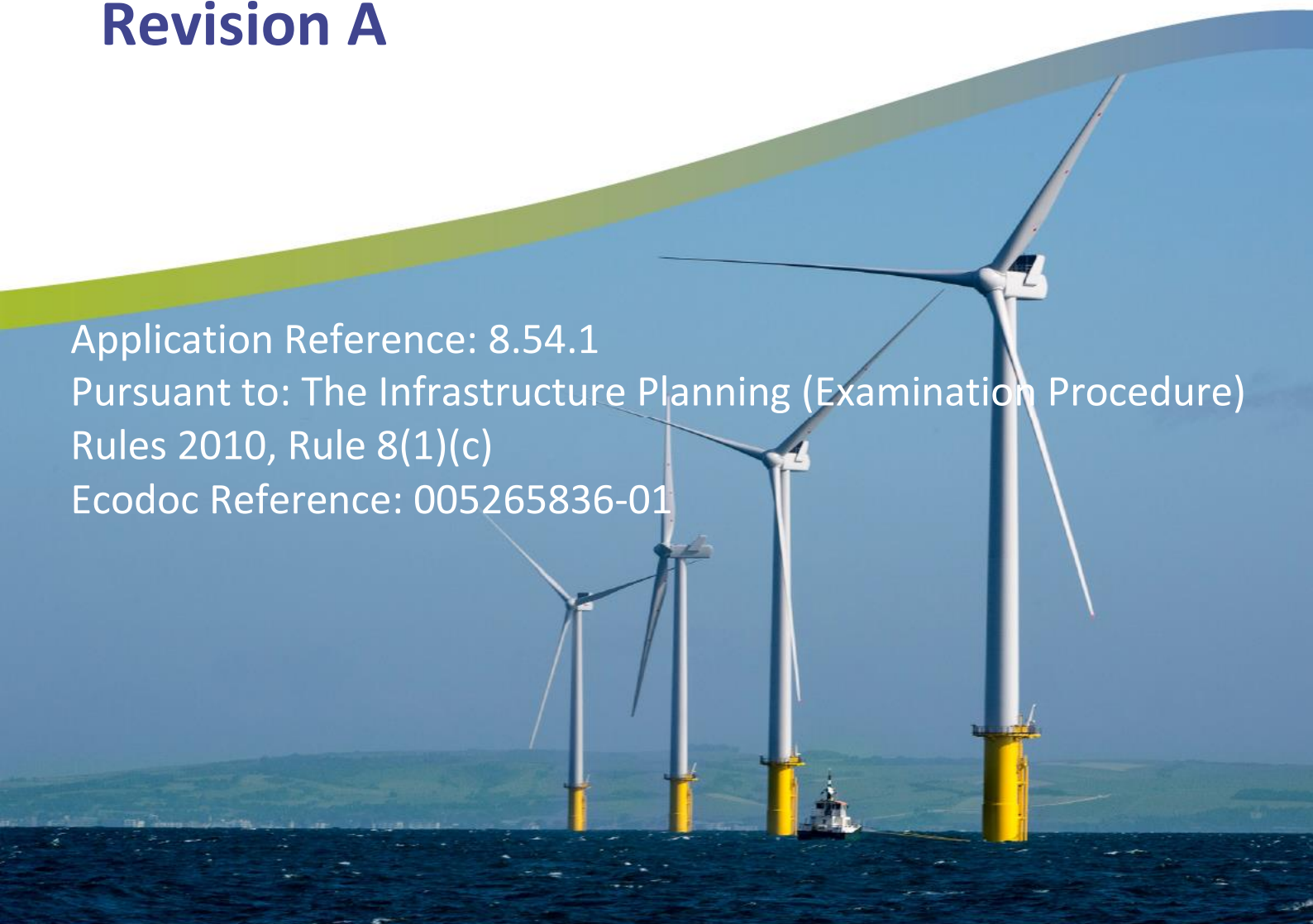


Rampion 2 Wind Farm

8.54 Applicant's Response to Examining Authority's Written Questions – Fish and Shellfish Appendix H: Appendix H Noise Thresholds for Black Seabream (clean)

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1. Introduction

1.1 Overview

- 1.1.1 Rampion Extension Development Limited (hereafter referred to as 'RED') (the 'Applicant') is developing the Rampion 2 Offshore Wind Farm Project ('Rampion 2') located adjacent to the existing Rampion Offshore Wind Farm Project ('Rampion 1') in the English Channel.
- 1.1.2 Rampion 2 will be located between 13km and 26km from the Sussex Coast in the English Channel and the offshore array area will occupy an area of approximately 160km². A detailed description of the Proposed Development is set out in **Chapter 4: The Proposed Development, Volume 2** of the Environmental Statement (ES), submitted with the DCO Application **[APP-045]**.

1.2 Purpose of this Document

- 1.2.1 Following the receipt of the Marine Management Organisation's Deadline 4 Submission **[REP4-088]** Paragraph 4.3.4, commenting on the original version of this document (**8.54 Applicant's Responses to Examining Authority's First Written Questions (ExQ1) [REP3-051]**) which states:

"The Applicant also states that the revised modelling presented here indicates the proposed zoning approach for piling during July in the western part of the array is also not feasible under either monopile or multileg piling scenarios. It should be noted that the MMO have not supported this zoning plan based on modelling of the inappropriate 141 dB threshold and have repeatedly asked the Applicant to demonstrate the feasibility of this approach when modelled using the more appropriate 135 dB threshold.

The Applicant wishes to clarify that the text on page 634 of **8.54 Applicant's Responses to Examining Authority's First Written Questions (ExQ1) [REP3-051]** was submitted in an incorrect form. The Applicant highlights that, whilst the implementation of zoning to accommodate the reduced (stricter) noise threshold of 135 dB SELss would be extremely challenging in combination with other environmental and construction factors, it remains feasible to undertake piling activities within parts of the Offshore Array Area with the proposed mitigation in place for both multileg foundations using pin-piles and monopile foundation structures.

- 1.2.2 The areas available for piling multileg and monopile foundations on the basis of achieving a 135 dB SELss threshold are clearly shown in figures within this document, which have not required updating from the original version submitted a Deadline 3 **[REP-051]**, specifically:
- **Figure 2-1: Piling exclusion zone for the piling of monopiles, with 20dB reduction (Unwtd 135dB SELss); and**

- **Figure 2-3: Piling exclusion zone for the piling of multileg foundations, with 20dB reduction (Unwtd 135dB SELss).**

1.2.3 The corrected wording describing the figures has been provided, in tracked changes for clarity, in **paragraphs 2.3.3 and 2.3.6** of this updated document.

2. Response to FS1.5

- 2.1.1 FS 1.5 – Noise Thresholds for Black Seabream: The MMO suggests a threshold of 135dB SELss is used (as per *Hawkins et al*, 2014) for the reasons set out in section 7.1.6 [REP2-035]. Please respond to the MMO comments in this section of their submission. Furthermore, if this threshold was adopted by the Applicant, please set out how that would affect mitigation such as zoning of piling, using diagrams where possible.
- 2.1.2 The Applicant has provided detailed responses to the MMO's comments in [Applicant's Comments on Deadline 2 Submissions \(document reference 8.55\)](#). In summary, the Applicant maintains their position that the 141dB SELss threshold (as defined by Kastelein et al. (2017)) is appropriate to inform the potential for behavioural effects on black seabream (*Spondyliosoma cantharus*). The 131dB SELss and 135dB SELss thresholds as proposed by the MMO are not considered applicable for the Proposed Development, as they are not supported in the literature (Hawkins et al., 2014) for use in impact assessments and nor are the results of the study applicable to a busier sea area (i.e. the English Channel) with much higher background noise levels.
- 2.1.3 Notwithstanding this, as requested by the ExA, the Applicant has set out piling mitigations as defined using a threshold of 135dB SELss for behavioural responses (based on the findings of *Hawkins et al*. 2014). For context, the Applicant has also set out the proposed mitigations as defined using 141dB SELss threshold.

2.2 Spatial and temporal zoning plan design

Zoning Exercise

- 2.2.1 A revised zoning exercise has been undertaken to delimit areas of the Rampion 2 offshore array area where piling could be undertaken whilst maintaining noise levels below a 135dB SELss threshold within the Kingmere Marine Conservation Zone (MCZ). Where areas within which noise modelling indicated immission levels at the MCZ would exceed this threshold, noise abatement mitigation is proposed, and noise propagation re-modelled to identify distance limits from the MCZ at which the required noise threshold could be achieved at receptor locations. These outputs are then used to develop a zoning plan of areas that are subject to specific mitigation values (including the delineation of piling exclusion boundaries and the application of noise abatement systems) during sensitive periods for black seabream at Kingmere MCZ during the spawning/nesting season.
- 2.2.2 Underwater noise modelling has been undertaken for the worst-case piling scenarios with noise abatement systems implemented, for both the installation of monopile and multileg foundations. The following worst-case piling scenarios have been modelled:
- 13.5m diameter monopiles, 4,400kJ hammer energy; and

- 4.5m diameter pin piles for multileg foundations, 2,500kJ hammer energy.

- 2.2.3 The modelling outputs depicted in a set of figures presented below Figure 2-1 to Figure 2-6 define areas within which mitigated piling using a combination of noise mitigation or abatement techniques serves to reduce received noise levels at the relevant MCZs below the disturbance threshold of 135dB SELss. The remaining areas of the offshore array therefore become piling exclusion areas, as the available mitigation techniques do not provide sufficient noise reduction to ensure that noise immission levels at the MCZs are below this threshold.
- 2.2.4 Taking this forward and using the assumption of the maximum design scenarios for both monopile and multileg foundations, Figure 2-1 to Figure 2-4 the Rampion 2 boundary alongside the Kingmere MCZ, with the Beachy Head East and West MCZs and the Selsey Bill and the Hounds MCZ also presented for information.
- 2.2.5 Since Deadline 2, the Applicant has held discussions with the Institute of Technical and Applied Physics (ITAP) regarding the implementation of noise abatement measures in the English Channel. ITAP have been heavily involved in biological monitoring for impulsive noise for offshore windfarms in Germany, following the implementation of an underwater noise limit for impulsive noise.
- 2.2.6 What has become apparent during this process is that noise reductions delivered through currently available noise mitigation or abatement systems may not reliably deliver reductions greater than 20dB. Whilst greater noise reductions could be possible through equipment development or improvement, or through methodology adaptation in the future, and in consideration of the currently understood soil conditions and bathymetry at the Proposed Development site, the Applicant has therefore sensibly adopted a precautionary approach in developing the zoning plan. The zoning plans depicted in the Figures below present the results for achieving a threshold of 135dB SELss and also, for comparison, the 141dB SELss threshold.
- 2.2.7 The consideration of site characteristics and noise abatement levels undertaken by ITAP, whilst still to be completed, shows achievement of the 20dB reduction within certain depth and other parameters from the implementation of two noise abatement systems. The noise abatement of up to 20dB (rather than 22dB or 25dB as presented in the **In Principle Sensitive Features Mitigation Plan [REP1-012]** (updated at Deadline 3),) has therefore been modelled for monopile and multileg foundations, to establish the potential implications on the proposed mitigation measures (as detailed in the **In Principle Sensitive Features Mitigation Plan [REP1-012]** (updated at Deadline 3),). The underwater noise abatement of up to 20dB is to be achieved through the use of a combination of measures, comprising the DBBC as the principal measure, together with, for the purposes of the modelling and zoning exercise, the PULSE or MNRU hammer mitigation, although the Applicant notes that the actual equipment to be used during the construction of the Proposed Development will be selected based on the most appropriate equipment available at the time. The primary objective of the mitigation is obviously to achieve the required noise reduction levels (and thereby respect an agreed threshold at the sensitive receptor location) rather than specify precise equipment at this stage. To ensure direct comparison of the difference to the zoning plan (exclusion areas) that targeting a threshold of 135dB SELss rather than the proposed 141dB SELss noise level, both are shown in the Figures below.

The blue area on each plot shows the piling exclusion areas derived from the modelling, according to the following scenarios:

- Piling of monopiles, with DBBC + PULSE or MNRU hammer mitigation (20dB reduction) (135dB SELss threshold) (Figure 2-1);
- Piling of monopiles, with DBBC + PULSE or MNRU hammer mitigation (20dB reduction) (141dB SELss threshold) (Figure 2-2);
- Piling of multileg foundations, with DBBC + PULSE or MNRU hammer mitigation (20dB reduction) (135dB SELss threshold) (Figure 2-3); and
- Piling of multileg foundations, with DBBC + PULSE or MNRU hammer mitigation (20dB reduction) (141dB SELss threshold) (Figure 2-4)

Figure 2-1: Piling exclusion zone for the piling of monopiles, with 20dB reduction (Unwtd 135dB SELs)

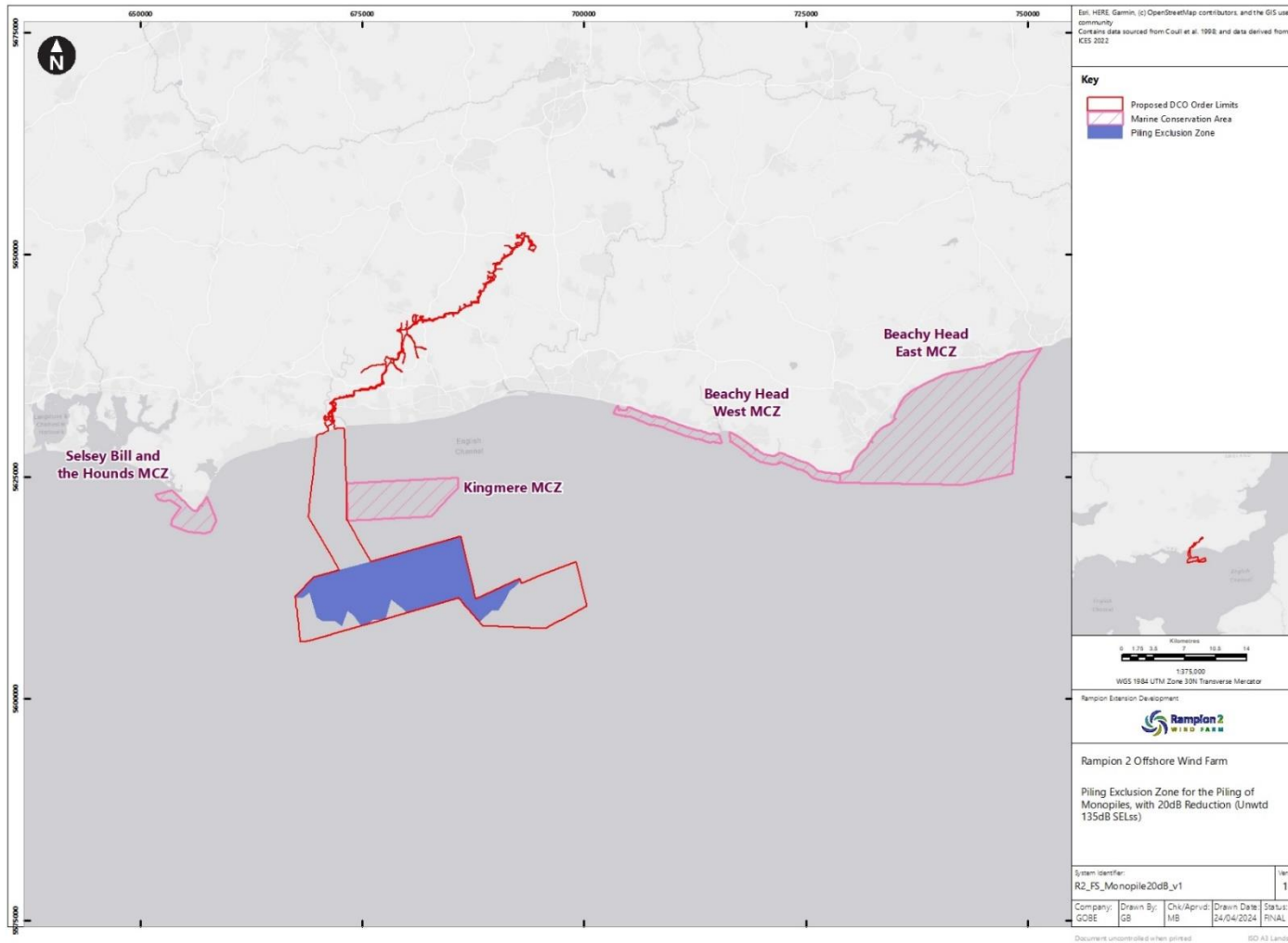


Figure 2-2: Piling exclusion zone for the piling of monopiles, with 20dB reduction (Unwtd, 141dB SELss)

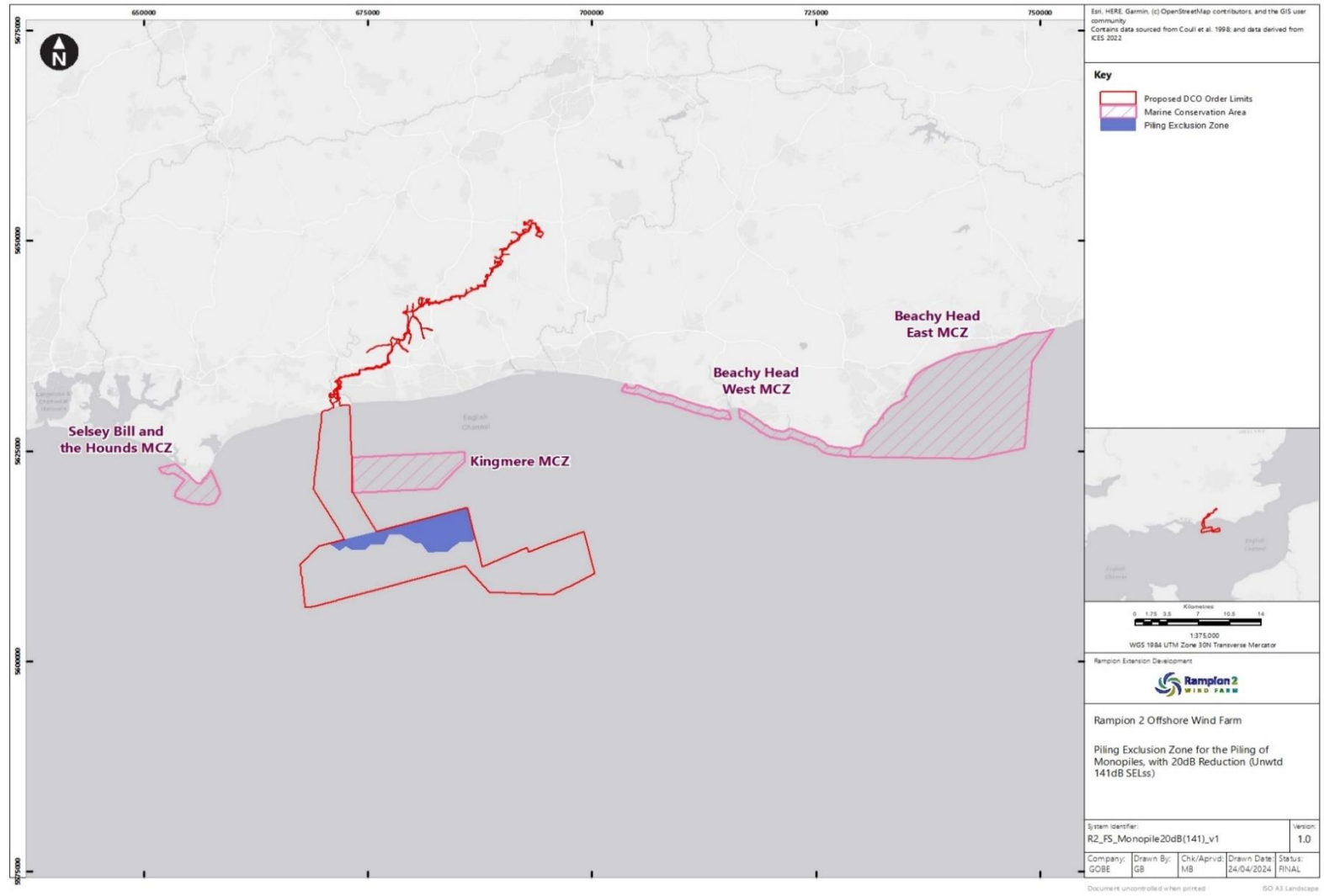


Figure 2-3: Piling exclusion zone for the piling of multileg foundations, with 20dB reduction (Unwtd 135dB SELss)

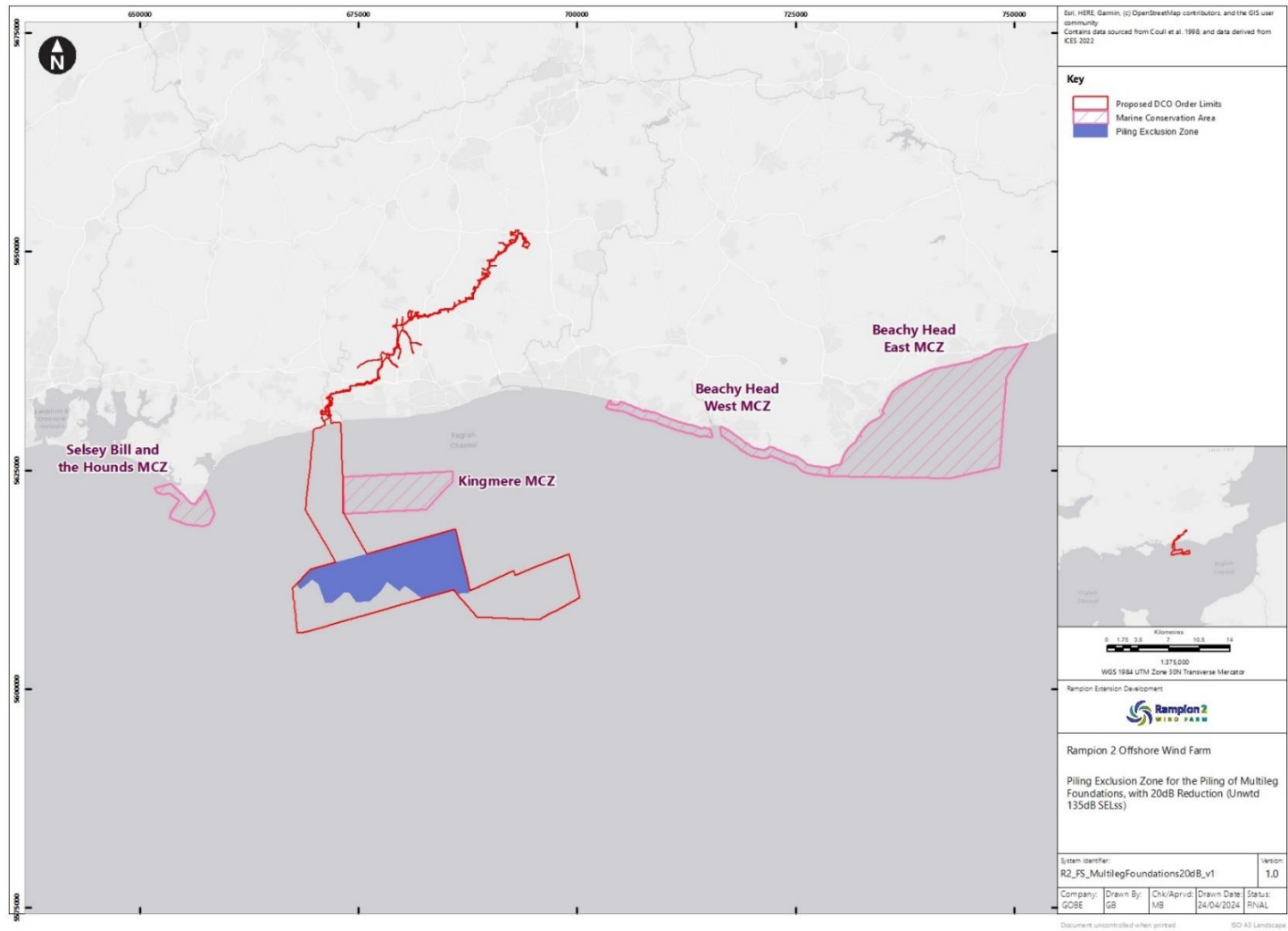
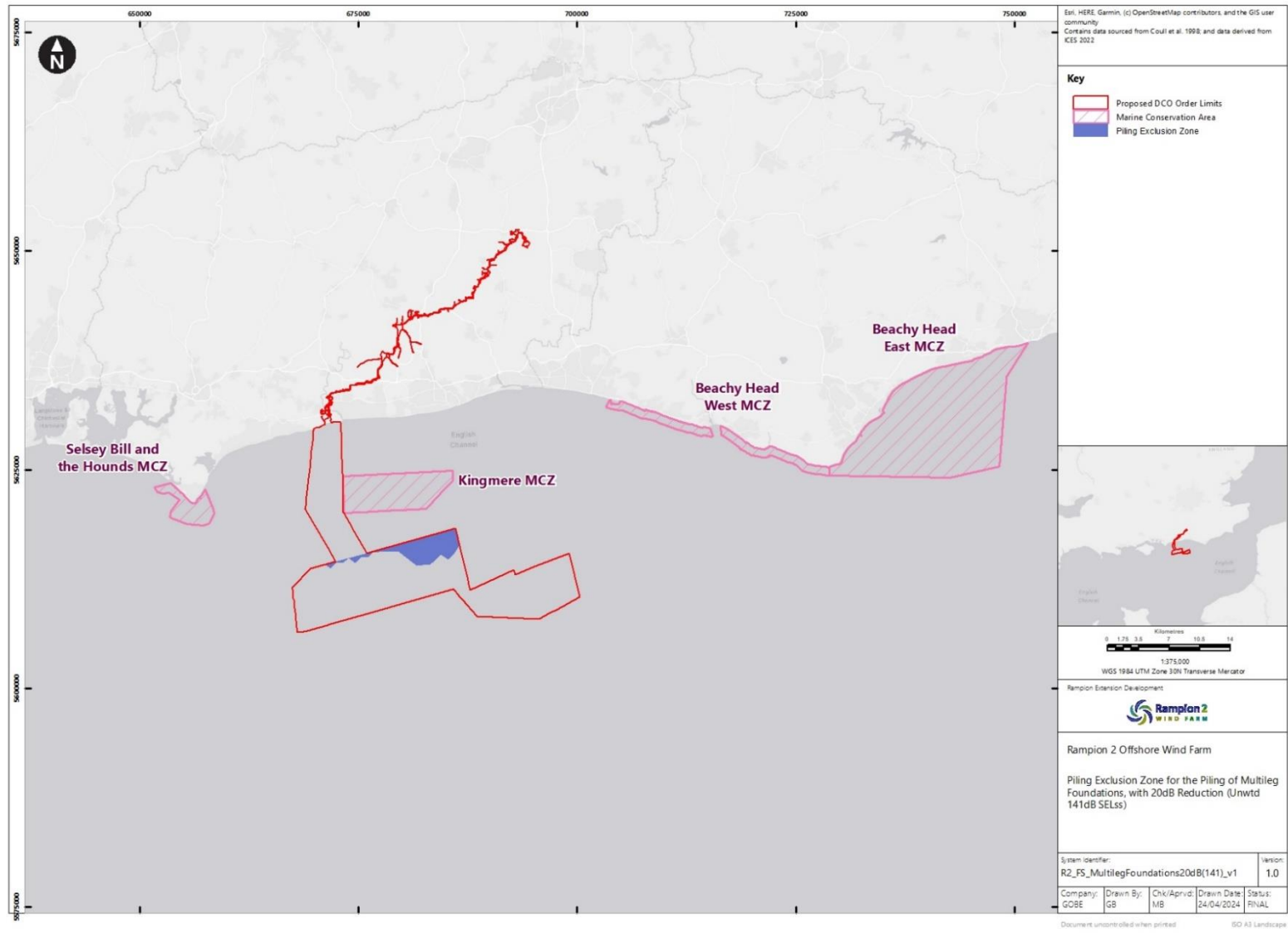


Figure 2-4: Piling exclusion zone for the piling of multileg foundations, with a 20dB reduction (Unwtd 141dB SELss)



- 2.2.8 It is clear from Figure 2-1 to Figure 2-4, to achieve a level of received noise no more than 135dB SELss at the Kingmere MCZ site, the piling of multileg or monopile foundations with the implementation of DBBC + PULSE or MNRU hammer mitigation (20dB mitigation) results in significant piling exclusion zones being required across the western portion of the array area.
- 2.2.9 As evident in Figure 2-1 and Figure 2-2, the piling of monopile foundations with 20dB mitigation results in a substantially larger piling exclusion area in the northern section of the offshore array area for the 135dB SELss threshold in comparison to 141dB SELss. Due to the reduced hammer energy when piling multileg foundations, compared to that of monopiles, the impact ranges are smaller under the same mitigation scenarios, therefore the defined piling exclusion zones are also smaller (Figure 2-3 and Figure 2-4), though again the use of the 135dB SELss behavioural threshold (which is not applicable for a noisy environment such as the English Channel) to inform the zoning exercise has led to the definition of significantly larger piling exclusion zones than those defined using the 141dB SELss threshold. The Applicant highlights that the exclusion zones resulting from the 135dB SELss target noise level, which encompass the majority of the western array area, will have significant implications on the mitigation measures proposed in the **In Principle Sensitive Features Mitigation Plan [REP1-012]** (updated at Deadline 3), and consequently the, piling programme. Such implications are detailed in Section 2.4 below.

2.3 Piling restrictions and mitigations

- 2.3.1 Taking into account the exclusion zones presented, as defined using a threshold of 135dB SELss for behavioural responses (based on the findings of Hawkins *et al.* 2014), the piling mitigations (both spatial and temporal) are as followed:

March to June

- 2.3.2 To summarise, the mitigation measures proposed in the **In Principle Sensitive Features Mitigation Plan [REP1-012]** (updated at Deadline 3), from March to June, are:
- From 1st March to 30th June, during the majority of the black seabream nesting period, no piling will be undertaken in the western part of the array area.
 - Piling in the eastern portion of the array will be subject to mitigation using a combination of mitigation/abatement techniques (illustrated here as of a low noise hammer technology and DBBC).
- 2.3.3 A zoning approach will also be implemented, with piling in the eastern area commencing in the southeast corner (area furthest away from the Kingmere MCZ) (band A buffer, as illustrated in Figure 2-6), and progressing across the array as piling operations continue (into band B, then C etc.).
- 2.3.4 The proposed mitigations from March through to June, as detailed in the **In Principle Sensitive Features Mitigation Plan [APP-239]** can be applied if they are defined using the 135dB SELss threshold, with a 20dB noise abatement. However, it should be noted, that whilst the piling exclusion area resulting from the implementation of the 135dB SELss threshold (as opposed to the proposed 141dB

threshold) increases the exclusion zone across a relatively small part of the eastern array area (as evident in Figure 2-2 this still has significant issues on the piling programme for the project. Such implications are detailed in Section 2.5 of this clarification note.

July

- 2.3.5 To summarise, the mitigation measures proposed in the **In Principle Sensitive Features Mitigation Plan [REP1-012]** (updated at Deadline 3), for July, are:
- If piling in the western part of the offshore array is to be undertaken, foundation installation will be conducted using the combination of a low noise hammer technology and DBBC.
 - Piling activities in the western part of the array will also be subject to a sequencing plan such that piling in July will commence at locations of the western part of the Array furthest from the Kingmere MCZ. Piling will commence from the pile locations in the furthest south-west corner of the western part of the Array (commencing in the band C buffer shown on Figure 2-6).
- 2.3.6 During July, the exclusion zones as detailed in the **In Principle Sensitive Features Mitigation Plan [REP1-012]** (updated at Deadline 3) can be applied if they are defined using the 135dB SELss threshold, with a 20dB noise abatement. However, it should be noted, that whilst the piling exclusion area resulting from the implementation of the 135dB SELss threshold (as opposed to the proposed 141dB threshold) increases the exclusion zone across a relatively small part of the eastern array area (as evident in Figure 2-2) this still has significant issues on the piling programme for the project. Such implications are detailed in **Section 2.4** of this clarification note.

August through to February

- 2.3.7 As there is no requirement for a spatial zoning plan for the remainder of the year, there are no changes to the proposed mitigation from the use of the threshold of 135dB SELss for behavioural responses, however, as set out in Commitment C-265 double bubble curtains will be used through-out the piling campaign.

Figure 2-5: Zoning plan restriction areas

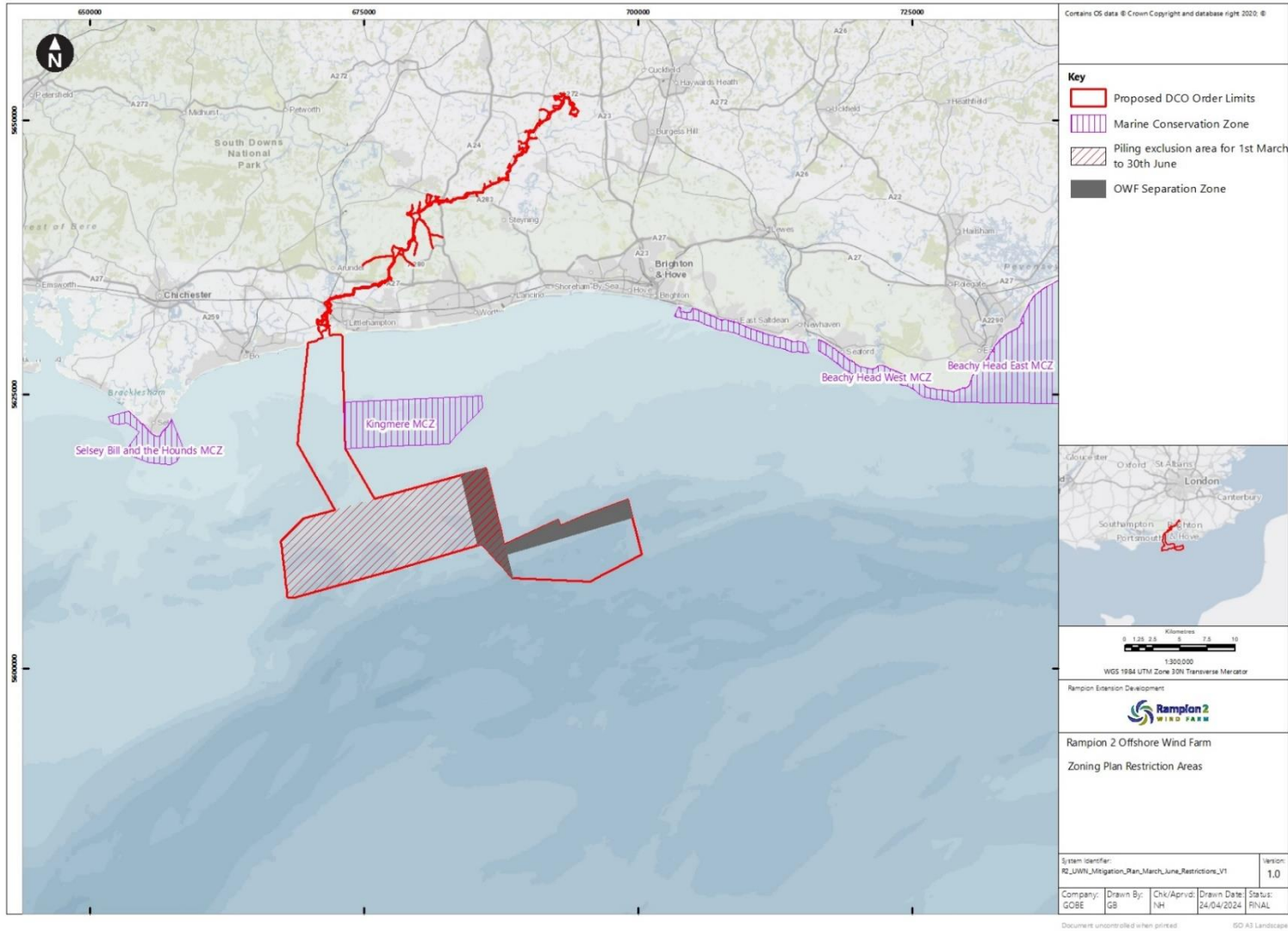
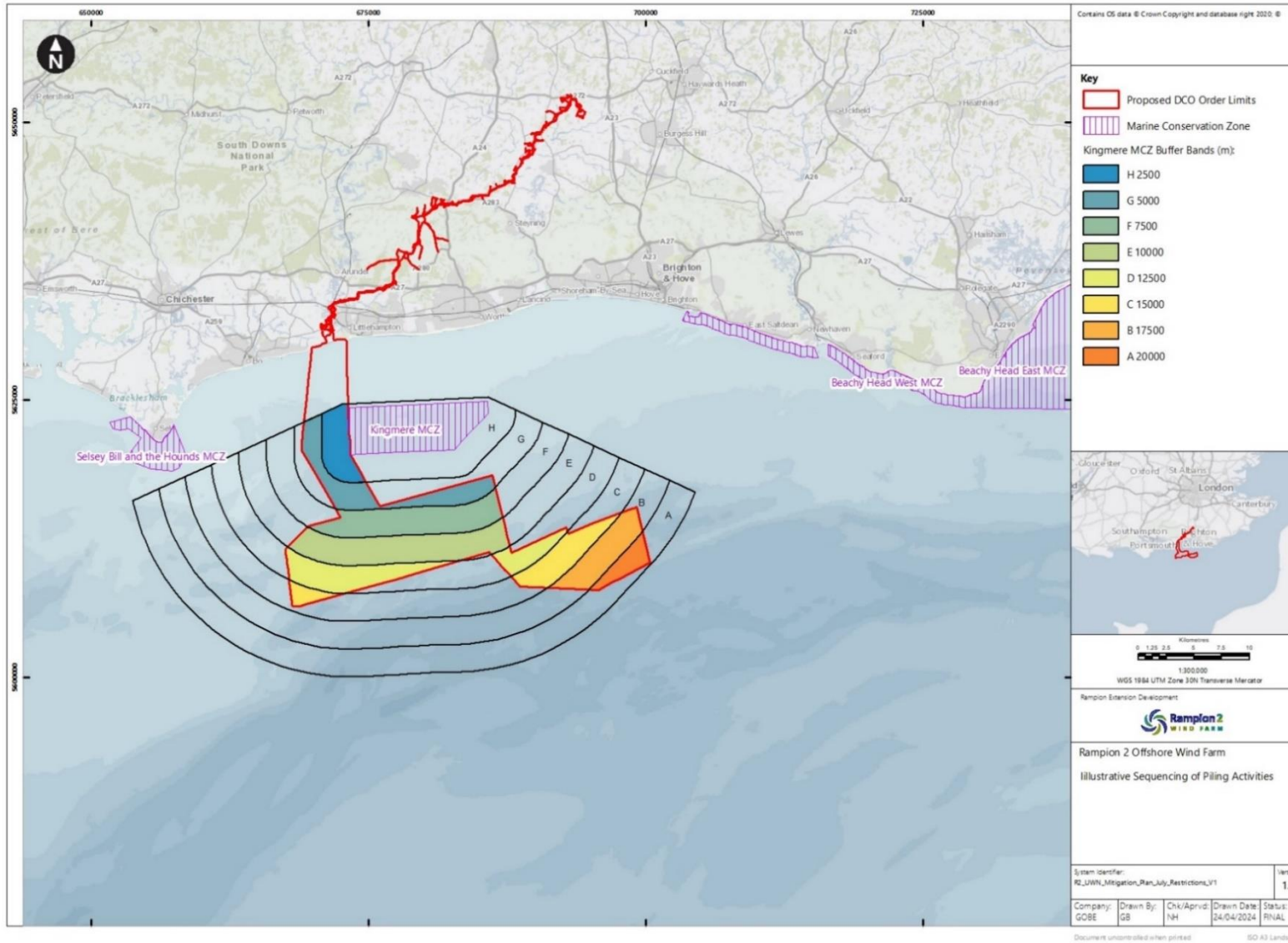


Figure 2-6: Illustrative sequencing of piling activities



2.4 Piling programme implications

- 2.4.1 Seasonal restrictions represent a significant hindrance to be able to complete a foundation installation piling campaign, particularly when they are set within the spring and summer months which are the periods operational weather restrictions are generally at their lowest and work can proceed in the most efficient manner possible. The Applicant has proposed a seasonal restriction covering the western array area, which is closest to the Kingmere MCZ during the most sensitive period for black seabream spawning (March to June inclusive) and proposed that piling works are spatially limited in the western array area during July and in the eastern array area during March to July inclusive.
- 2.4.2 To enable a viable construction programme with the bounds set out within the ES it is almost certain that the project will have to utilise a two-installation vessel strategy, which has been the practical solution on projects where similar restrictions have been present. This will involve committing to piling works outside of what are the ideal working months generally used for offshore wind construction and add more weather risk related costs. However, this approach does come with more onerous procurement risks on being able to secure both suitable installation vessels and some of the key installation equipment such as hammers, as opposed to a single vessel campaign without seasonal restrictions. A two-vessel strategy will also have additional costs associated with engineering for two vessel spreads and will require a greater degree of marine co-ordination. Despite adding considerable cost, the application of noise abatement methods will have only a minimal impact to the scheduling for proposed piling works. The application of any further seasonal restrictions, particularly for July which is one of the least weather restricted months, is likely to significantly affect the construction viability of the envisaged project size.
- 2.4.3 The alternative approach to working around the piling restrictions would be to significantly reduce the scale of the wind farm. The scale of the wind farm will be the ultimate determining factor as to whether it will be considered viable and subsequently constructed. This application has been designed with a generation capacity of approximately 1,200MW in mind and details a 400kV connection and an associated transmission design to reflect this large generation capacity. This includes a new onshore substation and relatively long export cables. Therefore, the application allows for required flexibility on the final design, as the scale of the wind farm will need to be sufficiently large be able to pay for the use of the transmission assets used to connect it as well as maximising energy generating potential in response to Government policy.

References

Hawkins, A.D., Roberts, L. and Cheesman, S. (2014). Responses of free-living coastal pelagic fish to impulsive sounds. *Journal of the Acoustic Society of America*, 135(5), pp. 3101–3116.

Kastelein, R.A., Jennings, N., Kommeren, A., Helder-Hoek, L. and Schop, J. (2017). Acoustic dose-behavioural response relationship in sea bass (*Dicentrarchus labrax*) exposed to playbacks of pile driving sounds. *Marine environmental research*, 130, pp.315-324.

