THE PLANNING ACT 2008

THE INFRASTRUCTURE PLANNING (EXAMINATION PROCEDURE) RULES

2010

Natural England Response to Examining Authority's further written questions and requests for information (ExQ2) issued on 30th May 2022.

For:

The construction and operation of Hornsea Project Four Offshore Wind Farm, located approximately 69 km from the East Riding of Yorkshire in the Southern North Sea, covering an area of approximately 468 km[2].

Planning Inspectorate Reference EN010098

20th June 2022

ExQ Code	Question to:	QUESTION	NE RESPONSE
BGC2.4	**Applicant & All interested parties entering into SoCG**	**Statements of Common Ground** A significant number of matters remain unresolved in the various Statement of Common Ground In each case, could the Applicant please indicate your expectations in terms of reaching a conclusion, or highlight any fundamental problems that you may be experiencing in progressing negotiations. Please note that should matters not be resolved in a SoCG, the ExA will require the submission of Final Position Statements from relevant parties by no later than Deadline 7.	Natural England have meetings with the Applicant planned to update our SoCG in July and August. This should enable the applicant to submit updated SoCG at Deadline 7. Natural England will also continue to update and submit our Risk and Issues log at each deadline.
DCO2.4	**Natural England RSBP MMO**	**Drafting of the DCO** In your various written submissions, you have raised a number of concerns in relation to the general drafting of the DCO and Deemed Marine Licences (DMLs). Can you advise if these concerns have been addressed by the most recent version of the draft DCO submitted at D4 [REP4-050].	Due to staff illness, we have been unable to address this in time for Deadline 5, however we will be working towards providing comments on all concerns previously raised in relation to the DCO at Deadline 5a.
DCO2.7	**Natural England**	Article 36 (2)(a) In your response to ExQ1 DCO.1.17 [AS-029] you advised that you considered that this issue warranted further scrutiny but that you were unable to go into detail at Deadline 2. In addition, you wanted to know ERYC's views on this matter. ERYC advised [REP2-070] that "*ERYC does not have any concerns regarding this*". Have you now had the opportunity to consider the	The Applicant's response to ExQ1 DCO 1.17 clarifies that they consider Article 36(2)(a) only permits the removal of hedgerows which are both within the order limits <u>and</u> specified in Schedule 10, rather than any hedgerow within the order limits. Natural England are content that this is in line with the discussions held during the Evidence

		matter further and do you have anything further to add in light of ERYC's comment?	Plan Process and have no further concerns regarding this.
HRA2.1	**Natural England**	**Confidence in Southern North Sea Special Area of Conservation (SAC) site integrity plan** At Deadline 3, the MMO [REP3-052] expressed confidence that site integrity plans for relevant projects in the Southern North Sea SAC would provide sufficient control over the timing and nature of noisy activities to ensure that the relevant in-combination disturbance impact thresholds for marine mammals were not breached. However, this was subject to the Applicant updating the draft DMLs in the draft DCO [REP4-050] by the removal of condition 13(1)(j) and its replacement with the new, stand-alone condition that comes out of the Review of Consents process, as detailed in the MMO's submission. **To Applicant:** Will you be making the suggested amendments to the DML conditions, and, if so, when? If not, why not? Would any amendment include a definitive time period for review of the Site Integrity Plan in advance of the start of construction, as recommended by Natural England [REP4-054]? **To Natural England and The Wildlife Trusts:** Whilst recognising outstanding detailed matters (especially those relating to underwater noise control), following the MMO's Deadline 3 response [REP3-052], are you now content that,	Natural England have previously advised that a mechanism to manage multiple SIPs over varying timescales needs to be developed and put in place by the Regulators to ensure that the noise thresholds are not exceeded. Whilst we recognise steps have been taken to achieve this, we remain concerned that the current "case by case" approach is not fit for purpose and is likely to result in difficulties across all industries further down the line, as the next round of offshore windfarms come forward in the southern North Sea. We consider that it remains unclear how multiple SIPs will be regulated in tandem to ensure that in-combination disturbance impact thresholds for marine mammals will not be breached. This is particularly the case where multiple piling SIPs are submitted as the works are less flexible and have fewer mitigation options than other activities e.g. UXO clearance. It is also unclear if coordination by Developers will be subject to appropriate assessment and how changes to timetables made at short notice will be managed. Should potential exceedance of the thresholds occur, a process for dealing with

| | | in principle, proper implementation and oversight of a robust Southern North Sea SAC Site Integrity Plan would ensure that project-alone and in-combination disturbance impact thresholds for marine mammals would not be breached? | this issue needs to be in place. Until the mechanism by which the SIPs will be managed, monitored and reviewed is further developed, Natural England are unable to advise that this approach is sufficient to address the in-combination impacts described in this Application and therefore it is not possible to be certain that there will be no AEoI on the SNS SAC.

As noted in our previous submissions, we would have more confidence if mitigation was embedded within the application and committed to at this stage. If this approach was progressed, mitigation would be included in principle to minimise the risk of an adverse effect as far as possible, with the later outcomes of the SIP determining if the mitigation measures could be removed. |
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| HRA2.2 | **Applicant Natural England RSBP** | **Derogation case and alternatives** In response to ExQ1 HRA.1.21, the Applicant [REP2-038] noted an intention to refine the Maximum Design Scenario for some parameters. As these were downwards, the Applicant did not anticipate consequent implications for the HRA. Given the updates to the relevant baselines and assessments that have been submitted into the Examination subsequently, should the Applicant be considering and reporting on any further alternatives or mitigation options that might reduce any potential Adverse Effects on Integrity of European sites? | Ornithology We cannot advise further on this for ornithology at this time as the revised baseline data is yet to be submitted.

Benthic & Marine Processes The outcome of the MDS paper published at Deadline 3 (REP3-035) only refined parameters downwards, Natural England agree that this is unlikely to exclude the risk of significant impacts to Smithic Bank and the Flamborough Front, meaning that indirect impacts to designated sites cannot |

			be excluded, particularly on a cumulative/in combination basis. Natural England wishes to see this refinement go further, particularly with regard to Smithic Bank and Flamborough Front, and following that refinement further consideration of alternatives or mitigation options to reduce the risk of indirect impacts on designated sites to an acceptable level. Further details can be found within Appendix E5 of our Deadline 5 response.
HRA2.3	**Natural England RSBP**	**Timing for the approval of any compensation measures** In response to ExQ1 HRA.1.33, the Applicant noted [REP2-038] that the lead-in time for the submission of each ornithology compensation plan would be measure specific, and 'subject to discussion' with the Hornsea Four Offshore Ornithology Engagement Group (OOEG). Each implementation and monitoring plan would be submitted in accordance with a timetable, as *"included in a plan for the work of the… OOEG"*. Would you be content with this approach? If not, why not?	Natural England agrees that the lead-in time for each ornithology compensation measure will be measure specific. However, we note that previous offshore wind farms have all had conditions requiring the delivery of the associated implementation and monitoring plan(s) at a specified time period prior to operation, and we consider the same approach should apply to Hornsea 4. These periods should be discussed with stakeholders, but we do not consider this should be left to post-consent.
HRA2.5	**Applicant Natural England**	**Barrier effects in relation to Flamborough and Filey Coast Special Protection Area (SPA)** The Applicant's ES and Report to Inform Appropriate Assessment (RIAA) [APP-167 and APP-017] include consideration of barrier effects for fulmar, gannet and kittiwake from the	Natural England note that the Applicant's ES includes consideration of barrier effects on gannet and kittiwake, whilst the RIAA only considers barrier effects on the auks (guillemot, razorbill and puffin).

		Flamborough and Filey Coast SPA, based on an assumption that only these species forage on a regular basis out to a distance as far as, or further than, the array area of the Proposed Development.	We seek clarification on why the ES did not consider barrier effects during operation and maintenance for FFC SPA auks, and within the RIAA why consideration of barrier effects on kittiwake and gannet was omitted.
		Natural England (for example, [RR-029 and REP4-054]) seems to consider this assumption to be insufficiently evidenced and advises that either more evidence is provided to support the exclusion of auk species, or that the Applicant provides further assessment of the barrier effects on guillemot, razorbill and puffin.	Natural England highlight that the RIAA's assessment of potential barrier effects on auks is impaired by the exclusion of birds in flight during the assessment of disturbance and displacement impacts.
		To Natural England: • Please clarify your concerns and which seabird species you believe to have been overlooked in relation to the EIA and the screening of Likely Significant Effects for the HRA. • Which project phase(s) (construction, operation etc) do you believe require further consideration in relation to barrier effects? Are these the same for each seabird species?	Similarly Natural England seek clarification on why barrier effects, in line with disturbance and displacement, have not been assessed in relation to construction. Natural England consider that the inclusion of flying birds within the assessment of disturbance and displacement impacts for the auks (already included for gannet) would provide a proxy for barrier effects. It is anticipated that this revised assessment will be submitted at Deadline 5 (RR-029-APDX:B-25).
		To Applicant: • Please clarify which seabird species you considered in relation to barrier effects in the EIA and the screening of Likely Significant Effects for the HRA, and a brief summary of the outcome reported for each in your Examination documentation. • Which project phase(s) did you consider in relation to barrier effects in the EIA and the screening of Likely Significant Effects for the HRA?	Natural England currently do not require an assessment of displacement impacts for Kittiwake, with the focus remaining on collision risk. Thus, we consider a qualitative assessment of barrier effects, as provided by the Applicant within the ES, is appropriate for this species.

		• Why was puffin apparently screened out of barrier effect consideration based on mean foraging range, when maximum foraging range was used for other auk species? • Please indicate where this information is set out in the Examination documentation, provide evidence to justify the exclusion of relevant seabird species from assessment, or provide the further assessment requested.	
HRA2.6	**Natural England**	**Fulmar displacement and disturbance** In your Relevant Representation, you raise concern over the screening out of Likely Significant Effects on fulmar due to disturbance and displacement [RR-029, Appendix B]. Please clarify if this relates to fulmar as an interest feature of the Farne Islands SPA, as recorded in the Deadline 3 offshore and intertidal ornithology SoCG between the Applicant and Natural England [REP3-018]. Noting the Applicant's response [REP1-038] and reference to the Evidence Plan, are you now satisfied that Likely Significant Effects from displacement and disturbance on fulmar can be excluded? Please state which European site(s) your response relates to.	Natural England have not pursued the screening of fulmar specifically in our Risk and Issue log. We note that the Applicant's response to our Relevant Representation [RR-029, Appendix B] provided clarification in relation to this matter in document G1.9 submitted at Deadline 1 [RR-029-APDX:B-U]. Natural England agree that LSE from disturbance and displacement can be excluded on fulmar as a named component of the breeding seabird assemblage at Flamborough and Filey Coast SPA and as a component of the Farne Islands SPA.
MC2.3	**Applicant** **MMO** **Natural England**	**Consideration of climate change scenarios in modelling** Natural England suggested [RR-029] that the marine process modelling and assessment in the ES should have taken various climate change scenarios into account. The Applicant does not	Natural England's concerns do not to relate to the construction period and climate change impacts, but rather to: (a) the anticipated requirement for any remedial works for infrastructure at landfall beyond the lifetime of the project and consideration

		believe this to be a relevant consideration in the timescales associated with the construction of the Proposed Development [REP1-038]. Please signpost or provide an update on any progress on positions in relation to this matter.	of climate change impacts, and (b) increased lowering or morphological change of Smithic Bank due to remedial works, cable protection/cable crossings at Smithic Bank and the additional impacts of climate change. We are awaiting further information on the beach access ramp from the Applicant, and also more detailed information on the Dogger Bank A&B Cable Crossing location. We are tracking progress on this issue in our Risk and Issues log – Marine Processes tab point E16.
ME2.6	**Natural England**	**Centre for Research into Ecological and Environmental Matters (CREEM) report** At Deadline 3, the RSPB requested [REP3-056] that the CREEM report for Natural England (Scott-Hayward, L.A.S. (2021), *Statistical Review of Hornsea Project Four: Environmental Statement for Natural England,* CREEM) be submitted into Examination. Is it your intention to do so or has this been superseded by *CREEM review of G2.10 MRSea Baseline Sensitivity Report (Gannet) - Revision: 02* [REP3-029] submitted as Annex II to Appendix B4 of your Deadline 4 Submission [REP4-055]?	For transparency Natural England have appended the initial CREEM report to this submission, however we consider that it has since been superseded by submissions at Deadline 4 and the production of version 2 of the MRSea modelled baseline.
ME2.6	**Applicant MCA Natural England**	**Offshore infrastructure lighting requirements** **To Applicant:** Could the Applicant provide a reasoned and evidenced expansion of the content submitted at Deadline 4 in "Further Consideration of Lighting Requirements" [REP4-048], and in particular signpost where each of the possible measures	In the Applicant's ES, they have assessed the magnitude of lighting impacts as 'negligible', irrespective of the sensitivity of the receptor, and significance as 'not significant'. However, due to uncertainty in the assessment, and given the size and number of proposed turbines spread over a large area, the effect of lighting could be of

| | | originally suggested by Natural England in its Relevant Representation [RR-029] are excluded by binding standards and regulations. For example: please indicate where MGN_372 restricts the range of visible light spectrum that can be used; explain your conclusion that there are *"no industry standards or guidelines allowing light shielding"* and signpost any standards that might exclude upwards light shielding (noting that the standards seem to focus on horizontal visibility).
To Natural England:
Could Natural England indicate whether similar matters and advice have been raised for other recent offshore wind farm projects and if not, confirm if there is something particular about this Proposed Development that merits additional consideration of offshore operational lighting? Could Natural England also expand on the background to its concerns in relation to offshore ornithology and lighting, especially given that the Applicant's Deadline 4 Ornithological Assessment Sensitivity Report [REP4-041] suggests that all of the relevant species are diurnal.
To MCA:
In relation to its published lighting standards, does the MCA believe there could be room for further discussion to reduce any significant operational lighting impacts on birds, as long as minimum requirements continued to be met? | concern at Hornsea Project Four. Natural England therefore suggested in our Relevant Representation [RR-029] that further consideration of mitigation approaches to minimise potential impacts of lighting at Hornsea Project Four would be welcomed.

We have provided comment on the Applicant's document (G4.14 Further Consideration of Lighting Requirements) submitted at Deadline 4 in our Risk and Issues log (B27). We are grateful that the Applicant has provided further reference to relevant regulations, standards, and guidance. The Applicant suggests that there is currently very limited flexibility in lighting design and thus scope for mitigation. Whilst we consider it remains unclear what restrictions are in place within the relevant documents to prevent modification of lighting consistent with the OSPAR guidance, we do not consider this matter is of significant concern in relation to Hornsea 4.

Natural England have raised concerns over lighting mitigation in relation to other recent offshore wind farm projects, namely Hornsea Project Three during our Relevant Representations, and continue to consult with developers and other stakeholders on these matters. |

ME2.8	**Applicant Natural England RSBP**	**Re-Run of MRSea** and use of design based estimates for seabird baseline **To Natural England and RSPB** Please comment on the proposed scope of work provided by the Applicant at Deadline 4a [REP4a-001] for the re-run of the MRSea analysis and the partially revised approach using design-based estimates for the assessment. **To Applicant:** Please provide an update on the outcome of the sixteenth meeting of the Ornithology Technical Panel Meeting held on 25 May 2022 in relation to discussions about the re-run of MRSea or the use of design-based estimates for seabird baselines.	Natural England welcomes the scope of works provided by the Applicant at Deadline 4a [REP4a-001]. We agree that the proposed approach to the revised baseline, using MRSea_V2 where possible and design-based estimates where not, is aligned with NE advice. We will comment further when the revised baseline is submitted at Deadline 5.
NAR2.2	**MCA Natural England**	**Response to clarification of Highest Astronomical Tide (HAT) and Lowest Astronomical Tide (LAT) blade clearance** Please confirm if you are satisfied with the Applicant's insertion into the draft DCO and DMLs submitted at Deadline 4 of conversion dimension for HAT air draught and wind turbine blade clearance in relation to LAT [REP4-050, Article 2(7) and Schedules 11 and 12 Part 1 definitions item (7)] and, if not, why not?	Natural England are satisfied with this insertion and have no further comment to make.
PDS2.2	**Applicant Natural England**	**Reduction in Maximum Design Scenarios in the marine environment** In its Deadline 3 submission, *Clarification Note: Justification of Offshore Maximum Design Scenarios* [REP3-035], the Applicant proposes (6.2.4.1) a reduction in the Maximum Design Scenarios (MDS) for bedform clearance (for cable installation) and for cable protection across the Smithic Bank. The relevant information relating	Whilst Natural England welcome the changes made to the MDS in relation to bedform clearance volume, we had hoped the survey data would allow the bedform clearance area to be reduced in areas where there are no bedforms present. The requirement to clear an area of 40m along the full length of the cable corridor (for bedforms) leads to a huge area of temporary disturbance which we

| | | to bedform clearance was changed in updated versions of the Project Description chapter of the Environmental Statement and the pro rata annex [REP4-003] and [REP4-005]. Does this change now satisfy Natural England's concern in this respect?

 A caveat in the Applicant's post-Hearing note [REP4-038] states, *"Post-hearing clarification: The Applicant… is currently considering whether any updates are required in relation to the Smithic Bank rock protection."* Could the Applicant clarify the situation in relation to the Smithic Bank cable protection MDS and advise if and when any changes to the application documentation will be made? | believe is not standard practice amongst windfarm developments. For example, Rampion and EA1N & EA2 only proposed to carry out bedform clearance where known bedforms are located.

 Natural England would also like to see further refinement of the MDS/mitigation in particular locations in order to exclude the potential for significant impacts occurring, particularly in relation to Smithic Bank and Flamborough Front. Further detail is provided in Appendix E5 of our Deadline 5 submission. |

Statistical Review of Hornsea Project Four: Environmental Statement for Natural England

Summary

I have fundamental concerns about the analysis undertaken in this report. There are critical errors and omissions and, while it is not possible to know to what extent this may affect the outputs, I would not be happy using the current report for any decision-making.

The main points of concern that could affect the results, or change the way the results are viewed, include how covariates enter the model, model selection and the presentation/estimation of uncertainty. There is more detail about these and other issues below and I would be happy to discuss in more detail any of the suggestions.

Detailed Comments:

1. In general, the overall methods description is poor with some key errors. This suggests that author is not clear on how the methods work or how to adapt them to suit their needs. This is further indicated by including function names rather than the actual methods (for example *cv.gamMRSea* instead of k-fold cross-validation).

2. There is no description of the sightings data or visual representation of the sightings or transect data for any species which makes it very difficult to pass judgement on model fit and suitability of the analysis.

3. In paragraph 2.2.1.4. the authors state that the "CReSS" method incorporates auto-correlation. This is not strictly true, "CReSS" is the name given to the spatial smooth. The R package MRSea has the ability to allow for residual correlation but the user must specify its use via a panel variable.

4. In paragraph 2.3.1.3. it is stated that "autocorrelation within the data..". Data correlation is not a problem but residual correlation violates a major assumption of a GLM/GAM. How was residual correlation tested? ACF plot/ Runs Test? Additionally, it seems odd to include month/season in the blocking structure when survey date is already included.

5. It is earlier stated that the blocking structure is included in modelling to account for autocorrelation, why then in paragraph 2.3.1.4 are models re-fitted as GEEs? If a blocking structure was given to MRSea, all standard errors and *p*-values from the model will be adjusted for the presence of residual correlation. Assuming the GEE has been fitted using an independent working correlation matrix (as opposed to AR(1) for example) and robust standard errors calculated (the default in this scenario) then this part is entirely redundant.

   a. This paragraph also states that "The best model can have inaccurate *p*-values if auto-correlation still exists despite the blocking structure". This is not true if the

blocking structure has been specified correctly (and can be checked with a block based ACF plot). Further, MRSea uses a block structure and robust standard errors to account for residual correlation. It does not remove residual correlation as the methods for accounting for it operate solely on the standard errors (not the residuals themselves). In this case any residual correlation will still be present (even after the inclusion of a blocking structure) and an ACF plot would therefore still show the correlation.

    b. The inclusion of a sentence about co-linearity in a paragraph predominantly about residual correlation is confusing. VIFs can be checked up front (prior to any modelling) so collinearity as an issue can be dealt with early on.

6. Paragraph 2.3.1.4. states the use of cross validation but only the function name is given and no mention of the type of CV; k-fold. Was it 10-fold cross-validation and did it select folds whilst maintaining the block structure? There is also no mention of how the best model including s(x,y) was chosen and at the end of the paragraph it is then stated that *p*-values are used for model selection. A look at the results, where there are non-significant *p*-values would suggest that these have not been used for selection. It would be better to stick to a process and either use k-fold CV for everything (smoothness selection and variable inclusion) or k-fold CV for smoothness and p-values for variable inclusion, whichever you prefer.

7. In the methods section, the general models trialled are not specified at all. I would expect a generic equation/paragraph in the methods section stating what is being fitted and to include things like
    a. Poisson GAM with (over)dispersion and log link
    b. Discrete covariates (survey or season)
    c. Quadratic (?) B-splines for the 1D covariates (also allowed as linear?)
    d. Gaussian (?) radial basis function for the two dimensional smooth of coordinates
    e. How much flexibility has the user allowed for the B-splines and the spatial smooth – these are user defined.
    f. Were the discrete variables trialled as interaction terms with the spatial term? Given the 1D variables are all static over time, the only option in the model for a change in distribution over time would be to allow an interaction term of survey or season with s(x,y). Your model selection process would then be used to assess if the inclusion of this term was warranted. Alternatively, if there are computational issues with this, you could fit separate models to each survey. The possibility of a change in spatial distribution over time should, at the very least, be discussed.

8. Paragraph 2.2.1.4 briefly comments on the use of bootstraps to generate confidence intervals. Presumably this was done using the functionality in MRSea and so is a parametric bootstrap (each bootstrap replicate is based on sampling the model parameters from a multivariate normal). How many bootstraps were used? 500, 1000? Additionally, the glossary definition of "Bootstrapping" in the context of MRSea is incorrect.

9. Paragraph 2.3.1.6 describes the calculation of abundance and density estimates. It is not clear how the confidence intervals were calculated and why they were not also presented for the density. The bootstraps can be used to get a set of abundances for each time frame and then as for the cell-based estimates, take the quantiles to get your intervals.

10. In the results sections, the final model specifications are not given correctly as each one omits the spatial term (which appears to have been selected for in most models) and there is no reason given for why some variables are not in the final model (model selection, collinearity, model fitting issues etc). As mentioned earlier, I would not give R commands as

a result in a report. You could try a table with each of the potential variables and give estimated degrees of freedom (or reason for exclusion), and an image of the estimated 1D relationships etc. There is no discussion of the 1D variable relationships and some seem to have excessive flexibility (7df) which is often not warranted in these sorts of settings. Additionally, having fitted two types of model (survey or season) some information about which is the better fitting model would be useful (using say CV scores). If the survey model was best then, being the finer temporal resolution, the season estimates can be post processed from the predictions/bootstraps.

11. Model diagnostics (observed vs fitted and cumulative residuals) were mentioned in paragraph 2.3.1.4 but are not shown/described for any species so the reader has little idea of whether the models are any good. In addition to the diagnostics mentioned, the mean-variance relationship and spatial residuals could/should also be assessed.

12. There is no presentation of the spatial uncertainty. It could be shown in the form of plots of coefficient of variation or percentile-based confidence intervals. The bootstraps have been done so it would be easy to calculate either of these for each grid cell.

The table below indicates where I think the potential effects of each comment lie. The options are in reporting, reader understanding and model outputs, both in the point estimates and the uncertainty. Dark red indicates the potential for a strong effect and pale red is less so.

Comment Number	Detail	Potential effect			
				Model outputs	
		Reporting	Reader Understanding	Density / count estimates	Uncertainty
1	Poor methods description	■	■	■	■
2	Sightings data		■		
3	"CReSS incorporates correlation"	■			
4	Residual correlation testing				■
5	Extra gee fitting	■			
5a	Inaccurate p-values		▦		
5b	VIFs		▦		
6	Model selection	■		■	
7a-d	Model specification	■	■		
7e & &f	Covariate specification			■	■
8	Bootstraps				■
9	Density confidence intervals	■	■		■
10	Presentation of selected models	■	■	▦	
11	Diagnostics	▦	■	■	
12	Spatial uncertainty		■	■	■