East Anglia THREE

DCO Non-Material Change No.3

Supporting Statement

Prepared by:	Checked by:	Approved by:
GoBe Consultants Ltd *18/08/2021*	Philip Rew-Williamson Digitally signed by: Philip Rew-Williamson DN: CN = Philip Rew-Williamson email = prew-williamson@scottishpower.com C = GB O = East Anglia THREE OU = Consents Date: 2021.08.18 16:54:07 Z	Catherine Sibley Digitally signed by Catherine Sibley Date: 2021.08.18 17:04:05 +01'00'

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Rev	**Page**	**Section**	**Description**
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ABBREVIATIONS AND DEFINITIONS

Acronym	Definition
2011 Regulations	Infrastructure Planning (Changes to, and Revocation of, Development Consent Orders) Regulations 2011
2019 Amendment Order	East Anglia THREE Offshore Wind Farm (Amendment) Order 2019
2021 Amendment Order	East Anglia THREE Offshore Wind Farm (Amendment) Order 2021
AMSL	Above Mean Sea Level
BEIS	Department for Business, Energy and Industrial Strategy
CfD	Contract for Difference
CRM	Collision Risk Modelling
DCLG	Department for Communities and Local Government
DCO	Development Consent Order
DML	Deemed Marine Licence
EA THREE	East Anglia THREE Offshore Wind Farm
EATL	East Anglia THREE Limited
EIA	Environmental Impact Assessment
ES	Environmental Statement
GW	Gigawatt
HRA	Habitats Regulations Assessment
LAT	Lowest Astronomical Tide
LSE	Likely Significant Effect
LoS	Line of Sight
MHWS	Mean High Water Spring
MMO	Marine Management Organisation
MOD	Ministry of Defence
MSL	Mean Sea Level
MW	Megawatt
NATs	National Air Traffic Services
NMC	Non-Material Change
NRA	Navigational Risk Assessment

kJ	KiloJoule
OSSs	Offshore Substations
PD	Probability Detection
RLOS	Radar Line of Site
SoS	Secretary of State
SSC	Suspended Sediment Concentration
SPA	Special Protection Area
SPR	ScottishPower Renewables
WTG	Wind Turbine Generator

1. INTRODUCTION AND SCOPE

1 East Anglia THREE Limited (EATL) submitted an application for Development Consent and associated Deemed Marine Licences for the East Anglia THREE Offshore Wind Farm (EA THREE) in November 2015, with consent granted by the Secretary of State for the Department for Business, Energy and Industrial Strategy (BEIS) in August 2017. The East Anglia THREE Offshore Wind Farm Order 2017 (2017 Order) granted consent for the development of an offshore windfarm with a gross output of 1,200 Megawatts (MW) (1.2. Gigawatts (GW)), located 69 km off the coast of Suffolk. The 2017 Order consented up to 172 wind turbines and associated infrastructure. The East Anglia THREE Offshore Wind Farm (Correction) Order 2018 was subsequently granted on 12 July 2018 to correct certain errors in the 2017 Order. EATL submitted an application for a non-material change in 2019 to amend the maximum generating capacity of EA THREE from 1,200 MW to 1,400 MW. The resultant East Anglia THREE Offshore Wind Farm (Amendment) Order 2019 was made on 6 June 2019 (2019 Amendment Order).

2 EATL submitted a further application for a non-material change in July 2020 in which amendments to the parameters of the Wind Turbine Generators (WTGs) were sought including to reduce the number of WTGs; increase rotor and blade tip height; and reduce the number of offshore substations to one. The resultant East Anglia THREE Offshore Wind Farm (Amendment) Order 2021 was made on 15 April 2021 (2021 Amendment Order). In this document, the 2017 Order (as amended) refers to the 2017 Order as amended by both the 2019 Amendment Order and the 2021 Amendment Order.

3 In order to benefit from continuing technological developments in the offshore wind industry and to further reduce the cost of these projects to the consumer in line with Government policy, EATL have been engaging extensively with the supply chain. ScottishPower Renewables (the parent company of EATL) has signed a strategic agreement appointing Siemens Gamesa Renewable Energy Limited as its preferred bidder for the supply and installation of WTGs for the East Anglia Hub (of which East Anglia THREE Offshore Wind Farm is one of the projects). The parties have agreed to work together ahead of the next CfD auction, set to open in December 2021, to optimise the East Anglia THREE Offshore Wind Farm, with the ambition of signing turbine supply and installation agreements thereafter. The strategic agreement includes a commitment to the consumer to reduce the cost of energy by investing in new and more efficient technology. In line with that, a new technological improvement associated with a bigger rotor for the WTGs has been recently made available to EA THREE.

4 A review of the proposed amendments, current DCO and Environmental Impact Assessment (EIA) documentation has been undertaken and it concluded that the amendments represent a non-material change to the DCO. EATL therefore intends to submit an application for a non-material change to the 2017 Order (as amended) in relation to the offshore works associated with EA THREE.

5 This document has been prepared to support the application for a non-material change to the 2017 Order (as amended) and associated Deemed Marine Licences (DMLs). The document explains the proposed amendments to the DCO, with associated justification and supporting information to evidence the conclusion that the proposed changes represent a non-material change (NMC).

1.1. Approach

6 This document reviews the proposed parameter changes and receptors assessed within the EA THREE EIA and provides consideration as to whether there will be any new potential impacts and/or any changes in significance of impact to those that were described within the original application. Furthermore, it considers whether the proposed changes would alter the conclusions of the Habitats Regulations Assessment (HRA) undertaken in respect of the 2017 Order (as amended).

7 A summary of the changes is provided in Section 1.1.1 below, with further detail provided in Section 2.

8 In order to support the NMC process, additional Collision Risk Modelling has been undertaken by MacArthur Green (included in Appendix A); updated Ministry of Defence (MOD) and National Air Traffic Services (NATS) radar modelling has also been completed (included in Appendix B); and a review of the Seascape, Landscape and Visual Impact (SLVIA) assessment (included in Appendix C) has been undertaken.

9 This document follows the advice and guidance outlined in the Planning Act 2008: Guidance on Changes to Development Consent Orders published by the Department for Communities and Local Government (DCLG) (December 2015). The changes proposed are considered in light of the guidance in Section 3. This document provides justification for the requested amendment and explains why the change can be considered as non-material.

10 It is noted that this NMC application relates to parameters which are secured in both the DCO and the DMLs; separate applications will be made to BEIS and the Marine Management Organisation (MMO) and this document supports the application for amendments to both the DCO and the DMLs.

1.1.1. Parameter changes

11 This Application seeks to make a non-material change to the 2017 Order (as amended) relating to the WTGs. The changes in the parameters subject to this NMC application are:

- The removal of the stated gross electrical output capacity;
- An increase in the maximum tip height of the WTGs from 262 m to 282 m (relative to Lowest Astronomic Tide (LAT));
- An increase in the maximum rotor diameter of the WTGs from 230 m to 250 m; and
- A reduction in the maximum number of WTGs from 121 to 100.

2. PROPOSED AMENDMENTS

2.1. Consented and proposed parameters

12 The consented and proposed parameters relevant to this application are provided in Table 2-1 below, including those made under previous amendments. Rows that contain parameters that are being proposed to be amended under this NMC application are coloured in green.

Table 2-1 Summary of the proposed amendments sought by EATL to the consented parameters under the East Anglia THREE Offshore Wind Farm Order 2017 (as amended). Note, for completeness the key parameters that informed the EIA, 2019 Amendment Order and 2021 Amendment Order are also presented.

		Consented Parameters			Proposed Parameters	Reference
Relevant Parameter	**As stated in the original ES Project Description**	**2017 Order***	**2019 Amendment Order parameters†**	**2021 Amendment Order parameters‡**	**Proposed Changes**	**2017 Order (as amended)/ DML (as varied) reference**
Maximum generating capacity	1,200 MW	1,200 MW	1,400 MW	No change	Removal of the stated gross electrical output capacity	Schedule 1, Part 1, Work No. 1(a), and Part 3, Requirement 3 (8)(a) Schedule 10, DMLs Generation Assets, Part 1, Condition 3 (1)(a), and Part 2, Condition 6 (1)(b) Schedule 11, DMLs Generation Assets, Part 1, Condition 3 (1)(a), and Part 2, Condition 6 (1)(b)
Development area (offshore)	305 km^2	305 km^2	No change	No change	No change	Not stated
Maximum Hammer Energy	3,500 kJ	3,500 kJ	No change	No change	No change	Schedule 10 and 11, DMLs - Generation Assets, Part 2, Condition 2(6) Schedule 12 and 13, DMLs Transmission Assets, Part 2, Condition 3

* The East Anglia THREE Wind Farm Order 2017 was corrected by The East Anglia THREE Offshore Wind Farm (Correction) Order 2018
† The East Anglia THREE Offshore Wind Farm (Amendment) Order 2019
‡ The East Anglia THREE Offshore Wind Farm (Amendment) Order 2021

		Consented Parameters			Proposed Parameters	Reference
Relevant Parameter	**As stated in the original ES Project Description**	**2017 Order***	**2019 Amendment Order parameters†**	**2021 Amendment Order parameters‡**	**Proposed Changes**	**2017 Order (as amended)/ DML (as varied) reference**
Maximum scour protection for WTGs, accommodation platform, meteorological masts and offshore electrical stations	2,673,260 m^2	2,673,260 m^2	No change	No change	No change	Schedule 1, Part 3, Requirement 9(1)
Wind Turbine Generators (WTGs)						
WTG capacity	7 -12 MW	Not stated	No change	No change	No change	Not stated
Number of WTGs fixed to the seabed on monopile, jacket or suction caisson foundation types	172	172	No change	Reduction to a maximum of 121 turbines	Reduction to 100 turbines	Schedule 1, Part 1, Work No. 1(a) and Part 3, Requirement 3 (8)(a) Schedule 10 and 11 DMLs - Generation Assets Part 1, Condition 3 (1)(a) and Part 2, Condition 6 (1)(b)
Number of WTGs fixed to the seabed on gravity base foundations	172	100	No change	No change	No change	Schedule 1, Part 3, Requirement 9 Schedule 10 and 11 DMLs - Generation Assets Part 2, Condition 2(7)

		Consented Parameters			Proposed Parameters	Reference
Relevant Parameter	**As stated in the original ES Project Description**	**2017 Order***	**2019 Amendment Order parameters†**	**2021 Amendment Order parameters‡**	**Proposed Changes**	**2017 Order (as amended)/ DML (as varied) reference**
Wind turbine foundation type options	Jackets (piles or suction caissons), gravity base structures, suction caissons, monopiles	Jackets (piles or suction caissons), gravity base structures, suction caissons, monopiles	No change	No change (including with dimensions and number of piles of foundations)	No change (including with dimensions and number of piles of foundations)	Schedule 1, Part 3, Requirement 5 Schedule 10 and 11, DML Generation Assets, Part 1 Condition 3 (1)(a) and Part 2 Condition 4
Turbine rotor diameter	154 – 220 m	Must not exceed 220 m	No change	Increase in rotor diameter to a maximum of 230 m	Increase in rotor diameter to maximum of 250 m	Schedule 1, Part 3, Requirement 2 (1)(c) Schedule 10 and 11 DMLs - Generation Assets, Part 2 Condition 1 (1)(c)
Hub height Mean Sea Level (MSL)	150 m	Must not exceed 150.6 m	No change	No change	No change	Schedule 1, Part 3, Requirement 2(1)(b) Schedule 10 and 11 DMLs - Generation Assets, Part 2 Condition 1 (1)(b)
Tip height Lowest Astronomical Tide (LAT)	247 m	Must not exceed 247 m	No change	Increase in tip height to a maximum of 262 m	Increase in tip height to a maximum of 282 m	Schedule 1, Part 3, Requirement 2(1)(a) Schedule 10 and 11 DMLs - Generation Assets, Part 2 Condition 1 (1)(a)

		Consented Parameters			Proposed Parameters	Reference
Relevant Parameter	**As stated in the original ES Project Description**	**2017 Order***	**2019 Amendment Order parameters†**	**2021 Amendment Order parameters‡**	**Proposed Changes**	**2017 Order (as amended)/ DML (as varied) reference**
Minimum clearance above sea level (Mean High Water Springs (MHWS))	22 m	Minimum draught height of 22 m The number of WTGs with a draught height of less than 24 m must not exceed 52 turbines	No change	Increase to minimum draught height of 24 m for 100% of WTGs	No change (maintain minimum draught height of 24 m for 100% of WTGs)	Schedule 1, Part 3, Requirement 2 (1)(e) Schedule 10 and 11 DMLs - Generation Assets, Part 2 Condition 1 (1)(e)
Indicative minimum separation between WTGs	In a row spacing 675 m Inter-row spacing 900 m	In row spacing 675 m Inter-row spacing 900 m	No change	No change	No change	Schedule 1, Part 3, Requirement 2(d) Schedule 10 and 11 DMLs - Generation Assets, Part 2 Condition 1 (1)(d)
Maximum inert material disposed (WTG)	3,010,000 m^3	3,010,000 m^3	No change	No change	No change	Schedule 10 and 11, DMLs - Generation Assets, Part 1, Condition 2 (d)(ii) and Part 2, Condition 6 (1)(a)(ii)
Maximum scour protection area (WTGs, accommodation platform and meteorological masts)	2,572,460 m^2	2,572,460 m^2	No change	No change	No change	Schedule 10 and 11, DMLs, - Generation Assets, Part 2 Condition 6 (1)(f)

3. MATERIALITY OF CHANGES

3.1. Background

13 There is no statutory definition of what constitutes a material or non-material amendment for the purposes of Schedule 6 of the *Planning Act 2008* and Part 1 of the Infrastructure Planning (Changes to, and Revocation of, Development Consent Orders) Regulations 2011 (2011 Regulations). However, the Government has issued guidance on this point. Criteria for determining whether an amendment should be material or non-material is outlined in the Department for Communities and Local Government "Planning Act 2008: Guidance on Changes to Development Consent Orders" (December 2015).

14 Paragraphs 9-16 of this document set out the four characteristics which act to provide an indication on whether a proposed change to a DCO should be considered as material or non-material. The following characteristics are set out as examples of where an amendment is more likely to be considered 'material'.

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

15 The proposed amendments to the 2017 Order (as amended) have been considered in light of these four characteristics as presented in the following Sections 3.2.1 to 3.2.4.

3.2. Materiality of Change

3.2.1. EIA Consideration

"A change should be treated as material if it would require an updated Environmental Statement (from that at the time the original DCO was made) to take account of new, or materially different, likely significant effects on the environment."

16 Within this section EATL has considered the potential implications of the proposed amendments in relation to all of the offshore topics assessed during the original EIA process (the proposed amendments relating only to infrastructure to be installed in the offshore part of the Order Limits (below MHWS), with no changes proposed that could affect the onshore receptors originally considered in the application).

17 Consideration has been given to the effects of the proposed changes and whether these changes could result in impacts of significance (in EIA terms) which are new or materially different to those identified in the EIA that was set out in the ES that accompanied the original DCO application and as certified by the SoS under the 2017 Order and the subsequent amendments/variations.

18 There are a number of overriding factors that support the overall conclusion that the proposed amendments are non-material, as set out below. Further detail is provided in Table 3-1 below.

- 'There will be no change in impacts relating to cable installation as there is no change in the parameters relating to the installation/operation and decommissioning of cables;
- The change in parameters is limited to the WTGs and no other infrastructure or construction methodology will differ from that already consented; and
- The removal of stated gross electrical output capacity does not relate to any aspect of the impact assessment as the gross electrical output capacity does not inform any of the parameters used in defining the worst case scenario in the EIA.

Table 3-1 Review of EIA in respect to the proposed parameter amendments.

EIA Topic	Impacts as Described in the ES Chapter	2021 Amendment Order Change in Impact Significance	Proposed Application Change in Impact Significance
Marine Geology, Oceanography and Physical Processes	Relevant potential effects assessed within the EIA comprised: • Changes in suspended sediment concentrations (SSC); • Changes in seabed and coastal morphology; and • Changes to tidal, wave and sediment transport regimes. The EIA was based upon the following worst-case scenarios (noting that in relation to WTG impact assessments the worst-case scenario for this receptor refers to 172 turbines on the smaller foundation (40 m gravity base or 10 m monopile) as opposed to 100 WTGs on the largest of foundations (60 m gravity base or 12 m monopile): • The installation/presence of 172 40 m gravity base foundations for WTGs in relation to increased SSC and tidal/wave/sediment regime effects; • The installation/presence of 172 10 m diameter monopiles for seabed morphology effects; • Installation/presence of six gravity base foundations for the Offshore Substations (OSSs) (under the two phased approach) in relation to SSC and tidal/wave/sediment regime effects; and	Based upon the maximum design scenarios there will be no change in the EIA assessment conclusions for the following reasons: • The maximum number of OSSs will be reduced from six to one; resulting in a reduction in the number of foundations previously assessed and thus a smaller footprint of works. • The maximum number of legs on the OSS jacket will be increased from four to six. However, as there will be a total reduction in OSSs (see above) the total number of OSS foundation legs will reduce from 24 to 6 (6 x 4 = 24 vs 1 x 6 =6). This will, therefore, result in a reduced footprint of works. • In relation to the WTGs, there is a reduction in the maximum number of turbines from 172 to 121, (note this value will relate to WTGs installed on monopile and jacket foundations only as the consent provides a limitation of no more than 100 WTG gravity-based foundations to be installed). Therefore, the number of assessed foundations and associated impacts will not be exceeded. • The maximum design scenario for seabed morphology, more specifically the effects of drill arising mounds, is based upon the installation of 172 monopiles with a 10 m diameter. Whilst there is a very small	Based upon the maximum design scenarios there will be no change in the EIA assessment conclusions for the following reasons: • In relation to the WTGs, there is a reduction in the maximum number of turbines from 121 to 100, (note this value will relate to WTGs installed on monopile and jacket foundations only as the consent provides a limitation of no more than 100 WTG gravity-based foundations to be installed). Therefore, the number of assessed foundations and associated impacts will not be exceeded. • The maximum design scenario for seabed morphology, more specifically the effects of drill arising mounds, is based upon the installation of 172 monopiles with a 10 m diameter. There is a reduction in the drill arisings associated with the installation of 100 monopiles with a 12 m diameter. When considered in the context of the total seabed impact area across EA THREE this will equate to no more than 0.08% as assessed in the EIA. Therefore, the conclusions are not materially different from the conclusions presented in the original assessment. The 2017 Order (as amended) provides disposal allowance limitations for WTG preparation (see Table 2-1) which accounts for drill arisings. EATL will ensure compliance

EIA Topic	Impacts as Described in the ES Chapter	2021 Amendment Order Change in Impact Significance	Proposed Application Change in Impact Significance
	• Installation/presence of six OSS jacket foundations (under the two phased approach) for seabed morphology effects. The assessment of decommissioning activities was considered comparable to the construction activities and therefore the maximum design scenarios were no greater than what had already been detailed.	increase in the drill arisings associated with the installation of 121 monopiles with a 12 m diameter, when considered in the context of the total seabed impact area across EA THREE this remains at 0.08%, as assessed in the EIA. Therefore, the conclusions are not materially different from the conclusions presented in the original assessment. The 2017 Order (as amended) provides disposal allowance limitations for WTG preparation (see Table 2-1) which accounts for drill arisings. EATL will ensure compliance with these limitations, as stipulated in the DCO, which are not subject to change as part of this process. There will be no changes that relate to foundation size or installation methods, including volumes of disposal/scour protection. Consequently, all proposed parameter amendments relevant to Geology, Oceanography and Physical Processes fall within the worst-case scenarios assessed in the EIA and are controlled by existing measures secured in the 2017 Order (as amended). **Therefore, it was concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES.**	with these limitations, as stipulated in the DCO, which are not subject to change as part of this process. There will be no changes that relate to foundation size or installation methods, including volumes of disposal/scour protection. Consequently, all proposed parameter amendments relevant to Geology, Oceanography and Physical Processes fall within the worst-case scenarios assessed in the EIA and are controlled by existing measures secured in the 2017 Order (as amended). **Therefore, it is concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES.**

EIA Topic	Impacts as Described in the ES Chapter	2021 Amendment Order Change in Impact Significance	Proposed Application Change in Impact Significance
Marine Water and Sediment Quality	Relevant potential effects assessed within the EA THREE EIA comprised: • Re-suspension and deposition of sediments. The EIA was based upon the following worst-case scenarios (noting that in relation to WTG impact assessments the worst-case scenario for this receptor refers to 172 turbines on the smaller foundation (40 m gravity base or 10 m monopile) as opposed to 100 WTGs on the largest of foundations (60 m gravity base or 12 m monopile). • Seabed preparation for 172 WTGs on the 40 m gravity-based foundation equating to the production of 3,010,000 m^3 of spoil; and • Seabed preparation to install six offshore electrical stations on jacket foundations (two phased approach) equating to the production of 439,350 m^3 of spoil. The assessment of decommissioning activities was considered comparable to the construction activities and therefore the maximum design scenarios were no greater than what had already been detailed.	Based upon the maximum design scenarios there will be no change in the EIA assessment conclusions for the following reasons: • In relation to the WTGs, there is a reduction in the number of turbines to 121 (note this value will relate to WTGs installed on monopile and jacket foundations only as the consent provides a limitation of no more than 100 WTG gravity-based foundations to be installed). As monopiles and jackets require a far smaller amount of seabed preparation activity the number of assessed foundations and associated impacts will not be exceeded. Notwithstanding this the 2017 Order (as amended) does provide disposal allowances for seabed preparation for WTG installation which will be complied with and which are not subject to amendment as part of this process (see Table 2-1). • The maximum number of OSSs will be reduced from six to one; resulting in a reduction in the number of assessed foundations and thus a smaller footprint of works. • The maximum number of legs on the OSS jacket will be increased from four to six. However, as there will be a total reduction in OSSs (see above) the total number of OSS foundation legs will reduce from 24 to 6 (6 x 4 = 24 vs 1 x 6 =6). This will	Based upon the maximum design scenarios there will be no change in the EIA assessment conclusions for the following reasons: • In relation to the WTGs, there is a reduction in the number of turbines to 100 (note this value will relate to WTGs installed on monopile and jacket foundations only as the consent provides a limitation of no more than 100 WTG gravity-based foundations to be installed). As monopiles and jackets require a far smaller amount of seabed preparation activity the number of assessed foundations and associated impacts will not be exceeded. Notwithstanding this the 2017 Order (as amended) does provide disposal allowances for seabed preparation for WTG installation which will be complied with and which are not subject to amendment as part of this process (see Table 2-1). • There will be no changes that relate to foundation size or installation methods, including volumes of disposal/scour protection which are secured in the 2017 Order (as amended). Consequently, all proposed parameter amendments relevant to Marine Water and Sediment Quality fall within the worst-case scenarios assessed in the EIA and are

EIA Topic	Impacts as Described in the ES Chapter	2021 Amendment Order Change in Impact Significance	Proposed Application Change in Impact Significance
		therefore result in a reduced footprint of works. • There will be no changes that relate to foundation size or installation methods, including volumes of disposal/scour protection which are secured in the 2017 Order (as amended). Consequently, all proposed parameter amendments relevant to Marine Water and Sediment Quality fall within the worst-case scenarios assessed in the EIA and are controlled by existing measures secured in the 2017 Order (as amended). **Therefore, it was concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES.**	controlled by existing measures secured in the 2017 Order (as amended). **Therefore, it is concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES.**
Underwater Noise and Vibration and Electromagnetic Fields	This chapter includes an underwater noise assessment, the worst-case noise source modelled is impact pile driving of the maximum pile size, with hammer strike energies of up to 3,500 kJ. For consideration of the impact of noise on marine mammals, fish and shellfish, benthic ecology, see those respective sections.	Based upon the maximum design scenarios there will be no change in the predicted noise emissions as there will be no changes to parameters that informed the noise modelling which formed the basis of the corresponding assessments on relevant receptors, noting relevant parameters such as hammer energy are secured via the 2017 Order (as amended) (see Table 2-1).	Based upon the maximum design scenarios there will be no change in the predicted noise emissions as there will be no changes to parameters that informed the noise modelling which formed the basis of the corresponding assessments on relevant receptors, noting relevant parameters such as hammer energy are secured via the 2017 Order (as amended) (see Table 2-1).

EIA Topic	Impacts as Described in the ES Chapter	2021 Amendment Order Change in Impact Significance	Proposed Application Change in Impact Significance
Benthic, Subtidal and Intertidal Ecology	Relevant potential impacts assessed within the EA THREE EIA comprised: • Temporary physical disturbance; • Smothering due to increased suspended sediment; • Remobilisation of contaminated sediment; • Underwater noise and vibration; • Permanent habitat loss; and • Colonisation of introduced substrate. The EIA was based upon the following worst-case scenarios noting that in relation to WTG impact assessments the worst-case scenario for this receptor refers to 100 WTGs on the larger foundation (60 m gravity base or 12 m monopile) as opposed to 172 WTGs on the smaller of foundations (40 m gravity base or 10 m monopile). • Installation/presence of 100 60 m gravity-based foundations and associated scour protection with a total impact area of 2,550,000 m^2 for seabed disturbance and permanent habitat loss. • Installation/presence of six OSSs (two phased approach) on gravity-based foundations and associated scour protection with a total impact area of 100,800 m^2 for seabed disturbance and permanent habitat loss. • Seabed preparation required for 172 foundations on 40 m gravity base foundations resulting in increased SSC	Based upon the maximum design scenarios there will be no change in the assessment conclusions for the following reasons: • In relation to the WTGs, there is a reduction in the number of turbines to 121 (note this value will relate to WTGs installed on monopile and jacket foundations only as the consent provides a limitation of no more than 100 WTG gravity-based foundations to be installed). The installation of monopiles and jacket foundations require significantly less seabed preparatory works and scour protection and therefore will not represent an impact of greater significance than what was concluded within the ES. In addition, the 2017 Order (as amended) secures disposal allowances for seabed preparation for WTG installation and maximum allowances for scour protection which will be complied with, and are not subject to change as part of this process (see Table 2-1). • The maximum number of OSSs will be reduced from six to one; resulting in a reduction in the number of assessed foundations and thus a smaller footprint of works. • The maximum number of legs on the OSS jacket will be increased from four to six. However, as there will be a total reduction in OSSs (see above) the total number of OSS foundation legs will reduce from 24 to	Based upon the maximum design scenarios there will be no change in the assessment conclusions for the following reasons: • In relation to the WTGs, there is a reduction in the number of turbines to 100 (note this value will relate to WTGs installed on monopile and jacket foundations only as the consent provides a limitation of no more than 100 WTG gravity-based foundations to be installed). The installation of monopiles and jacket foundations require significantly less seabed preparatory works and scour protection and therefore will not represent an impact of greater significance than what was concluded within the ES. In addition, the 2017 Order (as amended) secures disposal allowances for seabed preparation for WTG installation and maximum allowances for scour protection which will be complied with, and are not subject to change as part of this process (see Table 2-1). • There will be no change to the maximum hammer energy as stipulated in the 2017 Order (as amended) (see Table 2-1). • There will be no changes that relate to foundation size or installation methods, including volumes of disposal/scour protection which are secured in the 2017 Order (as amended).

EIA Topic	Impacts as Described in the ES Chapter	2021 Amendment Order Change in Impact Significance	Proposed Application Change in Impact Significance
	effects equating to the production of 3,010,000m^3 of spoil. • Seabed preparation required for the installation of six OSSs on jacket foundations resulting in increased SSC effects equating to the production of 439,350m^3 of spoil; • Increased SSC due to the presence of 172 40 m gravity-based foundations WTGs with no scour protection; and • Installation of monopiles with up to two concurrent piling events using a maximum of 3,500 kJ hammer energy. The impacts of decommissioning activities were considered less than those described for the construction activities and therefore the maximum design scenarios were no greater than what had already been detailed.	6 (6 x 4 = 24 vs 1 x 6 =6). This will therefore result in a reduced footprint of works. • There will be no change to the maximum hammer energy as stipulated in the 2017 Order (as amended) (see Table 2-1). • There will be no changes that relate to foundation size or installation methods, including volumes of disposal/scour protection which are secured in the 2017 Order (as amended). Consequently, all proposed parameter amendments relevant to Benthic, Subtidal and Intertidal Ecology fall within the worst-case scenarios assessed in the EIA and are controlled by existing measures secured in the 2017 Order (as amended). **Therefore, it was concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES.**	Consequently, all proposed parameter amendments relevant to Benthic, Subtidal and Intertidal Ecology fall within the worst-case scenarios assessed in the EIA and are controlled by existing measures secured in the 2017 Order (as amended). **Therefore, it is concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES.**
Fish and Shellfish Ecology	Relevant potential impacts assessed within the EA THREE EIA comprised: • Physical disturbance and temporary loss of seabed habitat; • Increase suspended sediment concentrations and sediment re-deposition;	Based upon the maximum design scenarios there will be no change in the assessment conclusions for the following reasons: • In relation to the WTGs, there is a reduction in the number of turbines to 121 (note this value will relate to WTGs installed on monopile and jacket foundations only as the consent provides a limitation of no more	Based upon the maximum design scenarios there will be no change in the assessment conclusions for the following reasons: • In relation to the WTGs, there is a reduction in the number of turbines to 100 (note this value will relate to WTGs installed on monopile and jacket foundations only as the consent provides

EIA Topic	Impacts as Described in the ES Chapter	2021 Amendment Order Change in Impact Significance	Proposed Application Change in Impact Significance
	• Underwater noise; and • Permanent habitat loss. The EIA was based upon the following worst-case scenarios noting that in relation to WTG impact assessments the worst-case scenario for this receptor refers to 100 WTGs on the larger foundation (60 m gravity base or 12 m monopile) as opposed to 172 WTGs on the smaller of foundations (40 m gravity base or 10 m monopile). • Installation/presence of 100 60 m gravity-based foundations and associated scour protection with a total impact area of 2,550,000 m^2 for seabed disturbance and permanent habitat loss. • Installation/presence of six OSSs (two phased approach) on gravity-based foundations and associated scour protection with a total impact area of 100,800 m^2 for seabed disturbance and permanent habitat loss. • Seabed preparation required for 172 foundations on 40 m gravity base foundations resulting in increased SSC effects equating to the production of 3,010,000m^3 of spoil; • Seabed preparation required for the installation of six OSSs on jacket foundations resulting in increased SSC effects equating to the production of 439,350m^3 of spoil;	than 100 WTG gravity-based foundations to be installed). The installation of monopiles and jacket foundations require significantly less seabed preparatory works and scour protection and therefore will not represent an impact of greater significance than what was concluded within the EIA. In addition, the 2017 Order (as amended) secures disposal allowances for seabed preparation for WTG installation and maximum allowances for scour protection which will be complied with, and are not subject to change as part of this process. • The maximum number of OSSs will be reduced from six to one; resulting in a reduction in the number of assessed foundations and thus a smaller footprint of works. • The maximum number of legs on the OSS jacket will be increased from four to six. However, as there will be a total reduction in OSSs (see above) the total number of OSS foundation legs will reduce from 24 to 6 (6 x 4 = 24 vs 1 x 6 =6). This will therefore result in a reduced footprint of works. • There will be no change to the maximum hammer energy as stipulated in the 2017 Order (as amended) (see Table 2-1). • There will be no changes that relate to foundation size or installation methods, including volumes of disposal/scour protection which are secured in the 2017	a limitation of no more than 100 WTG gravity-based foundations to be installed). The installation of monopiles and jacket foundations require significantly less seabed preparatory works and scour protection and therefore will not represent an impact of greater significance than what was concluded within the EIA. In addition, the 2017 Order (as amended) secures disposal allowances for seabed preparation for WTG installation and maximum allowances for scour protection which will be complied with, and are not subject to change as part of this process (see Table 2-1). • There will be no change to the maximum hammer energy as stipulated in the 2017 Order (as amended) (see Table 2-1). • There will be no changes that relate to foundation size or installation methods, including volumes of disposal/scour protection which are secured in the 2017 Order (as amended). Consequently, all proposed parameter amendments relevant to Fish and Shellfish Ecology fall within the worst-case scenarios assessed in the EIA and are controlled by existing measures secured in the 2017 Order (as amended). **Therefore, it is concluded that the proposed amendments will not result in any new or materially different likely**

EIA Topic	Impacts as Described in the ES Chapter	2021 Amendment Order Change in Impact Significance	Proposed Application Change in Impact Significance
	• Installation of 12 m monopiles with up to two concurrent piling events using a maximum of 3,500 kJ hammer energy. In the absence of detailed methodologies and schedules, the worst-case scenarios for decommissioning activities and associated implications for fish and shellfish were considered analogous with those assessed for the construction phase.	Order (as amended). Consequently, all proposed parameter amendments relevant to Fish and Shellfish Ecology fall within the worst-case scenarios assessed in the EIA and are controlled by existing measures secured in the 2017 Order (as amended). **Therefore, it was concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES.**	**significant effects from those described in the original ES.**
Marine Mammal Ecology	Relevant potential impacts assessed within the EA THREE EIA comprised: • Underwater noise from pile driving; and • Impacts upon prey species. The worst case used two alternative scenarios to assess temporal and spatial impacts; • Temporal impacts were assessed using a worst-case scenario which included 172 WTGs jackets (688 piles) and six OSSs (24 piles) with no concurrent piling and with a 1800kJ hammer (2,000kJ was modelled for the noise impact assessment as a proxy). • The spatial worst case considered the maximum area over which displacement could occur at any one time based on two concurrent 12 m (the larger model)	Based upon the maximum design scenarios there will be no change in the assessment conclusions for the following reasons: • In relation to the temporal impacts; there will be a reduction in the number of WTGs and therefore a reduced number of piles (172 x 4 = 688 vs 121 x 4 = 484). In relation to the OSS, there will be an increase in the number of jacket legs per foundation from four to six and piles per leg from one to four. However, as there will be a reduction in the number of OSSs from six to one there will be no change in the number of required piles (6 OSSs x 4 legs x 1 pile =24 vs 1 OSSs x 6 x 4 piles = 24). • There is no amendment to the parameters that informed the spatial worst case i.e. monopile diameter/hammer energy and	Based upon the maximum design scenarios there will be no change in the assessment conclusions for the following reasons: • In relation to the temporal impacts; there will be a reduction in the number of WTGs and therefore a reduced number of piles (172 x 4 = 688 vs 100 x 4 = 400). The number of required piles for the OSS remains the same as per the previous 2021 amendment order. • There is no amendment to the parameters that informed the spatial worst case i.e. monopile diameter/hammer energy and therefore there will be no changes to the assessment or associated noise modelling. • In addition, mitigation to reduce adverse effects on marine mammals is secured

EIA Topic	Impacts as Described in the ES Chapter	2021 Amendment Order Change in Impact Significance	Proposed Application Change in Impact Significance
	monopile foundations being installed using a maximum hammer energy of 3,500 kJ. For impacts on prey species see the Benthic, Intertidal and Subtidal Ecology, and Fish and Shellfish Sections. The impacts of decommissioning activities were considered less than those described for the construction activities and therefore the maximum design scenarios were no greater than what had already been detailed.	therefore there will be no changes to the assessment or associated noise modelling. • In addition, mitigation to reduce adverse effects on marine mammals is secured within the 2017 Order (as amended) (Schedules 10-14, Condition 13(f)) which will be complied with, and are not subject to change as part of this process. Consequently, all proposed parameter amendments relevant to Marine Mammal Ecology fall within the worst-case scenarios assessed in the EIA and are controlled by existing measures secured in the 2017 Order (as amended). **Therefore, it was concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES.**	within the 2017 Order (as amended) (Schedules 10-14, Condition 13(f)) which will be complied with, and are not subject to change as part of this process. Consequently, all proposed parameter amendments relevant to Marine Mammal Ecology fall within the worst-case scenarios assessed in the EIA and are controlled by existing measures secured in the 2017 Order (as amended). **Therefore, it is concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES.**
Offshore Ornithology	Relevant potential impacts assessed within the EA THREE EIA comprised: • Indirect effects as a result of displacement of prey species due to disturbance to seabed; • Collision risk; and • Barrier effects. In reference to spatial impacts i.e. disturbance/ displacement and barrier effects the worst-case layout was a maximum of 172 WTGs with a minimum spacing of 675 m x	In relation to displacement of prey species the Fish and Shellfish Section above concluded that the proposed parameter amendments will be within the worst-case scenario as assessed in the EIA. On this basis the parameters associated with the worst-case scenario for indirect effects of displacement of prey species does not differ from what was presented in the ES. In relation to barrier effects the worst-case scenario considered the largest space occupied which equated to 172 WTGs and six OSSs.	In relation to displacement of prey species the Fish and Shellfish Section above concluded that the proposed parameter amendments will be within the worst-case scenario as assessed in the EIA. On this basis the parameters associated with the worst-case scenario for indirect effects of displacement of prey species does not differ from what was presented in the ES. In relation to barrier effects the worst-case scenario considered the largest space occupied which equated to 172 WTGs and six

EIA Topic	Impacts as Described in the ES Chapter	2021 Amendment Order Change in Impact Significance	Proposed Application Change in Impact Significance
	900 m between turbines as this creates the most densely packed area within the Order Limits. The Collision Risk Modelling (CRM) as presented in the ES assessed a scenario of 172 smaller modelled (7MW) WTGs (although the 100 x 12 MW scenario has a greater swept volume ratio per MW installed capacity, the Band CRM model approach produces higher risk using a larger number of small turbines. i.e. the maximum number of the smallest WTGs represents the worst case for collision impacts) and uses those relevant turbine specific parameters for the 7MW WTGs to inform the modelling. For further details see Appendix A. For impacts on prey species see the Benthic, Intertidal and Subtidal Ecology, and Fish and Shellfish Sections. The impacts of decommissioning activities were considered less than those described for the construction activities and therefore the maximum design scenarios were no greater than what had already been detailed.	The total number of structures will be reduced to 121 WTGs and one OSS therefore occupying less space and ultimately decreasing the barrier effects from what was considered in the ES. Based upon the worst-case scenarios there will be no change in the assessment conclusions as can be seen from the updated CRM which addresses the potential for changes in collision risk predictions. The CRM provides annual collision estimates calculated using the Band (2012[4]) CRM using parameters for the consented turbine models and a proposed alternative turbine model which reflects the amended parameters. Only the turbine parameter values have been changed in the CRM, with all other input parameters to the model (seabird density, biometrics, flight heights, avoidance rates, nocturnal activity, wind farm operational percentage etc) kept the same as those reported within Appendix 13.3 of the EIA. The conclusions of the CRM showed that although WTG parameters such as rotor diameter and tip height are slightly increasing, the reduction in the number of turbines results in a reduced collision risk of between 18%	OSSs. The total number of structures will be reduced to 100 WTGs and one OSS therefore occupying less space and ultimately decreasing the barrier effects from what was considered in the ES. Based upon the worst-case scenarios there will be no change in the assessment conclusions as can be seen from the updated CRM (included as Appendix A) which addresses the potential for changes in collision risk predictions. The estimates have been calculated using the Band (2012) Collision Risk Model (CRM) using the turbine parameters for (i) the consented turbine models, (ii) the non-material change (2021 Amendment Order, granted on 15th April 2021, and (iii) for a proposed alternative turbine model (this application). This comparison is provided to allow the predicted changes in the collision risk to be clearly seen. Band option 2 collision estimates for gannet and kittiwake have been included in addition to Band option 1 collision estimates, in line with current Natural England guidance received via pre-application consultation on Monday 12th July 2021. Option 2 collision estimates from the original assessment and the NMC[2] application have been included to

[4] Band, B. (2012). Using a Collision Risk Model to Assess Bird Collision Risks for Offshore Windfarms

EIA Topic	Impacts as Described in the ES Chapter	2021 Amendment Order Change in Impact Significance	Proposed Application Change in Impact Significance
		(kittiwake) and 11% (herring gull and black blacked gull) compared with the consented design. Furthermore, WTG installation methods will not change from that which was assessed in the EIA as secured in the 2017 Order, including those parameters relevant to noise modelling or number of vessel movements. **Therefore, it was concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES.**	avoid inappropriate intra-band comparisons (option 1 against option 2) between the original consent and NMC[3]. It should be noted that option 2 outputs were included in the assessment of the consented design and therefore were considered as part of the decision to grant the original consent. Only the turbine parameter values have been changed in the CRM, with all other input parameters to the model (seabird density, biometrics, flight heights, avoidance rates, nocturnal activity, wind farm operational percentage etc) kept the same as those reported within Appendix 13.3 of the EIA. The conclusions of the CRM show that although WTG parameters such as rotor diameter and tip height are slightly increasing, the reduction in the number of turbines has reduced the predicted collision impact estimates, irrespective of the Band option used. When compared to the consented design, this includes a reduction of up to 25% for Gannet and 28% for kittiwake using option 1; and 21% for herring gull and 22% for black backed gull using option 2. Furthermore, WTG installation methods will not change from that which was assessed in the EIA as secured in the 2017 Order,

EIA Topic	Impacts as Described in the ES Chapter	2021 Amendment Order Change in Impact Significance	Proposed Application Change in Impact Significance
			including those parameters relevant to noise modelling or number of vessel movements. **Therefore, it is concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES.**
Commercial Fisheries	Relevant potential impacts assessed within the EA THREE EIA comprised: • Adverse impacts on commercially exploited fish and shellfish populations; • Temporary/complete loss or restricted access to traditional fishing grounds; • Safety issues for fishing vessels: • Increased steaming times to fishing grounds; • Obstacles on the seabed; and • Displacement of fishing activity into other areas. The EIA was based upon the following worst-case scenarios: • Installation/presence of 172 WTGs separated at a minimum distance of 675 m x 900 m and 6 OSSs in relation to potential vessel allision; and • Temporary transitory 500 m safety zones around installed or partially installed infrastructure leading to a period of total exclusion/displacement of all fishing	Based upon the maximum design scenarios there will be no change in the assessment conclusions for the following reasons: • There will be a total reduction in structures present in the EA THREE site i.e. reduction of WTGs from 172 to 121 (note this value will relate to WTGs installed on monopile and jacket foundations only as the consent provides a limitation of no more than 100 WTG gravity-based foundations to be installed) and reduction of OSSs from six to one. • There will be no change to the minimum spacing requirements and maximum area of offshore development as secured in the 2017 Order (as amended). **Therefore, it was concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES.**	Based upon the maximum design scenarios there will be no change in the assessment conclusions for the following reasons: • There will be a total reduction in structures present in the EA THREE site i.e. reduction of WTGs from 172 to 100 (note this value will relate to WTGs installed on monopile and jacket foundations only as the consent provides a limitation of no more than 100 WTG gravity-based foundations to be installed). • There will be no change to the minimum spacing requirements and maximum area of offshore development as secured in the 2017 Order (as amended) (see Table 2-1). **Therefore, it is concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES.**

EIA Topic	Impacts as Described in the ES Chapter	2021 Amendment Order Change in Impact Significance	Proposed Application Change in Impact Significance
	activities from the entire EA THREE site (305 km²) and increased steaming times. The impacts of decommissioning activities were considered less than those described for the construction activities and therefore the maximum design scenarios were no greater than what had already been detailed.		
Shipping and Navigation	Relevant potential impacts assessed within the EA THREE EIA comprised: • Commercial and recreational vessel to vessel collision or encounter risk; • Commercial and recreational vessel allision with partially constructed or deconstructed structures; • Commercial and recreational vessel deviations; • Impacts on operations within ports; and • Reduced emergency response capability/ oil spill response owing to the presence of EA THREE. The assessment was informed by a Navigational Risk Assessment (NRA) model in which two layouts were assessed; • 172 WTGs and six OSSs on jacket suction caisson foundations with a maximum separation distance (1,250m x 1,250 m) and therefore a 100% fill of the array Order Limits; and • 172 WTGs and six OSSs on jacket	Based upon the maximum design scenarios there will be no change in the assessment conclusions for the following reasons: • There will be a total reduction in structures present in the EA THREE site i.e. reduction of WTGs from 172 to 121 (note this value will relate to WTGs installed on monopile and jacket foundations only as the consent provides a limitation of no more than 100 WTG gravity-based foundations to be installed) and reduction of OSSs from six to one. • No parameters that are used to inform the NRA model, including spacing requirements and Order Limits, will be changed when compared to those that were assessed in the EIA and secured in the 2017 Order (as amended). • Furthermore, the maximum number of vessels at any one time will not exceed that assessed within the EIA. **Therefore, it was concluded that the proposed amendments will not result in any**	Based upon the maximum design scenarios there will be no change in the assessment conclusions for the following reasons: • There will be a total reduction in structures present in the EA THREE site i.e. reduction of WTGs from 172 to 100 (note this value will relate to WTGs installed on monopile and jacket foundations only as the consent provides a limitation of no more than 100 WTG gravity-based foundations to be installed). • No parameters that are used to inform the NRA model, including spacing requirements and Order Limits, will be changed when compared to those that were assessed in the EIA and secured in the 2017 Order (as amended) (see Table 2-1). • Furthermore, the maximum number of vessels at any one time will not exceed that assessed within the EIA. **Therefore, it is concluded that the proposed amendments will not result in**

EIA Topic	Impacts as Described in the ES Chapter	2021 Amendment Order Change in Impact Significance	Proposed Application Change in Impact Significance
	suction caisson foundations with the minimum separation distance (675m x 900m) therefore increasing the amount of available sea room but with less manoeuvre room between WTGs.	**new or materially different likely significant effects from those described in the original ES.**	**any new or materially different likely significant effects from those described in the original ES.**
Aviation and Ministry of Defence (MOD)	Relevant potential impacts assessed within the EA THREE EIA comprised: • Creation of aviation obstacle environment; • Wind turbines causing permanent interference on military radar; and • Increased air traffic in the area related to windfarm activities. This assessment was based upon two layouts; one layout was on the basis of 100 WTGs with a maximum blade tip height of 247 m Above Mean Sea Level (AMSL) and the other was 172 WTGs with a maximum tip height of 181 m. Further to this, a Radar Line of Sight (RLoS)) modelling exercise was undertaken based on a maximum wind turbine tip height of 247 m. Mitigation is secured within the DCO (see Requirement 33 and Certified Document '*EN010056-000485-2.11 Radar Line of Sight Coverage Plan*') through a Radar Line of Sight Coverage Plan due to potential impacts which were assessed on the MOD Trimingham Radar. This requires MoD air defence radar mitigation for WTGs of a certain height and within specific locations.	Based on the assumptions and outcomes of the assessment presented in the EA THREE EIA the revised turbine parameters have potential to affect both the MOD Trimingham radar and the NATS Cromer radar. Potential impacts on both radars were assessed in the EA THREE EIA. In order to establish whether the revised turbine parameters would result in a change to the conclusions of the EIA, an updated RLOS and Probability Detection (PD) modelling exercise was completed. With regard to the MOD Trimingham radar, the modelling concluded that the principle of the mitigation remains appropriate to mitigate significant effects, albeit that the MOD sought a revision to the terms of DCO Requirement 33 to better encapsulate its mitigation requirement, removing the reference to the Radar Line of Sight Coverage Plan from DCO Requirement 33. With regard to the NATS Cromer radar, the modelling confirmed that the increased tip height resulted in a small number of WTGs (up to 10) being detected. However, this small detection increase was not considered to represent a change to the ES conclusion that	Based on the assumptions and outcomes of the assessment presented in the EA THREE EIA the revised turbine parameters have potential to affect both the MOD Trimingham radar and the NATS Cromer radar. Potential impacts on both radars were assessed in the EA THREE EIA. In order to establish whether the revised turbine parameters would result in a change to the conclusions of the EIA, an updated RLOS and Probability Detection (PD) modelling exercise has been completed and is provided in full in Appendix B. Although this Application seeks to reduce the maximum number of turbines to 100, the indicative layout used for the modelling contains only 99 turbines and an offshore substation location. However, this small disparity does not significantly impact the assessment results. With regard to the MOD Trimingham radar, the modelling concludes that the principle of the mitigation remains appropriate to mitigate significant effects (refer to Appendix B). DCO Requirement 33, as agreed with the MOD in respect of the 2021 Amendment Order, remains sufficient and appropriate to

EIA Topic	Impacts as Described in the ES Chapter	2021 Amendment Order Change in Impact Significance	Proposed Application Change in Impact Significance
		there would be no significant impact on NATS Cromer radar; and NATS (En Route) concurred with this assessment. **Therefore, it was concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES.**	accommodate the increase in tip height to 282 m under this application. With regard to the NATS Cromer radar, the modelling has confirmed that the increased tip height to 282 m results in up to 14 turbines that could be detected. However, this small detection increase is not considered to represent a change to the ES conclusion that there would be no significant impact on NATS Cromer radar. Notwithstanding this, and if considered necessary, measures are available to mitigate the detection of WTGs by the NATS Cromer radar in the form of blanking alone or together with a Transponder Mandatory Zone (TMZ), which measures can be secured through a DCO Requirement if required. **Therefore, it is concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES.**
Offshore Archaeology and Cultural Heritage	Relevant potential impacts assessed within the EA THREE EIA comprised: • Direct disturbance to archaeological receptors and/or their physical setting; • Indirect disturbance of archaeological receptors and/or their physical setting from changes to hydrodynamic and sedimentary regimes; and • Changes to historic seascape character.	Based upon the maximum design scenarios there will be no change in the assessment conclusions for the following reasons: • In relation to the WTGs, there is a reduction in the number of turbines to 121 (note this value will relate to WTGs installed on monopile and jacket foundations only as the consent provides a limitation of no more	Based upon the maximum design scenarios there will be no change in the assessment conclusions for the following reasons: • In relation to the WTGs, there is a reduction in the number of turbines to 100 (note this value will relate to WTGs installed on monopile and jacket foundations only as the consent provides

EIA Topic	Impacts as Described in the ES Chapter	2021 Amendment Order Change in Impact Significance	Proposed Application Change in Impact Significance
	The EIA was based upon the following worst-case scenarios noting that in relation to WTG impact assessments the worst-case scenario for this receptor referred to 100 WTGs on the larger foundation (60 m gravity base or 12 m monopile) as opposed to 172 WTGS on the smaller of foundations (40 m gravity base or 10 m monopile). • Installation/presence of 100 60 m gravity-based foundations and associated scour protection with a total impact area of 2,550,000 m^2 for seabed disturbance and permanent habitat loss. • Installation/presence of six OSSs (two phased approach) on gravity-based foundations and associated scour protection with a total impact area of 100,800 m^2 for seabed disturbance and permanent habitat loss. The impacts of decommissioning activities are comparable to those described for the construction activities and therefore the maximum design scenarios were no greater than what had already been detailed.	than 100 WTG gravity-based foundations to be installed). The installation of monopiles and jacket foundations require significantly less seabed preparatory works and scour protection and therefore will not represent an impact of greater significance than what was concluded within the ES. In addition, the 2017 Order (as amended) provides disposal allowances for seabed preparation for WTG installation and maximum allowances for scour protection which will be complied with, and are not subject to change as part of this process. • The maximum number of OSSs will be reduced from six to one; resulting in a reduction in the number of assessed foundations and thus a smaller footprint of works. • The maximum number of legs on the OSS jacket will be increased from four to six. However, as there will be a total reduction in OSSs (see above) the total number of OSS foundation legs will reduce from 24 to 6 (6 x 4 = 24 vs 1 x 6 = 6). This will therefore result in a reduced footprint of works. Consequently, all proposed parameter amendments relevant to Offshore Archaeology and Cultural Heritage fall within the worst-case scenarios assessed in the EIA and are controlled by existing measures secured in the 2017 Order (as amended).	a limitation of no more than 100 WTG gravity-based foundations to be installed). The installation of monopiles and jacket foundations require significantly less seabed preparatory works and scour protection and therefore will not represent an impact of greater significance than what was concluded within the ES. In addition, the 2017 Order (as amended) provides disposal allowances for seabed preparation for WTG installation and maximum allowances for scour protection which will be complied with, and are not subject to change as part of this process (see Table 2-1). Consequently, all proposed parameter amendments relevant to Offshore Archaeology and Cultural Heritage fall within the worst-case scenarios assessed in the EIA and are controlled by existing measures secured in the 2017 Order (as amended). **Therefore, it is concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES.**

EIA Topic	Impacts as Described in the ES Chapter	2021 Amendment Order Change in Impact Significance	Proposed Application Change in Impact Significance
		Therefore, it was concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES.	
Infrastructure and Other Users	Relevant potential impacts assessed within the EA THREE ES comprised: • Impacts on other UK windfarms; • Increased burial of existing cables and pipelines; • Interference and damage to sub-sea cables and pipelines; • Disruption to aggregate extraction activity; • Disruption to oil and gas activity; Disruption of MOD activity; and • Disruption of unexploded ordnance. The assessment was based on a worst-case scenario of the entire area of the offshore Order Limits being occupied, approximately 305 km^2. The impacts of decommissioning activities are comparable to those described for the construction activities and therefore the maximum design scenarios were no greater than what had already been detailed.	The Infrastructure and Other Users chapter assessment is based upon the overall space occupied by the offshore structures i.e. the offshore Order Limits. The Order Limits will not change and will remain as per the 2017 Order (as amended). **Therefore, it was concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES.**	The Infrastructure and Other Users chapter assessment is based upon the overall space occupied by the offshore structures i.e. the offshore Order Limits. The Order Limits will not change and will remain as per the 2017 Order (as amended). **Therefore, it is concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES.**
Seascape, Landscape and Visual Impact Assessment	The offshore assessment addressed seascape, landscape and visual impacts during the construction, operation and decommissioning phases of the project. The offshore components have the potential to affect landward, coastal and seaward receptors, with the seaward area described in	In Chapter 29: Seascape, Landscape and Visual Impact Assessment of the ES, it was found that the offshore components of the East Anglia THREE project would not give rise to significant effects owing principally to their	A review of the impacts described in the ES Chapter against the proposed changes has been undertaken and is provided in full in Appendix C and summarised below. In Chapter 29: Seascape, Landscape and Visual Impact Assessment of the ES, it was

EIA Topic	Impacts as Described in the ES Chapter	2021 Amendment Order Change in Impact Significance	Proposed Application Change in Impact Significance
	terms of the inshore and offshore areas. The primary component of concern were the WTGs. The 100 to 172 wind turbines would be of a maximum tip height of 247 m. The closest possible location a wind turbine would be located was 69 km from the coastline. As there are no changes to parameters in respect of vessels no further consideration is required of this aspect of the assessment.	distant location, 69 km from the Suffolk coastline. This substantial separation distance means that even in good viewing conditions, when there could be the possibility that blade tips might be discernible from higher points along the coast, they would appear as extremely small and distant features. Furthermore, distant blade tips would be seen in the context of one of the busiest shipping channels around the UK, where built or human artefacts are a common feature in seaward views. The conclusion of the ES was that the magnitude of change would be negligible and the effect of the offshore components on coastal and landward receptors would not be significant. The proposed 15 m increase in turbine blade tip height, from 247 m to 262 m, would not be sufficient to alter the assessment presented in the ES. From a minimum distance of 69 km, the proposed 15 m increase would not be discernible. Visibility of the proposed turbines would continue to be especially limited, such that the magnitude of change would remain negligible and the effect would remain not significant. **Therefore, it was concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES.**	found that the offshore components of the East Anglia THREE project would not give rise to significant effects owing principally to their distant location, 69 km from the Suffolk coastline. This substantial separation distance means that even in good viewing conditions, when there could be the possibility that blade tips might be discernible from higher points along the coast, they would appear as extremely small and distant features. Furthermore, distant blade tips would be seen in the context of one of the busiest shipping channels around the UK, where built or human artefacts are a common feature in seaward views. The conclusion of the ES was that the magnitude of change would be negligible and the effect of the offshore components on coastal and landward receptors would not be significant. The proposed 19.37 m increase in turbine blade tip height, from 247 m to 281.37 m, would not be sufficient to alter the assessment presented in the ES. From a minimum distance of 69 km, the proposed 19.37 m increase would not be discernible. Visibility of the proposed turbines would continue to be especially limited, such that the magnitude of change would remain negligible and the effect would remain not significant. **Therefore, it is concluded that the proposed amendments will not result in any new or materially different likely**

EIA Topic	Impacts as Described in the ES Chapter	2021 Amendment Order Change in Impact Significance	Proposed Application Change in Impact Significance
			significant effects from those described in the original ES.

3.2.2. Habitats Regulations Assessment Consideration

"A change is likely to be material if it would invoke a need for a Habitats Regulations Assessment. Similarly, the need for a new or additional licence in respect of European Protected Species is also likely to be indicative of a material change."

19 Following a review of the HRA and the associated receptors, primarily birds and marine mammals, it can be concluded that the proposed parameter amendments will not give rise to any impacts beyond those already assessed in the original development consent application for the 2017 Order (as amended) (see Section 3.2.1). This is demonstrated in the topic assessments above.

20 Since EA THREE received its consent, the Outer Thames Special Protection Area (SPA) and Greater Wash SPA have been officially designated. Although official designation occurred following the grant of the DCO, these European sites were considered within the HRA. The HRA detailed that the maximum foraging ranges of breeding terns from their colonies are short (maximum range 54 km for Sandwich tern, 30 km for common tern, 11 km for little tern; Thaxter et al. 2012a) and so none would have connectivity with the East Anglia THREE site. Furthermore, foraging by these tern species tends to follow coastlines and be in shallow water, so the East Anglia THREE site is not optimal habitat for tern foraging. Survey results also demonstrated that terns (identified as either common or Arctic) were recorded in the East Anglia THREE site in only four of the 24 surveys, all during migration periods. Therefore, it was assumed at that stage that the East Anglia THREE site does not overlap with either SPA and there is no risk of a Likely Significant Effect (LSE) for these proposed additional breeding features (terns) of the Outer Thames Estuary SPA and Greater Wash SPA.

21 In May 2021 a Review of Consents for Major Infrastructure Projects and Special Protection Areas was published that identified East Anglia THREE as potentially having an LSE on The Greater Wash (due to displacement/collision risk from operating wind turbines on the Sandwich tern) as East Anglia THREE is within the upper Sandwich tern foraging ranges (Thaxter et al., 2012a; 54 km). Since the HRA, updated foraging distances for seabird species has been provided by Woodward et al. (2019). The updated maximum foraging range for Sandwich tern is 80 km; an increase on the distance provided in Thaxter et al. (2012a). The overlap between East Anglia THREE and Sandwich tern foraging range from The Greater Wash is from the SPA's offshore boundary only and to assess the risk of LSE on the SPA the distance to the colonies themselves must also be added to this to check for connectivity. The nearest colony at Blakeney Point is approx.120 km from East Anglia THREE and due to this distance a potential impact pathway on the breeding season, using updated distances provided in Woodward et al. (2019), is still screened out as per the assessment within the HRA.

22 Therefore, there will be no impacts beyond those assessed in the HRA and the amended parameters will not introduce the need for a new, or revised, HRA (as also evidenced by the CRM modelling (Appendix A) and detail provided in Section 3.2.1).

3.2.3. Compulsory Acquisition

"A change should be treated as material that would authorise the compulsory acquisition of any land, or an interest in or rights over land that was not authorised through the existing DCO.".

23 The proposed change applies to activities being undertaken within the existing DCO Order Limits and in offshore areas that will be leased to the project by The Crown Estate. As such, the possible requirement for compulsory acquisition beyond that provided for by the original DCO does not arise.

3.2.4. Local Population

"The potential impact of the proposed changes on local people will also be a consideration in determining whether a change is material."

24 As discussed above in Section 3.2.1 there will be no changes in impact significance in relation to seascape and landscape and visual, commercial fisheries and shipping and navigation and therefore the proposed amendment will not affect local onshore or offshore stakeholders.

4. PRE-SUBMISSION STAKEHOLDER CONSULTATION

25 EATL will submit a statement setting out the details of the steps EATL has taken to comply with the requirements of regulations 6 and 7 of the 2011 Regulations (Consultation and Publicity Statement) in due course.

26 In the meantime, this section outlines the consultation that has been or will be undertaken as part of the application for a NMC.

4.1. Pre-Application Consultation

27 EATL has undertaken informal pre-application consultation with the Marine Management Organisation (MMO), the Department for Business, Energy and Industrial Strategy (BEIS), the Environment Agency, Suffolk County Council , Mid Suffolk Council, East Suffolk Council, the Civil Aviation Authority (CAA), The Crown Estate, Historic England, Natural England, RSPB, Whale and Dolphin Conservation (WDC), The Wildlife Trusts, the Marine Coastguard Agency (MCA), the Ministry of Defence (MoD), NATS, the National Federation of Fishermen's Organisations (NFFO) and Trinity House in order to brief consultees on the nature of the proposed amendments.

Table 4-1 List of confirmed consultees as per Regulation 7 of the 2011 Regulations

Consultee	Date of Consultation	Consultation Format	Summary of Consultation	Confirmed Consultee
MMO	28 May 2021	Email	Notification of the proposed NMC application.	✓
	21 July 2021	Email	Confirmed that MMO should be included in list of consultees.	
	15 June 2021	Email	Notification of electronic submission.	
BEIS	18 May 2021	Email Meeting	Notification of the proposed NMC application. Notification of electronic submission.	N/A
	02 July	Email Letter	Regulation 7 request sent.	
	19 July	Email Letter	Regulation 7 letter response received.	
Environment Agency	28 May 2021	Email	Notification of the proposed NMC application. Confirmation that the Environment Agency would not require consultation as the proposed changes will not alter any of the parameters used in the assessment there will be no change to the impacts previously assessed. Because of the limited changes to the project it was agreed with The Environment Agency that they do not need to be consulted in relation to the MNC application.	X
Suffolk County Council	27 May 2021	Email	Notification of the proposed NMC application. Confirmed Suffolk County Council to be included in list of consultees.	✓
	15 June 2021	Email	Notification of electronic submission.	

Consultee	Date of Consultation	Consultation Format	Summary of Consultation	Confirmed Consultee
Mid Suffolk Council	27 May 2021	Email	Notification of the proposed NMC application. Confirmed Mid Suffolk Council to be included in list of consultees.	✓
	15 June 2021	Email	Notification of electronic submission.	
East Suffolk Council	27 May 2021	Email	Notification of the proposed NMC application. Confirmed East Suffolk Council to be included in list of consultees.	✓
	15 June 2021	Email	Notification of electronic submission.	
CAA	28 May 2021	Email	Notification of the proposed NMC application. Confirmed CAA to be included in list of consultees.	✓
	16 June 2021	Email	Notification of electronic submission.	
The Crown Estate	28 May 2021	Email	Notification of the proposed NMC application. Confirmed The Crown Estate to be included in list of consultees.	✓
	16 June 2021	Email	Notification of electronic submission.	
Historic England	28 May 2021	Email	Notification of the proposed NMC application. Confirmed Historic England to be included in list of consultees.	✓
	16 June 2021	Email	Notification of electronic submission.	
Natural England	28 May 2021	Email	Notification of the proposed NMC application. Confirmed Natural England to be included in list of consultees.	✓
	16 June 2021	Email	Notification of electronic submission.	

Consultee	Date of Consultation	Consultation Format	Summary of Consultation	Confirmed Consultee
RSPB	28 May 2021	Email	Notification of the proposed NMC application. Confirmed RSPB to be included in list of consultees.	✓
	16 June 2021	Email	Notification of electronic submission.	
WDC	28 May 2021	Email	Notification of the proposed NMC application. WDC stated that they do not currently have the capacity to engage on case work consultations. However, WDC are to be included in the list of consultees.	✓
	16 June 2021	Email	Notification of electronic submission.	
The Wildlife Trusts	28 May 2021	Email	Notification of the proposed NMC application. Confirmed The Wildlife Trusts to be included in list of consultees.	✓
	16 June 2021	Email	Notification of electronic submission.	
MCA	28 May 2021	Email	Notification of the proposed NMC application. Confirmed the MCA to be included in list of consultees.	✓
	16 June 2021	Email	Notification of electronic submission.	
MoD	28 May 2021	Email	Notification of the proposed NMC application. Confirmed the MoD to be included in list of consultees.	✓
	16 June 2021	Email	Notification of electronic submission.	
NATS	28 May 2021	Email	Notification of the proposed NMC application. Confirmed that NATS are to be included in list of consultees.	✓
	16 June 2021	Email	Notification of electronic submission.	

Consultee	Date of Consultation	Consultation Format	Summary of Consultation	Confirmed Consultee
NFFO	28 May 2021	Email	Notification of the proposed NMC application. Confirmed that NFFO are to be included in list of consultees.	✓
	16 June 2021	Email	Notification of electronic submission.	
Trinity House	28 May 2021	Email	Notification of the proposed NMC application. Confirmed that Trinity House are to be included in list of consultees.	✓
	16 June 2021	Email	Notification of electronic submission.	

4.2. Post-Application Process

28 The 2011 Regulations set out, in regulations 6 and 7, the prescribed process for the publication and consultation of the Application. Regulation 6 requires a notice of the Application (Regulation 6 Notice) to be published for two consecutive weeks in one or more local newspapers and in any other publication necessary in order to ensure that notice of the Application is given in the vicinity of the land. The Regulation 6 Notice will be published in the following newspapers:

- Fishing News;
- East Anglian Daily Times;
- Eastern Daily Press;
- Ipswich Star;
- The Lowestoft Journal;
- The Great Yarmouth Mercury;
- Beccles and Bungay Journal;
- Norwich Evening News**;**
- The West Suffolk Mercury;
- Great Yarmouth Advertiser; and
- The Waveney Advertiser.

29 EATL intends to publicise the Application by the following means:

- EATL will publicise the Regulation 6 Notice on the ScottishPower Renewables website;
- The Application documents will be made accessible electronically at the following websites:
  - The National Infrastructure Planning Portal (under East Anglia THREE Offshore Wind Farm, Documents, NMC 3):
    - https://infrastructure.planninginspectorate.gov.uk/projects/eastern/east-anglia-three-offshore-wind-farm/?ipcsection=docs
  - The ScottishPower Renewables Website (under East Anglia, Projects, East Anglia THREE, Non Material Change to East Anglia THREE, Latest Updates):
    - https://www.scottishpowerrenewables.com/pages/non_material_change_application_to_east_anglia_three.aspx
- Any enquiries on the documents can be sent to the Applicant by emailing the Stakeholder Team on Eastangliathree@scottishpower.com or by calling 07738 063 259 or 07928 655 088. A limited number of paper copies of the Application are available, by special request;
- Distribution of the Regulation 6 Notice to the list of interested parties, as collated from registered users of the ScottishPower Renewables website; and
- Provision of the application to the ScottishPower Renewables nominated Fisheries Liaison Officer for communication to the fishing community.

30 Further, as set out in regulation 7(3) of the 2011 Regulations, EATL has confirmed the reduced list of relevant consultees with BEIS and these are set out in Table 4-1.

31 A copy of the newspaper notices, correspondence to the consultees and confirmation of the dates that these were published or sent will be set out and confirmed in the Consultation and Publicity Statement.

5. CONCLUSION

32 EATL is seeking to amend the 2017 Order (as amended) for the EA THREE Offshore Wind Farm to benefit from continuing technological developments in the offshore wind industry and to further reduce the cost of these projects to the consumer in line with Government policy. The proposed amendments relate to removing the stated gross electrical output capacity, reducing the number of WTGs, and increasing the size of the WTGs including tip height and rotor diameter.

33 Taking into account the four tests outlined in the 2015 DCLG Guidance on Changes to Development Consent Orders it is concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES or HRA.

APPENDIX A

Collision Risk Modelling

East Anglia THREE Offshore Windfarm

Collision Risk Modelling for Revised Turbine Design

Date:	17th August 2021
Tel:	0141 342 5404
Web:	www.macarthurgreen.com
Address:	93 South Woodside Road |Glasgow | G20 6NT

#1833140v1<Active> - MacArthur Green EA3 CRM op2 trends jul2021 v1.0 (003)ASH (003...docx

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1	Internal Approval	Mark Trinder	08/07/2021
1.1	Internal Approval	Mark Trinder	17/08/2021

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1 INTRODUCTION

This note provides annual collision mortality estimates for the five seabird species of primary interest during the assessment and examination for the East Anglia THREE Offshore Windfarm: gannet, kittiwake, lesser black-backed gull, herring gull and great black-backed gull.

The estimates have been calculated using the Band (2012) Collision Risk Model (CRM) using the turbine parameters for (i) the consented turbine models, (ii) the non-material change (NMC[2]) granted on 15th April 2021 (SPR 2020), and (iii) for a proposed alternative turbine model (NMC[3]). This comparison is provided to allow the predicted changes in the collision risk to be clearly seen.

Band option 2 collision estimates for gannet and kittiwake have been included in Annex A in addition to Band option 1 collision estimates in line with current Natural England guidance received via pre-application consultation on Monday 12th July 2021. This report therefore contains option 2 estimates for all the species assessed as at risk of collisions at East Anglia THREE in Annex A (to avoid inappropriate comparisons between option 1 and option 2 collision estimates).

Only the turbine parameter values have been changed in the CRM, with all the other input parameters to the model (seabird density, biometrics, flight heights, avoidance rates, nocturnal activity, wind farm operational percentage, etc.) kept the same as those reported in Appendix 13.3 of the East Anglia THREE Offshore Windfarm Environmental Statement (ES) (APEM 2015), and in MacArthur Green (2016).

2 METHODS

The collision estimates were calculated with the Band (2012) CRM using the seabird species and turbine parameters presented below (Table 2-1, Table 2-2,

Table 2-3 and Table 2-4). The consented East Anglia THREE Offshore Windfarm design comprised 172 turbines, 52 (30%) of which had a lower rotor tip height of 22 m from Mean Sea level (MSL) with the remaining 120 (70%) with a lower rotor tip height of 24 m. The East Anglia THREE Offshore Windfarm CRM presented in the ES used Band CRM option 1 for gannet and kittiwake (as there were more than 100 flight height observations) and option 2 for the large gull species (for which smaller flight height samples were obtained). The same model options have been used in this update, with the addition of option 2 results for gannet and kittiwake (in Annex A), as advised by Natural England. For comparison, Option 2 results from the original assessment and the NMC[2] application have been included in Annex A in order to avoid inappropriate comparisons between Band options.

The proposed alternative wind farm design modelled here (100 turbines, NMC[3]) has a lower rotor tip height of 24 m for all turbines. This was also the lower tip height used in the modelling for the April 2021 NMC[2] (SPR 2020).

At the time of the East Anglia THREE assessment, Natural England advice was to use site specific estimates of flight height data in combination with Band model option 1 for those species with a large enough number of height observations (recommended minimum: 100) for this to be considered robust. For species with smaller numbers of observations the Natural England advice was to use Band model option 2, which derives height estimates from a pooled dataset analysed by the British Trust for Ornithology (BTO; Johnston et al. 2014a,b).

In the baseline survey data, gannet and kittiwake met the required sample size for using option 1, with 251 and 208 height observations, respectively. However, none of the large gull species had sufficient observations (11, 29, 38 for lesser black-backed gull, herring gull and great black-backed gull, respectively). Thus, the collision assessment for the large gulls used option 2.

Table 2-1 Wind turbine parameters [values used for the purposes of CRM].

Parameter	Consented turbine parameters	Turbine parameters used in NMC[2] granted 15/04/2021	Proposed alternative turbine parameters (NMC[3])
Maximum no. of turbines	172	121	100
Rotation speed (RPM)	11	8.2	8.4
Rotor radius (m)	77	115	125
Minimum hub height (m from MSL) *	99 / 101	139	139 (149#)
Max blade width (m)	5	7	7
Blade pitch (°)	15	15	15
Tidal offset (m)	0	0	0
Wind farm width (km)	33.25	33.25	33.25
Latitude (°)	52.67	52.67	52.67

* note that in the ES a hub height of 99m (from MSL) was used in the CRM for all turbines. This was superseded during the project examination with a 30:70 split in hub heights which ensure lower rotor tip heights of 22m for a maximum of 52 turbines and 24m for the remainder (120) and this was the basis of the consented design.

Whilst NMC[3] has proposed an increased rotor diameter, the minimum hub height has not increased in height to retain maximum design flexibility but also assesses all potential impacts. A commitment has been made to retain the lower tip height (minimum draft height) of 24m; therefore the maximum rotor radius would not be used in conjunction with the minimum hub height. A hub height of 149m from MSL was used in the CRM.

Table 2-2 Wind farm operating time percentages.

Month	Operating time (%)
January	95.23
February	93.65
March	92.30
April	91.04
May	91.78
June	88.86
July	90.00
August	89.60
September	92.20
October	94.29
November	95.40
December	95.03

Table 2-3 Seabird densities (birds in flight/km²).

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gannet	0.000	0.000	0.082	0.100	0.000	0.054	0.043	0.020	0.117	0.039	1.493	0.415
Kittiwake	0.597	0.597	0.158	0.198	0.079	0.133	0.000	0.000	0.000	0.061	0.855	1.965
Lesser black-backed gull	0.020	0.000	0.000	0.021	0.023	0.018	0.000	0.086	0.048	0.000	0.029	0.000
Herring gull	0.099	0.123	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.086	0.283
Great black-backed gull	0.178	0.240	0.000	0.049	0.000	0.000	0.034	0.000	0.000	0.035	0.062	0.193

Table 2-4 Seabird biometrics.

Species	Body length (m)	Wingspan (m)	Flight speed (ms-1)	Proportion at collision height		Flight type	Nocturnal activity score (Garthe & Hüppop 2004)	Band model option
				Lower tip 22m above MSL	Lower tip 24m above MSL			
Gannet	0.94	1.72	14.9	0.0637	0.0558	gliding	2	1 & 2
Kittiwake	0.39	1.08	13.1	0.1009	0.0673	flapping	3	1 & 2
Lesser black-backed gull	0.58	1.42	13.1	0.2391	0.2105	flapping	3	2
Herring gull	0.60	1.44	12.8	0.2773	0.2476	flapping	3	2
Great black-backed gull	0.71	1.58	13.7	0.2997	0.2693	flapping	3	2

3 RESULTS

The gannet and kittiwake flight height data recorded during the baseline digital aerial surveys are summarised in Table 3-1. This presents the numbers of birds recorded above heights of 10 m to 35 m above MSL at 1 m intervals, and the corresponding percentages for these heights (i.e. the percentage that would be at risk of collision for rotors with these lower tip heights). These data were used to estimate the proportion at rotor height used for the option 1 collision modelling presented in the original application.

Table 3-1 Summary of gannet and kittiwake flight height data recorded during the baseline East Anglia THREE aerial surveys. These data were used in the original application to estimate the proportion of birds at rotor height. The data used for lower tip heights of 22 m and 24 m (corresponding to the windfarm design in the ES and NMC[2] and NMC[3]) are highlighted.

Height (m above MSL)	Gannet		Kittiwake	
	No. recorded above height	Percentage above this height	No. recorded above height	Percentage above this height
10	66	26.29%	62	29.81%
11	61	24.30%	59	28.37%
12	55	21.91%	53	25.48%
13	49	19.52%	48	23.08%
14	43	17.13%	44	21.15%
15	36	14.34%	42	20.19%
16	31	12.35%	38	18.27%
17	23	9.16%	31	14.90%
18	23	9.16%	25	12.02%
19	20	7.97%	23	11.06%
20	18	7.17%	23	11.06%
21	17	6.77%	21	10.10%
22	16	6.37%	21	10.10%
23	15	5.98%	18	8.65%
24	14	5.58%	14	6.73%
25	12	4.78%	14	6.73%
26	11	4.38%	14	6.73%
27	9	3.59%	12	5.77%
28	8	3.19%	10	4.81%
29	8	3.19%	6	2.88%
30	7	2.79%	6	2.88%
31	6	2.39%	5	2.40%
32	5	1.99%	4	1.92%
33	5	1.99%	4	1.92%
34	5	1.99%	4	1.92%
35	4	1.59%	3	1.44%
35	4	1.59%	3	1.44%
Total	**251**	-	**208**	-

The annual collision mortality estimates for the consented wind farm design are presented in Table 3-2 alongside those used in the NMC[2], and those used for the alternative turbines (NMC[3]).

Option 2 results for gannet and kittiwake (which were only presented using option 1 for NMC[2]) are included in Annex A.

Table 3-2 Comparison of annual collision mortality estimates for the East Anglia THREE consented design (172 turbines), the NMC April 2021 design (121 turbines) and the proposed alternative design (100 turbines).

Species	Band option	Consented turbine parameters	Turbine parameters used in NMC[2] 15/04/2021	Proposed alternative turbine parameters (NMC[3])	Percentage reduction from consent to NMC[3]
Gannet	1	49.0	41.8	37.0	24.5
Kittiwake	1	112.2	92.3	81.0	27.8
Lesser black-backed gull	2	9.51	8.5	7.4	22.1
Herring gull	2	23.99	21.4	18.9	21.2
Great black-backed gull	2	38.85	34.4	30.3	22.1

Annual collision mortalities for the proposed alternative turbine design (100 turbines; NMC[3]), compared with the consented design, are reduced by up to 28% (kittiwake, option 1).

Monthly collision mortalities are presented in Table 3-3 for the alternative design (NMC[3]).

Table 3-3 Monthly collision mortalities for the East Anglia THREE proposed alternative design (100 turbines; NMC[3]).

Species	Option	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Gannet	1	0.0	0.0	1.5	1.9	0.0	1.1	0.9	0.4	2.1	0.7	22.5	6.0	37.0
Kittiwake	1	10.5	9.8	3.0	3.8	1.6	2.7	0.0	0.0	0.0	1.1	14.8	33.8	81.0
Lesser black-backed gull	2	0.5	0.0	0.0	0.6	0.8	0.6	0.0	2.7	1.4	0.0	0.8	0.0	7.4
Herring gull	2	3.2	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	9.1	18.9
Great black-backed gull	2	6.9	8.7	0.0	2.1	0.0	0.0	1.6	0.0	0.0	1.4	2.3	7.3	30.3

As can be seen in these collision predictions, the changes in windfarm design from that consented, to that in the approved NMC[2] and the current NMC[3], have all reduced the collision estimates. Thus the revisions to the proposed windfarm have reduced the predicted collision impacts.

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SPR (2020) East Anglia THREE DCO Non-Material Change Supporting Statement. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010056/EN010056-002456-EA3_NMC%20Report_rev1_July2020_004_clean_final.pdf

ANNEX A. BAND OPTION 2 COLLISION ESTIMATES FOR GANNET AND KITTIWAKE

Natural England guidance for more recent windfarm collision assessments is to use option 2 for all species, irrespective of the number of height observations recorded during surveys (due to concerns regarding the methods for seabird height estimation from digital aerial imagery). This was confirmed at a pre-application consultation meeting on Monday 12th July 2021 with Natural England. Thus, while the revised collision modelling provided in this note has followed the methods used in the original assessments and previous non-material change applications in order to present 'like-for-like' outputs (i.e. use of option 1 for gannet and kittiwake and option 2 for large gulls), in keeping with advice received from Natural England, option 2 outputs have also been calculated for gannet and kittiwake so that comparisons between different Band options for the consented design, the previous NMC design (NMC[2]) and the current design (NMC[3]) are not made. These are provided for the consented design, the previous NMC design (NMC[2]) and the current NMC design (NMC[3]) in order to demonstrate the same magnitude of reductions in collisions that have resulted from the modifications to the windfarm, irrespective of the model option used. It should be noted that option 2 outputs were included in the assessment of the consented design and therefore were considered as part of the decision to grant the original consent.

The option 2 annual collision mortality estimates for gannet and kittiwake for the consented wind farm design are presented in Table A-1 alongside those used in the NMC[2], and those used for the alternative turbines (NMC[3]). Note that results for gannet and kittiwake were only presented using option 1 for NMC[2].

Table A-1 Comparison of annual collision mortality estimates for the East Anglia THREE consented design (172 turbines), the NMC April 2021 design (121 turbines) and the proposed alternative design (100 turbines).

Species	Band option	Consented turbine parameters	Turbine parameters used in NMC[2] 15/04/2021	Proposed alternative turbine parameters (NMC[3])	Percentage reduction from consent to NMC[3]
Gannet	2	71.4	61.7	54.9	23.1
Kittiwake	2	152.5	137.7	121.4	20.4

Annual collision mortalities for the proposed alternative turbine design (100 turbines; NMC[3]), compared with the consented design, are reduced by up over 23% (gannet, option 2).

Monthly collision mortalities are presented in Table A-2 for the alternative design (NMC[3]) against option 2 results.

Table A-2 Monthly collision mortalities for the East Anglia THREE proposed alternative design (100 turbines; NMC[3]).

Species	Option	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Gannet	2	0.0	0.0	2.2	2.8	0.0	1.7	1.3	0.6	3.1	1.0	33.3	8.9	54.9
Kittiwake	2	15.7	14.6	4.5	5.7	2.5	4.0	0.0	0.0	0.0	1.7	22.2	50.7	121.4

As can be seen in these collision predictions, the changes in windfarm design from that consented, to that in the approved NMC[2] and the current NMC[3], have all reduced the collision estimates when considered using the same model option throughout. Thus, irrespective of the Band option used, the revisions to the proposed windfarm reduce the predicted collision impacts.

APPENDIX B

Radar Modelling Assessment

Aviation Radar Modelling for Revised Turbine Design

East Anglia THREE Offshore Windfarm – Non-Material Change 3

11 August 2021

CL-5630-RPT-002 V1.1

www.cyrrus.co.uk

info@cyrrus.co.uk

Executive Summary

A third non-material change (NMC[3]) to the consent for the East Anglia THREE Offshore Windfarm is proposed which includes an increase of wind turbine tip height from 262m to 282m and a reduction in the maximum number of turbines from 121 to 100. NMC[3] follows the NMC[2] application submitted in July 2020 and granted on 15th April 2021 (SPR 2020[1]) which amended the maximum turbine tip height from 247m to 262m and reduced the number of turbines from 172 to 121.

This assessment considers the extent to which the impacts on Ministry of Defence (MOD) Trimingham radar and NATS Cromer radar, as modelled for the turbine parameters for the consented turbine models and subsequently modelled for NMC[2], have changed with the revised turbine parameters and whether such change would give rise to new or materially different likely significant effects on the environment when compared to those previously assessed and consented. To that end an indicative turbine layout of 99 turbines and one offshore substation, representing a realistic worst-case for radar modelling purposes, is utilised in this report.

Radar Line of Sight (RLoS) modelling indicates that:

- 84 of the 99 turbines in the indicative layout will be visible to Trimingham radar;
- It can be assumed that any turbines in RLoS of Trimingham will be detected by the radar; and
- 58 of the 99 turbines in the indicative layout will be visible to Cromer radar.

Radar Probability of Detection (PD) modelling indicates that:

- All but the closest 14 turbines to Cromer radar are unlikely to be detected by that radar.

For MOD Trimingham radar this assessment concludes that:

- The principle of the mitigation remains appropriate to mitigate significant effects. Development Consent Order (DCO) Requirement 33 agreed with the MOD in respect of NMC[2] remains sufficient and appropriate to accommodate the increase in tip height to 282m under this NMC[3].

For NATS Cromer radar the assessment concludes that:

- Up to 14 turbines of 282m tip height may be detected by Cromer radar. This, however, is not considered to represent a change to the ES conclusion that there would be no significant impact on NATS Cromer radar. Notwithstanding this, and if considered necessary, measures are available to mitigate the detection of Wind Turbine Generators by the NATS Cromer radar in the form of blanking alone or together with a Transponder Mandatory Zone (TMZ), which measures can be secured through a DCO Requirement if required.

Full details of the modelling and findings are contained within the body of this assessment.

[1] SPR (2020) East Anglia THREE DCO Non-Material Change Supporting Statement. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010056/EN010056-002456-EA3_NMC%20Report_rev1_July2020_004_clean_final.pdf

Abbreviations

AGL	Above Ground Level
AMSL	Above Mean Sea Level
ATC	Air Traffic Control
DCO	Development Consent Order
DTM	Digital Terrain Model
EIA	Environmental Impact Assessment
ES	Environmental Statement
GIS	Geographic Information System
ITAR	International Traffic in Arms Regulations
LAT	Lowest Astronomical Tide
MOD	Ministry of Defence
NMC	Non-Material Change
PD	Probability of Detection
PSR	Primary Surveillance Radar
RCS	Radar Cross Section
RLoS	Radar Line of Sight
TMZ	Transponder Mandatory Zone
TOPA	Technical and Operational Assessment
WTG	Wind Turbine Generator

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1. Radar Re-Modelling

1.1. Introduction

1.1.1. The East Anglia THREE Offshore Windfarm project is the second offshore wind project to be developed in the East Anglia Zone. It is wholly owned by ScottishPower Renewables and received consent from the Secretary of State for Business, Energy and Industrial Strategy in August 2017.

1.1.2. The East Anglia THREE Offshore Windfarm site covers an area of approximately 305km^2 and is located 69km from the coast. The windfarm as currently consented has an anticipated installed capacity of up to 1400MW.

1.1.3. In July 2020 an application for a non-material change (NMC[2]) to its planning consent was submitted to amend the parameters of its offshore substations and wind turbines and was granted on 15th April 2021. The changes to the turbine parameters are:

- A reduction in the maximum number of turbines from 172 to 121;
- A maximum turbine tip height increase from 247m above Lowest Astronomical Tide (LAT) to 262m above LAT;
- A maximum rotor diameter increase from 220m to 230m.

1.1.4. A further NMC (NMC[3]) is now proposed which includes the following changes to the turbine parameters:

- A reduction in the maximum number of turbines from 121 to 100;
- A maximum turbine tip height increase from 262m above LAT to 282m above LAT;
- A maximum rotor diameter increase from 230m to 250m.

1.1.5. In light of these revised parameters, a radar re-modelling assessment is required to establish whether the predicted impacts on Ministry of Defence (MOD) and NATS radars would amount to new or materially different likely significant effects when compared with those assessed for the initial East Anglia THREE Offshore Windfarm Environmental Impact Assessment (EIA), and further assessed for NMC[2].

1.1.6. NMC[3] will also seek to remove the stated gross electrical capacity as one of the proposed changes to the Development Consent Order (DCO). This has no bearing on the assessment or conclusions contained within this report.

1.2. Effects of Wind Turbines on Radars

1.2.1. Wind turbines are a problem for aviation Primary Surveillance Radars (PSRs) as the characteristics of a moving wind turbine blade are similar to an aircraft. The PSR is unable to differentiate between wanted aircraft targets and clutter targets introduced by the presence of the turbines.

1.2.2. Radar impacts may be mitigated by either operational or technical solutions or a combination of both.

1.2.3. Initial modelling undertaken in support of the initial East Anglia THREE Offshore Windfarm application identified the potential impact of turbines on the MOD Air Defence radar at Trimingham and on the NATS Cromer radar.

1.2.4. To support the NMC[2], Cyrrus conducted a radar modelling assessment[2] of the amended turbine parameters. The assessment concluded that for MOD Trimingham radar the principle of the existing mitigation remained appropriate to mitigate significant effects. For NATS Cromer radar, analysis showed that with a tip height of 262m there could be a small impact in terms of radar detection. However, it was not considered to represent a change to the Environmental Statement (ES) conclusion that there would be no significant impact on Cromer radar.

1.2.5. This assessment revisits the NMC[2] radar modelling in light of the revised NMC[3] wind turbine parameters.

1.3. References

- Lockheed Martin TPS-77 radar: Lockheed Martin AN/TPS-77 Factsheet B013-03;
- MOD Trimingham radar positional data: Positional data pertaining to MOD Trimingham radar was received by email from DIO Estates-SnrSafegdgMgr3 on 17/04/20 12:59;
- NATS Cromer radar site data: Ofcom Protected Radar list updated 5 January 2021;
- Raytheon ASR-10SS radar: Raytheon ASR-10SS Factsheet.

1.4. Data

1.4.1. The following data from both MoD and NATS has been used to establish the drawings and calculations used in this report.

1.4.2. MOD Trimingham Radar

1.4.2.1. Radar position:

- Grid Ref: TG 28846 38256 (E628846, N338256);
- Site Height: 69.8m Above Mean Sea Level (AMSL);
- Antenna Aperture: 7.85m Above Ground Level (AGL).

1.4.2.2. The MOD has confirmed that the Trimingham radar is a Lockheed Martin TPS-77 used in the Air Defence role.

1.4.2.3. The MOD was unable to provide any technical information or specifications as these are ITAR (International Traffic in Arms Regulations) protected.

1.4.2.4. Additional data was derived from the Lockheed Martin Factsheet B013-03 referred to in Section 1.3 above.

[2] CL-5499-RPT-002 V2.0 dated 14 July 2020

1.4.3. NATS Cromer Radar

1.4.3.1. Radar position:

- Latitude: 52N5438;
- Longitude: 001E2059;
- Antenna Height: 17.5m AGL.

1.4.3.2. The radar is a Raytheon ASR-10SS used for en-route Air Traffic Control (ATC) and Southern North Sea operations.

1.4.3.3. Additional data was derived from the Raytheon ASR-10SS factsheet referred to in Section 1.3 above.

1.4.4. East Anglia THREE Offshore Windfarm

1.4.4.1. The boundary of the East Anglia THREE Offshore Windfarm site was provided as a geo-referenced Shapefile from SPR:

- EATHREE_Windfarm_v14_SPR_07182015.shp.

1.4.5. Turbines

1.4.5.1. Turbine parameters used in this assessment are shown in Table 1.

Max Tip Height above LAT	Max Rotor Diameter	Max number of turbines
282m	250m	100

Table 1: Turbine Data

1.4.5.2. Note that the maximum turbine tip height is expressed as being above LAT. Radar assessments are based on AMSL, which is 0.54m above LAT at the centre of the East Anglia THREE Offshore Windfarm site, therefore AMSL calculations incorporate an additional buffer.

1.4.5.3. An indicative turbine layout has been prepared to inform the radar modelling for NMC[3], and was provided as a geo-referenced Shapefile:

- EA3_WTG_Layout_Scenario44_20201126.shp.

1.4.5.4. Although NMC[3] seeks to reduce the maximum number of turbines to 100, the Shapefile indicative layout used for the modelling contains only 99 turbines and an offshore substation location. This small disparity does not significantly impact the assessment results.

1.4.5.5. The indicative turbine layout is shown in the following figure:

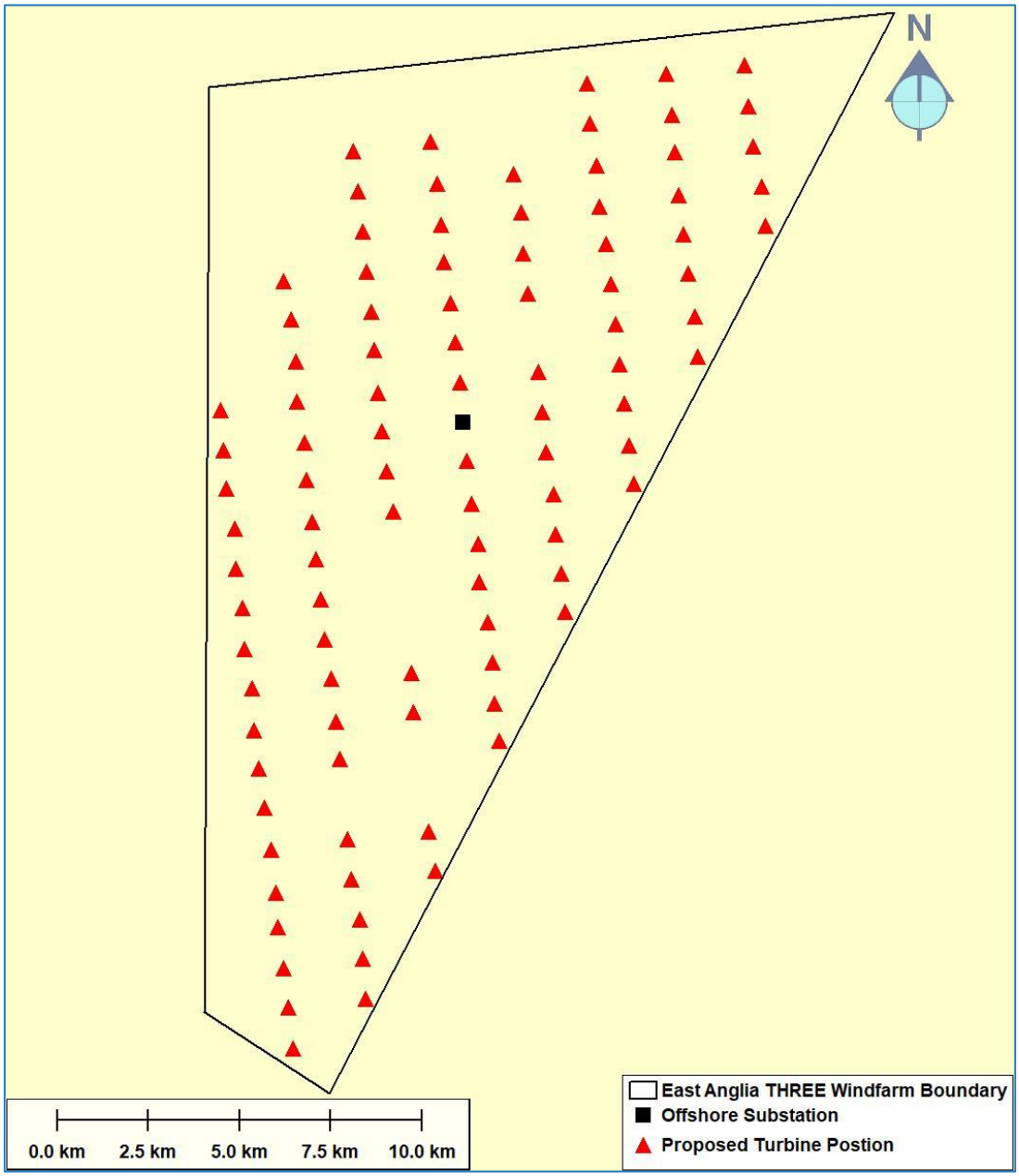

Figure 1: 282m Tip Height Turbine Model Indicative Layout - 99 Turbines (Plus 1 Offshore Substation)

1.4.5.6. This turbine layout represents a realistic worst-case for radar modelling purposes. Earlier indicative layouts were utilised to inform radar modelling in the Environmental Statement. The key consideration remains radar line of sight. The layout being utilised here provides specific test points across the entire East Anglia THREE Offshore Windfarm site footprint where turbines may be deployed in order to assist aviation stakeholders to fully assess the proposed NMC.

1.4.6. Terrain Data

- SRTM Worldwide Elevation Data 3 arc second resolution;

- NextMap 25m Digital Terrain Model (DTM) in area around radars (perpetual licence).

1.4.7. Analysis Tools

- ATDI HTZ communications V23.2.0 x64 release 1464 radio network analysis tool;
- Global Mapper v21.1.1 Geographic Information System (GIS);
- ZWCAD+ 2015 SP2 Pro.

1.4.8. Mapping Datums

1.4.8.1. Radar data was supplied in Ordnance Survey National Grid Reference (OSGB36 datum) and Latitude/Longitude (WGS84 datum) formats.

1.4.8.2. The indicative turbine layout was supplied in geo-referenced Shapefile format.

1.4.8.3. UTM31N (WGS84 datum) is used as a common working datum for all mapping and geodetic references.

1.4.8.4. Mapping datum transformations are made using Global Mapper v21.1.1 or Grid InQuest II.

1.4.8.5. All heights stated in this document are AMSL (Newlyn datum) unless stated otherwise.

1.5. Radar Line of Sight Assessment

1.5.1. Methodology

1.5.1.1. Initial Radar Line of Sight (RLoS) is determined by use of terrain data with a radio propagation model. A 25m horizontal DTM is used near the radars to provide accurate terrain mapping. SRTM data is used for the sea and other areas to provide a background context. The two datasets are combined and used in both the GIS and radar propagation models.

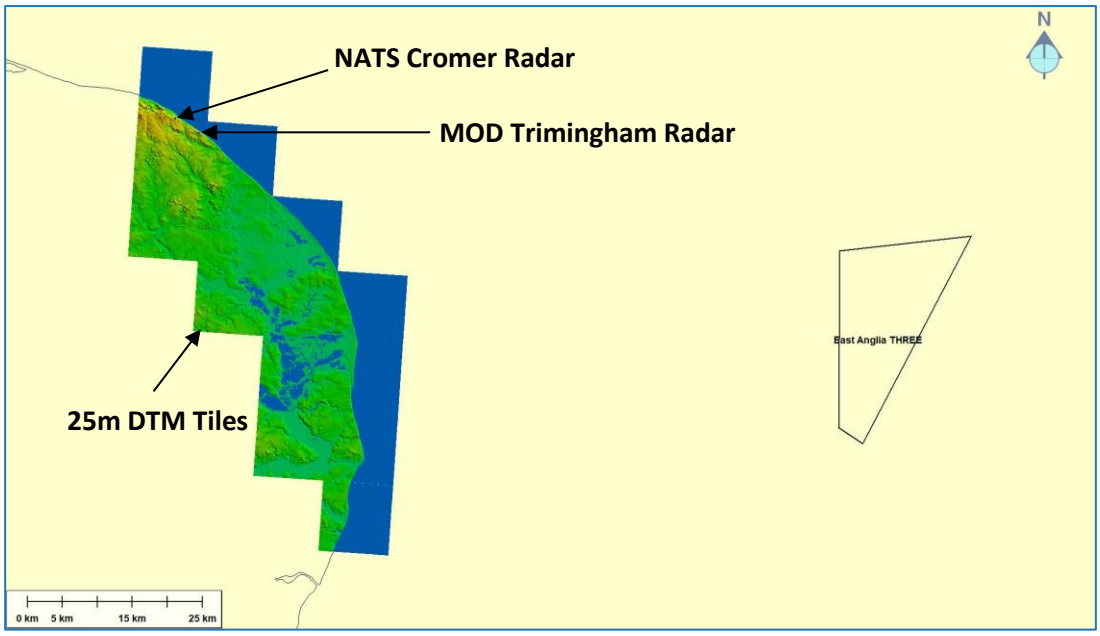

Figure 2: High Resolution DTM in Vicinity of Radars

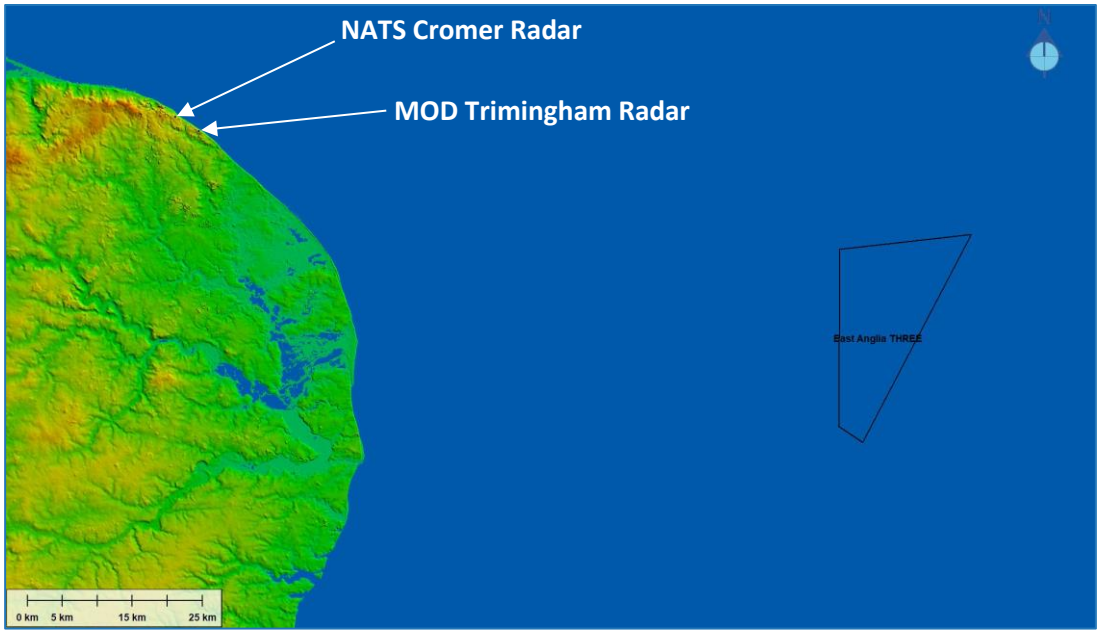

Figure 3: DTM with SRTM background

1.5.1.2. Initial coarse assessments are made using a GIS tool using a 4/3 earth curvature refraction model. This provides an illustrative overview of RLoS.

1.5.1.3. Detailed investigation and measurements are made using the same terrain data with ATDI HTZ communications, a radio propagation model.

2. MOD Trimingham Radar

2.1. Topography

2.1.1. The closest point of the East Anglia THREE Offshore Windfarm site is 50.2NM (92.9km) from Trimingham radar.

2.1.2. There is no intervening terrain to provide any screening of the East Anglia THREE Offshore Windfarm site; however, earth curvature does provide significant screening. The absence of terrain screening means that the edge of radar cover follows an arc.

2.2. Radar Line of Sight

2.2.1. An initial assessment established RLoS to turbines with a tip height of 282m across the East Anglia THREE Offshore Windfarm site, as shown in Figure 4 where RLoS is indicated by the magenta shading.

Figure 4: Trimingham Radar RLoS to 282m Tip Height Turbines

2.2.2. The calculated RLoS contour from Trimingham radar to 282m tip height turbines at the East Anglia THREE Offshore Windfarm site is depicted in more detail in Figure 5.

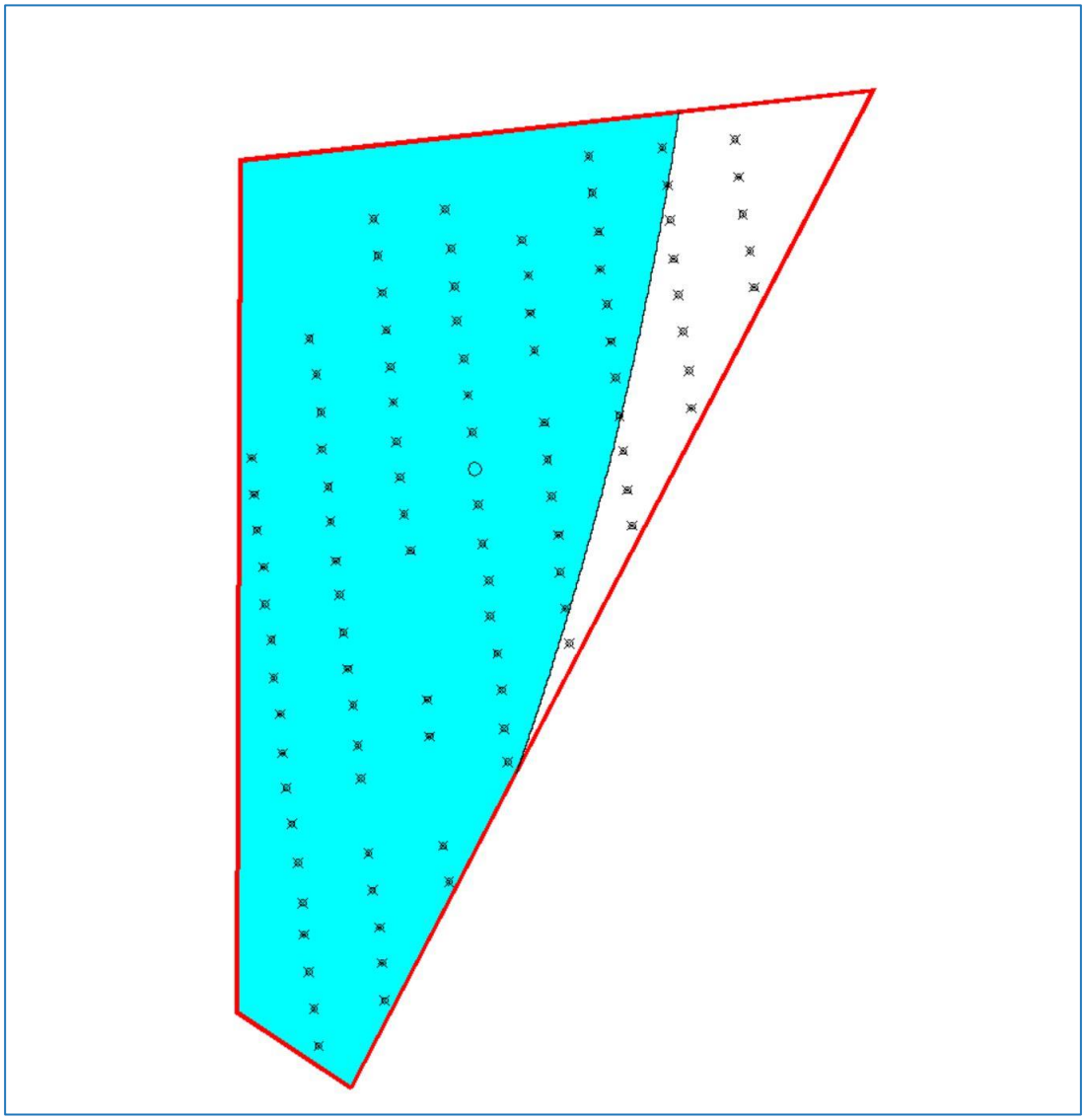

Figure 5: Trimingham Radar RLoS 282m Contour across East Anglia THREE Offshore Windfarm Site

2.2.3. The cyan shaded area depicts where Trimingham radar has RLoS to 282m turbines. 84 of the 99 turbines in this indicative visualisation layout are in RLoS of Trimingham radar.

2.2.4. The RLoS contours from Trimingham radar to 207m, 223m, 247m, 262m and 282m tip height turbines at the East Anglia THREE Offshore Windfarm site are depicted in Figure 6.

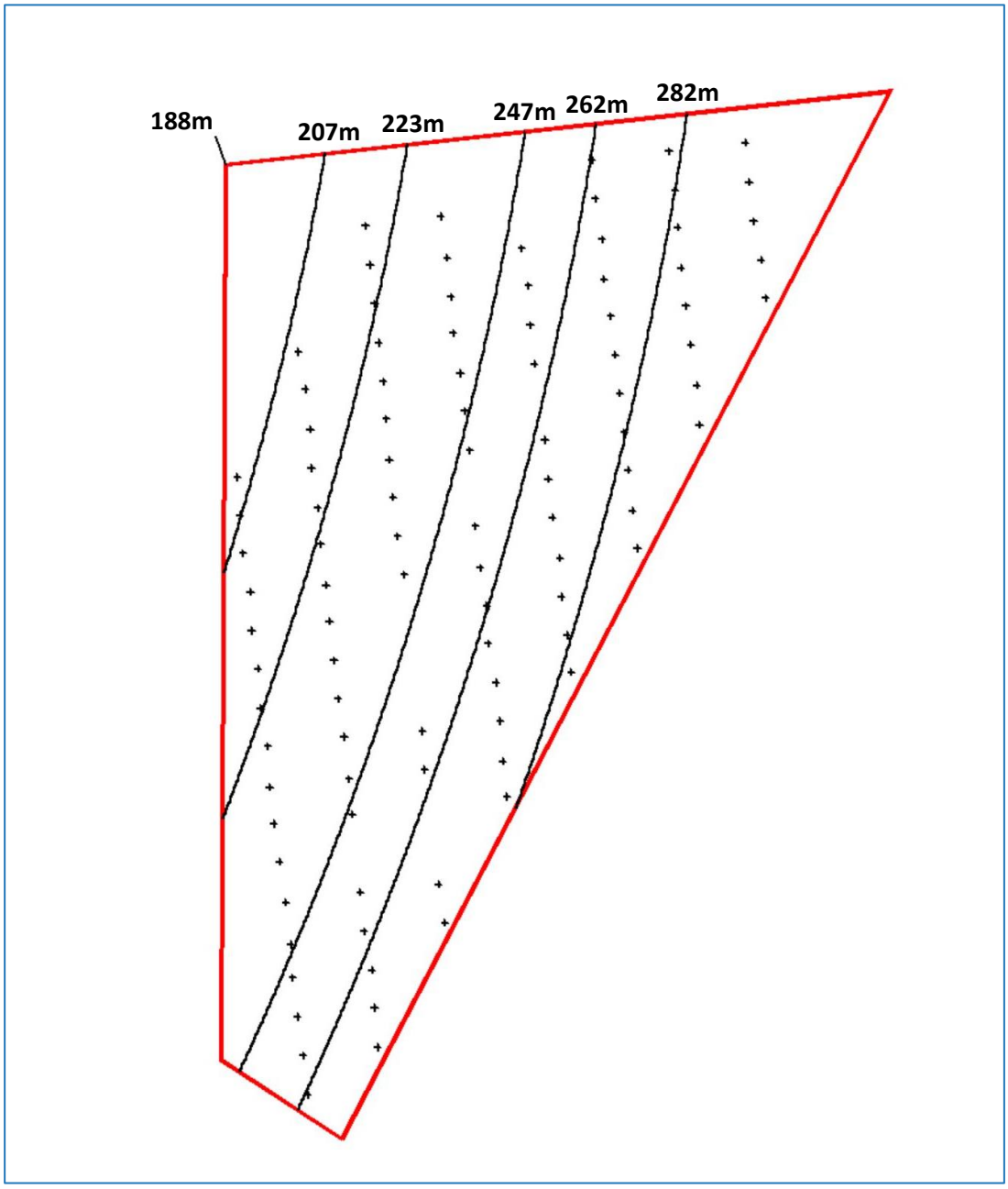

Figure 6: Trimingham Radar RLoS Contours across East Anglia THREE Offshore Windfarm Site

2.2.5. Trimingham radar RLoS at the north-western corner point of the East Anglia THREE Offshore Windfarm site is 188m AMSL.

2.3. Closest Turbine

2.3.1. A radar propagation model was used to determine the maximum turbine height for the closest turbine point in the indicative layout (Turbine 17) that would not be visible to Trimingham radar.

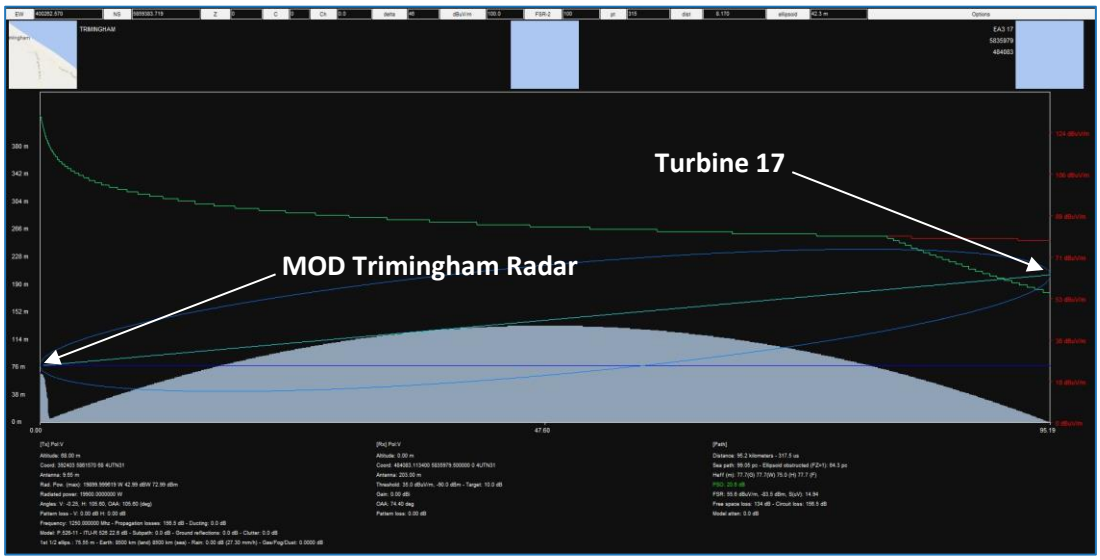

Figure 7: Trimingham Radar Propagation Model to Turbine 17 of East Anglia THREE Offshore Windfarm Indicative Layout

2.3.2. The maximum turbine height for Turbine 17 of the East Anglia THREE Offshore Windfarm indicative layout that would not be visible to Trimingham radar is 203m AMSL.

2.3.3. Visibility of a 203m tip height turbine at the East Anglia THREE Offshore Windfarm site from Trimingham radar is shown in Figure 8.

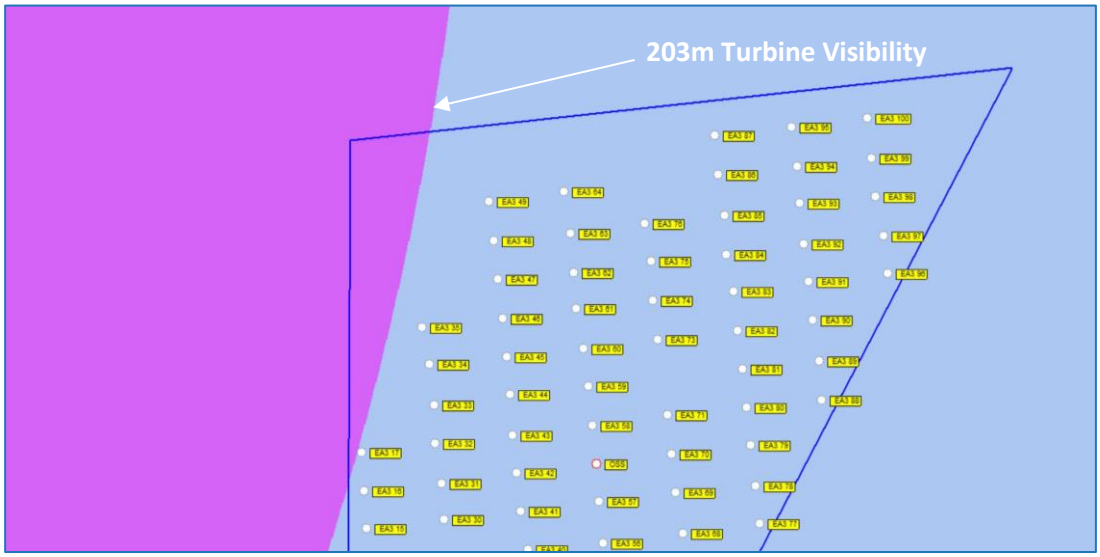

Figure 8: Trimingham Radar Visibility to 203m Turbine

2.4. Radar Probability of Detection

2.4.1. RLoS is only an indication as to whether the radar will 'see' a turbine. Depending on the radar configuration and the nature of the screening, the Probability of Detection (PD) may be greater or less than the RLoS distance.

2.4.2. Calculations in Appendix 16.1 of Volume 3 of the Environmental Statement have already indicated that, in the absence of detailed technical data on the TPS-77 radar, PD and RLoS can effectively be treated as the same for Trimingham radar. This means that wind turbines in the indicative layout with a tip height of 203m or less would be below the RLoS of the Trimingham radar and would require no further mitigation. If the wind turbine tip heights exceed the relevant RLoS heights as shown in Figure 6 in those areas, then it can be assumed that any turbines in RLoS of Trimingham radar will be detected by the radar and a technical mitigation solution will be required for the MOD Trimingham radar.

2.4.3. As part of NMC[2] the MOD and SPR agreed a revised form of words for DCO Requirement 33, which provides for the provision of relevant technical mitigation on the RLoS turbines. The wording of DCO Requirement 33 as set out in NMC[2] will apply to the revisions proposed in NMC[3].

3. NATS Cromer Radar

3.1. Topography

3.1.1. The closest point of the East Anglia THREE Offshore Windfarm site is 52.2NM (96.6km) from Cromer radar.

3.1.2. There is no intervening terrain to provide any screening of the East Anglia THREE Offshore Windfarm site; however, earth curvature does provide significant screening. The absence of terrain screening means that the edge of radar cover follows an arc.

3.2. Radar Line of Sight

3.2.1. An initial assessment established RLoS to turbines with a tip height of 282m across the East Anglia THREE Offshore Windfarm site, as shown in Figure 9 where RLoS is indicated by the magenta shading.

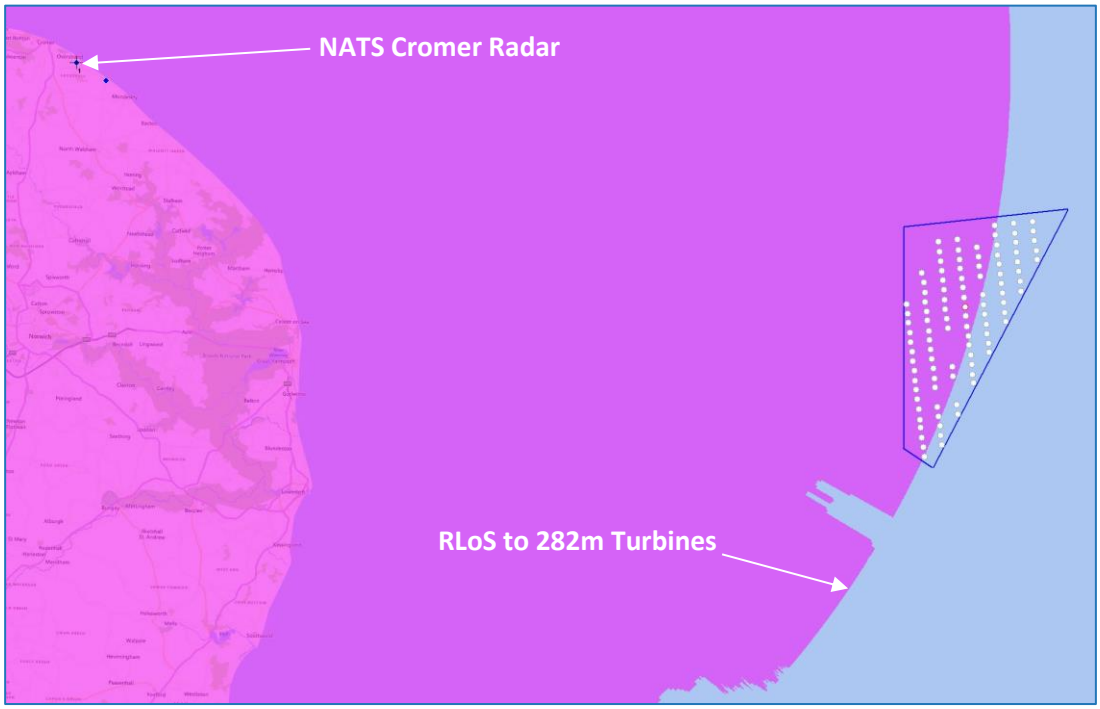

Figure 9: Cromer Radar RLoS to 282m Tip Height Turbines

3.2.2. The calculated RLoS contour from Cromer radar to 282m tip height turbines at the East Anglia THREE Offshore Windfarm site is depicted in more detail in Figure 10.

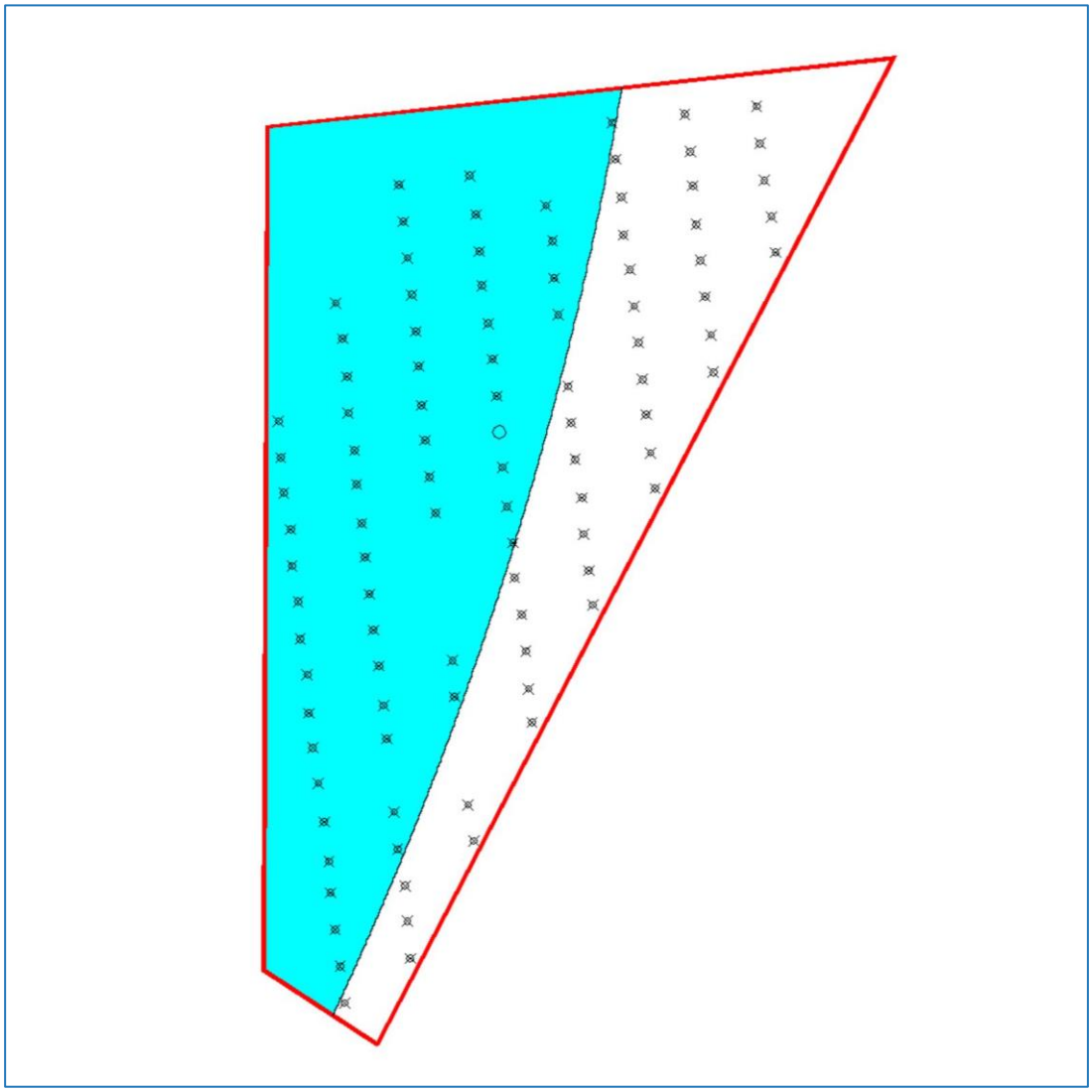

Figure 10: Cromer Radar RLoS 282m Contour across East Anglia THREE Offshore Windfarm Site

3.2.3. The cyan shaded area depicts where Cromer radar has RLoS to 282m turbines. 58 of the 99 turbines in this indicative visualisation layout are in RLoS of Cromer radar.

3.2.4. Cromer radar RLoS at the north-western corner point of the East Anglia THREE Offshore Windfarm site is 204m AMSL.

3.3. Closest Turbine

3.3.1. A radar propagation model was used to determine the maximum turbine height for the closest turbine point in the indicative layout (Turbine 17) that would not be visible to Cromer radar.

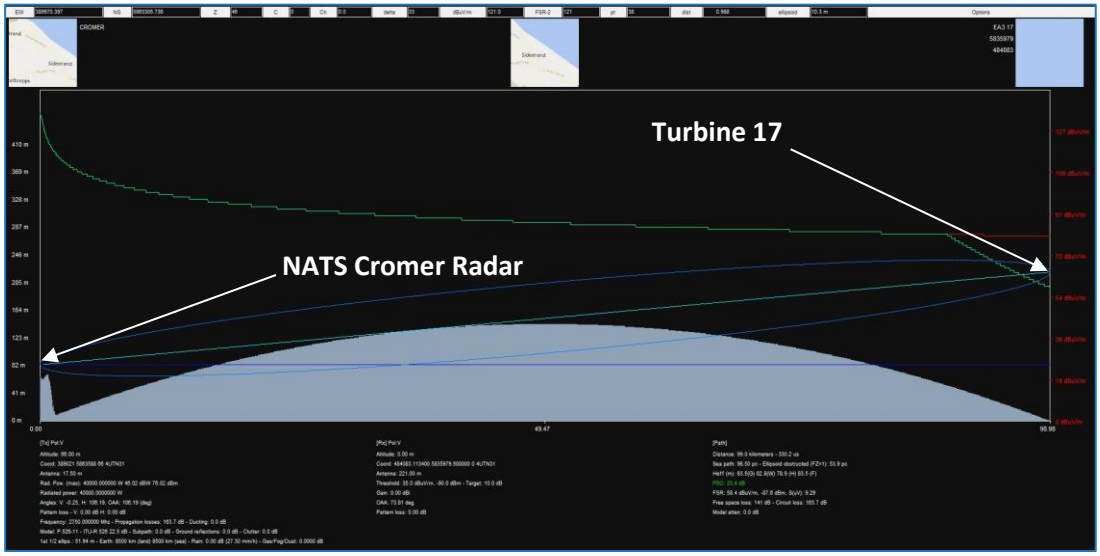

Figure 11: Cromer Radar Propagation Model to Turbine 17 of East Anglia THREE Offshore Windfarm Indicative Layout

3.3.2. The maximum turbine height for Turbine 17 of the East Anglia THREE Offshore Windfarm indicative layout that would not be visible to Cromer radar is 221m AMSL.

3.3.3. Visibility of a 221m tip height turbine at the East Anglia THREE Offshore Windfarm site from Cromer radar is shown in Figure 12.

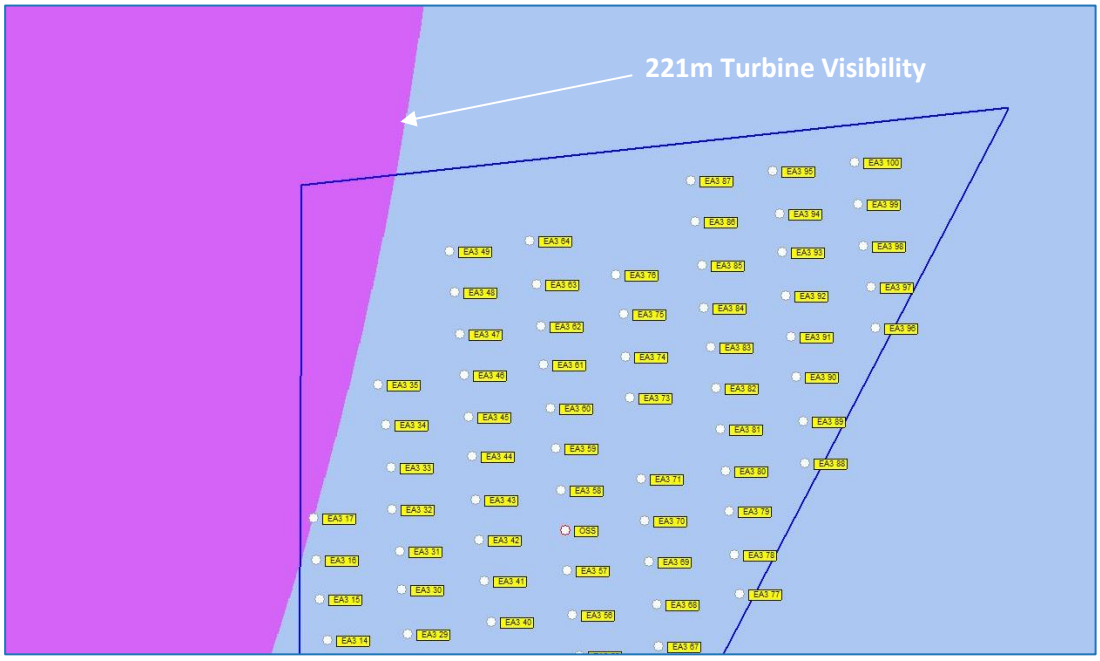

Figure 12: Cromer Radar Visibility to 221m Turbine

3.4. Radar Probability of Detection

3.4.1. RLoS is only an indication as to whether the radar will 'see' a turbine. Depending on the radar configuration and the nature of the screening, the PD may be greater or less than the RLoS distance.

3.4.2. PD may be calculated using a radio propagation model and the technical characteristics of the radar.

3.4.3. Cromer PSR is a Raytheon ASR-10SS. Parameters are taken from data published by Raytheon for a 16-Module radar.

3.4.4. The PD analysis conducted for the original assessment in the ES is outlined in paragraphs 71 to 79 of Appendix 16.1 and concluded that even for turbines of 247m tip height the closest wind turbine to Cromer PSR in the indicative layout would not be detected by the radar. NATS concurred with these findings, their Technical and Operational Assessment (TOPA) confirming that Cromer PSR is unlikely to detect any wind turbines within the East Anglia THREE Offshore Windfarm site.

3.4.5. Further PD analysis conducted for NMC[2], which increased the maximum tip height from 247m to 262m, showed that up to 10 of the 121 turbines in the indicative layout could be detected by Cromer PSR, but that this small increase would not give rise to new or materially different likely significant effects from those previously assessed.

3.4.6. The following analysis examines the impact of increasing the maximum turbine tip height from 262m to 282m AMSL.

3.4.7. Path loss calculations are made to a selection of turbines within the 282m indicative visualisation turbine layout. Three parts of each turbine are considered for the calculations, with the turbine blade pointing vertically: the turbine tip, the blade mid-point and the turbine nacelle. The calculations are made using the ITU526 propagation model.

3.4.8. The turbines and their associated location IDs selected for modelling are indicated in Figure 13. In order to establish the correlation between RLoS and PD, the turbine locations chosen are within RLoS of Cromer radar.

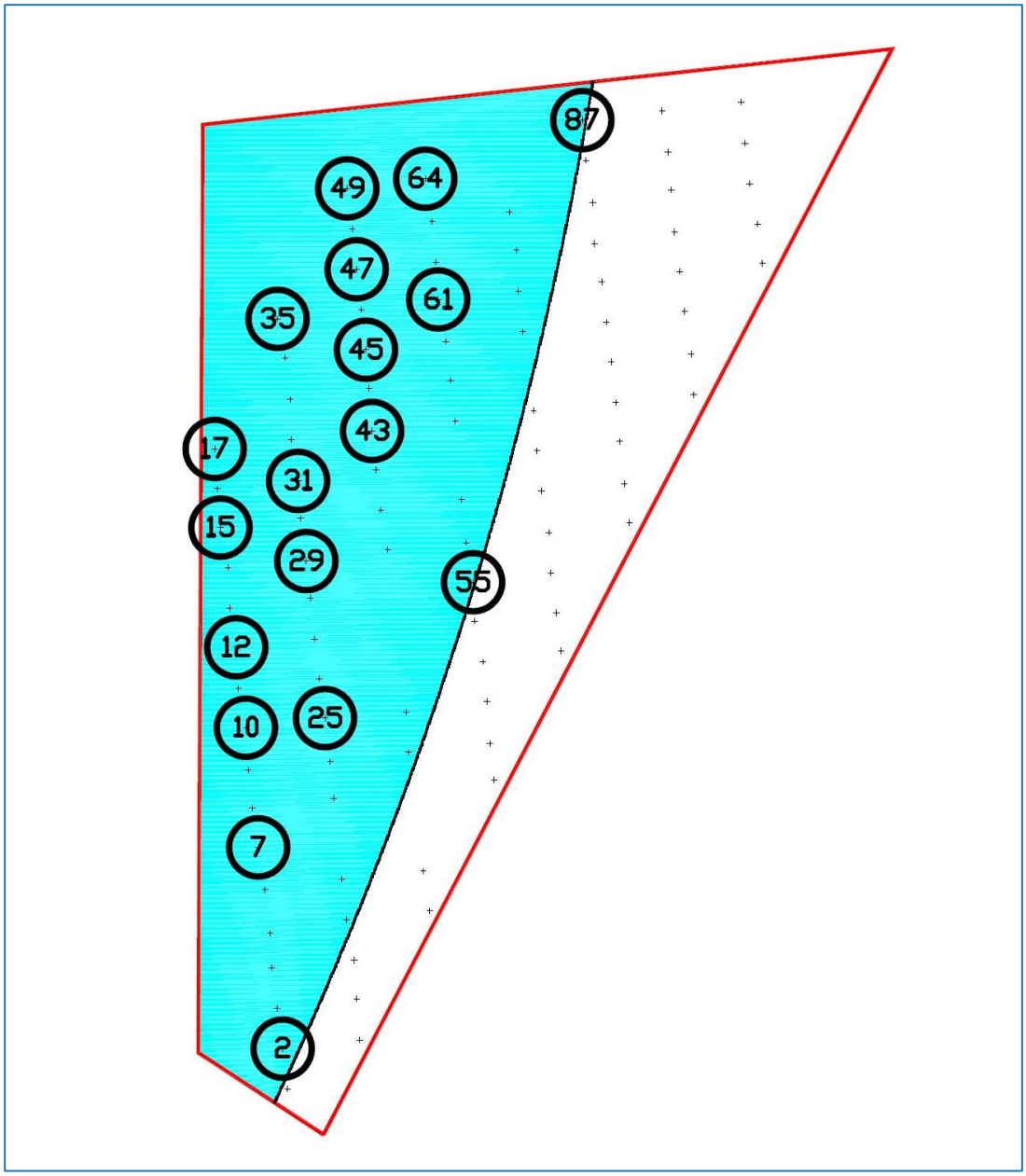

Figure 13: 282m Turbine IDs Selected for Modelling

3.4.9. For each selected turbine location, the free space path loss from Cromer radar to the turbine together with the path loss to three points on the selected turbine was calculated. The results are presented in Table 2.

Cromer: Path Loss Calculations – 282m Max Tip Height				
Turbine ID	Equivalent Free Space path loss (dB)	Path loss to turbine tip (dB)	Path loss to blade mid-point (dB)	Path loss to turbine nacelle (dB)
2	141.8	163.6	175.8	185.0
7	141.5	157.8	171.9	182.2
10	141.4	154.4	169.6	180.6
12	141.3	152.0	168.0	179.5
15	141.2	148.5	165.5	177.9
17	141.1	146.4	164.1	176.9
25	141.6	158.8	172.6	182.7
29	141.4	154.6	169.7	180.7
31	141.3	152.6	168.4	179.8
35	141.3	148.4	165.4	177.8
43	141.5	156.3	170.9	181.5
45	141.4	154.6	169.7	180.7
47	141.4	152.8	168.5	179.9
49	141.3	151.0	167.3	179.1
55	141.8	164.3	176.3	185.3
61	141.6	158.3	172.2	182.4
64	141.5	155.9	170.6	181.3
87	141.8	164.2	176.2	185.3

Table 2: 282m Turbine Path Loss Calculation

3.4.10. Path loss is greatest to the turbines closest to the 282m RLoS contour: turbine IDs 2, 55 and 87.

3.4.11. The amount of radar energy reflected back to the radar by the turbine will depend on the Radar Cross Section (RCS) of the turbine blade. With a rotor diameter of 250m, turbine blades of length 125m are assumed. For 125m blades a nominal RCS of 140m^2 is used to determine the energy reflected from each of the three points on the turbine (tip, mid-point and nacelle).

3.4.12. Maximum on-axis antenna gain has been assumed, notwithstanding that the elevation angle from the radar to the turbine tips varies between -0.22° and -0.24°.

3.4.13. The parameters used for the PD calculations are shown in Figure 14.

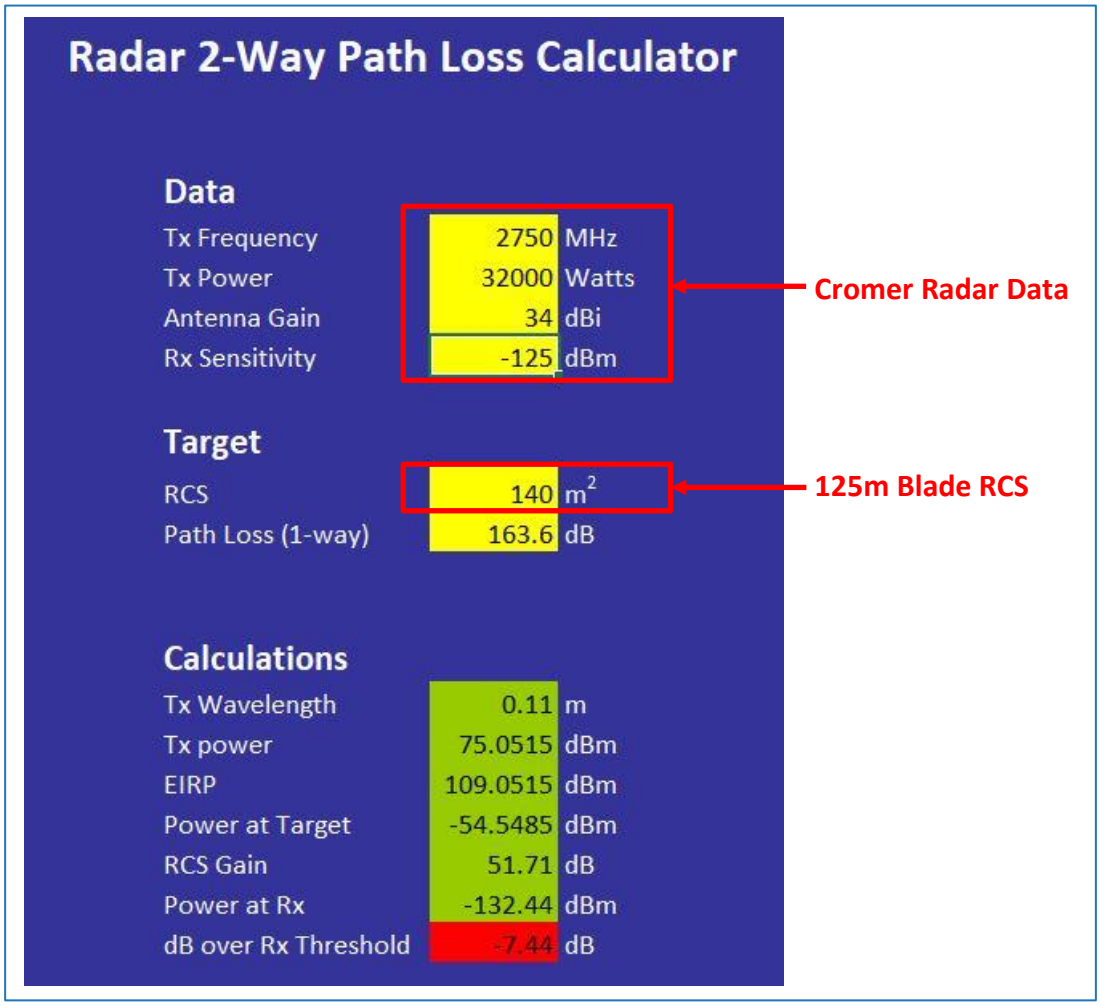

Figure 14: Cromer Radar PD Calculation for 282m Turbines

3.4.14. The results of the PD calculations for 282m turbines are presented in Table 3.

Cromer: Probability of Detection – 282m Max Tip Height			
Turbine ID	Equivalent Free Space path loss (dB)	Path loss to turbine tip (dB)	dB over RX threshold RCS=120m^2 (dB)
2	141.8	163.6	**-7.43**
7	141.5	157.8	**4.16**
10	141.4	154.4	**10.96**
12	141.3	152.0	**15.76**
15	141.2	148.5	**22.76**
17	141.1	146.4	**26.96**
25	141.6	158.8	**2.17**

Cromer: Probability of Detection – 282m Max Tip Height			
Turbine ID	Equivalent Free Space path loss (dB)	Path loss to turbine tip (dB)	dB over RX threshold RCS=120m^2 (dB)
29	141.4	154.6	**10.56**
31	141.3	152.6	**14.56**
35	141.3	148.4	**22.96**
43	141.5	156.3	**7.16**
45	141.4	154.6	**10.56**
47	141.4	152.8	**14.16**
49	141.3	151.0	**17.76**
55	141.8	164.3	**-8.82**
61	141.6	158.3	**3.17**
64	141.5	155.9	**7.96**
87	141.8	164.2	**-8.62**

Table 3: Cromer Radar – 282m Turbine PD

3.4.15. The radar received signal level (dB over RX threshold) is colour coded to aid interpretation. Red is >-6dB below the receiver threshold and unlikely to be detected. Levels between -3dB and -6dB are shaded orange with a low probability of detection. Levels between -3dB and +3dB are shaded yellow with a possibility of detection. Levels above +3dB are shaded green, with a high probability of detection.

3.4.16. Cromer radar is unlikely to detect turbine IDs 2, 55 and 87.

3.4.17. The results in Table 3 represents the worst-case, using maximum on-axis radar antenna gain, and indicate that turbines that are not in RLoS of Cromer radar are unlikely to be detected.

3.4.18. Cromer radar uses a modified Cosec^2 vertical antenna pattern which has reduced gain at low elevation angles to moderate the effects of ground clutter. The actual antenna gain at the turbine elevations (between -0.22° and -0.24°) is expected to be significantly lower than the on-axis gain.

3.4.19. If the antenna gain at -0.2° is assumed to be 10dB lower than the on-axis gain, then the PD calculations may be revised as shown in Table 4.

Cromer: Probability of Detection – 282m Max Tip Height – Antenna Gain Reduced by 10dB			
Turbine ID	Equivalent Free Space path loss (dB)	Path loss to turbine tip (dB)	dB over RX threshold RCS=120m^2 (dB)
2	141.8	163.6	**-27.43**

Cromer: Probability of Detection – 282m Max Tip Height – Antenna Gain Reduced by 10dB			
Turbine ID	Equivalent Free Space path loss (dB)	Path loss to turbine tip (dB)	dB over RX threshold RCS=120m^2 (dB)
7	141.5	157.8	**-15.84**
10	141.4	154.4	**-9.04**
12	141.3	152.0	**-4.24**
15	141.2	148.5	**2.76**
17	141.1	146.4	**6.96**
25	141.6	158.8	**-17.83**
29	141.4	154.6	**-9.44**
31	141.3	152.6	**-5.44**
35	141.3	148.4	**2.96**
43	141.5	156.3	**-12.84**
45	141.4	154.6	**-9.44**
47	141.4	152.8	**-5.84**
49	141.3	151.0	**-2.24**
55	141.8	164.3	**-28.82**
61	141.6	158.3	**-16.83**
64	141.5	155.9	**-12.04**
87	141.8	164.2	**-28.62**

Table 4: Cromer Radar – 282m Turbine PD with Reduced Antenna Gain

3.4.20. With a 10dB reduction in antenna gain, Cromer radar is additionally unlikely to detect turbine IDs 7, 10, 25, 29, 43, 45, 61 and 64.

3.4.21. Previous discussion with NATS (the radar operating authority) has confirmed that a 10dB reduction in antenna gain at an elevation of -0.2° is a reasonable assumption.

3.4.22. The colour-coded results are illustrated in Figure 15 and suggest that all but the closest 14 of the 99 turbines in the 282m indicative layout are unlikely to be detected by Cromer radar. This represents an additional impact of 4 detected turbines when compared with the analysis carried out by Cyrrus for NMC[2], where it was suggested that 10 of the 121 262m turbines would be detected by Cromer PSR.

3.4.23. Although up to 14 turbines of the indicative layout are detected by Cromer PSR, this small detection increase is not considered to represent a change to the ES conclusion that there would be no significant impact on NATS Cromer radar. Notwithstanding this, and if considered necessary, measures are available to mitigate the detection of Wind Turbine Generators (WTGs) by the NATS Cromer radar in the form of blanking alone or together with a Transponder Mandatory Zone (TMZ), which measures can be secured through a DCO Requirement if necessary.

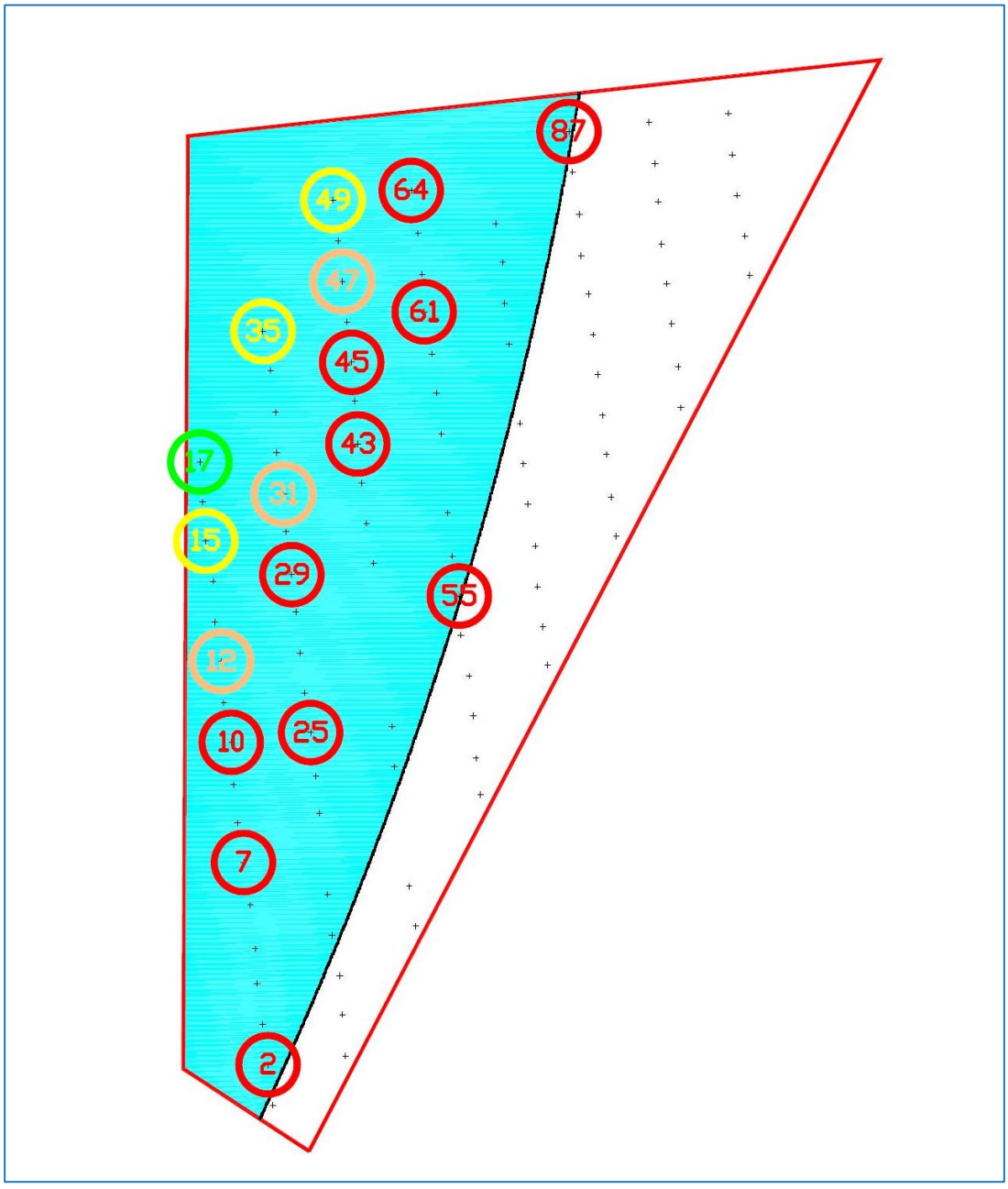

Figure 15: Cromer Radar PD of 282m Turbines with Reduced Antenna Gain

4. Conclusion

4.1. For MOD Trimingham radar, the modelling concludes that the principle of the mitigation remains appropriate to mitigate significant effects. DCO Requirement 33 agreed with the MOD in respect of NMC[2] remains sufficient and appropriate to accommodate the increase in tip height to 282m under this NMC[3].

4.2. For NATS Cromer radar, analysis of 262m tip height turbines for NMC[2] showed that up to 10 turbines could be detected. With an increase in tip height to 282m, PD analysis shows that there may be a further small impact in terms of radar detection, with up to 14 turbines in the indicative layout detected. This small detection increase is not, however, considered to represent a change to the ES conclusion that there would be no significant impact on NATS Cromer radar. Notwithstanding this, and if considered necessary, measures are available to mitigate the detection of WTGs by the NATS Cromer radar in the form of blanking alone or together with a TMZ, which measures can be secured through a DCO Requirement if required.

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APPENDIX C

Seascape, Landscape and Visual Impact Overview

East Anglia THREE Offshore Windfarm Non Material Change (NMC[3]) Application – Seascape, Landscape and Visual Impact Overview – Prepared by Optimised Environments Limited (OPEN) 30/04/2021

In Chapter 29: Seascape, Landscape and Visual Impact Assessment (SLVIA) of the 2015 ES for East Anglia THREE Offshore Windfarm, it was found that the offshore components of the East Anglia THREE Offshore Windfarm project would not give rise to significant effects owing principally to their distant location, which is a minimum distance of approximately 69 km from the Suffolk / Norfolk coastline.

This substantial separation distance means that for turbines of 247 m to tip, even in excellent viewing conditions, when there could be the possibility that blade tips might be discernible from higher points along the coast, they would appear as extremely small and distant features. Furthermore, distant blade tips would be seen in the context of one of the busiest shipping-channels around the UK, where built or human artefacts are a common feature in seaward views. The conclusion of the 2015 ES was that the magnitude of change would be negligible and the effect of the offshore components on coastal and landward receptors would not be significant even in instances where high sensitivity receptors were to occur. As a result, the effects of the offshore components were scoped out of the detailed assessment in the 2015 ES.

The NMC[2] Application for East Anglia THREE Offshore Windfarm proposed a 15 m increase in blade tip height from 247 m to 262 m which was recently accepted. This NMC[3] Application for East Anglia THREE Offshore Windfarm proposes a 34.37 m increase in turbine blade tip height, from 247 m to 281.37 m, or in respect of the already accepted NMC[2] Application, a 19.37 m increase in blade tip height from 262 m to 281.37 m. This increase would not be sufficient to alter the assessment presented in the 2015 ES or the findings presented in the NMC[2] Application.

From a minimum distance of approximately 69 km, the proposed 34.37 m increase (or 19.37 m in respect of NMC[2] Application) would not be readily discernible. Visibility of the proposed turbines would continue to be especially limited, such that the magnitude of change would remain negligible, and the effect would remain not significant. In considering the changes that the increased blade tip height could potentially have on coastal and landward receptors, it is important to consider the value, character and nature of the visual receptors located along or close to the nearest coastline. The section of coastline adjacent to the East Anglia THREE offshore components, lies between Great Yarmouth and Lowestoft and is not covered by any national or county level designations, which would otherwise denote a special value and sensitivity. It is a relatively flat and low-lying coast, with the hinterland also limited in terms of elevation. The absence of high vantage points along the coastline and in the hinterland, eliminates the possibility for increased extents of visibility of the offshore components from becoming available. It is also a relatively built-up coast, where there is influence from the existing urban areas, busy shipping channels and a number of closer range proposed offshore windfarms. These baseline characteristics moderate the sensitivity of landscape receptors and this adds to the improbability of significant effects arising when combined with a negligible magnitude of change. The same is true of visual receptors; despite the high volumes of people who live, work and spend time along this coastline, which has potential to raise the sensitivity, the magnitude of change would still be negligible, and significant effects would not arise.

In order to demonstrate the limited effect that the increase in the blade tip height is likely to give rise to, a comparison with East Anglia ONE North Offshore Windfarm is briefly presented below. The SLVIA for East Anglia ONE North Offshore Windfarm was submitted in November 2019 and is currently pending determination following the close of the Examination in July 2021. The offshore components would be located a minimum distance of approximately 36 km from the Suffolk coastline, which would be 33 km closer than the East Anglia THREE offshore components. The worst-case scenario considered 53 wind turbines with a maximum blade tip height of 300 m, which would be 13 m taller than the increased blade tip heights for East Anglia THREE Offshore Windfarm. A full and detailed assessment of the potential effects of the East Anglia ONE North offshore components on landscape and visual receptors along the Suffolk coastline was presented in the SLVIA of the East Anglia ONE North Offshore Windfarm Environmental Statement[5]. The findings were that there would be no significant effects on any of the landscape or visual receptors. Despite the assessed higher sensitivities of many of the coastal receptors, especially those associated with the nationally important Suffolk

[5] ScottishPower Renewables (2019). East Anglia ONE North Offshore Windfarm, Chapter 28 Offshore Seascape, Landscape and Visual Amenity Environmental Statement, Volume 1.

Coast and Heaths Area of Outstanding Natural Beauty (AONB), the separation distances of 36 km or more, meant that the magnitude of change was assessed as being no higher than low. It should be noted that the height of the East Anglia ONE North Offshore Windfarm turbines was reduced during the examination to 282 m.

The findings from the East Anglia ONE North Offshore Windfarm SLVIA, establish a useful comparison in which it was assessed that 300 m tall wind turbines located substantially closer to the Suffolk coastline would not give rise to significant effects. In the document entitled '[6]Appendix E to the Relevant Representations of Natural England', it is stated at 3.10.1 that '*Natural England agrees with the assessment of no significant effect for landscape and visual receptors within the AONB or its seascape setting. We also agree with the judgement that of no significant effects on the special qualities of the AONB and users of the Suffolk Coastal Path'*. Natural England also agree (at 3.10.2) that the '*contribution made by the EA1N OWF project to the cumulative effects of the EA2 OWF project is small. This is due entirely to the limited lateral spread of the EA1N array and greater separation distance between the western edge of the development area and the coast of the AONB.'* The Suffolk Coast and Heaths AONB is located at a minimum distance of 37.7km from the East Anglia ONE North Offshore Windfarm site. Note that the EA3 project was scoped out of the EA1N (and EA2) SLVIA (as agreed at scoping) due to the "likelihood that there will be no visibility of East Anglia THREE offshore windfarm" (Chapter 28: Seascape, Landscape and Visual Impact Assessment (SLVIA) of the 2019 ES for East Anglia ONE North Offshore Windfarm). The proposed 34.37 m increase (or 19.37 m in respect of NMC[2] Application) would not alter the potential for visibility of EA3, or therefore affect the rationale, to scope out the EA3 project from the cumulative impact assessment with the EA1N (and EA2) SLVIA(s).

This helps to substantiate the assessment, that the 287 m tall wind turbines of the proposed non-material change for East Anglia THREE Offshore Windfarm, located a further 33 km from the Suffolk coastline than East Anglia ONE North Offshore Windfarm (69 km in total) would not give rise to significant effects.

Therefore, it is concluded that the proposed amendments will not result in any new or materially different likely significant effects from those described in the original ES or NMC[2].

[6] Natural England (27 January 2020). Appendix E to the Relevant Representations of Natural England Seascape and Landscape Visual Impact Assessment (SLVIA) Natural England's Specialist Review of the 'offshore' elements of the EA1N project to inform our advice For: The construction and operation of East Anglia One North Offshore Windfarms, 800 MW Wind Farm located approximately 36 km off the Suffolk coast, covering an area of approximately 208 km2. Planning Inspectorate Reference: EN010077