Hornsea Offshore Wind Farm

Project Two

Appendix referred to in response to EOMM13 – Tabular Summary

Appendix FF to the Response submitted for Deadline I

Application Reference: EN010053

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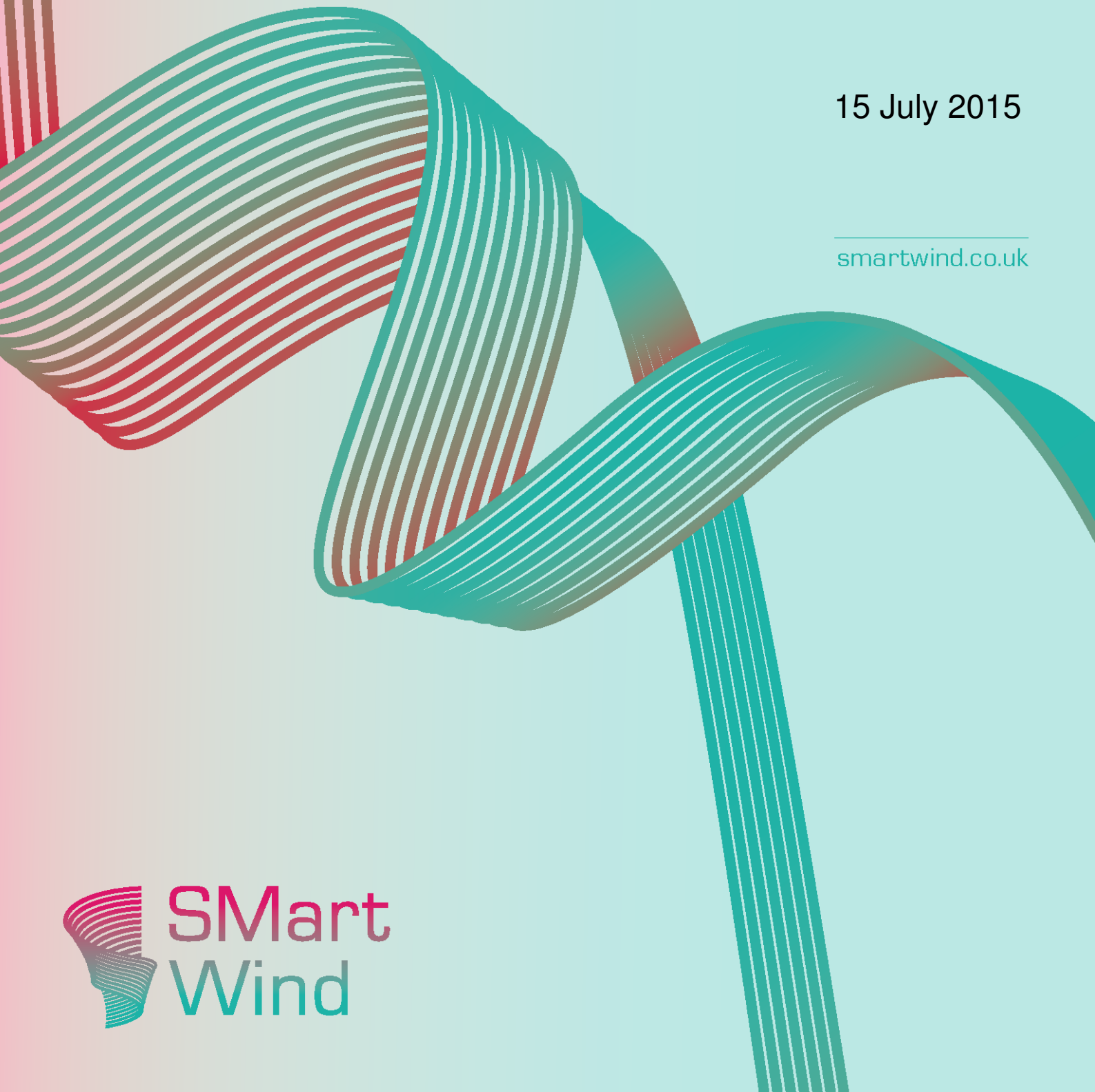

SMart Wind

Appendix FF: Appendix referred to in response to EOMM13 – Tabular Summary

As explained in Volume 1, Chapter 5: Environmental Impact Assessment Methodology of the ES (Doc ref No 7.1.5), the Project EIA has employed the Design Envelope approach, also known as the Rochdale Envelope approach, which allows for a project to be assessed on the basis of project design parameters that are not specific at the time of writing, but are indicated with a range of potential values. For each impact assessment, the maximum adverse scenario from the range of parameters within the Design Envelope is identified, and the assessment is undertaken on this basis.

Within each of the topic chapters (Volume 2, Chapters 1 to 11; Volume 3, Chapters 1 to 11) and for each of the impacts assessed, the selected parameters from the Design Envelope reflect those that would give rise to the greatest potential impact. The greatest potential impact will depend on the receptor subject to assessment, and therefore the maximum adverse scenarios presented within each topic chapter vary from topic to topic.

In response to the Ex.A request for a table to summarise and compare the information with the clauses and requirements of the DCO and other chapters of the ES, the Applicant has provided two separate tables:

- Firstly Table 1.1 provides detail of where the worst case scenario parameters noted in Table 4.17 of Volume 2, Chapter 4: Marine Mammals of the ES (Doc ref No 7.2.4) are addressed in the draft DCO and draft DMLs. For each maximum adverse scenario presented in the marine mammal ES chapter, Table 1.1 provides details of where and how this is addressed in the DCO; and
- Secondly, there are a number of potential impacts assessed within the marine mammals ES chapter, where the same potential impact is also assessed in other ES chapters for other receptor groups. For example: Underwater noise from foundation piling and other construction activities having the potential to (a) cause physical injury or disturbance to marine mammals and (b) result in potential effects on fish and shellfish receptors. For each of these potential impacts, Table 1.2 below, identifies the design envelope parameters that have been used in the assessment in each chapter within which an assessment is presented. These tables have been developed to demonstrate the consistency in the application of design envelope scenarios for similar impacts.

Table 1.1 Summary of the worst case scenarios for Marine Mammal Chapter (Volume 2, Chapter 4 of the ES (Doc ref No 7.2.4) and cross references to clauses within the draft DCO.

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
Construction phase		
1. Underwater noise from foundation piling and other construction activities (e.g., drilling of piles) has the potential to cause physical injury or disturbance to marine mammals.	**Maximum adverse spatial (monopile foundations and HVDC transmission):**	
	Piling of 225 x 8 MW turbines, comprising 10 m diameter monopiles foundations with a maximum pile energy per strike of 3,000 kJ;	Schedule A Part 1 paragraph 2 of the draft DCO limits the maximum capacity of the Project to 1,800 MW. The maximum number of turbines that can be installed is limited by the maximum total capacity of the Project and therefore no more than 225 8 MW turbines can be installed since 225 x 8 MW = 1,800 MW. Requirement 5 (7)(a)(ii) of the draft DCO states (a) where monopile foundations are used— (ii) the diameter of each foundation must not exceed ten metres; Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement and including details of foundation installation, including any seabed preparation, drilling and disposal of arisings methods to be submitted to and approved in writing by the MMO before commencement of any works. This statement will include details of the maximum hammer energy. Condition 10(2)(e) of the draft DMLs states that in the event that driven or part-driven pile foundations are proposed to be used, a marine mammal mitigation protocol following current best practice as advised by the statutory nature conservation agencies is to be submitted to and approved in writing by the MMO. This document will also include details of the maximum hammer energy.
	Piling of substations and platforms with a maximum pile energy per strike	Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
	of 2,300 kJ;	Statement and including details of foundation installation, including any seabed preparation, drilling and disposal of arisings methods to be submitted to and approved in writing by the MMO before commencement of any works. This statement will include details of the maximum hammer energy. Condition 10(2)(e) of the draft DMLs requires that in the event that driven or part-driven pile foundations are proposed to be used, a marine mammal mitigation protocol following current best practice as advised by the statutory nature conservation agencies is to be submitted to and approved in writing by the MMO. This document will also include details of the maximum hammer energy.
	Six offshore HVAC collector substations (eight 3.5 m diameter piles per foundation) = 48 piles	Schedule A Part 1 paragraph 6 limits the maximum number of offshore HVAC collector substations that can be constructed to six. Requirement 5(5)(b) of the draft DCO limits the maximum number of piles per jacket to a maximum of eight and the maximum diameter of each pile to 3.5 m for the HVAC collector substations.
	Two offshore accommodation platforms (eight 3 m diameter piles per foundation) = 16 piles;	Schedule A Part 1 paragraph 4 limits the maximum number of offshore accommodation platforms to two. Requirement 5(4)(b) of the draft DCO limits the maximum number of piles to eight and the maximum diameter of each pile to 3m for the offshore accommodation platforms.
	Two offshore HVDC converter substations (four jacket foundations with 18 3.5 m piles per foundation) = 144 piles	Schedule A Part 1 paragraph 6 limits the maximum number of offshore HVDC converter substations to two. Requirement 5(6)(a) of the draft DCO limits the maximum number of jacket foundations per topside to four with a maximum of eighteen piles per jacket and a maximum diameter of each pile of 3.5 m for the HVDC converter substations.

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
	Total number of piles for monopile foundations = 225 piles Piling duration for monopiles ranges between 2.5 to 15.5 hours per foundation, but depending on the soil profile, an interval of up to 55 hours of drilling may also be required.	Requirement 5 of the draft DCO lists foundation methods and limits the diameter of piles per foundation type. Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement to be submitted to and approved in writing by the MMO prior to commencement of the works. Included in this plan will be details of the foundation installation procedures, piling equipment to be used and the duration of piling (see the Applicant's response to question EOMM19 of the Ex. A's first written questions).
	Total number of piles for substation and platform jacket foundations = 208 piles. Indicative piling duration is 11.5 hours per pile with up to 25 hours of drilling where necessary.	Requirement 5 of the draft DCO lists foundation methods and limits the foundation parameters for each foundation method including the maximum number and diameter of piles per foundation type. Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement to be submitted to and approved in writing by the MMO prior to commencement of the works. Included in this plan will be details of the foundation installation procedures, piling equipment to be used and the duration of piling (see the Applicant's response to question EOMM19 of the Ex. A's first written questions).
	Piling will occur over up to four phases with either one or two vessels operating at any one time. However, the worst case spatial is based on concurrent (two) vessel piling with vessels located a maximum distance of 20 km apart within Subzone 2. The actual time piling (i.e., not including drilling, downtime or handling time	Condition 10(2)(a) of the draft DMLs requires a Construction and Monitoring Programme to be submitted to and approved in writing by the MMO prior to commencement of the works which will include proposed timings for the installation works. Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement to be submitted to and approved in writing by the MMO prior to commencement of the works. Included in this plan will be details of the foundation installation

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
	etc.) for installation of monopiles is estimated as 4.5 months and the estimated piling time for substations and platforms is 3.3 months.	procedures, piling equipment to be used and the duration of piling (see the Applicant's response to question EOMM19 of the Ex. A's first written questions).
	Maximum adverse temporal: Jacket foundations (HVDC transmission):	
	Piling of 120 foundations for 15 MW turbines, comprising twelve 2.2 m diameter piles per foundation and with a maximum pile energy per strike of 1,700 kJ = 1,440 piles	Schedule A Part 1 paragraph 2 of the draft DCO limits the maximum capacity of the Project to 1,800 MW. The maximum number of turbines that can be installed is limited by the maximum total capacity of the Project and therefore no more than 120 15 MW turbines can be installed since 120 x 15 MW = 1,800 MW. Requirement 5(3) of the draft DCO lists foundation methods and limits the foundation parameters for each foundation method including the maximum number and diameter of piles per foundation type. Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement to be submitted to and approved in writing by the MMO prior to commencement of the works. Included in this plan will be details of the foundation installation procedures, piling equipment and maximum hammer energy to be used (see the Applicant's response to question EOMM19 of the Ex. A's first written questions).
	Piling of substations and platforms with a maximum pile energy per strike of 2,300 kJ	Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement and including details of foundation installation, including any seabed preparation, drilling and disposal of arisings methods to be submitted to and approved in writing by the MMO before commencement of any works. This statement will include details of the maximum hammer energy. Condition 10(2)(e) of the draft DMLs requires that in the event that driven

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
		or part-driven pile foundations are proposed to be used, a marine mammal mitigation protocol following current best practice as advised by the statutory nature conservation agencies is to be submitted to and approved in writing by the MMO. This will also include details of the maximum hammer energy.
	Six offshore HVAC collector substations (eight 3.5 m diameter piles per foundation) = 48 piles	Schedule A Part 1 paragraph 6 limits the maximum number of offshore HVAC collector substations to six. Requirement 5(5)(b) of the draft DCO limits the maximum number of piles per jacket to eight and the maximum diameter of each pile to 3.5 m for the HVAC Collector substations.
	Two offshore accommodation platforms (eight 3 m diameter piles per foundation) = 16 piles	Schedule A Part 1 paragraph 4 limits the maximum number of offshore accommodation platforms to two. Requirement 5(4)(b) of the draft DCO limits the maximum number of piles per jacket to eight and the maximum diameter of each pile to 3 m for the offshore accommodation platforms.
	Two offshore HVDC converter substations (four jacket foundations with 18 3.5 m piles per foundation) = 144 piles.	Schedule A Part I paragraph 6 limits the maximum number of offshore HVDC converter substations to two. Requirement 5(6)(a) of the draft DCO limits the maximum number of jacket foundations per topside to four with a maximum of eighteen piles per jacket and a maximum diameter of each pile of 3.5 m for the HVDC converter substations.
	Total number of piles for jacket turbine foundations = 1,440 piles (twelve 2.2 m diameter piles per foundation for 120 foundations). Piling duration for 1,700 kJ jackets ranges between 1 to 6 hours per pile.	Schedule A Part 1 paragraph 2 of the draft DCO limits the maximum capacity of the Project to 1,800 MW. The maximum number of turbines that can be installed is limited by the maximum total capacity of the Project and therefore no more than 120 15 MW turbines can be installed since 120 x 15 MW = 1,800 MW. Requirement 5(3) of the draft DCO details foundation methods and limits

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
		the foundation parameters for each foundation method including the maximum number of piles per jacket foundation for turbine foundations which is limited by Condition 5(3)(b) to a maximum of twelve piles per jacket foundation. Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement to be submitted to and approved in writing by the MMO prior to commencement of the works. Included in this plan will be details of the foundation installation procedures, piling equipment and maximum hammer energy to be used (see the Applicant's response to question EOMM19 of the Ex. A's first written questions).
	Total number of piles for substations and platform jacket foundations = 208 piles (48 piles for six offshore HVAC collector substations (eight per foundation), 16 piles for two offshore accommodation platforms (eight per foundation) and 144 piles for two offshore HVDC converter substations (four foundations with 18 piles per foundation)). Indicative piling duration is 11.5 hours per pile with up to 25 hours of drilling where necessary	Schedule A Part 1 paragraph 6 limits the maximum number of offshore HVAC collector substations to six and Requirement 5(5)(b) limits the maximum number of piles per jacket to eight. Schedule A Part 1 paragraph 4 limits the maximum number of offshore accommodation platforms to two and Requirement 5(4)(b) limits the maximum number of piles per jacket to eight. Schedule A Part I paragraph 6 limits the maximum number of offshore HVDC converter substations to two and Requirement 5(6)(a) limits the maximum number of jacket foundations per topside to four with a maximum of eighteen piles per jacket. Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement to be submitted to and approved in writing by the MMO prior to commencement of the works. Included in this plan will be details of the foundation installation procedures, piling equipment to be used and the duration of piling (see the Applicant's response to question EOMM19 of the Ex. A's first written questions).

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
	The actual time piling (i.e., not including drilling, downtime or handling time etc.) for installation of 15 MW jackets is estimated as 12.5 months and the estimated piling time for substations and platforms is 3.3 months. Total piling is therefore 15.8 months (1.32 years) and piling will occur over four phases. This estimate is based upon a single piling vessel, but the duration may be shortened if two vessels pile concurrently.	Condition 10(2)(a) of the draft DMLs requires a Construction and Monitoring Programme to be submitted to and approved in writing by the MMO prior to commencement of the works which will include proposed timings for the installation works. Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement to be submitted to and approved in writing by the MMO prior to commencement of the works. Included in this plan will be details of the foundation installation procedures, piling equipment to be used and the duration of piling (see the Applicant's response to question EOMM19 of the Ex. A's first written questions).
	Maximum piling construction period	
	The piling construction period is the total length of time over which piling will intermittently occur to complete the installation of the foundations for the WTGs, substations, platforms and HVAC substations. The maximum piling construction period is estimated as five years.	Condition 10(2)(a) of the draft DMLs requires a Construction and Monitoring Programme to be submitted to and approved in writing by the MMO prior to commencement of the works which will include the proposed construction start date and timings for the installation works. Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement to be submitted to and approved in writing by the MMO prior to commencement of the works. Included in this plan will be details of the foundation installation procedures, piling equipment to be used and the duration of piling (see the Applicant's response to question EOMM19 of the Ex. A's first written questions).
2. Underwater noise from foundation piling and other	Piling activity using jacket foundations as described below: - Two offshore HVAC reactive compensation substations (eight 3 m	Schedule A Part 1 paragraph 7 limits the maximum number of offshore HVAC reactive compensation substations that can be constructed to two. Requirement 5(7) of the draft DCO details the foundation parameters that must be applied in respect of the foundation methods used to fix the

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construction activities (e.g., drilling of piles) for the two offshore HVAC reactive compensation substations may cause physical injury or disturbance to marine mammals.	diameter piles at two locations adjacent to each other within the cable route corridor) = 16 piles.	offshore reactive compensation substation to the seabed. The requirement limits the maximum number of piles per jacket to eight and the maximum diameter of each pile to 3 m.
	Maximum hammer energy per strike is 2,300 kJ with a maximum piling duration of 11.5 hours per pile. Total piling duration of eight days completed within a six month piling phase.	Condition 10(2)(a) of the draft DMLs requires a Construction and Monitoring Programme to be submitted to and approved in writing by the MMO prior to commencement of the works which will include proposed timings for the installation works. Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement to be submitted to and approved in writing by the MMO prior to commencement of the works. Included in this plan will be details of the foundation installation procedures, the piling equipment to be used and the duration of piling (see the Applicant's response to question EOMM19 of the Ex. A's first written questions).
3. Increased vessel traffic during construction may result in an increase in noise disturbance to marine mammals.	Disturbance from vessel movements from a range of vessel types: - jack-ups, scour protection installation vessels, grout support vessels, safety boats, tugs/support vessels, heavy lift vessels, diver support vessels, cable installation vessels (cable laying, pre-cable laying and cable post-lay burial vessels); and - vessels for dredging and ploughing for sand wave clearance.	Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement to be submitted to and approved in writing by the MMO prior to commencement of the works. This plan will include details of vessels that will be utilised by the Project during construction. Condition 10(2)(f) of the draft DMLs require a cable specification and installation plan to be submitted to and agreed in writing by the MMO prior to commencement of any works.

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
	Cable installation vessels (as described above) required for installation of up to 1,200 km of subtidal (offshore) export cable (HVAC transmission, i.e., eight 150 km cables), 675 km of inter-array and 10 km of platform accommodation cables via ploughing/ trenching/jetting/rock cutting//surface laying.	Requirement 2(6) limits the maximum length of the electrical circuits whilst requirement 2(7) restricts the methods by which the electrical circuits can be installed. Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement to be submitted to and approved in writing by the MMO prior to commencement of the works. This plan will include details of vessels that will be utilised by the Project during construction. Condition 10(2)(f) of the draft DMLs have a requirement for a cable specification and installation plan to be submitted to and agreed in writing by MMO prior to commencement of any works.
	Noise from vessel engines for vessels described above, and from thrusters used during dynamic positioning (requiring up to 42 vessels per phase, (totalling 84 vessels at any one time based on a maximum of two phases being constructed simultaneously), of which up to 50% of vessels could have ducted propellers.	Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement to be submitted to and approved in writing by the MMO prior to commencement of the works. This plan will include details of vessels that will be utilised by the project during construction.
	Maximum of 6,200 round trips to port by construction vessels over the longest construction phase duration (i.e., maximum construction period duration of six years).	Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement to be submitted to and approved in writing by the MMO prior to commencement of the works. This plan will include details of vessels that will be utilised by the Project during construction

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
	Cable installation occurring over a period of five years in the subtidal.	Condition 10(2)(a) of the draft DMLs requires a Construction and Monitoring Programme to be submitted to and approved in writing by the MMO prior to commencement of the works which will include details of the proposed timings for the installation works. Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement to be submitted to and approved in writing by the MMO prior to commencement of the works. This plan will include details of cable installation, including any seabed preparation and cable protection. Condition 10(2)(f) of the Draft DMLs have a requirement for a Cable Specification and Installation Plan to be submitted to and agreed in writing by MMO prior to commencement of any works. This plan will include a detailed cable laying plan and cable laying techniques.
4. Increased vessel traffic during construction may result in an increased collision risk.	Vessels using ducted propellers are jack-ups, scour protection, grout support, pre-during-post-cable laying and diver support.	Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement to be submitted to and approved in writing by the MMO prior to commencement of the works. This plan will include details of vessels that will be utilised by the project during construction.
	Maximum of 6,200 vessel movements over the longest offshore construction phase duration (i.e., maximum construction period duration of six years).	Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement to be submitted to and approved in writing by the MMO prior to commencement of the works. This plan will include details of vessels that will be utilised by the project during the construction phase. Condition 10(2)(a) of the draft DMLs requires a Construction and Monitoring Programme to be submitted to and approved in writing by the MMO prior to commencement of the works. This plan will include details of the proposed timings for installation works.

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5. Increased suspended sediments may impair the foraging ability of marine mammals.	**Seabed preparation for gravity base foundation installation:**	
	Worst case per turbine based on 15 MW turbine: removal of up to 23,892 m^3 per turbine foundation Calculated based on the area associated with the maximum levelling diameter (78 m) and the maximum levelling depth (5 m) since 4,788 m^2 x 5 m = 23,892 m^3. Worst case total array turbine spoil volume: 2,389,181 m^3, based on an average levelling depth.	Schedule A Part 1 paragraph 2 of the draft DCO limits the maximum can be installed is limited by the maximum total capacity of the Project and therefore no more than 120 15 MW turbines can be installed since 120 x 15 MW = 1,800 MW. Requirement 5(3)(d) of the draft DCO details the parameters that must be applied in the event that gravity base foundations are utilised and limits the seabed levelling diameter to 78 m. Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement to be submitted to and approved in writing by the MMO prior to commencement of the works which will include details of turbine installation, including any seabed preparation required. Paragraph 2 of Schedules H and J to the draft DCO provides for the removal and subsequent disposal of material extracted during construction drilling and seabed preparation for foundation works. The volume of material that may be deposited is restricted by Paragraph (2)(1).
	Six offshore HVAC collector substations, two offshore HVDC converter stations, two accommodation platforms (gravity base foundations): - maximum spoil of 38,484 m^3 for the two accommodation platforms: based on area associated with maximum levelling diameter (70 m) and	Schedule A Part 1 paragraphs 4 and 6 limit the maximum number of offshore HVAC collector substations, offshore HVDC converter stations and offshore accommodation platforms to six, two and two respectively. Requirement 5 of the draft DCO lists foundation methods and limits the foundation parameters for each foundation method for the HVAC Collector substations, the HVDC converter stations and offshore accommodation platforms. Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
	the maximum levelling depth (5 m) since 3,848 m^2 x 5 m = 19,242 m^3 and 19,242 m^3 x 2 platforms = 38,484 m^3); - 115,454 m^3 for the six offshore HVAC collector substations: based on area associated with maximum levelling diameter (70 m) and the maximum levelling depth (5 m) since 3,848 m^2 x 5 m = 19,242 m^3 and 19,242 m^3 x 6 substations = 115,454 m^3); and - 209,000 m^3 for the two offshore HVDC converter stations: based on area associated with maximum area to be levelled (20,900 m^2) and the maximum levelling depth (5 m) since 20,900 m^2 x 5 m = 104,500 m^3 and 104,500 m^3 x 2 stations = 209,000 m^3).	Statement to be submitted to and approved in writing by the MMO prior to commencement of the works which will include details of turbine installation, including any seabed preparation required. Paragraph 2 of Schedules H. I, J and K to the draft DCO provides for the removal and subsequent disposal of material extracted during construction drilling and seabed preparation for foundation works. The volume of material that may be deposited is restricted by Paragraph (2)(1).

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
	Cable installation	
	Installation of 1,200 km of export cables (eight cable trenches 150 km in length) by jetting. Burial to depth of 3 m below the stable seabed and 10 m width of disturbance.	Requirement 2(6)(d) limits the maximum length of the electrical circuits comprised in Work Nos. 4A, 4B, 5A and 5B (i.e. the export cable) to 1,200 km whilst requirements 2(7) and 2(8) restrict the methods by which the electrical circuits can be installed. Condition 10(2)(f) of the Draft DMLs requires a Cable specification and installation plan to be submitted to and agreed in writing by the MMO prior to commencement of any works. Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement which will include details of cable installation to be submitted to and approved in writing by the MMO prior to commencement of the works.
	Installation of 675 km of inter-array cables, 300 km of platform interconnector cables and 10 km of accommodation platform cables by jetting. Burial to depth of 3 m below the stable seabed and 10 m width of disturbance.	Requirement 2(6) limits the maximum length of the electrical circuits whilst requirement 2(7) restricts the methods by which the electrical circuits can be installed. Condition 10(2)(f) of the Draft DMLs requires a Cable specification and installation plan to be submitted to and agreed in writing by the MMO prior to commencement of any works. Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement which will include details of cable installation to be submitted to and approved in writing by the MMO prior to commencement of the works.
	Sandwave clearance using trailer suction hopper dredging or mass flow excavator for Subzone 2 cable	Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement to be submitted to and approved in writing by the MMO prior to

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
	installation, with clearance of 13,974 m^3 through the largest sandwave along the Subzone 2 cable routes, assuming sandwave clearance occurring simultaneously with two seabed preparation operations for gravity base foundations	commencement of the works. This will include details of cable installation, including any seabed preparation. Paragraph 2 of Schedules H. I, J and K to the draft DCO provides for the removal and subsequent disposal of material extracted during construction drilling and seabed preparation for foundation works. The volume of material that may be deposited is restricted by Paragraph (2)(1).
	Sandwave clearance at the following Kilometre Point (KP) locations along the export cable route corridor: KP 52.2; KP 58.5 and KP 60; KP 61 to KP 63; KP 70 to 71.5; KP 76 to 77.5; KP 81 to KP 83.2; and KP 96 (see Figure 1.8 in Volume 2, Chapter 1: Marine Processes of the ES (Doc ref No 7.2.1). Sandwave clearance using trailer suction hopper dredging or mass flow excavator (see paragraphs 1.6.95 *et seq*. of Volume 2, Chapter 1 of the ES).	Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement to be submitted to and approved in writing by the MMO prior to commencement of the works. This will include details of cable installation including any seabed preparation. Condition 10(2)(c) of the draft DMLs requires a Project Environmental Management and Monitoring Plan be submitted to and approved in writing by the MMO prior to commencement of the works. This plan will include a disposal plan detailing the locations, methods and timings of dredging and disposal.
6. Accidental pollution events during the construction phase resulting in potential effects on marine mammal	**Synthetic compound, heavy metal and hydrocarbon contamination resulting from:**	
	Construction of up to 360 (5 MW) turbines (also includes six offshore HVAC collector substations, two offshore HVDC converter substations and two accommodation platforms);	Schedule A Part 1 paragraph 2 of the draft DCO limits the maximum capacity of the Project to 1,800 MW. The maximum number of turbines that can be installed is limited by the maximum total capacity of the Project and therefore no more than 360 5 MW turbines can be installed since 360 x 5 MW = 1,800 MW. Schedule A Part 1 paragraph 3 limits the maximum number turbines that can be constructed to 360.

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
receptors.		Schedule A Part 1 paragraph 6 limits the maximum number of offshore HVAC collector substations and offshore HVDC converter substations that can be constructed to six and two respectively. Schedule A Part 1 paragraph 4 limits the maximum number of offshore accommodation platforms to two.
	Offshore refuelling for up to a maximum of 6,200 vessel movements over the construction phase;	Condition 10(2)(c) of the draft DMLs requires a project environmental management and monitoring plan to be submitted to the MMO for approval and to include details of— (i) a marine pollution contingency plan to address the risks, methods and procedures to deal with any spills and collision incidents during construction and operation of the authorised scheme in relation to all activities carried out seaward of MHWS. The plan must include a mechanism for reporting oil, fuel and chemical spills to the MMO Marine Pollution Response Team; and (ii) a chemical risk analysis which is to include information regarding how and when chemicals are to be used, stored and transported in accordance with recognised best practice guidance. Condition 8(3) of the DMLs requires that the storage, handling, transport and use of fuels, lubricants, chemicals and other substances be undertaken so as to prevent releases into the marine environment including bunding of 110% of the total volume of all reservoirs and containers.
	Water-based drilling muds associated with drilling to install foundations, should this be required	Condition 8(4) of the draft DML requires thatwhere foundation drilling works are proposed, in the event that any system other than water based mud is proposed the MMO's written approval in relation to the proposed disposal of any arisings shall be obtained before the drilling commences, which disposal may also require a marine licence.

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
	A typical 15 MW turbine is likely to contain approximately 375 l of grease, 20,000 l of hydraulic oil and 3,750 l of gear oil, 79,500 l of nitrogen and 5,625 kg of transformer silicon/ester oil;	Condition 10(2)(c) of the draft DMLs requires a project environmental management and monitoring plan to be submitted to the MMO for approval and to include details of— (i) a marine pollution contingency plan to address the risks, methods and procedures to deal with any spills and collision incidents during construction and operation of the authorised scheme in relation to all activities carried out seaward of MHWS. The plan must include a mechanism for reporting oil, fuel and chemical spills to the MMO Marine Pollution Response Team; and (ii) a chemical risk analysis which is to include information regarding how and when chemicals are to be used, stored and transported in accordance with recognised best practice guidance. Condition 8(3) of the DMLs requires that the storage, handling, transport and use of fuels, lubricants, chemicals and other substances be undertaken so as to prevent releases into the marine environment including bunding of 110% of the total volume of all reservoirs and containers.
	A typical offshore accommodation platform is likely to contain approximately 400-10,000 l of coolant, 400-10,000 l of hydraulic oil and 1,000-3,500 kg of lubricates;	Condition 10(2)c of the draft DMLs requires a project environmental management and monitoring plan to be submitted to the MMO for approval and to include details of— (i) a marine pollution contingency plan to address the risks, methods and procedures to deal with any spills and collision incidents during construction and operation of the authorised scheme in relation to all activities carried out seaward of MHWS. The plan must include a mechanism for reporting oil, fuel and chemical spills to the MMO Marine Pollution Response Team; and (ii) a chemical risk analysis which is to include information regarding how and when chemicals are to be used, stored and transported in

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
		accordance with recognised best practice guidance. Condition 8(3) of the DMLs requires that the storage, handling, transport and use of fuels, lubricants, chemicals and other substances be undertaken so as to prevent releases into the marine environment including bunding of 110% of the total volume of all reservoirs and containers.

	- Four offshore fuel storage tanks:
	  ○ One on each of the two accommodation platforms for helicopter fuel, each with a capacity of 12,000 l; and
	  ○ One on each of the two accommodation platforms for crew transfer vessel fuel, each with a capacity of 210,000 l.
		Condition 10(2)c of the draft DMLs requires a project environmental management and monitoring plan to be submitted to the MMO for approval and to include details of—
		(i) a marine pollution contingency plan to address the risks, methods and procedures to deal with any spills and collision incidents during construction and operation of the authorised scheme in relation to all activities carried out seaward of MHWS. The plan must include a mechanism for reporting oil, fuel and chemical spills to the MMO Marine Pollution Response Team; and
		(ii) a chemical risk analysis which is to include information regarding how and when chemicals are to be used, stored and transported in accordance with recognised best practice guidance.
		Condition 8(3) of the DMLs requires that the storage, handling, transport and use of fuels, lubricants, chemicals and other substances be undertaken so as to prevent releases into the marine environment including bunding of 110% of the total volume of all reservoirs and containers.

7. Changes in the fish and shellfish community	**Changes in fish and shellfish community due to:**	
	Piling noise from maximum adverse scenario (as per Potential Impact 1 above);	Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement and including details of foundation installation, including any

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
resulting from construction impacts may lead to a loss in prey resources for marine mammals.		seabed preparation, drilling and disposal of arisings methods to be submitted to and approved in writing by the MMO before commencement of any works. Included in this plan will be details of the foundation installation procedure, the piling equipment and the maximum hammer energy to be used and the duration of piling (see the Applicant's response to question EOMM19 of the Ex. A's first written questions) Condition 10(2)(e) of the draft DML states that In the event that driven or part-driven pile foundations are proposed to be used, a marine mammal mitigation protocol following current best practice as advised by the statutory nature conservation agencies is to be submitted to and approved in writing by the MMO.
	45,526,841 m^2 of habitat loss due to seabed preparation for gravity bases, sandwave clearance and trenching for cable installation associated with the installation of up to: - 360 5 MW turbines, six offshore HVAC collector substations, two offshore HVAC reactive compensation substations and two accommodation platforms; - 675 km of inter-array cables; - 10 km of inter-accommodation platform - 1,200 km of export cable; - Seabed preparation works prior to the installation of all gravity base foundations;	Schedule A Part 1 paragraph 2 of the draft DCO limits the maximum capacity of the Project to 1,800 MW. The maximum number of turbines that can be installed is limited by the maximum total capacity of the Project and therefore no more than 360 5 MW turbines can be installed since 360 x 5 MW = 1,800 MW. Schedule A Part 1 paragraph 3 limits the maximum number turbines that can be constructed to 360. Schedule A Part 1 paragraph 6 limits the maximum number of offshore HVAC collector substations and offshore HVDC converter substations that can be constructed to six and two respectively. Schedule A Part 1 paragraph 4 limits the maximum number of offshore accommodation platforms to two. Schedule A Part 1 paragraph 7 limits the maximum number of offshore reactive compensation substations to two. Requirement 5 of the draft DCO details the parameters that must be applied in the event that gravity base foundations are utilised. Requirement 2(6) limits the maximum length of the electrical circuits whilst

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
	- Sandwave clearance activities along the cable route corridor, via trailer suction hopper dredging; and - Sandwave clearance activities associated with cable installation within Subzone 2 cables and export cables), via trailer suction hopper dredging.	requirements 2(7) and 2(8) restrict the methods by which the electrical circuits can be installed. Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement which will include details of cable installation to be submitted to and approved in writing by the MMO prior to commencement of the works. Condition 10(2)(f) of the Draft DMLs requires a Cable specification and installation plan to be submitted to and agreed in writing by the MMO prior to commencement of any works. Paragraph 2 of Schedules H. I, J and K to the draft DCO provides for the removal and subsequent disposal of material extracted during construction drilling and seabed preparation for foundation works. The volume of material that may be deposited is restricted by Paragraph (2)(1).
	Increased sedimentation and sediment deposition arising from installation of gravity base foundations, cable installation and sandwave clearance (as per Potential Impact 5 above).	See Potential Impact 5 above.

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
	Potential for contamination arising from installation works and construction vessels (maximum of 6,200 round trips to port by construction vessels over the longest construction phase)	Condition 10(2)(f) of the Draft DMLs have a requirement for a Cable specification and installation plan to be submitted to and agreed in writing by MMO prior to commencement of any works. Condition 10(2)(c) of the draft DMLs requires a project environmental management and monitoring plan to be submitted to the MMO for approval and to include details of— (i) a marine pollution contingency plan to address the risks, methods and procedures to deal with any spills and collision incidents during construction and operation of the authorised scheme in relation to all activities carried out seaward of MHWS. The plan must include a mechanism for reporting oil, fuel and chemical spills to the MMO Marine Pollution Response Team; and (ii) a chemical risk analysis which is to include information regarding how and when chemicals are to be used, stored and transported in accordance with recognised best practice guidance. Condition 8(3) of the DMLs requires that the storage, handling, transport and use of fuels, lubricants, chemicals and other substances be undertaken so as to prevent releases into the marine environment including bunding of 110% of the total volume of all reservoirs and containers.

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
Operation phase		
8. The operating noise of turbines may result in potential effects on marine mammals.	Operation of up to 360 5 MW turbines over the design life of the project (i.e., 25 years).	Schedule A Part 1 paragraph 2 of the draft DCO limits the maximum capacity of the Project to 1,800 MW. The maximum number of turbines that can be installed is limited by the maximum total capacity of the Project and therefore no more than 360 5 MW turbines can be installed since 360 x 5 MW = 1,800 MW. Schedule A Part 1 paragraph 3 limits the maximum number turbines that can be constructed to 360.
9. Increased vessel traffic may result in an increase in noise disturbance to marine mammals.	2,817 vessel movements during operation and maintenance (including from supply/crew vessels and jack-up vessels) per year the design life of the project (i.e., 25 years).	Condition 10(2)(i) of the draft DMLs requires a offshore project maintenance plan to be submitted to the MMO to be submitted to the MMO for approval at least four months prior to commencement of the operation of the licensed activities. This plan will include details of the vessel movements anticipated each year during the operation and maintenance of the Project. In addition, the project environmental management and monitoring plan required under Condition 10(2)(c) of the draft DMLs to be submitted to and approved in writing by the MMO prior to commencement of any works will also include maintenance plans which will detail expected vessel movements during operation and maintenance.
10. Increased vessel traffic may result in an increase in collision risk to marine mammals.	Collision risk from 2,817 vessel movements during operation and maintenance (including from supply/crew vessels and jack-up vessels) per year over the design life of the project (i.e., 25 years).	Condition 10(2)(i) of the draft DMLs requires a offshore project maintenance plan to be submitted to the MMO to be submitted to the MMO for approval at least four months prior to commencement of the operation of the licensed activities. This plan will include details of the vessel movements anticipated each year during the operation and maintenance of the Project. In addition, the project environmental management and monitoring plan required under Condition 10(2)(c) of the draft DMLs to be submitted to

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
		and approved in writing by the MMO prior to commencement of any works will also include maintenance plans which will detail expected vessel movements during operation and maintenance.
	Vessels using ducted propellers (only a proportion of the total number, assumed 50% of the 22 vessels required for operation).	Condition 10(2)(i) of the draft DMLs requires a offshore project maintenance plan to be submitted to the MMO to be submitted to the MMO for approval at least four months prior to commencement of the operation of the licensed activities. This plan will include details of the vessel movements anticipated each year during the operation and maintenance of the Project. In addition, the project environmental management and monitoring plan required under Condition 10(2)(c) of the draft DMLs to be submitted to and approved in writing by the MMO prior to commencement of any works will also include maintenance plans which will detail expected vessel movements during operation and maintenance.
11. Increased suspended sediment during cable maintenance may impair the foraging ability of marine mammals.	Maintenance works to rebury subtidal inter-array, inter accommodation platform, platform interconnector and export cables.	Condition 10(2)(i) of the draft DMLs requires a offshore project maintenance plan to be submitted to the MMO to be submitted to the MMO for approval at least four months prior to commencement of the operation of the licensed activities. This plan will include details of the maintenance works required in relation to the cables. In addition, the project environmental management and monitoring plan required under Condition 10(2)(c) of the draft DMLs to be submitted to and approved in writing by the MMO prior to commencement of any works will also include maintenance plans including details of cable maintenance.
12. Electromagnetic fields (EMF)	**Maximum EMF resulting from:**	
	Up to 675 km of single AC inter-array (maximum voltage of 70 kV);	Requirement 2(6)(b) limits the maximum length of the electrical circuits comprised in Work Nos. 1A and 1B (i.e. the inter array cables and inter

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
emitted by inter-array and export cables may affect marine mammal behaviour.		accommodation platform cables) to 685 km (note that 10 km of this total relates to the inter accommodation platform cables – see row below).
	Up to 10 km of single inter accommodation platform cables (maximum voltage of 70 kV);	Requirement 2(6)(b) limits the maximum length of the electrical circuits comprised in Work Nos. 1A and 1B (i.e. the inter array cables and inter accommodation platform cables) to 685 km (note that that 10 km of this total relates to the inter accommodation platform cables).
	Up to 300 km of platform inter-connector cables (maximum voltage of 400 kV; HVDC transmission); and	Requirement 2(6)(c) limits the maximum length of the electrical circuits comprised in Work Nos. 2A and 2B (i.e. the inter connector cables) to 300 km.
	Up to 600 km of HVDC export cable (maximum voltage of ±600 kV) and up to 1,200 km of HVAC export cables (maximum voltage of 400 kV).	Requirement 2(6)(d) limits the maximum length of the electrical circuits comprised in Work Nos. 4A, 4B, 5A and 5B (i.e. the export cable) to 1,200 km.
	The maximum adverse scenario is that inter-array cables, inter-accommodation cables, export cables and platform inter-connector cables will either be buried to a target minimum burial depth of 1 m or by cable protection subject to cable burial assessment.	Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement which will include details of cable installation to be submitted to and approved in writing by the MMO prior to commencement of the works. Condition 10(2)(f) of the Draft DMLs requires a Cable specification and installation plan to be submitted to and agreed in writing by the MMO prior to commencement of any works.

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
13. Accidental pollution events during the operation and maintenance phase resulting in potential effects on marine mammal receptors.	**Synthetic compound, heavy metal and hydrocarbon contamination resulting from operation of:**	
	Up to 360 (5 MW) turbines (also includes six offshore HVAC collector substations, two offshore HVDC converter substations and two accommodation platforms);	Schedule A Part 1 paragraph 3 limits the maximum number turbines that can be constructed to 360. Schedule A Part 1 paragraph 2 of the draft DCO limits the maximum capacity of the Project to 1,800 MW. The maximum number of turbines that can be installed is therefore also limited by the maximum total capacity of the Project and therefore no more than 360 5 MW turbines can be installed since 360 x 5 MW = 1,800 MW. Schedule A Part 1 paragraph 6 limits the maximum number of offshore HVAC collector substations and offshore HVDC converter substations that can be constructed to six and two respectively. Schedule A Part 1 paragraph 4 limits the maximum number of offshore accommodation platforms to two.
	Offshore refuelling for crew vessels and helicopters and up to 2,817 vessel movements during operation and maintenance (including from supply/crew vessels and jack-up vessels) per year over the design life of the project (i.e., 25 years);	Condition 10(2)(c) of the draft DMLs requires a project environmental management and monitoring plan to be submitted to the MMO for approval and to include details of— (i) a marine pollution contingency plan to address the risks, methods and procedures to deal with any spills and collision incidents during construction and operation of the authorised scheme in relation to all activities carried out seaward of MHWS. The plan must include a mechanism for reporting oil, fuel and chemical spills to the MMO Marine Pollution Response Team; and (ii) a chemical risk analysis which is to include information regarding how and when chemicals are to be used, stored and transported in accordance with recognised best practice guidance. Condition 8(3) of the DMLs requires that the storage, handling, transport and use of fuels, lubricants, chemicals and other substances be

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
		undertaken so as to prevent releases into the marine environment including bunding of 110% of the total volume of all reservoirs and containers.

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
	A typical 15 MW turbine is likely to contain approximately 375 l of grease, 20,000 l of hydraulic oil and 3,750 l of gear oil, 79,500 l of nitrogen and 5,625 kg of transformer silicon/ester oil;	Condition 10(2)(c) of the draft DMLs requires a project environmental management and monitoring plan to be submitted to the MMO for approval and to include details of— (i) a marine pollution contingency plan to address the risks, methods and procedures to deal with any spills and collision incidents during construction and operation of the authorised scheme in relation to all activities carried out seaward of MHWS. The plan must include a mechanism for reporting oil, fuel and chemical spills to the MMO Marine Pollution Response Team; and (ii) a chemical risk analysis which is to include information regarding how and when chemicals are to be used, stored and transported in accordance with recognised best practice guidance. Condition 8(3) of the DMLs requires that the storage, handling, transport and use of fuels, lubricants, chemicals and other substances be undertaken so as to prevent releases into the marine environment including bunding of 110% of the total volume of all reservoirs and containers.
	A typical offshore accommodation platform is likely to contain approximately 400-10,000 l of coolant, 400-10,000 l of hydraulic oil and 1,000-3,500 kg of lubricates;	Condition 10(2)c of the draft DMLs requires a project environmental management and monitoring plan to be submitted to the MMO for approval and to include details of— (i) a marine pollution contingency plan to address the risks, methods and procedures to deal with any spills and collision incidents during construction and operation of the authorised scheme in relation to all activities carried out seaward of MHWS. The plan must include a mechanism for reporting oil, fuel and chemical spills to the MMO Marine Pollution Response Team; and (ii) a chemical risk analysis which is to include information regarding how and when chemicals are to be used, stored and transported in

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
		accordance with recognised best practice guidance. Condition 8(3) of the DMLs requires that the storage, handling, transport and use of fuels, lubricants, chemicals and other substances be undertaken so as to prevent releases into the marine environment including bunding of 110% of the total volume of all reservoirs and containers.

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
	Four offshore fuel storage tanks: o One on each of the two accommodation platforms for helicopter fuel, each with a capacity of 12,000 l; and o One on each of the two accommodation platforms for crew transfer vessel fuel, each with a capacity of 210,000 l.	Condition 10(2)(c) of the draft DMLs require a project environmental management and monitoring plan to be submitted to the MMO for approval and to include details of— (i) a marine pollution contingency plan to address the risks, methods and procedures to deal with any spills and collision incidents during construction and operation of the authorised scheme in relation to all activities carried out seaward of MHWS. The plan must include a mechanism for reporting oil, fuel and chemical spills to the MMO Marine Pollution Response Team; and (ii) a chemical risk analysis which is to include information regarding how and when chemicals are to be used, stored and transported in accordance with recognised best practice guidance. Condition 8(3) of the DMLs requires that the storage, handling, transport and use of fuels, lubricants, chemicals and other substances be undertaken so as to prevent releases into the marine environment including bunding of 110% of the total volume of all reservoirs and containers.
	Potential leachate from zinc or aluminium anodes used to provide cathodic protection to the turbines.	Condition 10(2)(c) of the draft DMLs requires a project environmental management and monitoring plan to be submitted to the MMO for approval and to include details of— (i) a marine pollution contingency plan to address the risks, methods and procedures to deal with any spills and collision incidents during construction and operation of the authorised scheme in relation to all activities carried out seaward of MHWS. The plan must include a mechanism for reporting oil, fuel and chemical spills to the MMO Marine Pollution Response Team; and (ii) a chemical risk analysis which is to include information regarding how and when chemicals are to be used, stored and transported in

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
		accordance with recognised best practice guidance. Condition 8(2) of the DMLs requires the undertaker to ensure that any coatings or treatments are suitable for use in the marine environment and are used in accordance with guidelines approved by Health and Safety Executive or the Environment Agency Pollution Prevention Guidelines.
14. Changes in the fish and shellfish community resulting from operational impacts may lead to a loss in prey resources for marine mammals.	**Changes in fish and shellfish community due to:**	
	Long term loss of 5,446,510 m^2 of benthic habitat and introduction of new substrate (gravity base foundations): - Up to 7,543 m^2 per gravity base foundation (based on 15 MW WTGs) and a maximum loss across the Project Two array of 2,042,821 m^2 associated with 360 5 MW turbines; - Up to 76,341 m^2 from jacket (suction piles) foundations for six offshore HVAC collector substations; - Up to 12,724 m^2 from jacket (suction piles) foundations for two accommodation platforms; - Up to 12,724 m^2 from jacket (suction piles) foundations for two offshore HVAC reactive compensation substations;	Schedule A Part 1 paragraph 2 of the draft DCO limits the maximum capacity of the Project to 1,800 MW. The maximum number of turbines that can be installed is limited by the maximum total capacity of the Project and therefore no more than 360 5 MW turbines can be installed since 360 x 5 MW = 1,800 MW. Schedule A Part 1 paragraph 3 limits the maximum number turbines that can be constructed to 360 whilst Requirement 5(3)(d) of the draft DCO details the parameters that must be applied in the event that gravity base foundations are utilised for WTGs and limits the area occupied by the foundations and the scour protection for each individual to 7,543 m^2. Schedule A Part 1 paragraph 6 limits the maximum number of offshore HVAC collector substations to six and Requirement 5(5)(c) of the draft DCO details the parameters that must be applied in the event that jacket foundations (suction piles) are utilised for offshore HVAC collector substations and limits the area occupied by the foundations and the scour protection for each individual to 12,723 m^2. Schedule A Part 1 paragraph 4 limits the maximum number of offshore accommodation platforms to two and Requirement 5(4)(c) the draft DCO details the parameters that must be applied in the event that jacket foundations (suction piles) are utilised for offshore accommodation platforms and limits the area occupied by the foundations and the scour protection for each individual to 6,362 m^2.

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
	- 1,228,500 m^2 based on the installation of cable protection for 26% of the total 675 km of inter-array cables (i.e., 175.5 km and 7 m wide cable corridor); - 18,200 m^2 based on the installation of cable protection for 26% of the total 10 km of accommodation platform power cables (i.e., 2.6 km and 7 m wide cable corridor); - 2,005,200 m^2 based on the installation of cable protection for 25% of the total 1,174.4 km of export cable (i.e., 293.6 km excluding a total of 25.6 km in Humber Estuary SAC). Assumes eight cables affecting 7m width per cable.	Schedule A Part 1 paragraph 7 limits the maximum number of offshore HVAC reactive compensation substations to two and Requirement 5 Requirement 5(7)(c) of the draft DCO details the parameters that must be applied in the event that jacket foundations (suction piles) are utilised for offshore HVAC reactive compensation substations and limits the area occupied by the foundations and the scour protection for each individual to 6,362 m^2. Requirement 2(6) controls the maximum parameters in relation to the offshore electrical circuits.
	Underwater noise from operation of up to 360 5 MW turbines over the design life of the project (i.e., 25 years);	Schedule A Part 1 paragraph 3 limits the maximum number turbines that can be constructed to 360. Schedule A Part 1 paragraph 2 of the draft DCO limits the maximum capacity of the Project to 1,800 MW. The maximum number of turbines that can be installed is therefore further limited by the maximum total capacity of the Project and therefore no more than 360 5 MW turbines can be installed since 360 x 5 MW = 1,800 MW.
	Maximum EMF as described above	Requirement 2(6)(b) limits the maximum length of the electrical circuits

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
	for Potential Impact 12.	comprised in Work Nos. 1A and 1B (i.e. the inter array cables and inter accommodation platform cables) to 685 km. Requirement 2(6)(c) limits the maximum length of the electrical circuits comprised in Work Nos. 2A and 2B (i.e. the inter connector cables) to 300 km. Requirement 2(6)(d) limits the maximum length of the electrical circuits comprised in Work Nos. 4A, 4B, 5A and 5B (i.e. the export cable) to 1,200 km. Condition 10(2)(b) of the draft DMLs requires a Construction Method Statement in accordance with the project description and Environmental Statement which will include details of cable installation to be submitted to and approved in writing by the MMO prior to commencement of the works. Condition 10(2)(f) of the Draft DMLs requires a Cable specification and installation plan to be submitted to and agreed in writing by the MMO prior to commencement of any works.
	Reduced fishing pressure within Subzone 2 over the design life of the project (i.e., 25 years): - Up to 360 turbines with gravity base foundations, six offshore HVAC collector substations, two offshore HVDC converter stations and two accommodation platforms with infrastructure placed within Subzone 2 with closest foundation spacing of 810 m at	Schedule A Part 1 paragraph 3 limits the maximum number of turbines that can be constructed to 360. Schedule A Part 1 paragraph 6 limits the maximum number of offshore HVAC collector substations to six. Schedule A Part 1 paragraph 4 limits the maximum number of offshore accommodation platforms to two. Schedule A Part 1 paragraph 6 limits the maximum number of offshore HVDC converter substations to two. Schedule A Part 1 paragraph 7 limits the maximum number of offshore reactive compensation substations to two. Requirement 2(1)(e) restricts the minimum distance between turbines to

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
	the perimeter; - Operational safety zones of 500 m around offshore platforms, 500 m safety zone during major maintenance activities; and - No safety zones around turbines.	810 m.
	Accidental pollution events.	Condition 10(2)(c) of the draft DMLs requires a project environmental management and monitoring plan to be submitted to the MMO for approval and to include details of— (i) a marine pollution contingency plan to address the risks, methods and procedures to deal with any spills and collision incidents during construction and operation of the authorised scheme in relation to all activities carried out seaward of MHWS. The plan must include a mechanism for reporting oil, fuel and chemical spills to the MMO Marine Pollution Response Team; and (ii) a chemical risk analysis which is to include information regarding how and when chemicals are to be used, stored and transported in accordance with recognised best practice guidance. Condition 8(3) of the DMLs requires that the storage, handling, transport and use of fuels, lubricants, chemicals and other substances be undertaken so as to prevent releases into the marine environment including bunding of 110% of the total volume of all reservoirs and containers.

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
Decommissioning phase		
15. Underwater noise from turbine and cable removal may cause disturbance to marine mammals.	**Underwater noise associated with decommissioning of:**	
	360 5 MW turbines, six offshore HVAC collector substations, two offshore HVDC converter substations and two accommodation platforms);	Schedule A Part 1 paragraph 2 of the draft DCO limits the maximum capacity of the Project to 1,800 MW. The maximum number of turbines that can be installed is limited by the maximum total capacity of the Project and therefore no more than 360 5 MW turbines can be installed since 360 x 5 MW = 1,800 MW. Schedule A Part 1 paragraph 3 limits the maximum number turbines to 360. Schedule A Part 1 paragraph 6 limits the maximum number of offshore HVAC collector substations and offshore HVDC converter substations to six and two respectively. Schedule A Part 1 paragraph 4 limits the maximum number of offshore accommodation platforms to two. Condition 19 of the Draft DML states that no decommissioning activities shall commence until plans for the carrying out of such activities have been submitted to and approved in writing by the MMO. The plans shall be submitted for approval at least four months prior to the intended start of construction, except where otherwise stated or unless otherwise agreed in writing by the MMO.
	1,200 km of subtidal export cable (HVAC transmission, i.e., 150 km eight cables), 675 km of inter-array and 10 km of platform accommodation cables.	Requirement 2(6)(b) limits the maximum length of the electrical circuits comprised in Work Nos. 1A and 1B (i.e. the inter array cables and inter accommodation platform cables) to 685 km (note that 10 km of this total relates to the inter accommodation platform cables). Requirement 2(6)(d) limits the maximum length of the electrical circuits comprised in Work Nos. 4A, 4B, 5A and 5B (i.e. the export cable) to 1,200 km.

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
		Condition 19 of the Draft DML states that no decommissioning activities shall commence until plans for the carrying out of such activities have been submitted to and approved in writing by the MMO. The plans shall be submitted for approval at least four months prior to the intended start of construction, except where otherwise stated or unless otherwise agreed in writing by the MMO.
16. Increased vessel traffic may result in an increased noise disturbance to marine mammals or increased collision risk.	Noise and disturbance and increase in collision risk due to a maximum of 739 vessel movements in total over the decommissioning phase. Range of vessel types as described for construction phase (total number of vessels is 28 per phase of which 50% could have ducted propellers, as per the construction phase).	Condition 19 of the Draft DML states; No decommissioning activities shall commence until plans for the carrying out of such activities have been submitted to and approved in writing by the MMO. The plans shall be submitted for approval at least four months prior to the intended start of construction, except where otherwise stated or unless otherwise agreed in writing by the MMO.
17. Increased suspended sediments may impair the foraging ability of marine mammals.	**Increases of suspended sediment concentrations associated with:**	
	Removal of up to 360 5 MW turbines, six offshore HVAC collector substations, two offshore HVDC converter substations and two accommodation platforms);	Schedule A Part 1 paragraph 2 of the draft DCO limits the maximum capacity of the Project to 1,800 MW. The maximum number of turbines that can be installed is limited by the maximum total capacity of the Project and therefore no more than 360 5 MW turbines can be installed since 360 x 5 MW = 1,800 MW. Schedule A Part 1 paragraph 3 limits the maximum number turbines to 360. Schedule A Part 1 paragraph 6 limits the maximum number of offshore HVAC collector substations and offshore HVDC converter substations to six and two respectively. Schedule A Part 1 paragraph 4 limits the maximum number of offshore

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
		accommodation platforms to two. Condition 19 of the Draft DML states that no decommissioning activities shall commence until plans for the carrying out of such activities have been submitted to and approved in writing by the MMO. The plans shall be submitted for approval at least four months prior to the intended start of construction, except where otherwise stated or unless otherwise agreed in writing by the MMO.
	Removal of 1,200 km of subtidal export cable (HVAC transmission, i.e., 150 km eight cables), 675 km of inter-array and 10 km of platform accommodation cables.	Requirement 2(6)(b) limits the maximum length of the electrical circuits comprised in Work Nos. 1A and 1B (i.e. the inter array cables and inter accommodation platform cables) to 685 km (note that 10 km of this total relates to the inter accommodation platform cables). Requirement 2(6)(d) limits the maximum length of the electrical circuits comprised in Work Nos. 4A, 4B, 5A and 5B (i.e. the export cable) to 1,200 km. Condition 19 of the Draft DML states that no decommissioning activities shall commence until plans for the carrying out of such activities have been submitted to and approved in writing by the MMO. The plans shall be submitted for approval at least four months prior to the intended start of construction, except where otherwise stated or unless otherwise agreed in writing by the MMO.
18. Accidental pollution events during the decommissioning phase resulting in potential effects on marine	**Decommissioning of up to 360 5 MW turbines and 1,200 km of subtidal export cable (HVAC transmission i.e., 150 km eight cables), 675 km of inter-array and 10 km of platform accommodation cables:**	
	Range of vessels which carry synthetic compound, heavy metal and hydrocarbons;	Condition 19 of the Draft DML states that no decommissioning activities shall commence until plans for the carrying out of such activities have been submitted to and approved in writing by the MMO. The plans shall be submitted for approval at least four months prior to the intended start of construction, except where otherwise stated or unless otherwise

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
mammals.		agreed in writing by the MMO. Condition 8(3) of the DMLs requires that the storage, handling, transport and use of fuels, lubricants, chemicals and other substances be undertaken so as to prevent releases into the marine environment including bunding of 110% of the total volume of all reservoirs and containers.
	Potential for contamination resulting from machinery use and vessel movement; and	Condition 8(3) of the DMLs requires that the storage, handling, transport and use of fuels, lubricants, chemicals and other substances shall be undertaken so as to prevent releases into the marine environment including bunding of 110 per cent of the total volume of all reservoirs and containers. Condition 19 of the Draft DML states that no decommissioning activities shall commence until plans for the carrying out of such activities have been submitted to and approved in writing by the MMO. The plans shall be submitted for approval at least four months prior to the intended start of construction, except where otherwise stated or unless otherwise agreed in writing by the MMO.
	Maximum of 2,956 vessel movements in total over the decommissioning period.	Condition 19 of the Draft DML states that no decommissioning activities shall commence until plans for the carrying out of such activities have been submitted to and approved in writing by the MMO. The plans shall be submitted for approval at least four months prior to the intended start of construction, except where otherwise stated or unless otherwise agreed in writing by the MMO.
19. Changes in the fish and shellfish community resulting from	Changes in the fish and shellfish community associated with all decommissioning activities including temporary habitat loss, underwater noise, suspended sediments,	Condition 19 of the Draft DML states that no decommissioning activities shall commence until plans for the carrying out of such activities have been submitted to and approved in writing by the MMO. The plans shall be submitted for approval at least four months prior to the intended start of construction, except where otherwise stated or unless otherwise

Potential impact	Maximum adverse scenario (marine mammals)	Where/How addressed in DCO
decommissioning impacts may lead to a loss in prey resources for marine mammals.	sediment deposition and contamination: - Subtidal temporary habitat loss of 20,248,098 m^2 (as per parameters outlined for Potential Impact 7 but excluding seabed preparation and sandwave clearance); - Increased suspended sediments and deposition (as per parameters outlined for Potential Impact 17); and - Noise associated with removal of up to 360 foundations and 1,885 km of inter-array and export cables.	agreed in writing by the MMO. Schedule A Part 1 paragraph 3 limits the maximum number turbines to 360. Requirement 2(6)(b) limits the maximum length of the electrical circuits comprised in Work Nos. 1A and 1B (i.e. the inter array cables and inter accommodation platform cables) to 685 km (note that 10 km of this total relates to the inter accommodation platform cables). Requirement 2(6)(d) limits the maximum length of the electrical circuits comprised in Work Nos. 4A, 4B, 5A and 5B (i.e. the export cable) to 1,200 km.

Table 1.2(a) Design Envelope Parameters used within the assessment of potential impacts where commonality exists between marine mammal impacts and other ES impacts. Potential Impact: Construction phase: underwater noise from Foundation Pilling.

Topic	Marine Mammals	Fish and Shellfish
Impact	Underwater noise from foundation piling and other construction activities (e.g., drilling of piles) has the potential to cause physical injury or disturbance to marine mammals.	Underwater noise as a result of foundation installation (i.e., piling) and other construction activities (e.g., cable installation) resulting in potential effects on fish and shellfish receptors.
Maximum adverse scenario	**Maximum adverse spatial: Monopile foundations** (HVDC transmission): - Piling of 225 x 8 MW turbines, comprising 10 m diameter monopiles foundations with a maximum pile energy per strike of 3,000 kJ; and - Piling of substations and platforms with a maximum pile energy per strike of 2,300 kJ comprising: o Six offshore HVAC collector substations (eight 3.5 m diameter piles per foundation) = 48 piles; o Two offshore accommodation platforms (eight 3 m diameter piles per foundation) = 16 piles; and o Two offshore HVDC converter substations (four jacket foundations with 18 3.5 m piles per foundation) = 144 piles. Total number of piles for monopile foundations = 225 piles. Piling duration for monopiles ranges between 2.5 to 15.5 hours per foundation, but depending on the soil profile, an interval of up to 55 hours of drilling may also	**Maximum adverse spatial: Monopile turbine foundations with substation jacket foundations** (HVDC transmission): - Piling of 225 x 8 MW turbine foundations, comprising 10 m diameter monopile foundations and with a maximum pile energy per strike of 3,000 kJ; and - Piling of jacket foundations for substations and platforms with a maximum pile energy per strike of 2,300 kJ comprising: o Six HVAC collector substations (eight 3.5 m diameter piles per foundation) = 48 piles; o Two accommodation platforms (eight 3 m diameter piles per foundation) = 16 piles; and o Two HVDC converter substations (four jacket foundations with 18 3.5 m piles per foundation) = 144 piles. Total number of piles for monopile foundations = 225 piles. Total number of piles for jacket foundations = 208 piles. Total piling duration of 0.66 years and piling will occur over four phases with either one or two vessels

Topic	Marine Mammals	Fish and Shellfish
	be required. Total number of piles for substation and platform jacket foundations = 208 piles. Indicative piling duration is 11.5 hours per pile with up to 25 hours of drilling where necessary. Piling will occur over up to four phases with either one or two vessels operating at any one time. However, the worst case spatial is based on concurrent (two) vessel piling with vessels located a maximum distance of 20 km apart within Subzone 2. The actual time piling (i.e., not including drilling, downtime or handling time etc.) for installation of monopiles is estimated as 4.5 months and the estimated piling time for substations and platforms is 3.3 months. **Maximum adverse temporal: Jacket foundations** (HVDC transmission): - Piling of 120 foundations for 15 MW turbines, comprising twelve 2.2 m diameter piles per foundation and with a maximum pile energy per strike of 1,700 kJ = 1,440 piles. - Piling of substations and platforms with a maximum pile energy per strike of 2,300 kJ comprising: o Six offshore HVAC collector substations (eight 3.5 m diameter piles per foundation) = 48 piles; o Two offshore accommodation platforms (eight 3 m diameter piles per foundation) = 16 piles; and o Two offshore HVDC converter substations	operating at any one time. The worst case spatial is based on concurrent (two) vessel piling with vessels located a maximum distance of 20 km apart within Subzone 2. **Maximum adverse temporal: Jacket foundations for turbines and substations** (HVDC transmission): - Piling of 120 foundations for 15 MW turbines, comprising twelve 2.2 m diameter piles per foundation and with a maximum pile energy per strike of 1,700 kJ = 1,440 piles. - Piling of substations and platforms with a maximum pile energy per strike of 2,300 kJ comprising: o Six HVAC collector substations (eight 3.5 m diameter piles per foundation) = 48 piles; o Two accommodation platforms (eight 3 m diameter piles per foundation) = 16 piles; and o Two HVDC converter substations (four jacket foundations with 18 3.5 m piles per foundation) = 144 piles.

Topic	Marine Mammals	Fish and Shellfish
	(four jacket foundations with 18 3.5 m piles per foundation) = 144 piles. Total number of piles for jacket turbine foundations = 1,440 piles. Piling duration for 1,700 kJ jackets ranges between 1 to 6 hours per pile. Total number of piles for substations and platform jacket foundations = 208 piles. Indicative piling duration is 11.5 hours per pile with up to 25 hours of drilling where necessary. The actual time piling (i.e., not including drilling, downtime or handling time etc.) for installation of 15 MW jackets is estimated as 12.5 months and the estimated piling time for substations and platforms is 3.3 months. Total piling is therefore 15.8 months (1.32 years) and piling will occur over four phases. This estimate is based upon a single piling vessel, but the duration may be shortened if two vessels pile concurrently. **Maximum piling construction period:** The piling construction period is the total length of time over which piling will intermittently occur to complete the installation of the foundations for the WTGs, substations, platforms and HVAC substations. The maximum piling construction period is estimated as five years.	Turbine foundations: total of 1,440 piles with a maximum piling duration of 6 hours per pile for the stiffest soils. Substations/platforms foundations: total of 208 piles with a maximum piling duration of 11.5 hours per pile. Total accumulated piling duration for all foundations of 1.32 years, phased over a maximum piling construction period of five years. **Maximum piling construction period:** The piling construction period is the total length of time over which piling will intermittently occur to complete the installation of the foundations for the turbines, substations, platforms and HVAC substations. The maximum piling construction period is estimated as five years.

Table 1.2(b) Design Envelope Parameters used within the assessment of potential impacts where commonality exists between marine mammal impacts and other ES impacts. Potential Impact: Construction phase: underwater noise from foundation piling (HVAC Reactive Compensation Substation).

Topic	Marine Mammals	Fish and Shellfish
Impact	Underwater noise from foundation piling and other construction activities (e.g., drilling of piles) for the two offshore HVAC reactive compensation substations may cause physical injury or disturbance to marine mammals.	Underwater noise as a result of foundation installation (i.e., piling) and other construction activities (e.g., cable installation) resulting in potential effects on fish and shellfish receptors.
Maximum adverse scenario	Piling activity using jacket foundations as described below: - Two offshore HVAC reactive compensation substations (eight 3 m diameter piles at two locations adjacent to each other within the cable route corridor) = 16 piles. Maximum hammer energy per strike is 2,300 kJ with a maximum piling duration of 11.5 hours per pile. Total piling duration of eight days completed within a six month piling phase.	**HVAC Reactive Compensation Substations:** - Two HVAC reactive compensation substations (eight 3 m diameter piles) = 16 piles Maximum hammer energy of 2,300 kJ, with a maximum piling duration of 11.5 hours per pile. Total piling duration of eight days.

Table 1.2(c) Design Envelope Parameters used within the assessment of potential impacts where commonality exists between marine mammal impacts and other ES impacts. Potential Impact: Construction phase: vessel disturbance.

Topic	Marine Mammals	Ornithology
Impact	Increased vessel traffic during construction may result in an increase in noise disturbance to marine mammals.	The impact of construction activities such as increased vessel activity and underwater noise may result in direct disturbance or displacement from important foraging and habitat areas of birds.
Design envelope	Disturbance from vessel movements from a range of vessel types: - jack-ups, scour protection installation vessels, grout support vessels, safety boats, tugs/support vessels, heavy lift vessels, diver support vessels, cable installation vessels (cable laying, pre-cable laying and cable post-lay burial vessels); and - vessels for dredging and ploughing for sand wave clearance. Cable installation vessels (as described above) required for installation of up to 1,200 km of subtidal (offshore) export cable (HVAC transmission, i.e., eight 150 km cables), 675 km of inter-array and 10 km of platform accommodation cables via ploughing/ trenching/jetting/rock cutting//surface laying. Noise from vessel engines for vessels described above, and from thrusters used during dynamic positioning (requiring up to 42 vessels per phase, (totalling 84 vessels at any one time based on a maximum of two phases being constructed simultaneously), of which up to 50% of vessels could have ducted propellers. Maximum of 6,200 round trips to port by construction vessels over the longest construction phase duration	Maximum of 6,200 round trips to port by construction vessels over the longest construction period duration

Topic	Marine Mammals	Ornithology
	(i.e., maximum construction period duration of six years). Cable installation occurring over a period of five years in the subtidal and three and a half years in the intertidal.	(i.e., maximum of six years). Cable installation occurring over a period of five years in the subtidal and three and a half years in the intertidal. **Maximum adverse scenario: Construction vessels** Maximum of 6,200 round trips to port by construction vessels over the longest construction phase duration (i.e., maximum of 6 years).

Table 1.2(d) Design Envelope Parameters used within the assessment of potential impacts where commonality exists between marine mammal impacts and other ES impacts. Potential Impact: Construction phase: Increased suspended sediments

Topic	Marine Mammals	Benthic Subtidal and Intertidal Ecology	Fish and Shellfish
Impact	Increased suspended sediments may impair the foraging ability of marine mammals.	Temporary increases in suspended sediment concentrations and associated sediment deposition from cable and foundation installation and seabed preparation during the construction phase may affect benthic ecology.	Increased suspended sediment concentrations as a result of foundation installation, cable installation and seabed preparation resulting in potential effects on fish and shellfish receptors.
Design Envelope	Temporary increases in suspended sediments as described in Chapter 1: Marine Processes and summarised for the activities below: **Seabed preparation for gravity base foundation installation:** - 120 15 MW turbines: removal of up to 23,892 m^3 per turbine foundation and a maximum total spoil volume of 2,389,181 m^3; - Six offshore HVAC collector substations, two offshore HVDC converter stations, two accommodation platforms.: maximum spoil of 38,484 m^3 for the two accommodation platforms, 153,939 m^3 for the six offshore HVAC collector substations and 209,000 m^3 for the two offshore HVDC converter stations;	Temporary increases in suspended sediments and sediment deposition as a result of: - Seabed preparation for gravity base foundation installation of up to 120 15 MW turbines (with minimum spacing of 1,500 m), to a depth of up to 5 m over a circular area with a diameter of up to 78 m. Removal of a maximum of 23,892 m^3 per turbine foundation and maximum total spoil volume across the whole array of 2,389,181 m^3; - Seabed preparation for gravity base foundation installation of six offshore HVAC collector substations, and two accommodation platforms to a depth of up to 5 m over a circular area with a diameter of up to 70 m. Maximum spoil per platform of 19,242 m^3 and total for all substations of 153,939 m^3; - Seabed preparation for gravity base foundation installation of two offshore HVDC converter stations to	

Topic	Marine Mammals	Benthic Subtidal and Intertidal Ecology	Fish and Shellfish
		a depth of up to 5 m. Maximum spoil for two platforms of 209,000 m^3;	
	Cable installation: - Installation of 1,200 km of export cables (eight cable trenches 150 km in length) by jetting. Burial to depth of 3 m below the stable seabed and 10 m width of disturbance; and - Installation of 675 km of inter-array cables, 300 km of platform interconnector cables and 10 km of accommodation platform cables by jetting. Burial to depth of 3 m below the stable seabed and 10 m width of disturbance.	- Installation of 675 km of inter-array cables by jetting. Burial to depth of 3 m below the stable seabed and 10 m width of disturbance; and - Installation of 1,200 km of export cables (eight cable trenches 150 km in length) by jetting. Burial to depth of 3 m below the stable seabed and 10 m width of disturbance.	
	Sandwave clearance: - Sandwave clearance using trailer suction hopper dredging or mass flow excavator, for Subzone 2 cable installation, with clearance of 13,974 m^3 through the largest sandwave along the Subzone 2 cable routes, assuming sandwave clearance occurring simultaneously with two seabed preparation operations for gravity base foundations; - Sandwave clearance at the following Kilometre Point (KP) locations along the export cable route corridor: KP 52.2; KP 58.5 and KP 60; KP 61 to KP 63; KP 70 to 71.5; KP 76 to 77.5; KP 81 to KP 83.2; and KP 96 (see Figure 1.8 in Chapter 1: Marine Processes). Sandwave clearance using trailer suction hopper dredging or mass flow excavator;	- Sandwave clearance using trailer suction hopper dredging or mass flow excavator, for cable installation within Subzone 2, with clearance of 13,974 m^3 through the largest sandwave, assuming sandwave clearance occurring simultaneously with two seabed preparation operations for gravity base foundations; - Sandwave clearance at the following Kilometre Point (KP) locations along the cable route corridor: KP 52.2; KP 58.5 and KP 60; KP 61 to KP 63; KP 70 to 71.5; KP 76 to 77.5; KP 81 to KP 83.2; and KP 96 (see Figure 1.12 in Chapter 1: Marine Processes). Sandwave clearance using trailer suction hopper dredging or mass flow excavator;	

Table 1.2(e) Design Envelope Parameters used within the assessment of potential impacts where commonality exists between marine mammal impacts and other ES impacts. Potential Impact: Construction phase: Accidental pollution

Topic	Marine Mammals	Benthic Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Ornithology
Impact	Accidental pollution events during the construction phase resulting in potential effects on marine mammal receptors.	Accidental release of pollutants (e.g., from accidental spillage/leakage) may affect benthic ecology.	Accidental pollution events during the construction phase resulting in potential effects on fish and shellfish receptors.	The impact of pollution including accidental spills and contaminant releases which may affect species' survival rates or foraging activity.
Design Envelope	Synthetic compound, heavy metal and hydrocarbon contamination resulting from: - Construction of up to 360 (5 MW) turbines (also includes six offshore HVAC collector substations, two offshore HVDC converter substations and two accommodation platforms); - Offshore refuelling for up to a maximum of 6,200 vessel movements over the construction phase; - Water-based drilling muds associated with drilling to install foundations, should this be required; - A typical 15 MW turbine is likely to contain approximately 375 l of grease, 20,000 l of hydraulic oil and 3,750 l of gear oil, 79,500 l of nitrogen and 5,625 kg of transformer silicon/ester oil;	Synthetic compound, heavy metal and hydrocarbon contamination resulting from offshore infrastructure installation and a maximum of 6,200 round trips to port by construction vessels over the construction period. Water-based drilling muds associated with drilling to install foundations, should this be required.		

Topic	Marine Mammals	Benthic Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Ornithology

	- A typical offshore accommodation platform is likely to contain approximately 400-10,000 l of coolant, 400-10,000 l of hydraulic oil and 1,000-3,500 kg of lubricates;
	- Four offshore fuel storage tanks:
	  ○ One on each of the two accommodation platforms for helicopter fuel, each with a capacity of 12,000 l; and
	  ○ One on each of the two accommodation platforms for crew transfer vessel fuel, each with a capacity of 210,000 l.
		Four offshore fuel storage tanks:
		- One on each of the two accommodation platforms for helicopter fuel and each with a capacity of 12,000 l; and
		- One on each of the two accommodation platforms for crew transfer vessel fuel and each with a capacity of 210,000 l.		

Table 1.2(f) Design Envelope Parameters used within the assessment of potential impacts where commonality exists between marine mammal impacts and other ES impacts. Potential Impact: Operation phase: underwater noise

Topic	Marine Mammals	Fish and Shellfish Ecology
Impact	The operating noise of turbines may result in potential effects on marine mammals.	Underwater noise as a result of operational turbines and maintenance vessel traffic resulting in potential effects on fish and shellfish receptors.
Design Envelope	Underwater noise vibration generated by operation of up to 360 5 MW turbines over the design life of the project (i.e., 25 years).	Underwater noise during the operational phase from up to 360 turbines and maintenance vessel operations over the design lifetime of the project (i.e., 25 years).

Table 1.2(g) Design Envelope Parameters used within the assessment of potential impacts where commonality exists between marine mammal impacts and other ES impacts. Potential Impact: Operation phase: disturbance from vessel traffic

Topic	Marine Mammals	Ornithology
Impact	Increased vessel traffic may result in an increase in noise disturbance to marine mammals.	The impact of disturbance as a result of activities associated with maintenance of operational turbines, cables and other infrastructure may result in disturbance or displacement of bird species.
Design Envelope	Noise and disturbance from 2,817 vessel movements during operation and maintenance (including from supply/crew vessels and jack-up vessels) per year the design life of the project (i.e., 25 years).	Up to 2,817 vessel return trips per year during operation and maintenance (including from supply/crew vessels (2,743 return trips) and jack-up vessels (74 return trips) per year over the design life of the project (i.e., 25 years).

Table 1.2(h) Design Envelope Parameters used within the assessment of potential impacts where commonality exists between marine mammal impacts and other ES impacts. Potential Impact: Operation phase: EMF

Topic	Marine Mammals	Fish and Shellfish Ecology
Impact	Electromagnetic fields (EMF) emitted by inter-array and export cables may affect marine mammal behaviour.	Electromagnetic fields (EMF) emitted by inter-array and export cables during the operational phase causing behavioural responses in fish and shellfish receptors.
Design Envelope	Maximum EMF resulting from: - Up to 675 km of single AC inter-array (maximum voltage of 70 kV); - Up to 10 km of single inter accommodation platform cables (maximum voltage of 70 kV); - Up to 300 km of platform inter-connector cables (maximum voltage of 400 kV; HVDC transmission); and - Up to 600 km of HVDC export cable (maximum voltage of ±600 kV) and up to 1,200 km of HVAC export cables (maximum voltage of 400 kV). The maximum adverse scenario is that inter-array cables, inter-accommodation cables, export cables and platform inter-connector cables will either be buried to a target minimum burial depth of 1 m or by cable protection subject to cable burial assessment.	Maximum EMF resulting from: - Up to 675 km of single AC inter-array (maximum voltage of 70 kV); - Up to 10 km of single inter accommodation platform cables (maximum voltage of 70 kV); - Up to 300 km of platform inter-connector cables (maximum voltage of 400 kV; HVDC transmission); and - Up to 600 km of HVDC export cable (maximum voltage of ±600 kV) and up to 1,200 km of HVAC export cables (maximum voltage of 400 kV). The maximum adverse scenario is that inter-array cables, inter-accommodation cables, export cables and platform inter-connector cables will either be buried to a target minimum burial depth of 1 m or by cable protection subject to cable burial assessment.

Table 1.2(i) Design Envelope Parameters used within the assessment of potential impacts where commonality exists between marine mammal impacts and other ES impacts. Potential Impact: Operation phase: Accidental pollution

Topic	Marine Mammals	Benthic Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Ornithology
Impact	Accidental pollution events during the operation and maintenance phase resulting in potential effects on marine mammal receptors.	Accidental release of pollutants (e.g., from accidental spillage/leakage) may affect benthic ecology.	Accidental pollution events during the operation and maintenance phase resulting in potential effects on fish and shellfish receptors.	The impact of pollution including accidental spills and contaminant releases associated with maintenance or supply/service vessels which may affect species' survival rates or foraging activity.
Design Envelope	Synthetic compound, heavy metal and hydrocarbon contamination resulting from operation of: - Up to 360 (5 MW) turbines (also includes six offshore HVAC collector substations, two offshore HVDC converter substations and two accommodation platforms); - Offshore refuelling for crew vessels and helicopters and up to 2,817 vessel movements during operation and maintenance (including from supply/crew vessels and jack-up vessels) per year over the design life of the project (i.e., 25 years); - A typical 15 MW turbine is likely to contain approximately 375 l of grease, 20,000 l of	Synthetic compounds, heavy metal and hydrocarbon contamination resulting from up to 360 turbines, six offshore HVAC collector substations, up to two offshore HVDC converter, up to two HVAC reactive compensation substations and two accommodation platforms. Accidental pollution may also result from offshore refuelling for crew vessels and helicopters and up to 3,183 round trips to port by operational and maintenance vessels (including supply/crew vessels and jack-up vessels) per year over the design life. A typical 15 MW turbine is likely to contain approximately 375 l of grease, 20,000 l of hydraulic oil and 3,750 l of gear oil, 79,500 l of nitrogen and 5,625 kg of transformer		Synthetic compound, heavy metal and hydrocarbon contamination resulting from operation of: - Up to 120 (15 MW) turbines: ○ 375 l of grease; ○ 20,000 l of hydraulic oil; ○ 3,750 l of gear oil; ○ 79,500 l of liquid nitrogen; and ○ 5,625 kg of transformer silicon/ester oil.

Topic	Marine Mammals	Benthic Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Ornithology
	hydraulic oil and 3,750 l of gear oil, 79,500 l of nitrogen and 5,625 kg of transformer silicon/ester oil; - A typical offshore accommodation platform is likely to contain approximately 400-10,000 l of coolant, 400-10,000 l of hydraulic oil and 1,000-3,500 kg of lubricates; - Four offshore fuel storage tanks: ○ One on each of the two accommodation platforms for helicopter fuel, each with a capacity of 12,000 l; and ○ One on each of the two accommodation platforms for crew transfer vessel fuel, each with a capacity of 210,000 l. ○ Potential leachate from zinc or aluminium anodes used to provide cathodic protection to the turbines.	silicon/ester oil. A typical offshore accommodation platform is likely to contain approximately 400-10,000 l of coolant, 400-10,000 l of hydraulic oil and 1,000-3,500 kg of lubricates. Four offshore fuel storage tanks: - One on each of the two accommodation platforms for helicopter fuel, each with a capacity of 12,000 l; and - One on each of the two accommodation platforms for crew transfer vessel fuel, each with a capacity of 210,000 l. - Potential leachate from zinc or aluminium anodes used to provide cathodic protection to the turbines. Potential contamination in the intertidal resulting from machinery use and vehicle movement.		- Four offshore fuel storage tanks: ○ One on each of the two accommodation platforms for helicopter fuel, each with a capacity of 12,000 L; and ○ One on each of the two accommodation platforms for crew transfer vessel fuel, each with a capacity of 210,000 L. ○ Potential leachate from zinc or aluminium anodes used to provide cathodic protection to the turbines.

Table 1.2(j) Design Envelope Parameters used within the assessment of potential impacts where commonality exists between marine mammal impacts and other ES impacts. Potential Impact: Decommissioning phase: underwater noise

Topic	Marine Mammals	Fish and Shellfish Ecology
Impact	Underwater noise from turbine and cable removal may cause disturbance to marine mammals.	Decommissioning activities producing subsea noise resulting in potential effect on fish and shellfish receptors.
Design Envelope	Underwater noise associated with decommissioning of: - 360 5 MW turbines, six offshore HVAC collector substations, two offshore HVDC converter substations and two accommodation platforms); and - 1,200 km of subtidal export cable (HVAC transmission, i.e., 150 km eight cables), 675 km of inter-array and 10 km of platform accommodation cables.	Underwater noise associated with decommissioning of up to 370 foundations and 1,885 km of inter-array and export cables.

Table 1.2(k) Design Envelope Parameters used within the assessment of potential impacts where commonality exists between marine mammal impacts and other ES impacts. Potential Impact: Decommissioning phase: disturbance from vessel traffic

Topic	Marine Mammals	Ornithology
Impact	Increased vessel traffic may result in an increased noise disturbance to marine mammals or increased collision risk.	The impact of disturbance and displacement due to underwater noise and vessel traffic may stop birds from accessing important foraging and habitat areas.
Design Envelope	Noise and disturbance and increase in collision risk due to a maximum of 739 vessel movements in total over the decommissioning phase. Range of vessel types as described for construction phase (total number of vessels is 28 per phase of which 50% could have ducted propellers, as per the construction phase).	Up to 739 return vessel trips over the decommissioning phase (up to 28 vessels per phase, equating to 112 vessels across the four phases of decommissioning).

Table 1.2(l) Design Envelope Parameters used within the assessment of potential impacts where commonality exists between marine mammal impacts and other ES impacts. Potential Impact: Decommissioning phase: Increased suspended sediments

Topic	Marine Mammals	Benthic Subtidal and Intertidal Ecology	Fish and Shellfish Ecology
Impact	Increased suspended sediments may impair the foraging ability of marine mammals.	Temporary increases in suspended sediment concentrations and deposition from removal of inter-array cables, export cables and foundations resulting in potential effects on benthic ecology.	Temporary increases in suspended sediment concentrations from removal of inter-array and platform inter-connector cables, export cables and turbine foundations resulting in potential effects on fish and shellfish receptors.
Design Envelope	Increases of suspended sediment concentrations associated with: - Removal of up to 360 5 MW turbines, six offshore HVAC collector substations, two offshore HVDC converter substations and two accommodation platforms); and - Removal of 1,200 km of subtidal export cable (HVAC transmission, i.e., 150 km eight cables), 675 km of inter-array and 10 km of platform accommodation cables.	Increases of suspended sediment concentrations associated with the removal of up to 370 foundations (i.e., 360 turbines, six offshore HVAC collector substations, two offshore HVAC reactive compensation substations and two accommodation platforms) and 1,885 km of inter-array (including accommodation platform power cables) and export cables.	

Table 1.2(m) Design Envelope Parameters used within the assessment of potential impacts where commonality exists between marine mammal impacts and other ES impacts. Potential Impact: Decommissioning phase: Accidental pollution

Topic	Marine Mammals	Benthic Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Ornithology
Impact	Accidental pollution events during the decommissioning phase resulting in potential effects on marine mammals.	Accidental release of pollutants (e.g., from accidental spillage/leakage) may affect benthic ecology.	Accidental pollution events during the decommissioning phase resulting in potential effects on fish and shellfish receptors.	The impact of pollution including accidental spills and contaminant releases associated with removal of infrastructure and supply/service vessels may lead to direct mortality of birds or a reduction in foraging capacity.
Design Envelope	Decommissioning of up to 360 5 MW turbines and 1,200 km of subtidal export cable (HVAC transmission i.e., 150 km eight cables), 675 km of inter-array and 10 km of platform accommodation cables: - Range of vessels which carry synthetic compound, heavy metal and hydrocarbons; - Potential for contamination resulting from machinery use and vessel movement; and - Maximum of 739 vessel	Synthetic compound, heavy metal and hydrocarbon contamination resulting from a maximum of 360 turbines and a maximum of 2,956 round trips to port by decommissioning vessels over the decommissioning period.		Decommissioning of: Up to 360 5 MW turbines, six offshore HVAC collector substations, two offshore HVDC converter stations and two offshore accommodation platforms placed up to the edge of Subzone 2 (HVDC transmission); - Up to 1,200 km of export cable, 675 km inter-array cables and 10 km of accommodation cables (HVAC transmission); and - Up to 739 return vessel trips over the decommissioning phase (up to 28 vessels per phase, equating to 112 vessels across the four phases of decommissioning).

Topic	Marine Mammals	Benthic Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Ornithology
	movements in total over the decommissioning period.			Potential for accidental pollution events from: - Range of vessels which carry synthetic compound, heavy metal and hydrocarbons; and - Potential for contamination resulting from machinery use and vessel movement.