

From: [Dominika Phillips](#)
To: [Hornsea Project Three](#); [KJ Johansson](#); [Kay Sully](#)
Cc: [Andrew Guyton](#); [Stuart Livesey](#)
Subject: Hornsea Project Three (UK) Ltd response to Deadline 4 (Part 9)
Date: 15 January 2019 23:10:44
Attachments: [image001.png](#)
[D4_HOW03_Appendix 32_Option 1.pdf](#)
[D4_HOW03_Appendix 34_Herring Spawning Clarifications.pdf](#)
[D4_HOW03_Appendix 36_Aitchinson 2012.pdf](#)
[D4_HOW03_Appendix 37_Riddington et al 2008.pdf](#)

Dear Kay, K-J

Please find attached the 9th instalment of documents.

Best regards,
Dr Dominika Chalder PIEMA
Environment and Consent Manager



Environmental Management UK | Wind Power
5 Howick Place | London | SW1P 1WG



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Appendix 34 to Deadline 4 submission - Noise Clarifications (Herring Spawning)

Date: 15th January 2019

Document Control			
Document Properties			
Organisation	Ørsted Hornsea Project Three		
Author	Kevin Linnane		
Checked by	Felicity Browner		
Approved by	Andrew Guyton		
Title	Appendix 34 to Deadline 4 submission - Noise Clarifications (Herring Spawning)		
PINS Document Number	n/a		
Version History			
Date	Version	Status	Description / Changes
15/01/2019	A	Final	Submission at Deadline 4 (15/01/2019)

Ørsted

5 Howick Place,

London, SW1P 1WG

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Table of Contents

1. Hornsea Three Noise Clarifications	1
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1. Hornsea Three Noise Clarifications

- 1.1 In their Deadline 3 submissions, the Marine Management Organisation (MMO) requested a number of clarifications with respect to the potential for effects on herring spawning at Flamborough Head (REP3-095). Specifically, the MMO requested the following:
- The modelled received levels for SEL_{cum} based on concurrent piling, as has been done for the peak SPL (showing the contours and spawning habitats);
 - The hammer energy profiles for the SEL_{cum} scenarios (including the number of piles installed in 24 hours, number of strikes, source level); and
 - The unweighted single strike SEL (SEL_{ss}) received levels based on concurrent piling and a 5,000 kJ hammer energy (showing the contours and spawning habitats).
- 1.2 Figure 1.1 shows the updated modelling of received levels for cumulative Sound Exposure Levels (SEL_{cum}) assuming a stationary fish receptor. This modelling assumes two monopiles being installed simultaneously, using the maximum design scenario for hammer energy (i.e. 5,000 kJ) in the north-west corner of the Hornsea Three array area (i.e. the closest point to the Flamborough Head herring spawning ground).
- 1.3 Figure 1.1 shows the impact thresholds for injury and temporary threshold shift (TTS) from Popper et al. (2014) with the TTS threshold (i.e. 186 dB SEL_{cum}) over 60 km from the eastern edge of the mapped herring spawning ground off Flamborough Head, confirming that there is no risk of injury to herring at the Flamborough Head spawning ground. Figure 1.1 also shows that the received noise levels in the vicinity of the Flamborough Head herring spawning ground are very low, i.e. approximately 155 dB SEL_{cum} , which is of the same order as if a receptor was exposed to ambient coastal noise for 24 hours. The Applicant would like to clarify that the received level previously provided to the MMO (clarification provided to MMO on 3rd December 2018; see REP3-095) was based on a simple calculation based on the absolute worst case, rather than modelling. The more detailed modelling presented in Figure 1.1, shows that this was over-conservative and the predicted SEL_{cum} noise levels are even lower than the estimate provided in the previous clarification.
- 1.4 All modelling was undertaken using the piling ramp-up as defined in the Volume 4, Annex 3.1: Subsea Noise Technical Report (APP-085), reproduced in Table 1.1 below. This assumes up to two monopiles installed in a 24 hour period.

Table 1.1: Summary of ramp up used for calculating cumulative SEL for maximum design scenario blow energy (i.e. 5,000 kJ at 100%).

% of max blow hammer energy	15%	40%	60%	80%	100%
Strike Rate	1 strike every 6 seconds	1 strike every 6 seconds	1 strike every 4 seconds	1 strike every 4 seconds	1 strike every 2 seconds
Duration	7.5 minutes	7.5 minutes	7.5 minutes	7.5 minutes	3.5 hours

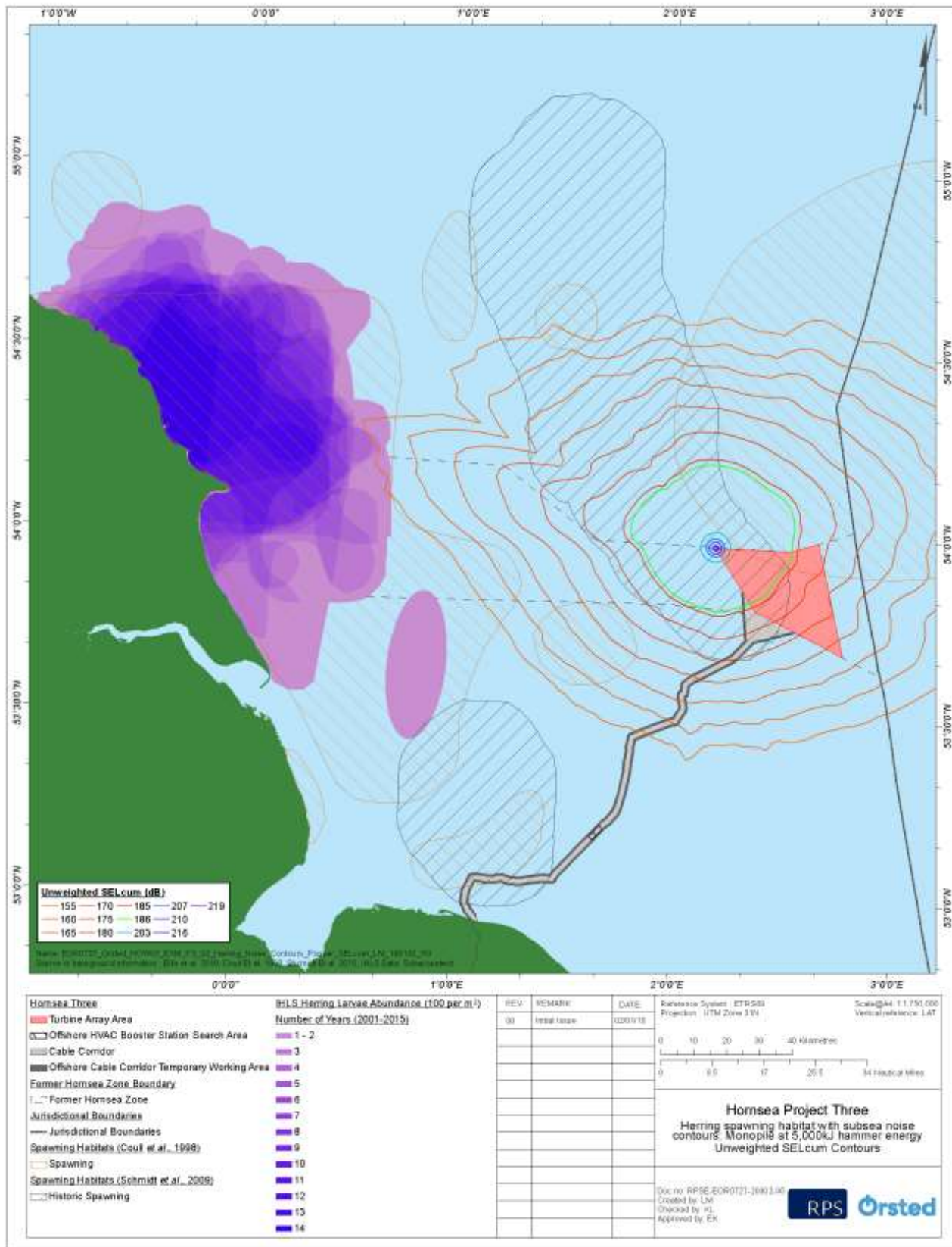


Figure 1.1: Unweighted cumulative Sound Exposure Levels (SEL_{cum}) for concurrent piling of monopiles at 5,000 kJ hammer energy (assumes a stationary fish).

- 1.5 Figure 1.2 shows the results of this modelling of the single strike SEL (SEL_{ss}) noise levels based on a 5,000 kJ energy and concurrent piling, as requested by the MMO. The results of these modelling also demonstrate that noise levels will be extremely low, even in a maximum design scenario for hammer energy and location of piling, with noise levels <125 dB SEL_{ss} considered to be approaching the order of background noise.
- 1.6 In summary, the clarifications above, alongside previous clarifications provided by the Applicant, demonstrate that the risk to herring spawning as a result of piling at the Hornsea Three array area is very low and will not lead to a significant effect in EIA terms. This is in line with the conclusions of Volume 2, Chapter 3: Fish and Shellfish Ecology of the Environmental Statement (APP-063). The Applicant trusts this provides the MMO with the necessary information to allow agreement to be reached on this point.

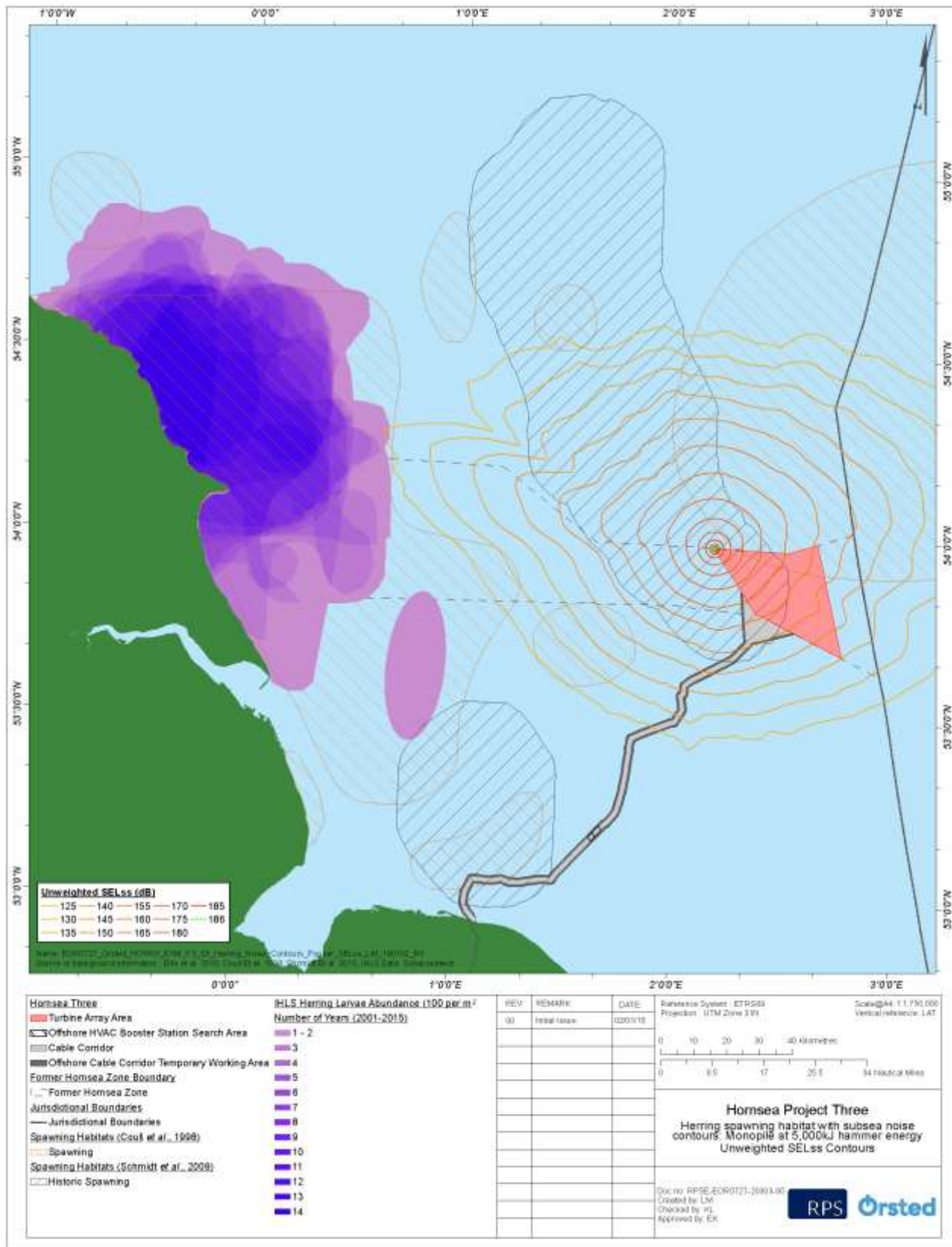


Figure 1.2: Unweighted single strike Sound Exposure Levels (SEL_{ss}) for concurrent piling of monopiles at 5,000 kJ hammer energy.