Dogger Bank Project –RE-PM575-00019
Non-Material Change Application: Environmental Report

Validity area: Dogger Bank Project / Offshore

ASSURANCE OF CONTENT

Role for assurance*	Role in organisation	Name	Date
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Note *:

Role for assurance	Responsibility
Prepared by	The person who is regarded as the author of the document
Process Control by	The person who has made sure that a sufficient process for quality assurance and quality control has been followed, and has the authority to recommend implementation
Approved by	The person who has the authority to accept the document and release it for implementation

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1 Introduction

Dogger Bank Creyke Beck A & B are two consented offshore wind farms approximately 130km from shore in the North Sea (**Figure 1**) (herein referred to as the Project(s)). The Projects were originally developed by Forewind, a consortium comprising SSE, Equinor (formerly Statoil), Innogy (formerly RWE) and Statkraft. Following the grant of The Dogger Bank Creyke Beck Offshore Wind Farm 2015 Order (the DCO) the Projects were split between the parent companies.

A Joint Venture between SSE and Equinor, known as 'The Dogger Bank Offshore Wind Project' (herein referred to as the Project Team), has been set up to deliver the development of the Projects.

The Projects will comprise two offshore wind farms each with an installed capacity of up to 1.2 gigawatts (GW):

- Dogger Bank Creyke Beck A (Creyke Beck A) is in the southern corner of the former Dogger Bank Zone. It covers 515km^2 and is 131km from shore at its closest point.
- Dogger Bank Creyke Beck B (Creyke Beck B) is on the western edge of the former Dogger Bank Zone. It covers 599km^2 and is also 131km from shore at its closest point.

The DCO states that construction must have commenced on or before the 11th March 2020. The Project Team is now progressing with the Projects to meet this commencement date, with the expectation that work will start onshore in early 2020. It is likely that the earliest offshore construction would begin is 2021.

In the three years since the DCO was granted there have been a number of advancements in technology that would make the wind farm more efficient and cost effective. These advances are based on the size of wind turbine generators that are available, or that are likely to become available during the course of the development programme. As some of these would require a limited number of changes to the consented parameters (Section 2), the Project Team is looking to make a non-material change (NMC) to the DCO to enable the Projects to be constructed in the most efficient and cost-effective manner.

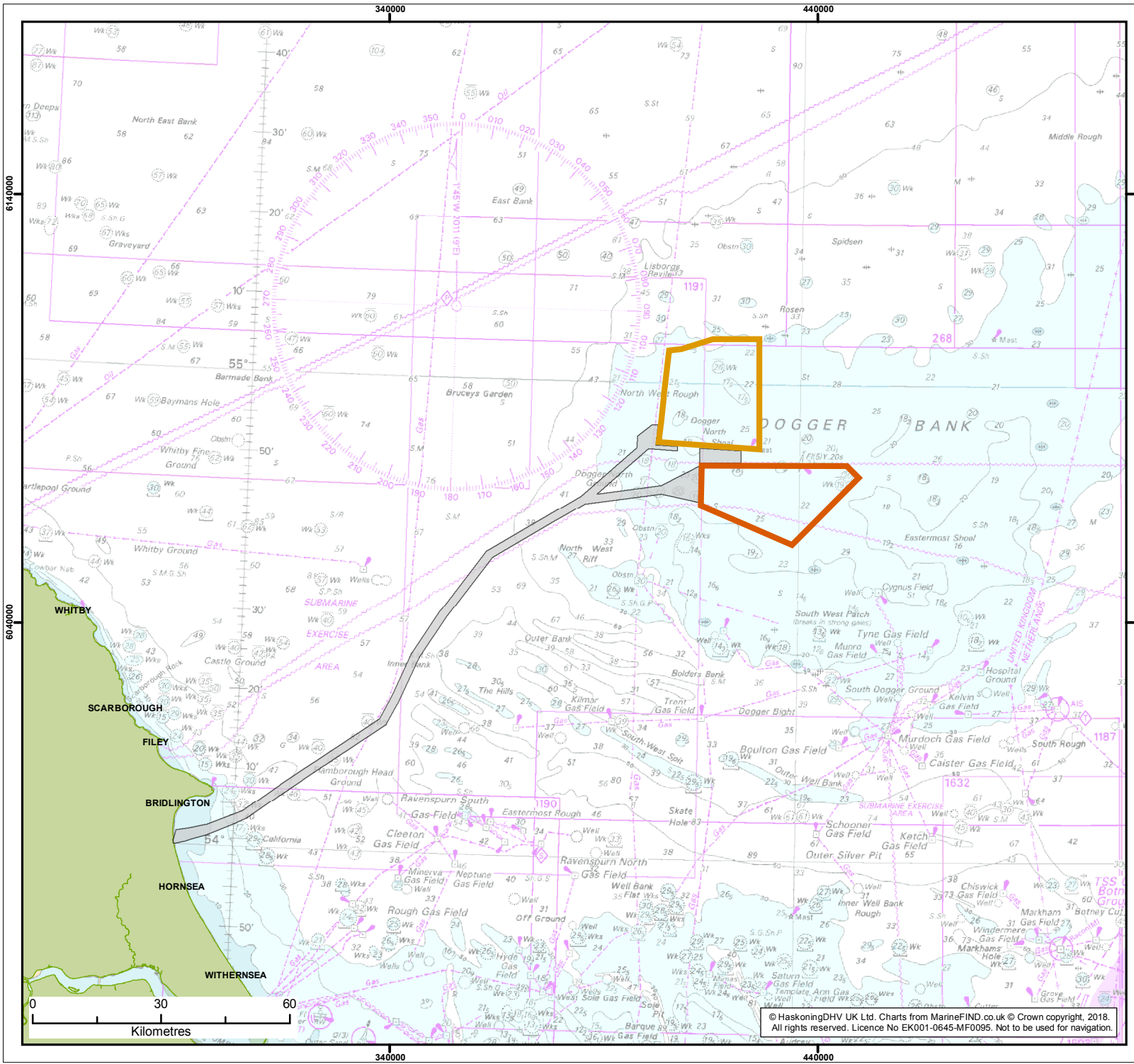
The purpose of this report is to:

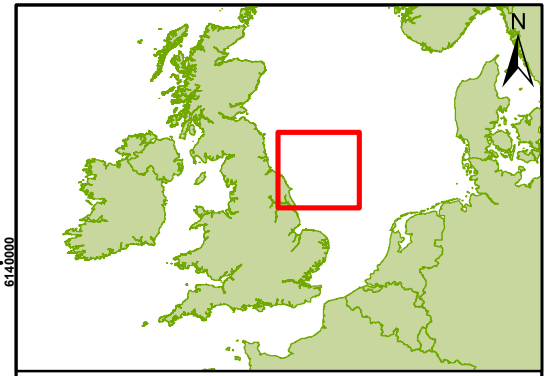
1. Provide information on the nature of the proposed changes;
2. Describe the predicted effects of the changes alongside the outcome of the original assessments that informed the DCO;
3. Set out why it is considered appropriate for the Application to be determined as an NMC to the DCO;
4. Ensure compliance with relevant nature conservation legislation, in particular the Conservation of Offshore Marine Habitats and Species Regulations 2017.

An application to vary the deemed marine licences (dMLs) has been made to the Marine Management Organisation (MMO) at the same time. Details of these changes are set out in the covering letter provided to the MMO separately. This report is also intended to support that application.

The report is structured as follows:

- **Section 2 Details of Proposed Changes** – Overview of the proposed changes;
- **Section 3 Consultation** – Consultation undertaken prior to submitting the NMC application and the proposals for consultation on the application once submitted;
- **Section 4 Methodology** – Approach to considering the effects of the proposed changes;
- **Section 5 Screening** – Screens in/out all receptors based on the effects that may result from the proposed changes;
- **Section 6 Assessment of Screened in Receptors** – Assessment of receptors screened in;
- **Section 7 Assessment of Materiality** – Test of materiality; and
- **Section 8 Conclusions** – Clear account of assessment outcomes.





Legend:

- Dogger Bank Creyke Beck A
- Dogger Bank Creyke Beck B
- Export cable corridor

Client:	Project:
SSE and Equinor	Dogger Bank Creyke Beck

Title: Location of Dogger Bank Creyke Beck A and B

Figure: 1 | Drawing No: PB6994-100-201

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
01	05/06/2018	GC	GC	A4	1:1,250,000

Co-ordinate system: WGS84 UTM 31N

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2 Details of proposed changes

There is now the potential for larger rotor-diameter wind turbines to be available to the Projects compared to those previously considered, which the Project Team would like the option to use. The larger size of the wind turbines also requires consequential changes to the foundations (if monopole foundations are used). This NMC application is therefore for an increase to the consented parameters for rotor diameter, monopile diameter and hammer energy whilst leaving all other DCO parameters unchanged including site boundary, total generating capacity and rotor swept area.

In effect, the amendments mean that it would be possible for fewer, larger turbines to be installed. **Table 1** summarises the currently consented parameters and those where an amendment to the DCO is being sought.

To support the NMC application a review of the proposed amendments has been undertaken to confirm that the proposed changes would not give rise to new or materially different likely significant effects or invoke the need for a new Habitats Regulations Assessment. To inform this review a comparison with the current consented Projects has been being undertaken on a like for like basis with the Environmental Statement ("ES") (Forewind, 2013) and the Habitats Regulations Assessment ("HRA") (DECC, 2015) that informed the DCO.

It should be noted that both the requirement for and scale of the changes under consideration have been the subject of careful and detailed study such that the minimum amount of change is being sought in order to achieve the required gains in efficiency discussed above.

Table 1 Proposed consent amendments

Parameter	Consented Envelope	Proposed Amendment	Notes
Maximum hammer energy – monopile	3,000kJ	Up to 4,000kJ	There are no proposed changes to the maximum hammer energy in relation to pin-piles.
Monopile diameter	Up to 10m	Up to 12m	With respect to seabed footprint, the worst case in assessment terms is based on a gravity base system. Potential implications for underwater noise are considered below.
Rotor diameter	Up to 215m	Up to 280m	See comment below on number of turbines.
Capacity	Up to 1.2GW per project	No change	The Projects will be constrained by capacity, which is unchanged.
Number of turbines	Up to 200 turbines per project	No change	When considering the larger rotor diameter, the total number of wind turbines used will be constrained by the maximum capacity and rotor-swept area (both unchanged). For example, for the maximum proposed rotor diameter of 280m, the maximum number of turbines would be 70 per Project.
Total rotor-swept area	Up to 4.35km^2	No change	The Projects will be constrained by the total rotor-swept area, which is unchanged.
Blade tip height	Up to 315m above highest astronomical tide (HAT)	No change	N/A
Lower tip height	26m or greater above HAT	No change	N/A

3 Consultation

3.1 Pre-application consultation

This section provides a summary of the consultation that has been carried out on the proposed amendments prior to submission of the NMC application. Further details will be provided with the Consultation and Publicity Statement that will be submitted following submission of the application.

Prior to submission of this NMC application, meetings were held with the following stakeholders:

- Department of Business, Energy & Industrial Strategy (BEIS);
- MMO;
- Natural England (NE);
- Planning Inspectorate (PINs);
- Royal Society for the Protection of Birds (RSPB);
- Whale and Dolphin Conservation (WDC); and
- The Wildlife Trusts.

These stakeholders were identified as either key to discuss the procedures and approach with (e.g. BEIS and PINs) or were key stakeholders in relation to the topics which may be impacted by the proposed amendments. Through these meetings the Project Team explained the nature of the proposed amendments, the approach and methodology for reviewing the effects of the proposed changes on the key topic areas (marine mammals and ornithology) and the outcomes of the assessments on the changes to the Project parameters. In addition to the meetings, the draft Technical Reports for ornithology (**Appendix 1**) and marine mammals (**Appendix 2**) were provided to NE, RSPB, WDC and The Wildlife Trusts. Feedback from these meetings and comments received on the reports has been taken into account in producing the final version of this Environmental Report and the associated Technical Reports.

In addition to these meetings, an introductory letter was sent to all those persons proposed to be consulted on the application (see Section 3.2 below) providing an update on the Projects and the proposed amendments. Following the issue of the Regulation 7(3) letter by BEIS, an introductory letter was also issued to the additional consultees that BEIS had identified.

Following submission of the NMC application, the Project will seek to agree Statements of Common Grounds with key stakeholders that were consulted on the draft Technical Reports for submission during the consultation period.

3.2 Proposed consultation on the application

A reduced and focused scope of consultation from that carried out with respect to the DCO application was agreed with BEIS through a request in accordance with Regulation 7(3) of the Infrastructure Planning (Changes to, and Revocation of, Development Consent Orders) Regulations 2011 (the 2011 Regulations). This provided a targeted list of consultees that will be consulted for this NMC application.

Letters to inform consultees that the NMC application has been made will be sent following the submission of this NMC application: this will include the application documents and will explain how such consultees can make a representation. In addition, the Project Team will publicise the application in accordance with the 2011 Regulations.

4 Methodology

4.1 Approach to Assessment

A screening exercise has been undertaken of all of the topic areas that were considered in the ES which supported the grant of the DCO to determine if there could be any potential for new or materially different likely significant effects as a result of the proposed DCO amendments. This approach has enabled this report to focus on the receptors that could be affected by the proposed DCO amendments, alongside providing a clear rationale for those receptors where no effects are predicted.

For the receptors that were not screened out of this assessment, a review of the proposed amendments has been undertaken to confirm that the proposed changes will not give rise to new or materially different likely significant effects. This has been undertaken by carrying out a like for like comparison with the ES informed the grant of the DCO.

Alongside this, consideration is also given to the HRA undertaken by the Secretary of State to inform the grant of the DCO in order to determine whether the proposed DCO amendments have the potential to impact designated sites. This includes all the sites that were considered at the time of the granting of the DCO and the Southern North Sea candidate Special Area of Conservation (cSAC) which was not proposed at the time of consent.

5 Screening

This section sets out the environmental topics (receptors) as they were assessed in the ES and considers whether the proposed amendments will lead to any new or materially different likely significant effects. Where it could not be immediately ruled out that a receptor would not be impacted by the proposed amendments this topic is "screened in" and further assessed in Section 6.

Screening has been undertaken for each proposed change, with details provided in **Table 2**.

Table 2 Screening table

Topic area from ES	Potential change in effect	Screened In/Out
Chapter 8 – Designated Sites	Potential effect on Special Protection Areas (SPAs) from increase in rotor diameter is considered further under marine and coastal ornithology (Section 6.1). Gravity base foundations were considered the worst case for habitat loss and disturbance on the Dogger Bank SAC – the increase in monopile diameter to 12m does not alter the worst case assessed. Potential effects of the increase in hammer energy and monopile diameter on marine mammals is considered under Marine Mammals (Section 6.2).	Out
Chapter 9 – Marine Physical Processes	No effect on this topic from an increase in rotor diameter as there is no impact pathway. During construction the ES assessed the installation of 24, 12m drilled monopiles over a 30 day period as the worst case for an increase in suspended sediments. The 12m drilled monopile was also considered the worst case scenario for scour and drill arisings. For seabed preparation the worst case scenario was conical gravity bases. As such there is no change in effects from those already assessed. During operation the ES assessed the use of conical gravity bases as the worst case for both changes in waves and tidal currents and increases in suspended sediment concentration. The use of monopile foundations of up to 12m in diameter would have less of an impact than the gravity bases. No effect on this topic from an increase in hammer energy as there is no impact pathway.	Out
Chapter 10 – Marine Water and Sediment Quality	No effect on this topic from an increase in rotor diameter as there is no impact pathway. The ES assessed the impacts of using a 12m monopile foundation as such there is no change in the worst case previously assessed. No effect on this topic from an increase in hammer energy as there is no impact pathway.	Out
Chapter 11 – Marine and Coastal Ornithology	Potential for effects on collision risk and displacement from an increase in rotor diameter considered further in section 6.1.	Screened in for increase in rotor

Topic area from ES	Potential change in effect	Screened In/Out
	No effect due to an increase in monopile diameter and hammer energy. Consideration of the effects on the prey species of birds due to the increase in monopile diameter and hammer energy is provided under Fish and Shellfish.	diameter – see Section 6.1. Other changes screened out.
Chapter 12 – Marine and Intertidal Ecology	No effect on this topic from an increase in rotor diameter as there is no impact pathway. The ES assessed the use of 12m monopiles as the worst case for increased suspended sediment concentration and sediment deposition and the impact on benthic ecology. For physical disturbance to habitat and species and temporary habitat loss the worst case is a combination of the use of 12m monopiles (footprint of drill arisings) and gravity bases (seabed preparation). Therefore, no change in effect from that previously assessed. The ES assessed the use of conical gravity bases as the worst case for all impacts during operation. This assessment does not alter based on the increase in monopile diameter.	Out
Chapter 13 – Fish and Shellfish	No effect on this topic from an increase in rotor diameter as there is no impact pathway. The ES assessed the worst case for increased suspended sediment concentration and sediment re-deposition to be the use of 12m monopiles and gravity bases for temporary physical seabed disturbance from seabed preparation. Therefore, no change from previous assessment. The ES assessed the worst case for both loss of habitat and the introduction of hard substrate to be the use of gravity base foundations. No change in impact from that previously assessed. Potential change in effect due to an increase in underwater noise from both the increase in monopile diameter and hammer energy on fish species considered further in section 6.3.	Screened out for rotor diameter. Screened in for increase in monopile diameter and hammer energy for fish – see Section 6.3.
Chapter 14 – Marine Mammals	No effect on this topic from an increase in rotor diameter as there is no impact pathway. Potential change in effect due to an increase in underwater noise from both the increase in monopile diameter and hammer energy considered further in section 6.2.	Screened out for rotor diameter. Screened in for monopile diameter and

Topic area from ES	Potential change in effect	Screened In/Out
		hammer energy.
Chapter 15 – Commercial Fisheries	No change in effect due to an increase rotor diameter as the agreed lower tip height will remain as a minimum at 26m above HAT. No change in effect from monopile diameter – the wind farm area remains the same. Potential changes in impacts on fish receptors from underwater noise caused by the increase in monopile diameter and hammer energy are considered under Fish and Shellfish (Section 6.3).	Out
Chapter 16 – Shipping and Navigation	No change in effect due to an increase rotor diameter as the agreed lower tip height will remain as a minimum at 26m above HAT. No change in effect due to increase in monopile diameter – wind farm area remains the same as does the maximum number of turbines and there is no impact pathway from an increase in hammer energy.	Out
Chapter 17 – Other Marine Users	No change in effect due to an increase in rotor diameter as the agreed lower and upper tip heights (26m and 315m above HAT), wind farm area and maximum number of turbines will remain the same. The ES does not specifically state a worst case scenario for noise. It does however assess the impact of piling noise on oil and gas seismic surveys. The increased hammer energy is associated with the installation of larger turbines with a higher maximum capacity. As the maximum generating capacity of each wind farm and total rotor-swept area will remain the same it is possible this will lead to a reduction in the number of piled structures. This would result in fewer piling events and a consequent reduction in any impact on seismic surveys. It is considered that there will be no change to impacts during construction or operation when compared to what was assessed in the ES in relation to the increase in monopile diameter or hammer energy.	Out
Chapter 18 – Marine and Coastal Archaeology	No effect on this topic from an increase in rotor diameter as there is no impact pathway. No change in effect from an increase in monopile diameter – worst case scenario for disturbance was based on gravity base foundations. No effect on this topic from an increase in hammer energy as there is no impact pathway.	Out

Topic area from ES	Potential change in effect	Screened In/Out
Chapter 19 – Military Activities and Civil Aviation	No change in effect due to an increase in rotor diameter as the agreed lower and upper tip heights will remain the same (26m and 315m above HAT). No effect on this topic from an increase in monopile diameter or hammer energy as there is no impact pathway.	Out
Chapter 20 – Seascape and Visual Character	The ES sets out two worst case scenarios for this topic. The first is the maximum turbine height. This will remain at 315m above HAT, even with the proposed increase in rotor diameter. The second is the maximum number of turbines. The increased rotor diameter will allow for the installation of larger turbines with a higher maximum capacity. As the maximum generating capacity and total rotor swept area of each wind farm will remain the same, the maximum number of the largest turbines that could be installed would be constrained at 70 and so will not alter the worst case assessment for maximum number of turbines. It is therefore considered that there will be no change to impacts during construction or operation when compared to what was assessed in the ES. No effect on this topic from an increase in monopile diameter or hammer energy as there is no impact pathway.	Out
Chapter 21 – Landscape and Visual	The wind farm array is located approximately 131km from shore and is therefore not visible from the coastline. The maximum tip height of the blades is not being altered. Therefore, no change in effect from that assessed in the ES.	Out
Chapter 22 – Socio-economics	Socio-economic impacts were considered in relation to the duration of the Projects and whether one or both were built at the same time. The proposed amendments do not alter the potential Project duration or the construction and operation scenarios and therefore there will be no effect due to the increase in rotor diameter, monopile diameter or hammer energy.	Out
Chapter 23 – Tourism and Recreation	No effect due to the increase in rotor diameter, monopile diameter or hammer energy as there is no impact pathway	Out
Chapter 24 – Geology, water resources and land quality Chapter 25 – Terrestrial Ecology Chapter 26 – Land Use and Agriculture	No effect due to the increase in rotor diameter, monopile diameter or hammer energy as there is no impact pathway	Out

Topic area from ES	Potential change in effect	Screened In/Out
Chapter 27 – Onshore Cultural Chapter 29 – Noise and Vibration Chapter 30 – Air Quality		
Chapter 28 – Traffic and Access	No alteration to traffic requirements or accesses as all changes offshore. Therefore, no change in effect from that assessed in the ES due to the increase in rotor diameter, monopile diameter or hammer energy	Out
Chapter 32 – Transboundary Effects	Total area of the Projects will not change therefore no additional impacts from the proposed amendments on transboundary effects. Any transboundary issues in relation to ornithology, marine mammals and fish are considered, where appropriate, in Section 6.	Out

6 Assessment

6.1 Marine and Coastal Ornithology

The ES assesses four potential impacts on ornithology: disturbance and displacement; barrier effects; habitat loss and change; and collision impacts.

The ornithology chapter of the ES and its supporting technical appendix identified a list of 12 sensitive receptors. They were, in alphabetical order: Arctic skua *Stercorarius parasiticus*, Atlantic puffin *Fratercula arctica*, black-legged kittiwake *Rissa tridactyla*, common guillemot *Uria aalge*, great black-backed gull *Larus marinus*, great skua *Stercorarius skua*, lesser black-backed gull *Larus fuscus*, little auk *Alle*, northern fulmar *Fulmarus glacialis*, northern gannet *Morus bassanus*, razorbill *Alca torda* and white-billed diver *Gavia adamsii*. They were assessed against each of the following impacts:

- Disturbance and displacement during construction, operation and decommissioning;
- Barrier effects during operation;
- Habitat loss and change during construction, operation and decommissioning; and
- Collision risk during operation.

In relation to the effects from disturbance, displacement and barrier effects, the worst case scenario (WCS) was based on the total area of the wind farm, number of turbines and the maximum tip height. The proposed amendment to increase the rotor diameter does not alter these parameters. For these reasons there would be no change to the WCS assessed in the ES and its conclusions therefore are not affected by the proposed changes for disturbance, displacement and barrier effects.

Habitat loss could directly affect the resource available to foraging seabirds and was assessed in the ES based on the area of seabed lost to the turbine foundations and scour protection, with the WCS being 200 gravity-based structures. Habitat change may occur due to construction effects such as suspension and deposition of sediments, underwater noise, electro-magnetic fields and the introduction of new habitats. This is most likely to have an indirect effect on seabirds by affecting their prey species. The WCS for this aspect of the impact in the ES was assessed based on 200 jacket foundations with pin piles. As the WCS remains unchanged by the proposed amendment the conclusions of the ES are not affected.

It is recognised that collision impacts are potentially the most sensitive to changes to the turbine parameters. Therefore, this is the focus of the work that has been undertaken. The Ornithological Technical Report (**Appendix 1**) provides the full details of the assessment with a summary provided within this Environmental Report.

6.1.1 Outcomes of the assessment

The ‘worst case’ identified for the existing ornithology assessments in relation to collision impact, was the largest number of smallest rotor diameter turbines which could be accommodated within the maximum swept area – this is 200 turbines with a 167m rotor diameter (which would be the maximum rotor diameter to deliver 200 turbines within the total rotor swept area).

To confirm whether the proposed rotor increase to a 280m rotor diameter would give rise to new or materially different likely significant effects, collision risk modelling was carried out on a 'like for like' basis with the existing assessment that informed the ES (i.e. using the same Band collision risk model options and avoidance rates and keeping all data the same as that underpinning the DCO, except the revised turbine parameters). Two sensitive species, as identified in the ES and the HRA: northern gannet and black-legged kittiwake were re-modelled in full. This was undertaken for both the maximum rotor diameter being applied for of 280m, and also an intermediary value of 250m, given that the NMC seeks flexibility in rotor diameter and that, within the confines of the total swept path area, turbines with a rotor diameter of 167m, 250m or 280m could be installed.

Table 3 and **Table 4** show the results of this collision risk modelling for gannet and kittiwake, respectively, for a 280m rotor diameter (i.e. the maximum increase in rotor diameter). This demonstrates that using 'like for like' collision risk modelling and the revised turbine parameters the predicted collision estimates for both species decreased as compared to the worst case scenario in the ES. Full details of the parameters used and the results of the collision risk modelling for a 250m rotor diameter are provided in the Ornithological Technical Report (**Appendix 1**). This modelling also resulted in a decrease in the predicted collision estimates for both species compared to the WCS in the ES.

Table 3: Annual northern gannet collision estimates for Creyke Beck A & B consented and revised projects calculated 'like for like' with the original consent based on a 280m rotor diameter

NORTHERN GANNET	CRM Option and avoidance rate					
Project	Option 1			Option 3		
	98%	98.90%	99%	98%	98.90%	99%
Consented: Creyke Beck A & B[1]	397	218.8	**199**	120	60	30
Revised: Creyke Beck A	106	58	53	4	2	2
Revised: Creyke Beck B	142	78	71	6	3	3
Revised: Creyke Beck A & B	248	136	124	10	5	5

[1] Figures taken from Table 5 of the HRA. Bold text = consented value.

Table 4: Annual black-legged kittiwake collision estimates for Creyke Beck A & B consented and revised projects calculated using parameters 'like for like' with the original consent based on a 280m rotor diameter.

BLACK-LEGGED KITTIWAKE	CRM Option and avoidance rate					
	Option 2			**Option 3**		
	98%	**98.90%**	**99%**	**98%**	**98.90%**	**99%**
Consented Creyke Beck A & B[1]	1307	N/A	654	**217**	N/A	109
Revised Creyke Beck A	289	159	145	34	19	17
Revised Creyke Beck B	388	213	194	46	25	23
Revised Creyke Beck A & B	677	372	339	80	44	40

[1] Figures taken from Table 7 of the HRA. Bold text = consented value.

For the specific scenario discussed in the HRA, namely Option 1 and a 99% avoidance rate, collisions are reduced from 199 to 124 individuals for gannets. For kittiwake, the specific scenario discussed in the HRA,

namely Option 3 and a 98% avoidance rate, collisions are reduced from 217 to 80 individuals based on a 280m rotor diameter.

When considered the impacts on specific SPAs, identified in the ES and the HRA and using the same apportioning rate as the ES, the revised projects would exert a reduced effect on all SPAs considered and the in-combination effects would be reduced accordingly. This means that the conclusions of the HRA are not affected; therefore, the collision risk from the proposed changes to the Projects (alone and in combination with other projects) does not have the potential to give rise to likely significant effects on any European site.

In summary, the impact of the proposed changes for ornithology is that there are no new or materially different likely significant effects arising from the proposed changes to the DCO. In fact there is a reduction in impacts compared to the Project as currently consented if fewer, larger turbines are used for the Project. The conclusions of the ES that ornithology impacts are not significant for the Project alone and cumulatively with other projects are not affected. Similarly, the conclusions of the HRA of no adverse effects on the integrity of any European site arising from the Project alone and in-combination with all other sites are not affected and the proposed changes do not have the potential to give rise to likely significant effects on any SPAs. The worst case position remains the same and no further assessment based on new data is required for ornithology in support of the proposed changes to the DCO.

6.2 Marine Mammals

The ES assesses the potential impact on marine mammals from permanent auditory injury, temporary auditory injury and likely or possible avoidance of an area in respect of the relevant receptors, which were:

- Harbour porpoise *Phocoena phocoena*;
- White-beaked dolphin *Lagenorhynchus albirostris*;
- Minke whale *Balaenoptera acutorostrata*;
- Grey seal *Halichoerus grypus*; and
- Harbour seal *Phoca vitulina*.

To confirm what the effects of the proposed increase in monopile diameter and hammer energy would be, updated underwater noise modelling was carried out on a 'like for like' basis with the existing assessment that informed the ES. Underwater noise propagation modelling for the original assessment was carried out by the National Physical Laboratory (NPL) (Theobald *et al.*, 2012) to assess the effects of noise from the construction of the Dogger Bank Creyke Beck offshore wind farms. Since the NPL modelling was completed for the ES, NPL no longer conduct noise modelling for individual projects. The updated noise modelling has been undertaken by Subacoustech Environmental Ltd.

In addition, since the underwater noise modelling was completed for the ES, new noise thresholds and criteria have been developed by the US National Marine Fisheries Service (NMFS, 2016) for both permanent threshold shift (PTS) where unrecoverable hearing damage may occur, as well as temporary threshold shift (TTS) where a temporary reduction in hearing sensitivity may occur.

Therefore, for the proposed increase in hammer energy, underwater noise modelling has been undertaken to:

(i) Compare the NPL model used in the original assessment and Subacoustech INSPIRE model used in this assessment to ensure the models are comparable. This is presented in **Appendix 2 Marine Mammal Technical Report**, **Annex A Subacoustech Report**.

(ii) Replicate underwater noise modelling undertaken for the original assessment, for equivalent inputs and scenarios to enable a like for like comparison to be made between the consented hammer energy of 3,000kJ and the proposed increase of 4,000kJ.

(iii) Update the underwater noise modelling based on the latest inputs and scenarios for increased pile diameter and hammer energy using the latest (NMFS, 2016) thresholds and criteria for PTS and TTS. This was requested by NE (see RHDHV 2018).

This aim of the assessment is to determine whether there are any new or materially different likely significant effects in relation to marine mammals between using the proposed maximum hammer energy of 4,000kJ compared to the currently consented maximum hammer energy of 3,000kJ. The updated underwater noise modelling has been undertaken based on the increase in monopile diameter to 12m compared to the currently consented monopile diameter of 10m (12m monopiles were assessed in the ES in relation to drilled piles only).

6.2.1 Outcomes of the assessment

The results presented in this section provide a summary of the information provided in the Marine Mammal Technical Report (**Appendix 2**) where a full breakdown of the results is provided.

Results of like for like comparison

This was undertaken based on the Subacoustech modelling of the predicted impact ranges for the maximum hammer energy of 3,000kJ and 4,000kJ using the same parameters as used in the original assessment. This allows for a like for like comparison of the potential impacts of increasing the maximum hammer energy to 4,000kJ compared to the currently consented maximum hammer energy of 3,000kJ.

Each comparison considers in turn:

- The increase in impact range; and
- The number of individuals and percentage of the reference population at risk.

In relation to each of the potential impacts for each species, the like for like comparison demonstrates that for all species there is no difference in the impact significance between the impacts as assessed under the original assessment and the updated assessment for PTS, TTS and likely or possible avoidance. This demonstrates that an increase in maximum hammer energy from 3,000kJ to 4,000kJ would not alter the outcomes of the original assessment made with the ES, including the cumulative and transboundary impact assessment and, where relevant, the HRA. A summary of the results is provided in **Table 5**.

Table 5: Summary of the like for like comparison of the predicted impact ranges, number of marine mammals and % of reference population (based on values used in ES) and impact assessment for maximum hammer energy of 3,000kJ in ES and proposed increased maximum hammer energy of 4,000kJ

Species	PTS		TTS / fleeing response		Behavioural response	
	3,000kJ in ES	4,000kJ	3,000kJ in ES	4,000kJ	3,000kJ in ES	4,000kJ
Harbour porpoise[1]	<700m 1 harbour porpoise (0.0004%) Minor adverse / No impact	860m 1.5 harbour porpoise (0.0006%) Minor adverse / No impact	5.5km 62 harbour porpoise (0.03%) Negligible	6.9km 91.5 harbour porpoise (0.04%) Negligible	43km 2,276 harbour porpoise (0.98%) Negligible	42.6km 2,418 harbour porpoise (1%) Negligible

Species	PTS		TTS / fleeing response		Behavioural response	
	3,000kJ in ES	4,000kJ	3,000kJ in ES	4,000kJ	3,000kJ in ES	4,000kJ
	with mitigation	with mitigation				
	No significant difference		**No significant difference**		**No significant difference**	
White-beaked dolphin[2]	<50m	<50m	<150m 0.0004 white-beaked dolphin (<0.00001%) Negligible	170m 0.0007 white-beaked dolphin (0.000004%) Negligible	9km 1.1 white-beaked dolphin (0.007%) Negligible	10.7km 2.3 white-beaked dolphin (0.01%) Negligible
	No difference		**No significant difference**		**No significant difference**	
Minke whale[3]	<50m	50m	<350m 0.0009 minke whale (<0.00001%) Negligible	470m 0.002 minke whale (0.000008%) Negligible	56km 13 minke whale (0.05%) Negligible	52.5km 12.4 minke whale (0.05%) Negligible
	No difference		**No significant difference**		**No difference**	
Grey seal[4]	<150m 0.06 grey seal (<0.0004%) Minor adverse / No impact with mitigation	700m 0.084 grey seal (0.00037%) Minor adverse / No impact with mitigation	<1.9m	1.7m	N/A	
	No significant difference		**No increase**			

[1]based on Lucke *et al*. (2009) unweighted criteria for instantaneous PTS (SEL_{ss} 179 dB re 1 μPa^2s); TTS / fleeing response (SEL_{ss} 164 dB re 1 μPa^2s); and possible avoidance (SEL_{ss} 145 dB re 1 μPa^2s). ES harbour porpoise density = 0.6536/km^2; ES harbour porpoise reference population = 232,450.

[2]based on Southall *et al*. (2007) M-weighted criteria for instantaneous PTS (SEL_{ss} 198 dB re 1 μPa^2s); TTS / fleeing response (SEL_{ss} 183 dB re 1 μPa^2s); and possible avoidance (SEL_{ss} 160 dB re 1 μPa^2s). ES white-beaked dolphin density = 0.0071/km^2; ES white-beaked dolphin reference population = 16,536.

[3]based on Southall *et al*. (2007) M-weighted criteria for instantaneous PTS (SEL_{ss} 198 dB re 1 μPa^2s); TTS / fleeing response (SEL_{ss} 183 dB re 1 μPa^2s); and possible avoidance (SEL_{ss} 142 dB re 1 μPa^2s). ES minke whale density = 0.0023/km^2; ES minke whale reference population = 25,723.

[4]based on Southall *et al*. (2007) M-weighted criteria for instantaneous PTS (SEL_{ss} 186 dB re 1 μPa^2s); TTS / fleeing response (SEL_{ss} 171 dB re 1 μPa^2s); and possible avoidance ES grey seal density = 0.84/km^2; ES grey seal reference population = 22,412.

Results of the updated assessment based on the new criteria

The underwater noise modelling for this assessment was undertaken based on the latest inputs and scenarios for increased pile diameter and hammer energy using the latest (NMFS, 2016) thresholds and criteria for PTS and TTS. As with the like for like comparison set out above, each assessment considers in turn:

- The increase in impact range; and
- The number of individuals and percentage of the reference population at risk.

Since the ES was completed, updated information on the density estimates and reference populations for marine mammals in the Dogger Bank area has become available. Therefore, the most recent density estimates have been used for the updated assessment based on the SCANS-III survey for cetaceans (Hammond *et al*., 2017) and the latest Sea Mammal Research Unit (SMRU) seal at-sea usage maps (Russell *et al*., 2017). Further details are provided in the Marine Mammal Technical Report (**Appendix 2**).

In relation to each of the potential impacts for each species, the updated assessment based on the new criteria demonstrates that there is no difference in the impact significance between the impacts as assessed for a maximum hammer energy from 3,000kJ or 4,000kJ for any of the assessed receptors. A summary of the results is provided in **Table 6**.

The assessments undertaken demonstrate that there is no difference in the impact significance between the impacts as assessed under the original assessment and the updated assessment. Therefore, the assessments demonstrate that an increase in maximum hammer energy from 3,000kJ to 4,000kJ and an increase in monopile diameter from 10m to 12m do not affect impact significance on any of the assessed receptors.

It is therefore concluded that as there is no material difference between the impacts assessed in the ES and those resulting from the proposed amendments to the Projects, the conclusions of the ES and its associated documents are not affected by the proposed changes and that the recommendations of the Examining Authority and the conclusions of the HRA which underpin the DCO, are similarly not affected. The proposed changes do not have the potential to give rise to likely significant effects on any European sites. Therefore the proposed amendments to the DCO will not give rise to any new or materially different likely significant effects in relation to marine mammals and no further assessment is required for marine mammals in support of the proposed amendment to the DCO. In light of this, no new or additional mitigation will be required in relation to marine mammals other than that which is already secured through the DCO.

Since the Project was granted consent, the UK Government has submitted the Southern North Sea candidate Special Area of Conservation (cSAC) to the European Commission to designate an area of the southern North Sea for the protection of harbour porpoise. The cSAC itself was therefore not considered during the determination of the original DCO application; however, impacts on harbour porpoises, including the reference population, were considered. The May 2016 BEIS "Guidance on when new marine Natura 2000 sites should be taken into account in offshore renewable energy consents and licences" (DECC, 2016) states that as a matter of government policy where an amendment is sought to a DCO, pSPAs and pSACs should be considered as if they are designated/classified and *"any possible likely significant effects (and adverse effects on integrity) of the proposed changes in the variation or amendment would need to be considered."* It is clear from the Guidance that it is the likely significant effect (LSE) of the variation or amendment to the DCO that needs to be considered and not the LSE of the DCO as amended. The information provided in this section and the Marine Mammal Technical Report (**Appendix 2**) demonstrates that the possible avoidance of harbour porpoise from a single strike of the maximum monopile hammer energy of 3,000kJ and 4,000kJ, based on the unweighted Lucke *et al*. (2009) criteria (pulse SEL 145 dB re 1 μPa^2s), could result in the potential disturbance of an additional 0.06% of the reference population. Based on the updated noise modelling, the possible avoidance of harbour porpoise from a single strike of the maximum monopile hammer energy of 4,000kJ, based on the unweighted Lucke *et al*. (2009) criteria (pulse SEL 145 dB re 1 μPa^2s), could result in the potential disturbance of 0.1% of the North Sea Management Unit. It is considered that a 'like for like' assessment of the project as changed most accurately allows for the impact of the proposed changes themselves to be isolated and assessed. Based on both the like for like and the updated criteria, it is concluded that the proposed changes would not give rise to likely significant effects on the Southern North Sea cSAC in themselves. Therefore, the implications of the Project on the Southern

North Sea cSAC will continue to be considered as part of the BEIS review of consents. This is a separate process.

Table 6: Summary of the predicted impact ranges, number of marine mammals and% of reference population (based on updated values) and impact assessment for updated assessment of maximum hammer energy of 3,000kJ and 4,000kJ

Species	PTS		TTS / fleeing response		Behavioural response	
	3,000kJ	4,000kJ	3,000kJ	4,000kJ	3,000kJ	4,000kJ
Harbour porpoise[1]	490m 0.6 harbour porpoise (0.0002% NS MU) Minor adverse / No impact with mitigation	660m 1.2 harbour porpoise (0.0003% NS MU) Minor adverse / No impact with mitigation	1.1km 3.2 harbour porpoise (0.0009% NS MU) Negligible	1.5km 5.7 harbour porpoise (0.002% NS MU) Negligible	39.1km 2,065 harbour porpoise (0.6% NS MU) Negligible	42.6km 2,465 harbour porpoise (0.7% NS MU) Negligible
	No significant difference		**No significant difference**		**No significant difference**	
White-beaked dolphin[2]	<50m	<50m	<50m	<50m	9.4km 0.5 white-beaked dolphin (0.003% CGNS MU) Negligible	10.7km 0.7 white-beaked dolphin (0.004% CGNS MU) Negligible
	No difference		**No difference**		**No significant difference**	
Minke whale[3]	60m ($<0.1km^2$)	70m ($<0.1km^2$)	120m ($<0.1km^2$)	150m ($0.1km^2$)	48.4km 34.5 minke whale (0.2% CGNS MU) Negligible	52.5km 40.5 minke whale (0.2% CGNS MU) Negligible
	No difference in impact area		**No difference in impact area**		**No difference**	
Grey seal[4]	70m ($<0.1km^2$)	80m ($<0.1km^2$)			N/A	
	No difference in impact area		**No increase**			
Harbour seal[4]	70m ($<0.1km^2$)	80m ($<0.1km^2$)	130m ($0.1km^2$)	170m ($0.1km^2$)	N/A	
	No difference in impact area		**No difference in impact area**			

[1]based on the NOAA (NMFS, 2016) unweighted SPL_{peak} criteria for PTS (202 dB re 1 µPa); TTS (196 dB re 1 µPa); and Lucke *et al*. (2009) unweighted criteria for 75% possible avoidance (SEL_{ss} 145 dB re 1 μPa^2s). Updated SCANS-III harbour porpoise density = $0.888/km^2$; updated SCANS-III harbour porpoise reference population = 345,373.

[2]based on the NOAA (NMFS, 2016) unweighted SPL_{peak} criteria for PTS (230 dB re 1 µPa); TTS (224 dB re 1 µPa); and Southall *et al*. (2007) M-weighted criteria for 100% possible avoidance (SEL_{ss} 160 dB re 1 μPa^2s). Updated SCANS-III white-beaked dolphin density = $0.002/km^2$; updated white-beaked dolphin reference population = 15,895.

[3]based on the NOAA (NMFS, 2016) unweighted SPL_{peak} criteria for PTS (219 dB re 1 µPa); TTS (213 dB re 1 µPa); and Southall *et al*. (2007) M-weighted criteria for 75% possible avoidance (SEL_{ss} 142 dB re 1 μPa^2s). Updated SCANS-III minke whale density = $0.010/km^2$; updated minke whale reference population = 23,528.

[4]based on the NOAA (NMFS, 2016) unweighted SPL_{peak} criteria for PTS (218 dB re 1 µPa); and TTS (213 dB re 1 µPa.

6.3 Fish and Shellfish Ecology

In relation to Fish and Shellfish Ecology, the ES considered the worst case based on a 'peak' impact which would be building Creyke Beck A and Creyke Beck B concurrently and a worst case 'duration' of impact which would be to build the Projects sequentially.

For the proposed amendments both the increase in monopile diameter and hammer energy have been screened in for further consideration (Section 5). This is considered further below.

6.3.1 Outcomes of Environmental Assessment

Within the ES the worst case scenario in terms of construction noise was based on a maximum number of wind turbines (200) being installed on jacket / multi-pile foundations with a maximum of six pin-piles per foundation. This was based on a maximum hammer energy of 2,300kJ (Chapter 13, Table 5.1 of the ES). Whilst it was acknowledged that the installation of monopiles would result in the greatest associated impact range, given the significantly higher number of piling events associated with installation of jackets/multipile foundations (up to four piling events per foundation) in comparison to monopiles (one piling event per foundation) this option was considered the worst case.

The outcomes of the ES for construction noise, based on the worst case as described above, concluded that there would be negligible to minor adverse effects (which are not significant in EIA terms) on fish and shellfish.

As the worst case was based on the installation of monopiles and the proposed amendments do not alter these parameters there will be no alteration to the worst case assessed with respect to fish, however for completeness consideration has been given to the updated underwater noise modelling carried out for a 3,000kJ hammer energy and the increase to 4,000kJ and a monopile diameter of 12m.

With regard to operational noise the worst case scenario was assumed to be the minimum spacing between turbines of 700m and a maximum of 28 vessels per project per year for the noise associated with vessel movement. The proposed amendments will not alter this worst case, as the increase in rotor diameter would result in larger spacing between wind turbines. Therefore, operational noise is not considered further in this assessment.

Underwater noise modelling

NPL undertook the underwater noise modelling to support the Dogger Bank Creyke Beck Environmental Assessment (Theobald, *et al.,* 2012). **Table 7** and **Table 8** provide details of the criteria used for the modelling work. Modelling was undertaken at a number of locations within Creyke Beck A and Creyke Beck B with impact ranges provided in terms of both injury and behavioural effects for pelagic and demersal fish using different hammer energies (300kJ, 1900kJ, 2300kJ and 3000kJ).

Table 7: Summary of injury criteria used for fish

Species	Dual injury criteria (PTS)	
	Peak SPL**(dB re 1 µPa)[1]	SEL*** (dB re 1 µPa² s)[2]
Fish* (Popper *et al*. 2006 and Carlson *et al*. 2007)	206	187

* Applicable to all fish species with a mass of over 2g.
** Sound Pressure Level
*** Sound Exposure Level

Table 8: Summary of behavioural criteria for generic fish species

Potential response	Behavioural response criteria for generic fish species
	Peak SPL (dB re 1 µPa)
Possible moderate to strong avoidance (McCauley *et al*. 2000)	168-173*
Startle response or C-turn reaction (Pearson *et al*. 1992)	200

*These levels have been established from seismic airgun and should therefore only be applied for impulsive sound sources for fish that are sensitive to sound below around 500Hz

Since the NPL modelling was completed for the ES, NPL no longer conduct noise modelling for individual projects. In addition, new criteria have been developed by Popper *et al.* 2014. As such, the updated noise modelling has been undertaken on a 'like for like' basis to allow direct comparison with the ES and also based on the new criteria.

Outcomes of updated underwater noise modelling

Table 9 provides a comparison of the outcomes of the ES and the updated modelling based on a 4,000kJ hammer energy and 12m monopile diameter. This demonstrates that for the increase in hammer energy and monopile diameter the difference in the spatial extent of the impact ranges modelled is relatively small. At the onset of soft start piling with initial hammer energies of 300kJ the ranges for injury would be much smaller, which allows fish to flee the area before peak noise levels are reached. Based on this, it is concluded that there will be no new or materially different likely significant effects compared to the existing scheme due to the proposed amendments.

Table 9: Predicted fish impact ranges 'like for like' assessment as per the ES at Creyke Beck B

Impact criterion	3,000kJ	4,000kJ
Instantaneous injury/PTS (peak pressure level 206 dB re 1 µPa)	<250m	<380m
Startle response (peak pressure level 200 dB re 1 µPa)	<600m	<860m

[1] SPL: Sound Pressure Level, measure of the received acoustic energy at the receptor. Unit: dB re 1 $\mu Pa_2 \cdot s$

[2] 6 SEL: Sound Exposure Level: Sound Exposure Level, a measure of the received acoustic energy at the receptor. Unit: dB re 1 $\mu Pa_2 \cdot s$

Impact criterion	3,000kJ	4,000kJ
Possible avoidance of area*(peak pressure level 168 -173 dB re 1 µPa)	10.5 – 21.5km	12.9 – 24.6km

*Some particularly insensitive species of fish might only exhibit avoidance behaviour at lesser ranges

In addition to the 'like for like' comparison consideration has also been given to the new criteria (Popper *et al.* 2014). The modelling for this has been carried out based on the hammer energies used in the ES and for the increase in hammer energy to 4,000kJ and 12m monopile diameter. The results of this are shown in **Table 10** and **Table 11**. This is based on the worst case scenario (termed Scenario 3 in the ES) in terms of piling duration for the installation of a single monopile foundation. This demonstrates that the difference in impact ranges for a 3,000kJ and 4,000kJ hammer energy is relatively small and in addition the ranges are smaller than those predicted in the ES on account of the different criteria.

Table 10: Predicted unweighted SPLpeak impact ranges for fish using criteria from Popper et al. (2014) at Creyke Beck B

Fish - impact criterion		3,000kJ hammer energy	4,000kJ hammer energy
Injury (fish: no swim bladder) unweighted SPL_{peak} (213 re 1 µPa)	Maximum	120m	150m
	Minimum	110m	140m
	Mean	120m	150m
Injury (fish: with swim bladder) unweighted SPL_{peak} (207 re 1 µPa)	Maximum	250m	340m
	Minimum	240m	330m
	Mean	250m	340m

Table 11: Predicted unweighted SELcum impact ranges for fish using criteria from Popper et al. (2014) assuming a fleeing speed of 1.5 ms-1 for piling sequence 3 at Creyke Beck B

Fish – impact criterion		3,000kJ hammer energy	4,000kJ hammer energy
Mortality (fish: no swim bladder) SEL_{cum} (> 219 dB re 1 μPa^2s)	Maximum	<100m	<100m
	Minimum	<100m	<100m
	Mean	<100m	<100m
Recoverable injury (fish: no swim bladder) SEL_{cum} (> 216 dB re 1 μPa^2s)	Maximum	<100m	<100m
	Minimum	<100m	<100m
	Mean	<100m	<100m
Mortality (fish: swim bladder not involved in hearing) SEL_{cum} (210 dB re 1 μPa^2s)	Maximum	<100m	<100m
	Minimum	<100m	<100m
	Mean	<100m	<100m
Mortality (fish: swim bladder involved in hearing) SEL_{cum} (207 dB re 1 μPa^2s)	Maximum	<100m	<100m
	Minimum	<100m	<100m
	Mean	<100m	<100m

Fish – impact criterion		3,000kJ hammer energy	4,000kJ hammer energy
Recoverable injury (fish: with swim bladder) SEL_{cum} (203 dB re 1 μPa^2s)	Maximum	<100m	<100m
	Minimum	<100m	<100m
	Mean	<100m	<100m
TTS (all fish) SEL_{cum} (186 re 1 μPa^2s)	Maximum	20.2km	23.4km
	Minimum	10.4km	11.7km
	Mean	15.4km	17.6km

Based on the information above, and the fact that the worst case scenario in relation to construction noise has not altered due to the proposed amendments, it is concluded that there will be no new or materially different likely significant effects compared to the existing scheme. The conclusions of the existing ES that fish and shellfish impacts are not significant for the Project alone and cumulatively with other projects are not affected. The proposed changes do not have the potential to give rise to likely significant effects on any European sites. The worst case position remains the same and no further assessment is required for fish and shellfish in support of the proposed changes to the DCO.

7 Assessment of materiality

There is no statutory definition of what constitutes a material or non-material amendment for the purposes of Schedule 6 of the Planning Act 2008 and Part 1 of the 2011 Regulations.

However, criteria for determining whether an amendment should be material or non-material is outlined in the Department for Communities and Local Government (DCLG) guidance "Planning Act 2008: Guidance on Changes to Development Consent Orders" (December 2015) (the Guidance). Paragraphs 9 -16 of the Guidance sets out the four characteristics which act to provide an indication on whether a proposed change is material or non-material. The following characteristics are stated to indicate that an amendment is more likely to be considered material.

1. A change should be treated as material if it would require an updated ES (from that at the time the original DCO was made) to take account of new, or materially different, likely significant effects on the environment.
2. A change is likely to be material if it would invoke a need for a Habitats Regulations Assessment. Similarly, the need for a new or additional licence in respect of European Protected Species (EPS) is also likely to be indicative of a material change.
3. A change should be treated as material that would authorise the compulsory acquisition of any land, or an interest in or rights over land that was not authorised through the existing DCO.
4. The potential impact of the proposed changes on local people will also be a consideration in determining whether a change is material.

The proposed amendment to the DCO in relation to the rotor diameter, hammer energy and monopile diameter has been considered in light of these four characteristics as presented in the following sections.

7.1 EIA considerations

The information provided in Sections 5 and 6 demonstrates that the proposed amendments will not give rise to new or materially different likely significant effects on the environment. As such, the proposed amendments can be viewed as non-material changes to the DCO.

7.2 HRA and European Protected Species considerations

The information presented in Section 6 demonstrates that the conclusions of the HRA which underpin the DCO are not affected by the proposed amendments and the proposed changes do not have the potential to give rise to likely significant effects on any European sites. As such there will be no new HRA required.

In relation to the Southern North Sea cSAC, it is noted that the proposed amendments to rotor diameter, hammer energy and monopile diameter do not have the potential to give rise to any likely significant effects in themselves so do not invoke the need for HRA (see Section 6.2.1). The newly proposed cSAC designation invokes the need for BEIS (as the competent authority) to undertake a review of existing licences and consents that are likely to have a significant effect, either alone or in combination with other plans and projects, on harbour porpoise in accordance with The Habitats Regulations (see section 6.2 above), however, it would not be appropriate to regard the proposed amendments as material for this reason.

As the conclusions of the ES and HRA remain unchanged, it is not considered that there is a need for any new or additional licences in respect of European Protected Species.

7.3 Compulsory Acquisition of land

The proposed change applies to activities being undertaken within the existing DCO Order limits and on land that will be leased to the Project by The Crown Estate. As such, the possible requirement for compulsory acquisition does not arise.

7.4 Implications on local people

The proposed amendments will have no effect on the local population, given the distance of the Project from shore.

8 Conclusions

This Environmental Report has reviewed the potential effects of the proposed NMC application on all the topics considered in the ES and the HRA. A screening exercise was undertaken which identified the following topics as requiring more detailed consideration:

- Ornithology;
- Marine Mammals; and
- Fish and Shellfish.

With respect to ornithology, the WCS assessed in the ES in relation to disturbance and displacement; barrier effects; and habitat loss and change would not be affected by the proposed amendments and they were therefore screened out of further assessment. Collision risk was re-modelled as it is potentially the most sensitive to changes in turbine size. The collision risk modelling was undertaken for the two species that had been identified in the ES and the HRA as the most sensitive: northern gannet and black-legged kittiwake.

For northern gannet and black-legged kittiwake, collision risk modelling carried out on a 'like for like' basis with the original consent showed that for both species, the use of fewer larger turbines (as would be the case in the event of a rotor diameter greater than the current maximum of 215m being used) would reduce collision estimates from the Projects alone and cumulatively with other projects.

With respect to marine mammals, consideration of the impact of the proposed changes for permanent auditory injury (PTS), temporary auditory injury (TTS) and likely or possible avoidance for all species were considered. This was undertaken on a like for like basis with the modelling that informed the ES, the HRA and the grant of the DCO. In addition, due to the change in noise thresholds and criteria that have occurred since the Project was consented, an assessment of the potential impacts based on these was also undertaken, in line with advice received from Natural England.

The assessments undertaken demonstrate that there is no difference in the impact significance based on a like for like comparison between the impacts as assessed under the original assessment and the updated assessment. Therefore, the assessments demonstrate that an increase in maximum hammer energy from 3,000kJ to 4,000kJ and an increase in monopile diameter from 10m to 12m do not give rise to new or materially different likely significant effects in relation to any of the assessed receptors.

With respect to fish and shellfish, the WCS as assessed in the ES would not alter due to the increase in hammer energy and monopile diameter as the WCS in terms of construction noise was based on a maximum number of wind turbines (200) being installed on jacket / multi-pile foundations with a maximum of six pin-piles per foundation. However, updated noise modelling has been undertaken based on the increase in hammer energy and monopile diameter to consider whether there is any significant change for this parameter.

As per the other receptors, 'like for like' modelling has been undertaken to allow a direct comparison with the outcomes of the ES to be made. This shows that there are only relatively small increases in impact ranges that do not affect the outcome of the assessment. Since the ES was submitted new criteria for fish are available (Popper *et al.* 2014). Therefore, the modelling has also been carried out based on the new criteria using the hammer energies from the ES and for the increase in hammer energy to 4,000kJ and 12m monopile diameter. The results from this modelling show that the difference in impact ranges for a 3,000kJ and 4,000kJ hammer energy is relatively small and in addition the ranges are smaller than those predicted in the ES on account of the different criteria. Therefore, based on a like for the like comparison, the proposed

amendments do not give rise to any new or materially different likely significant effects in relation to fish and shellfish.

In relation to impacts on European sites the 'like for like' modelling has allowed a direct comparison with the HRA to demonstrate that its conclusions are not affected by the proposed changes. The analysis also demonstrates that the impacts of the proposed changes themselves do not have the potential to give rise to likely significant effects on any European sites (including the Southern North Sea cSAC). No further assessment is required in relation to European sites.

It is therefore concluded that the proposed changes would not give rise to any new or materially different likely significant effects on any receptor and that the conclusions of the ES and the HRA are not affected and no new HRA is required. Since the proposed changes also have no impact on Compulsory Acquisition Powers or local people, it is appropriate for the application to be consented as an NMC to the DCO.

9 References

DECC (2015). Dogger Bank Creyke Beck Offshore Wind Farm: Record of the Habitats Regulations Assessment undertaken under Regulation 61 of the Conservation of Habitats and Species Regulation 2010 (as amended) and Regulation 25 of the Offshore Habitats Regulation for an application under the Planning Act 2008 (as amended). 17th February 2015.

DECC (2016) Guidance on when new marine Natura 2000 sites should be taken into account into account in offshore renewables energy consents and licences. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/525765/Final-Guidance_on_when_new_marine_Natura_2000_sites_should_be_taken_into_account_in_offshore_renewable_energy_consents_and_licences.pdf [Accessed: 13th June 2018].

Forewind (2013). Dogger Bank Creyke Beck A & B Environmental Statement

Lucke, K., Siebert, U., Lepper, P. A. and Blanchet, M. A. (2009). Temporary shift in masked hearing thresholds in a harbor porpoise (*Phocoena phocoena*) after exposure to seismic airgun stimuli, J. Acoust. Soc. Am., 125 (6), pp. 4060-4070.

Hammond, P.S., Lacey, C., Gilles, A., Viquerat, S., Boerjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M., Scheidat, M. and Teilmann, J. (2017). Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys. Wageningen Marine Research.

McCauley, R.D., Fewtrell, K., Duncan, A.J., Jenner C., Jenner, M-N., Penrose, J.D., Prince, R.I.T, Adhitya, A., Murdoch, J. and McCabe, K. (2000). Marine seismic surveys – A study of environmental implications. Appea Journal, pp 692-708.

NMFS (National Marine Fisheries Service) (2016). Technical guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-55, 178 p.

Pearson W.H., Skalski, J.R. and Malme, C.I. (1992). Effects of sounds from a geophysical survey device on behaviour of captive rockfish *(Sebastes spp.)*. Can. J. Fish. Aquat. Sci., 49, pp. 1343-1355.

Popper, A.N., Carlson, T.J., Hawkins, A.D., Southall, B.D. and Gentry, R.L. (2006). Interim criteria for injury in fish exposed to a pile driving operation. A white paper, available from http://www.wsdot.wa.gov/NR/rdonlyres/84A6313A-9297-42C9-BFA6-750A691E1DB3/0/BA_PileDrivingInterimCriteria.pdf 2005.

Popper A N, Hawkins A D, Fay R, Mann D A, Bartol S, Carlson T J, Coombs S, Ellison W T, Gentry R L, Halvorsen M B, Løkkeborg S, Rogers P H, Southall B L, Zeddies D G, Tavolga W N (2014). *Sound Exposure Guidelines for Fishes and Sea Turtles*. Springer Briefs in Oceanography, DOI 10. 1007/978-3-319-06659-2.

RHDHV 2018. Minutes of meeting held 11th April 2018 to discuss scope of non-material change application environmental assessment (dated 16th April 2018).

Russell, D.J.F, Jones, E.L. and Morris, C.D. (2017) Updated Seal Usage Maps: The Estimated at-sea Distribution of Grey and Harbour Seals. Scottish Marine and Freshwater Science Vol 8 No 25, 25pp. DOI: 10.7489/2027-1.

Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene Jr., C.R., Kastak, D., Ketten, D.R., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A., and Tyack, P.L. (2007). Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. Aquatic Mammals, 33 (4), pp. 411-509.

Theobald P, Pangerc T, Wang L, Lepper P (2012). Underwater noise modelling to support the Dogger Bank Wind Farm Environmental Impact Assessment for Creyke Beck A and Creyke Beck B. NPL Report AIR (RES) 059, 18th October 2012. In 'Dogger Bank Creyke Beck Environmental Statement Chapter 5 Appendix A: Underwater Noise Technical Report' Appendix Reference 6.5.1, August 2013.