



Hornsea 4 Project Team
Planning Inspectorate
HornseaProjectFour@planninginspectorate.gov.uk
(By email only)

Planning Inspectorate Reference: EN010098
MMO Reference: DCO/2018/00014
Identification Number: 20029896

17 August 2022

Dear Jo Dowling,

Planning Act 2008 - Application by Ørsted Hornsea Project Four (UK) Limited (“Ltd”) for an Order Granting Development Consent for Hornsea Project Four Offshore Wind Farm

Deadline 8 Submission

On 4 November 2021, the Marine Management Organisation (the “MMO”) received notice under Section 56 of the Planning Act 2008 (the “PA 2008”) that the Planning Inspectorate (“PINS”) had accepted an application made by Orsted Hornsea Project Four (UK) Ltd (the “Applicant”) for a development consent order (the “Application”).

The Application seeks authorisation to construct, operate and maintain Hornsea Project Four offshore wind farm, comprising of up to 180 offshore wind turbines together with associated offshore and onshore infrastructure and all associated development (the “Project”).

The MMO submits the following as part of our Deadline 8 submission:

- 1. Comments on any submissions received at Deadline 7**
- 2. Any further information requested by the ExA under Rule 17 of the Examination Procedure Rules**

This written representation is submitted without prejudice to any future representation the MMO may make about the Application throughout the Examination process. This representation is also submitted without prejudice to any decision the MMO may make on any associated application for consent, permission, approval or any other type of authorisation submitted to the MMO either for the works in the marine area or for any other authorisation relevant to the proposed development.

Yours Sincerely



[REDACTED]

Gregg Smith
Marine Licencing Case Officer

[REDACTED]



Contents

1.	Comments on any submissions received at Deadline 7	4
1.1.	Outline Marine Monitoring Plan [REP7-058].....	4
1.2.	Outline Southern North Sea Special Area of Conservation Site Integrity Plan [REP7-054].....	6
1.3.	G1.10 Hornsea Four Clarification Note on Peak Herring Spawning Period and Seasonal Piling Restriction) [REP7-065]	7
1.4.	Additional remaining issues additional to REP7-111	11
1.5.	Statement of Common Ground (SoCG) [REP7-070]	12
2.	Any further information requested by the ExA under Rule 17 of the Examination Procedure Rules	19
	References.....	20



1. Comments on any submissions received at Deadline 7

1.1. Outline Marine Monitoring Plan [REP7-058]

1.1.1. The MMO has reviewed the Outline Marine Monitoring Plan which the Applicant provided us at Deadline 7 [REP7-058], along with our scientific advisors at Cefas, and have the following comments to make.

Coastal Processes

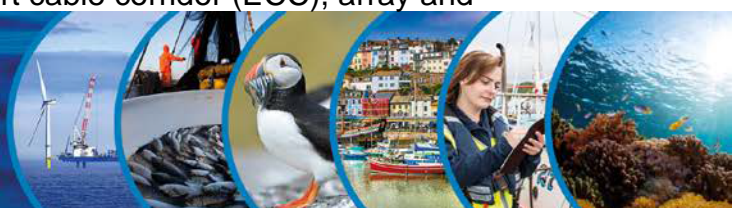
- 1.1.2. The MMO welcomes the addition of Table 3 referring to Smithic Bank and Flamborough Front. However, a 10% buffer either side of the cable is proposed (10% of the corridor width). The MMO requests that this is defined, and query whether this is sufficient to identify sources of sediment disturbance that could impact the integrity of the cable on the active Smithic bank region?
- 1.1.3. In terms of the coverage of swath bathymetry surveys of Smithic Bank, a chart showing the planned route, the cable corridor and the 10% margin along with a background of the latest bathymetry from winter 2020/21 would enable reviewers to assess if the 10% margin is sufficient to detect sources of disturbance.
- 1.1.4. Table 2 outlines that pre-construction surveys will be undertaken for a variety of pressures or activities, including cables, boulders, sandwave clearance, and UXO clearance etc. The MMO notes that as these will provide the “baseline” which is key to subsequent surveys, the coverage of these surveys will need to be agreed.

Benthic

- 1.1.5. The MMO notes that the outline marine monitoring plan has been updated to include a more detailed monitoring approach for benthic subtidal and intertidal ecology with relevant objectives and information on the monitoring rationale.
- 1.1.6. The MMO confirms that the benthic monitoring requirements are included within the outline marine monitoring plan. It is also recognised that the Applicant has outlined that the precise design of any monitoring work is iterative, based on an increasing knowledge base specific to the project, the exact design of Hornsea Four and the presence of benthic receptors, and therefore may differ to the outline presented currently.
- 1.1.7. The MMO also welcomes the commitment to monitor the predicted impacts of the development at the scale proposed i.e., to identify changes to the benthic community structure from before and after construction in relation to Gravity Base Structures (GBS) wind turbine generator foundations.
- 1.1.8. The MMO requests that section BIE-O-13 of the updated outline marine monitoring plan should cover the monitoring of a minimum of 10% of the total amount of turbines proposed for construction.

Fisheries

1.1.9. The MMO notes that the outline marine monitoring plan, in its current form, does not fully identify all the areas within the export cable corridor (ECC), array and



adjacent areas where monitoring of sandeel habitat and herring spawning habitat is required. The MMO recognises that this is an outline plan and therefore assume that the specific details of monitoring plan could be refined post-consent. Therefore, the following comments have been made to highlight previous comments raised by the MMO in relation to the specific areas of the project site which require monitoring for sandeel and herring.

Sandeel:

- 1.1.10. The MMO recommends that pre- and post-construction monitoring of sandeel habitat suitability should include the array and adjacent area (i.e., in addition to the export cable corridor and adjacent areas. Please refer to our comments in section 1.5.2 of this submission for further details.

Herring

- 1.1.11. The MMO support the proposal for pre- and post-construction monitoring herring spawning habitat for Hornsea Four Project. There is scope for this monitoring to be targeted to those areas of the ECC where herring spawning occurs and where seabed sediments are shown to comprise of coarse sand and gravel, i.e., are suitable substrates for herring to lay their eggs on. Please refer to our advice in sections 3.15 - 3.28 of the MMO's Deadline 7 [REP7-111] for our detailed comments on herring spawning within the nearshore section of the ECC and reiterates our concerns regarding potential impacts to herring and herring spawning substrate during construction and disposal activities.
- 1.1.12. The MMO welcomes discussions with the Applicant on any refinements that can be made to the locations of pre- and post-construction monitoring for this project.

Underwater Noise

- 1.1.13. The MMO notes that the outline marine monitoring plan appropriately confirms in Table 7 that measurements of noise generated by the installation of the first 4 foundations of each driven or part-driven pile foundations to be constructed collectively under the Generation and Transmission DMLs will be obtained, to validate the underwater noise modelling predictions. It is also appropriate the transects monitored in the survey will be informed by the predictions for noise propagation within the Environmental Statement. The MMO welcomes that transects will be planned to ensure validation of the underwater noise towards or over deeper water around the monitored turbines. It is also important that the worst-case in terms of noise propagation is considered.
- 1.1.14. The MMO also notes that monitoring will also be undertaken by Marine Mammal Observers prior to the start of piling as part of the Marine Mammal Mitigation Protocol (MMMP) for at least 30 minutes.
- 1.1.15. The only other monitoring not captured within this outline marine monitoring plan is whether Passive Acoustic Monitoring (PAM) is undertaken as part of the MMMP. PAM can provide a useful supplement to visual observations undertaken by Marine Mammal Observers.



1.1.16. The MMO highlights that the construction noise monitoring can also be used to validate the predictions made in the Environmental Statement with regard to fish ecology.

1.2. Outline Southern North Sea Special Area of Conservation Site Integrity Plan [REP7-054]

1.2.1. The MMO has reviewed the Outline Southern North Sea Special Area of Conservation Site Integrity Plan (outline SNS SAC SIP) which the Applicant has provided us at Deadline 7, along with our scientific advisors at Cefas, and have the following comments to make.

1.2.2. The MMO believes the outline SNS SAC SIP is robust and contains the necessary information required at this stage. We note that this Outline SNS SAC SIP is intended to identify the available mitigation and management measures that could be brought forward during the development of the final SNS SAC SIP prior to the construction of Hornsea Four, that ensures that a conclusion of no Adverse Effect on Integrity (AEol) can be maintained under all scenarios.

1.2.3. We also note that any requirement for noise mitigation shall be determined following confirmation of final hammer energies and foundation types, collection of additional survey data (noise or geophysical data), and/or acquisition of noise monitoring data, the update of the project and location specific noise model(s) including information on maturation of emerging technologies. The mitigation measure (or suite of measures) that may be implemented during the construction of Hornsea Four will be determined in consultation with the regulator and relevant statutory nature conservation body.

1.2.4. With regard to the project in-combination assessment, the final SNS SAC SIP will confirm which plans and projects fall within the construction timeframe for Hornsea Four and therefore which plans and projects require further consideration in-combination with Hornsea Four. The purpose of the process being to confirm whether the conclusion of no AEol in-combination is valid in the absence of additional mitigation, and if not, which measure(s) is required to provide that certainty.

1.2.5. However, the MMO reiterates the request made at Deadline 7 [REP7-111] that the following is clarified.

1.2.6. Page 16 of the document sets out the following Commitment: “Co85 – There will only be a maximum installation of 2 piled foundations within a 24 hour period. It is possible for installation of the two piled foundations to occur concurrently i.e., within a 24 hour period at up to two locations within the HVAC search area or up to two locations within the array. The two piled foundation locations may also be piled simultaneously”. This statement is confusing as ‘concurrently’ and ‘simultaneously’ have the same meaning. Presumably, the Applicant means that consecutive piling is likely (i.e., up to two piles installed in a 24-hour period, one after the other) but simultaneous piling may also occur (two piles installed in different locations at the same time within either the HVAC area or within the array). We request that the Applicant clarifies this.



1.3. G1.10 Hornsea Four Clarification Note on Peak Herring Spawning Period and Seasonal Piling Restriction) [REP7-065]

- 1.3.1. The MMO has reviewed the Applicant's proposal to amend the dates of the timing restriction which the Applicant has provided us at Deadline 6, and the updated clarification note they provided at Deadline 7 [REP7-065] along with our scientific advisors at Cefas and have the following comments to make.
- 1.3.2. The Applicant maintains that the originally proposed restriction period of 1st September to 16th October per year utilises a sufficiently precautionary approach and as a result, provides a robust mitigation of the potential effects of piling of the HVAC booster station on herring spawning.
- 1.3.3. The MMO do not support this statement. We maintain the position that the proposed restriction period of 1st September to 16th October is not precautionary, not based on robust evidence, and does not provide robust mitigation to protect the Banks herring population.
- 1.3.4. The Applicant acknowledges that there are three outstanding areas of disagreement with which the MMO concur.
- a) Temperatures used in the calculation (which in turn also influence egg development rates and yolk absorption periods).
 - b) The presentation of the 135dB behavioural contour.
 - c) The growth rate applied.
- 1.3.5. Regarding point a) the MMO have highlighted significant variability in minimum sea temperatures recorded in the Banks spawning ground, particularly in recent years. We have recommended that the back-calculation method should use more conservative minimum values, which in this instance range from 8.56°C – 9.15°C (rather than the Applicant's suggested 12°C).
- 1.3.6. Regarding point b) the MMO reiterates the request made on multiple occasions through the pre-examination and examination stages for the Applicant to provide appropriate modelled noise contours to demonstrate the range of impact for behavioural effects on herring migrating to/from, and at, the spawning grounds. This remains outstanding, and we maintain that this is a major barrier to reaching agreement on the piling restrictions. The MMO do not consider this request to be overly burdensome and other offshore developers have provided such information.
- 1.3.7. The MMO repeats our comments from Section 2.1.10 of our Deadline 6 response [REP6-050]. The MMO requested that the modelled noise contour was presented for the received levels of the 135dB single strike sound exposure level (SELss) at the herring spawning ground, based on the findings in Hawkins *et al.* (2014) as this is considered the best available scientific evidence by our specialists at Cefas. In this instance the paper has reputable, experienced co-authors, and it is regularly referred to within Environmental Impact Assessments to inform noise exposure guidelines in fish. Further, the application of the 135dB threshold has been accepted and widely used in underwater noise modelling by other offshore windfarm developments during the planning process. We recognise that the Applicant has a view on the level of risk, however we do not consider this to be



adequately supported by the evidence. We have also stated that we are willing to consider the use of an alternative threshold for modelling behavioural responses in herring (or a similar clupeid fish), should the Applicant be able to provide one which is based on suitable, peer-reviewed literature. However, to date, such an alternative threshold has not been provided for review.

- 1.3.8. Regarding point 13c, whilst we maintain that using a larval growth rate of 0.25mm per day (based on Heath (1993)) is appropriate for the purpose of a conservative calculation, we have previously stated that we would be conditionally content to accept the use of the Oeberst *et al.* (2009) model using all the literature data ($G=0.11+(0.017*T)$) subject to the use of an appropriate temperature (as outlined in section 1.4.5), but caveated that the model was not based on autumn spawning Banks herring larvae. We asked that workings for the calculated daily larval growth rate value should be presented in the Applicant's response. The Applicant has now agreed to use the growth rate of 0.25mm per day and we support this.
- 1.3.9. The Applicant maintains their Deadline 5 position in relation to growth rate but is willing to compromise and use the MMO's preferred growth rate in the calculation. As per 1.4.8, we support the use of a larval growth rate of 0.25mm per day, based on Heath (1993).
- 1.3.10. The Applicant outlines that they are confident that the equation presented by Oeberst *et al.* (2008) to calculate growth rates is appropriate to estimate the growth rate for the Banks herring stock. The MMO maintain that using a larval growth rate based on Heath (1993) is more appropriate for the purpose of a conservative calculation.
- 1.3.11. Regardless of the residual disagreement, the Applicant has used the Heath (1993) growth rate of 0.25mm d-1 (with all other parameters remaining as presented in the Scenario C calculations at Deadline 5 (REP5-048)), which results in the following spawning start dates for the various scenarios presented:

Table 1: Spawning start dates for the various scenarios presented

	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E
Hatch length	6.5mm	8mm	5mm	6mm	10mm
'Peak' period start date	27 th August	2 nd September	21 st August	25 th August	10 th September

- 1.3.12. As per section 1.4.5, the MMO recommended that the back-calculation method should use more conservative minimum values, which in this instance range from 8.56°C – 9.15°C. Sea temperature values influence the duration of egg development and yolk absorption period (see Russell, 1976). The Applicant had already modified the parameters to accept the MMO's suggested conservative values for larval length in survey sample (10mm) and larval length hatch size (5mm).

1.3.13. Based on MMO recommended values for an appropriate, evidence-based back-calculation, we have provided the following table to demonstrate why we do not believe that Scenario C is adequately conservative:

Table 2: MMO recommended values for an appropriate, evidence-based back-calculation

Factor	Value as recommended by MMO
Mean survey start date	24 th September
Larval length at catch	10mm
Indicative hatch length	5mm
Egg development period (Russell, 1976)	14 days
Yolk absorption period (Russell, 1976)	20 days
Assumed growth rate (Heath, 1993)	0.25mm/day

1.3.14. Based on the above values recommended for the back-calculation, the resulting start date is 1st August, which is in-line with the MMO's original recommendation that the restriction period should start on 1st August.

1.3.15. Workings are as follows:

- It will take a 5mm newly hatched larvae 20 days to reach the larval length at catch of 10mm.
- 24th September – (20 days growth + 20 days yolk absorption + 14 days egg development) = 1st August.

1.3.16. The MMO have highlighted that consideration needs to be given to a period of time for herring to migrate to/from the spawning grounds. The Applicant notes that the Banks herring stock migrate in a clockwise circuit in the North Sea, migrating from the Northeast to the Banks spawning ground, and then continuing in a northerly direction (Cushing, 2001).

1.3.17. The Applicant maintains that noise effects from the Hornsea Four Project construction works will not cause a barrier effect to that herring migration given the position of the circuit and the location of the noise contours in relation to that circuit (mapped in REP5-048). As such, the Applicant considers that there is no need to allow additional time for a migration period within the peak spawning period timing. That said, the Applicant is willing to propose an end date for the peak spawning period of 23rd October, 7 days later than originally proposed in DCO Schedule 12, Part 2 - Condition 23.

1.3.18. Please refer to section 1.4.6 and 1.4.7 of this submission regarding the request for the modelling of the 135dB noise contour to determine the likely range for behavioural responses in herring migrating to, and from, the spawning grounds. The mapped noise contours are needed to substantiate the Applicant's statement that noise effects from the Hornsea Four Project construction works will not cause a barrier effect to herring migration.

1.3.19. Due to this late stage in the examination process, we expect that the Applicant will not be able to fulfil this request, so in a bid to reach some sort of acceptable agreement for an appropriate piling restriction period, the MMO are content to accept the Applicant's proposed end date for the restriction period of 23rd October.



We caveat this by adding that owing to the lack of appropriate modelling, our agreement is not based on project-specific evidence, but is based on two assumptions as follows:

i) If the peak herring spawning period occurs at the beginning of August, we can expect that post-spawning herring will have moved off the spawning grounds and away from the Hornsea Four Project construction area to continue their path of migration by 23rd October.

ii) Based on IHLS survey data, peak larval densities are observed in this area during the latter half of September (see mean survey start date of 24th September in Table 1). According to Heath & Rankine (1988) herring larvae can drift up to 9km a day, and post-larval MIK net survey data carried out during International Bottom Trawl Surveys (IBTS) show that larvae generally move in an easterly direction (see Figure 1). Therefore, over the course of a month (i.e., between 24th September and 23rd October) we would expect that larvae would have drifted eastwards, with the wind and prevailing North Sea currents, away from the Hornsea Four Project construction area.

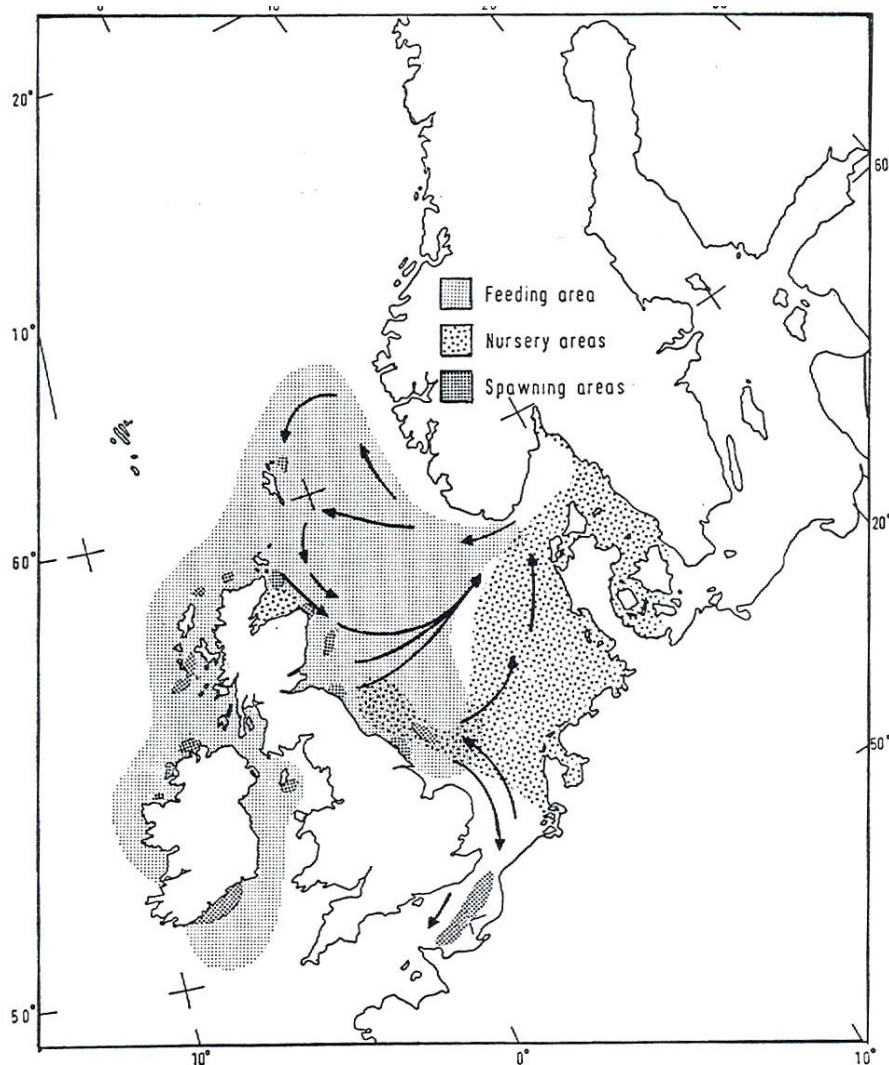


Figure 1: General migration patterns of North Sea herring, from Burd (1978)



- 1.3.20. With respect to migration to/from spawning grounds, the Applicant considers that this additional 7 days, coupled with the additional 10 days at the start of the peak spawning period, allow for additional conservatism which should provide MMO with further comfort that impacts on spawning herring will be further mitigated.

Summary

- 1.3.21. Based on the recommended values for the back-calculation, we maintain that a start date of 1st August is required for the piling restriction. We are conditionally content to accept the Applicant's proposed end date to the piling restriction of 23rd October.
- 1.3.22. Based on these parameters, the Applicant has proposed a start date for the peak spawning period of 21st August, 10 days earlier than originally proposed in DCO Schedule 12, Part 2, Condition 23.
- 1.3.23. The Applicant has proposed a compromised restriction period of 21st August – 23rd October, taking into account the MMO's preferred growth rate and consideration of time for herring to migrate to/from spawning grounds.
- 1.3.24. Our proposed restriction wording comprises: *No piling of any kind is permitted from 1st August to 23rd October (inclusive) in any year.*

1.4. Additional remaining issues additional to REP7-111

Underwater noise:

- 1.4.1. Linking to comments 3.7.11 of RR-020: Regarding the calculation of the underwater noise transmission loss (TL) for the non - impulsive sources, specifically for vessel noise ($12 \log R - 0.0021 R$). We acknowledge that the approach undertaken by Subacoustech is conservative (and on that basis we are not overly concerned). We also agree that the noise from these 'other sources' will likely have fallen below any level of concern at long ranges. However, further clarity or explanation on this (somewhat unusual) simple modelling approach (and TL formula) is lacking, especially as the propagation loss becomes negative beyond 25 km.

Fisheries

- 1.4.2. Regarding sandeel (linking to comment 4.5.12 of RR-020): the MMO maintains that post-construction monitoring of sandeel habitat suitability should include the array and adjacent area (i.e., in addition to the export cable corridor and adjacent areas) for the following reasons:
- 1.4.2.1. Both greater sandeel and lesser sandeel were caught within the Hornsea Four Project array and adjacent area during the former Hornsea Zone surveys, despite both gear types used (otter trawl and scientific beam trawl) being unsuitable for targeting sandeel species (owing to their burrowing nature). Had an appropriate type of fishing gear (e.g. a sandeel dredge) been used during the former Hornsea Zone surveys, then there is a strong



likelihood that larger catches of sandeel may have occurred.

1.4.2.2. The array area is classified as a high intensity spawning ground in Ellis *et al.* (2012). This publication was informed through long-term collections of fisheries and ichthyoplankton survey data.

1.4.2.3. Sediments across the Hornsea Four Project array and ECC have been shown to be suitable (i.e., 'preferred') as sandeel habitat across multiple benthic surveys, thus supporting our points that the Hornsea Four Project array and ECC area is sandeel habitat.

1.4.2.4. The MMO has, in the past, recommended sandeel dredge surveys for the purpose of determining sandeel abundance in areas of offshore development (e.g., Dogger Bank OWFs). However, the surveys are costly and not without risk, and it was considered that the MarineSpace (2013) method, (developed by the Aggregates industry, in consultation with Cefas fisheries advisors and the MMO) provided a suitable approach to determining sandeel habitat suitability, as a proxy for sandeel dredge surveys. Whilst the MarineSpace (2013) method does not provide data on sandeel abundance, it does mean that the additional costs and risk of dredge surveys can be avoided, as well as avoidance of disturbance to sandeel habitat.

1.4.2.5. By following the MarineSpace (2013) method, analysis of particle size analysis (PSA) data can be used to demonstrate that the seabed has remained/recovered/returned to an environment which is still suitable as a spawning, nursery ground and habitat for sandeel species. Any catches of sandeels from sediment grabs will provide supplementary evidence of their presence in the windfarm and export cable route areas post-construction, thus supporting the findings of PSA data. By collecting PSA data in the array, ECC and adjacent areas, the Applicant will have data that can be used to support the predictions made within the ES for sandeels.

1.4.2.6. Collecting grab samples of sediment for PSA and observing sandeels in grab samples is not considered an onerous task as it typically forms part of a post-construction benthic monitoring programme.

1.5. Statement of Common Ground (SoCG) [REP7-070]

1.5.1. The MMO has engaged with the Applicant to finalise the SoCG submitted at Deadline 7 REP7-070 and understand this will be submitted at this Deadline (8).

1.5.2. We note there were a number of matters which required Deadline 7 submissions, or adequate timescales to review, and these have been outlined in the final SoCG signed and submitted at Deadline 8.

1.5.3. Regarding the MMO's final positions outlined within section 8 of REP7-111 the MMO provides the following updates. Please note where an update is not provided here, it is because the final position remains in section 8 of REP7-111.



Table 3: Updated positions to section 8 of REP7-111

<p>Piling restriction (DMLs Schedule 12, Part 2, Condition 23)</p>	<p><u>MMO comments:</u> The MMO's present position is that the restriction should be "<i>between 1st August and 31st October each year</i>".</p>	<p><u>MMO DL8 position:</u> The MMO has reviewed the Applicant's updated G1.10 Clarification Note on Peak Herring Spawning Period and Seasonal Piling Restriction and provided comments within 1.3 of this submission.</p> <p>To conclude, our proposed restriction wording comprises: <i>No piling of any kind is permitted from 1st August to 23rd October (inclusive) in any year.</i></p> <p>However, we have utilised a number of assumptions outlined in 1.3.19 to come to this position, that we leave to the Examiners (ExA's) discretion.</p>
<p>Commitments outlined in the outline marine monitoring plan-</p> <p>Monitoring Smithic Bank</p>	<p><u>MMO comments:</u> As put forward at Deadline 6 [REP6-050], regarding Smithic Bank monitoring the MMO advise a high-resolution pre-construction survey is undertaken followed by a post-cable installation survey every 6 months for 2 years (including two winters periods and one summer) and further surveys every 5-years for the duration of the project. Comparison reports should be produced, incorporating a comparison with existing bathymetric survey data.</p>	<p><u>MMO DL8 position:</u> The MMO has reviewed the Applicant's updated F2.7: Outline Marine Monitoring Plan Outline Marine Monitoring Plan [REP7-058] and are content with its contents regarding this matter, we provide some remaining minor comments in sections 1.1.2 – 1.1.4 of this submission.</p>
<p>Marine Processes: Commitments outlined in the outline marine monitoring plan-</p>	<p><u>MMO DL7 comments:</u> As put forward at Deadline 6 [REP6-050], the MMO consider that tighter control measures should be implemented to ensure that the least amount of rock protection is deployed within Smithic Bank, in line with the</p>	<p><u>MMO DL8 position:</u> The MMO has reviewed the Applicant's updated F2.7: Outline Marine Monitoring Plan Outline Marine Monitoring Plan [REP7-058] and are</p>



<p>Maximum rock protection in Smithic Bank</p>	<p>proposed maximum 5% of cables getting rock protection in the Smithic Bank area. We believe the Applicant should be conditioned to submit the detailed pre-construction surveys and the cable burial risk assessment for the Smithic Bank area showing the % of cables that will be buried, and what the method of construction will be. This would then be reviewed and approved by the MMO.</p>	<p>content with its contents regarding this matter, we provide some remaining minor comments in sections 1.1.2 – 1.1.4 of this submission.</p>
<p>Marine Processes: Commitments outlined in the outline marine monitoring plan-</p> <p>Flamborough Front monitoring</p>	<p><u>MMO DL7 comments:</u> Regarding the Flamborough Front, the MMO confirms that we believe the Applicant is making progression regarding satellite monitoring, we confirm that the level of detail, and resolution of the satellite monitoring proposed is good. However, the MMO believes that this monitoring needs to expand to an array scale in the first instance, and not wait to see if monitoring of 3 distinct locations triggers the need for a wider scale monitoring. We believe this monitoring should look at productivity, by looking at chlorophyll, and sediment plumes which will help illustrate and monitor turbine wake interactions. Regarding the timing of monitoring the MMO believe we would need to see the stratification and as such, covering periods of spring, summer and autumn. The MMO proposes a first set of monitoring is undertaken to then help with the identification and the wider design of the monitoring to be suitably tailored.</p>	<p><u>MMO DL8 position:</u> The MMO has reviewed the Applicant's updated F2.7: Outline Marine Monitoring Plan Outline Marine Monitoring Plan [REP7-058] and are content with its contents regarding this matter, we provide some remaining minor comments in sections 1.1.2 – 1.1.4 of this submission.</p>
<p>Herring: Temperatures used</p>	<p><u>MMO DL7 Comments:</u> The MMO still does not support the Applicant's proposal to use a value of 12°C to determine the durations for egg development and yolk absorption, as it is not conservative. A conservative approach should take the minimum values, which in this instance range from 8.56°C – 9.15°C. This range accounts for six out of twenty-four (25%) of these temperatures.</p> <p>Since Russell (1976) only provides egg</p>	<p><u>MMO DL8 position:</u> The MMO has reviewed the Applicant's updated G1.10 Clarification Note on Peak Herring Spawning Period and Seasonal Piling Restriction and provided a number of comments within 1.3 of this submission.</p> <p>To conclude, our</p>



	<p>development periods for temperature ranges of 7 - 8°C (14 - 18 days) and 10 - 11°C (10 - 12 days) (Table 2 of this submission) but not for temperatures between 8 - 10°C, the MMO recommends that the Applicant uses an egg development period of 14 days for their calculations, based on using the lower temperature range of 7-8°C and the minimum development period for this range i.e., 14 days rather than 18 days.</p> <p>The MMO recommends that the full 20-day period is used in the Applicant's calculation, on the basis that temperatures observed in IHLS data shown in Table 1 of this submission have been below 10.3°C in more recent years, and because the calculation being proposed needs to take a conservative approach.</p>	<p>proposed restriction wording comprises: <i>No piling of any kind is permitted from 1st August to 23rd October (inclusive) in any year.</i></p> <p>However, we have utilised a number of assumptions outlined in 1.3.19 to come to this position, that we leave to the ExA's discretion.</p>
<p>Herring: Behaviour responses</p>	<p><u>MMO DL7 Comments:</u> We recognises that the Applicant has a view on the level of risk, however this is not supported, in our view, in the evidence. The MMO would be willing to consider the use of an alternative threshold for modelling behavioural responses in herring (or a similar clupeid fish), should the Applicant be able to provide one which is based on suitable, peer-reviewed literature. In the absence of a suitable alternative threshold, we again request that this threshold is modelled, and the mapped noise contour presented for review.</p> <p>We further outline that due to this, we maintain the position that it is not possible to determine the extent of the transboundary impact or determine whether there will be any spatial overlap of noise with spawning and nursery grounds of fish in the Netherlands or any other neighbouring countries.</p>	<p><u>MMO DL8 position:</u> The MMO has reviewed the Applicant's updated G1.10 Clarification Note on Peak Herring Spawning Period and Seasonal Piling Restriction and provided a number of comments within 1.3 of this submission.</p> <p>To conclude, our proposed restriction wording comprises: <i>No piling of any kind is permitted from 1st August to 23rd October (inclusive) in any year.</i></p> <p>However, we have utilised a number of assumptions outlined in 1.3.19 to come to this position, that we leave to the ExA's discretion.</p>
<p>Herring: Conclusions</p>	<p><u>MMO DL7 Comments:</u> The MMO maintains that the proposed</p>	<p><u>MMO DL8 position:</u> The MMO has reviewed</p>



	<p>'peak' spawning period of 1st September – 16th October is not appropriate for the reasons outlined above. We believe that the calculated 'peak' spawning period is neither precautionary nor conservative. Further revisions and amendments are needed including the requirement for behavioural response noise modelling and the use of appropriate minimum sea temperatures which influence the duration of egg and larval development, and larval growth rates, all of which are factors which will affect the calculation of a 'peak' spawning period. The MMO maintains the position that the restriction should be between 1st August and 31st October each year.</p>	<p>the Applicant's updated G1.10 Clarification Note on Peak Herring Spawning Period and Seasonal Piling Restriction and provided a number of comments within 1.3 of this submission.</p> <p>To conclude, our proposed restriction wording comprises: <i>No piling of any kind is permitted from 1st August to 23rd October (inclusive) in any year.</i></p> <p>However, we have utilised a number of assumptions outlined in 1.3.19 to come to this position, that we leave to the ExA's discretion.</p>
<p>Benthic: R-020- 3.4.18</p>	<p><u>MMO DL7 comments:</u> We note the Applicants comments regarding non-native invasive species (NIS), however, Hornsea Four does represent a potential vector and stepping-stone to other offshore infrastructure and the coast. Whilst we recognise the commitment of a marine biosecurity plan to prevent introduction of NIS during construction and maintenance, this will not prevent NIS from colonising Hornsea Four turbines during the operation lifetime. As such, we advise monitoring of NIS is undertaken.</p>	<p><u>MMO DL8 position:</u> The MMO confirms that this matter has now been addressed, by the inclusion of NIS monitoring within the outline marine monitoring plan [REP7-058].</p>
<p>Benthic: Commitments outlined in the outline marine monitoring plan</p>	<p><u>MMO DL7 Comments:</u> The MMO requests that the following are added to the outline marine monitoring plan regarding benthic ecology matters:</p> <ul style="list-style-type: none"> • The monitoring of NIS is undertaken. • A minimum of 10% of the total amount of turbines proposed for construction to be monitored for 	<p><u>MMO DL8 position:</u> The MMO confirms that the monitoring of NIS matter has now been addressed by the updated outline marine monitoring plan [REP7-058].</p> <p>However, the MMO maintains that section</p>



	benthic impacts.	BIE-O-13 of the updated outline marine monitoring plan [REP7-058] should cover the monitoring of a minimum of 10% of the total amount of turbines proposed for construction. If the Applicant is in agreement with this figure, makes this amendment then this matter can be considered agreed and final.
Outline marine monitoring plan	<p><u>MMO DL7 Comments:</u></p> <ul style="list-style-type: none"> • The MMO believes that there should be monitoring of NIS as any management measures put in place would not prevent the colonisation of turbine foundations (and scour protection) by NIS and that this should be updated within the OMMP. • The MMO requests the inclusion of benthic monitoring around a selection of GBS foundations (10%). • As put forward at Deadline 6 [REP6-050], regarding Smithic Bank monitoring the MMO advise a high-resolution pre-construction survey is undertaken followed by a post-cable installation survey every 6 months for 2 years (including two winters periods and one summer) and further surveys every 5-years for the duration of the project. Comparison reports should be produced, incorporating a comparison with existing bathymetric survey data. • Regarding the Flamborough Front, the MMO confirms that we believe the Applicant is making progression regarding satellite monitoring, we confirm that the level of detail, and resolution of the satellite monitoring proposed is good. However, the 	<p><u>MMO DL8 position:</u></p> <p>The MMO provides the following updated positions on the updated outline marine monitoring plan [REP7-058].</p> <ul style="list-style-type: none"> • The MMO confirms that the monitoring of NIS matter has now been addressed by the updated outline marine monitoring plan [REP7-058]. • The MMO maintains that section BIE-O-13 of the updated outline marine monitoring plan [REP7-058] should cover the monitoring of a minimum of 10% of the total amount of turbines proposed for construction. • The MMO are content that the Smithic bank monitoring put forward the updated outline marine monitoring plan [REP7-058] is



	<p>MMO believes that this monitoring needs to expand to an array scale in the first instance, and not wait to see if monitoring of 3 distinct locations triggers the need for a wider scale monitoring. We believe this monitoring should look at productivity, by looking at chlorophyll, and sediment plumes which will help illustrate and monitor turbine wake interactions. Regarding the timing of monitoring the MMO believe we would need to see the stratification and as such, covering periods of spring, summer and autumn. The MMO proposes a first set of monitoring is undertaken to then help with the identification and the wider design of the monitoring to be suitably tailored.</p>	<p>appropriate. we provide some remaining minor comments in sections 1.1.2 – 1.1.4 of this submission.</p> <ul style="list-style-type: none"> • The MMO are content that the Flamborough Front monitoring put forward the updated outline marine monitoring plan [REP7-058] is appropriate. we provide some remaining minor comments in sections 1.1.2 – 1.1.4 of this submission.
<p>Table 4: Benthic Ecology REP7-111</p>	<p><u>MMO DL7 Comments:</u> See Table 4 of REP7-111.</p>	<p><u>MMO DL8 Position:</u> The MMO has been informed by the Applicant that both 'A2.2 ES Volume A2 Chapter 2 Benthic and Intertidal Ecology' and 'ES Volume A5 Annex 2.1 Benthic and Intertidal Ecology Technical Report' documents have been updated to capture all of the MMO requested edits at Deadline 7. In the interests of efficient time management the MMO have not checked these amendments. However, if the documents have been updated to capture our comments, we confirm this matter is agreed and final.</p>



2. Any further information requested by the ExA under Rule 17 of the Examination Procedure Rules

2.1. The MMO has reviewed the Rule 17 letter issued on 11 August 2022 and notes no questions are posed to us. As such we have no comment.

Yours Sincerely



Gregg Smith
Marine Licencing Case Officer



References

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