstam et al. (2007) / Pennycuick (1987) **13.1 m/s**
2. Avoidance rate	Prefers recommendations in Bowgen & Cook (2018) published by JNCC **99.0%**	Prefers existing SNCB guidance, JNCC *et al.* (2014) **98.9%**
3. Band (2012) collision risk model option	Prefers **Option 1** due to availability of site specific flight height data	Prefers **Option 2**
4. Apportioning	Prefers **41.7%** based on proportion of adults present	Prefers **93.1%** based on number of adults observed
5. Biological seasons	Prefers seasons defined by activity at Hornsea Three **Apr – Jul**	Prefers seasons defined by activity at FFC SPA **Mar-Aug**
6. Nocturnal activity	Prefers rates indicated by **Furness (20% in breeding season, 17% in non-breeding seasons)**	Prefers categorisation of Garthe & Huppop (2004) **2 -3 (25-50%)**

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Collision risk for kittiwake (FFC SPA)

Quantifying the differences between Natural England and the Applicant

- Following slides present collision risk estimates for Hornsea Three using Natural England's assumed position as a starting point.
- The collision rate arising, when the Applicant's positions in relation to the 6 issues listed in slide 1 are applied progressively, is also shown.
- Natural England's position on a number of issue is to consider a range of values, in these cases, to simplify presentation, the upper (precautionary) limit of the assumed range has been used.
- With respect to the density of kittiwake in flight, mean density obtained only from digital aerial surveys is used with upper and lower confidence intervals shown for these means.
- For other parameters, e.g. avoidance rate, only the mean value is shown.

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Project alone

Assumptions	**NE**	**1**	**2**	**3**	**4**	**5**	**Applicant**
Flight speed	13.1	8.71	8.71	8.71	8.71	8.71	8.71
Avoidance rate	98.9	98.9	99.0	99.0	99.0	99.0	99.0
Model option	2	2	2	1	1	1	1
Apportioning rate (breeding)	93.10%	93.10%	93.10%	93.10%	41.70%	41.70%	41.70%
Biological seasons	NE	NE	NE	NE	NE	Appl	Appl
Nocturnal activity factor	3	3	3	3	3	3	Furness
Annual collision rate							
LCL	112	82	75	14	7	5	4
Mean	**181**	**132**	**120**	**23**	**11**	**8**	**7**
UCL	257	188	171	33	15	12	10

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In-combination

No refinement (+250)

Assumptions	**NE**	**1**	**2**	**3**	**4**	**5**	**Applicant**
Flight speed	13.1	8.71	8.71	8.71	8.71	8.71	8.71
Avoidance rate	98.9	98.9	99.0	99.0	99.0	99.0	99.0
Model option	2	2	2	1	1	1	1
Apportioning rate (breeding)	93.10%	93.10%	93.10%	93.10%	41.70%	41.70%	41.70%
Biological seasons	NE	NE	NE	NE	NE	Appl	Appl
Nocturnal activity factor	3	3	3	3	3	3	Furness
Annual collision rate							
LCL	362	332	325	264	257	255	254
Mean	**431**	**382**	**370**	**273**	**261**	**258**	**257**
UCL	507	438	421	283	265	262	260

NIRAS

In-combination

Refined to take account of 'as built' impacts (+ 170)

Assumptions	**NE**	**1**	**2**	**3**	**4**	**5**	**Applicant**
Flight speed	13.1	8.71	8.71	8.71	8.71	8.71	8.71
Avoidance rate	98.9	98.9	99.0	99.0	99.0	99.0	99.0
Model option	2	2	2	1	1	1	1
Apportioning rate (breeding)	93.10%	93.10%	93.10%	93.10%	41.70%	41.70%	41.70%
Biological seasons	NE	NE	NE	NE	NE	Appl	Appl
Nocturnal activity factor	3	3	3	3	3	3	Furness
Annual collision rate							
LCL	282	252	245	184	177	175	174
Mean	**351**	**302**	**290**	**193**	**181**	**178**	**177**
UCL	427	358	341	203	185	182	180

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Previous advice and decisions

In-combination impacts

Project	European site	Cited population size (pairs)	Current population (year) (pairs)	Colony status	In-combination impact	PVA metric	Project status
Hornsea Two	Flamborough & Filey Coast SPA	44,520	51,535 (2017)	See note 1	314-356	*CPS: 0.873-0.887**	Consented 2016
East Anglia Three	Flamborough & Filey Coast SPA	44,520	51,535 (2017)	See note 1	323	*CPS: 0.884*	Consented 2017
Neart na Gaoithe	Forth Islands SPA	8,400	4,333 (2015)	Declining	102	CPS: 0.82-0.85	Consented 2018
Neart na Gaoithe	Fowlsheugh SPA	36,650	9,655 (2015)	Declining	230	CPS: 0.84-0.88	Consented 2018

1. At the time of consent the colony was assumed to be declining by Natural England, although this wasn't necessarily the view of the ExA or SoS. The trend is now considered to be stable or slightly increasing. It is not known what was assumed at EA3
* Based on PVA metrics produced for Hornsea Three.

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PVA predictions

	CPS35			CGR		
Impact	LCL	**Mean**	UCL	LCL	**Mean**	UCL
0	1.000	**1.000**	1.000	1.000	**1.000**	1.000
50	0.981	**0.981**	0.981	0.999	**0.999**	0.999
100	0.962	**0.962**	0.963	0.999	**0.999**	0.999
150	0.943	**0.944**	0.945	0.998	**0.998**	0.998
200	0.925	**0.926**	0.927	0.998	**0.998**	0.998
250	0.907	**0.909**	0.910	0.997	**0.997**	0.997
300	0.890	**0.892**	0.893	0.997	**0.997**	0.997
350	0.873	**0.875**	0.876	0.996	**0.996**	0.996
400	0.856	**0.858**	0.860	0.995	**0.996**	0.996
450	0.840	**0.842**	0.844	0.995	**0.995**	0.995
500	0.823	**0.826**	0.828	0.994	**0.994**	0.994
550	0.807	**0.810**	0.813	0.994	**0.994**	0.994
600	0.792	**0.795**	0.797	0.993	**0.993**	0.993

- Presented at Deadline 4 (REP4-092)
- Matched runs
- Density independent (more precautionary)
- Demographic rate set 1 (most similar to recent data, although model relatively insensitive to rates used (REP4-092))
- Impacts calculated at 50 bird increments but interpolated to 1 bird increments for presentation
- **CPS35** = counterfactual of population size after 35 years (ratio of impacted to unimpacted final population size)
- **CGR** = counterfactual of growth rate (ratio of impacted to unimpacted growth rate)

Results

PVA model metrics

Collision rate	**NE**	**1**	**2**	**3**	**4**	**5**	**Applicant**
Alone	181	132	120	23	11	8	7
In-combination	431	382	370	273	261	258	257
In-combination refined	351	302	290	193	181	178	177

PVA (CPS 35)	**NE**	**1**	**2**	**3**	**4**	**5**	**Applicant**
Alone	0.933	0.950	0.955	0.991	0.996	0.997	0.997
In-combination	0.848	0.864	0.868	0.901	0.905	0.906	0.907
In-combination refined	0.875	0.891	0.895	0.929	0.933	0.934	0.934

PVA (CGR)	**NE**	**1**	**2**	**3**	**4**	**5**	**Applicant**
Alone	0.998	0.998	0.999	1.000	1.000	1.000	1.000
In-combination	0.995	0.996	0.996	0.997	0.997	0.997	0.997
In-combination refined	0.996	0.997	0.997	0.998	0.998	0.998	0.998

Lower than impact predicted at EA3

Higher than impact predicted at EA3

Higher than CPS associated with EA3 impact

Lower than CPS associated with EA3 impact

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Raising lower tip height to 37.5m (msl)

Reduces collision rate by approximately 34%

Collision rate	NE	1	2	3	4	5	Applicant
Alone	119	87	79	17	8	6	5
In-combination	369	337	329	267	258	256	255
In-combination refined	289	257	249	187	178	176	175

PVA (CPS 35)	NE	1	2	3	4	5	Applicant
Alone	0.955	0.967	0.970	0.994	0.997	0.998	0.998
In-combination	0.869	0.879	0.882	0.903	0.906	0.907	0.907
In-combination refined	0.896	0.907	0.909	0.931	0.934	0.935	0.935

PVA (CGR)	NE	1	2	3	4	5	Applicant
Alone	0.999	0.999	0.999	1.000	1.000	1.000	1.000
In-combination	0.996	0.996	0.996	0.997	0.997	0.997	0.997
In-combination refined	0.997	0.997	0.997	0.998	0.998	0.998	0.998

Lower than impact predicted at EA3

Higher than impact predicted at EA3

Higher than CPS associated with EA3 impact

Lower than CPS associated with EA3 impact

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Raising lower tip height to 40m (msl)

Reduces collision rate by approximately 48%

Collision rate	NE	1	2	3	4	5	Applicant
Alone	94	69	62	17	8	6	5
In-combination	344	319	312	267	258	256	255
In-combination refined	264	239	232	187	178	176	175

PVA (CPS 35)	NE	1	2	3	4	5	Applicant
Alone	0.964	0.974	0.976	0.994	0.997	0.998	0.998
In-combination	0.877	0.886	0.888	0.903	0.906	0.907	0.907
In-combination refined	0.904	0.913	0.915	0.931	0.934	0.935	0.935

PVA (CGR)	NE	1	2	3	4	5	Applicant
Alone	0.999	0.999	0.999	1.000	1.000	1.000	1.000
In-combination	0.996	0.997	0.997	0.997	0.997	0.997	0.997
In-combination refined	0.997	0.997	0.997	0.998	0.998	0.998	0.998

Lower than impact predicted at EA3

Higher than impact predicted at EA3

Higher than CPS associated with EA3 impact

Lower than CPS associated with EA3 impact

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