East Anglia THREE
DCO Non-Material Change

Supporting Statement

Prepared by:	Checked by: C Bolanos	Approved by: D Boyd
GoBe Consultants Ltd *14/07/2020*	cbolanos@scottishpower.com Digitally signed by: cbolanos@scottishpower.com DN: CN = cbolanos@scottishpower.com Date: 2020.07.16 15:11:10 Z	dboyd@scottishpower.com Digitally signed by: dboyd@scottishpower.com DN: CN = dboyd@scottishpower.com Date: 2020.07.16 15:13:04 Z

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TABLE OF CONTENTS

ABBREVIATIONS AND DEFINITIONS

Acronym	Definition
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
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
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 Ltd (EATL) submitted an application for development consent for the East Anglia THREE Offshore Wind Farm (EA THREE) in November 2015, with a Development Consent Order (DCO) granted by the Secretary of State (SoS) for the Department for Business, Energy and Industrial Strategy (BEIS) in August 2017. The 2017 Order granted consent for the development of an offshore wind farm with a gross output of 1,200 Megawatt (MW) (1.2 Gigawatt (GW)), located approximately 69 km off the coast of Suffolk. This DCO was subsequently amended in 2019 to increase the generating capacity to 1,400 MW. As such the current DCO is referred to as the East Anglia THREE 2017 Order (as amended).

2 Following a review of the supply chain and to increase efficiencies to deliver a reduction in levelized energy costs, some of the EA THREE design parameters as secured in the 2017 Order (as amended) require non-material amendments.

3 This document has been prepared to support the application for a non-material change to the EA THREE 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

4 This document reviews the proposed parameter changes and receptors assessed within the EA THREE Environmental Impact Assessment (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).

5 A summary of the changes is provided in Sections 1.2.1 and 1.2.2 below, with further detail provided in Section 2.

6 In order to support the non-material change process, additional Collision Risk Modelling has been undertaken by MacArthur Green (see Appendix A) and updated Ministry of Defence (MOD) and National Air Traffic Services (NATS) radar modelling has also been completed (including an updated Radar Line of Site Plan) (included at Appendix B).

7 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). 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.

8 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

9 EATL wish to make amendments relating to the Offshore Substations (OSSs)* and Wind Turbine Generators (WTGs); a breakdown of the proposed amendments are detailed below.

10 The changes in OSS parameters subject to the NMC application are:

- Reduction in the number of OSS from 6 to 1;
- Increase in the number of pin piles per OSS jacket leg from 1 to 4; and
- Increase in the number of legs of the OSS from 4 to 6.

11 The changes in WTGs parameters subject to the NMC application are:

- Increase in the maximum tip height of 247 m to 262 m (relative to Lowest Astronomic Tide (LAT));
- Increase in the minimum air draft of all WTGs from 22 m to 24 m (relative to Mean High Water Springs

* It is noted that the OSS is referred to in the DCO as an 'offshore electrical station'

(MHWS));

- Increase in maximum rotor diameter from 220 m to 230 m; and
- Reduction in the maximum, total number of WTGs from 172 to 121.

1.1.2. Correction changes

12 Notification is also provided of an administrative error within the DMLs concerning scour protection allowances for which a correction is sought from the MMO; this is detailed in Section 2.2.

2. PROPOSED AMENDMENTS

2.1. Comparison of consented and proposed parameters

13 A comparison of the consented and proposed parameters relevant to the amendment are provided in Table 2-1 below.

Table 2-1 Details of the consented and proposed parameters associated with the non-material amendment request (parameters are taken from Chapter 5 Project Description of the EA THREE ES, with details of consented parameters taken from the 2017 Order (as amended)). Note relevant parameters associated with maximum design scenarios are also presented to demonstrate where no change is proposed to support the EIA review in Section 3.2.1.

Relevant Parameter	Consented Parameters: As stated in the ES Project Description	Consented Parameters: 2017 Order (as amended)	DCO/DML Reference	Proposed Change from Consented Parameters
Development area (offshore)	305 km^2	305 km^2	Secured through the Order Limits	No change
Maximum Hammer Energy	3,500 kJ	3,500 kJ	Schedule 10 and 11, DMLs - Generation Assets, Part 2, Condition 2(9) Schedule 12 and 13, DMLs Transmission Assets, Part 2 Condition 3	No change
Maximum scour protection for WTGs, accommodation platform, meteorological masts and offshore electrical stations	2,673,260 m^2	2,673,260 m^2	Schedule 1, Part 3, Requirement 9(1)	No change
WTGs				
WTG capacity	7 -12 MW	Not stated	Not stated	No change
Maximum number of WTGs fixed to the seabed on monopile, jacket or suction caisson foundation types	172	172	Schedule 1, Part 1, Work No. 1(a) and Part 3 Requirement 3 (8)(a) Schedule 10 and 11 DMLs - Generation Assets Part 1, Activity 3 (1)(a) and Part 2, Condition 6 (1)(b)	Reduction to a maximum of 121 turbines

Consented Parameters				
Relevant Parameter	**As stated in the ES Project Description**	**2017 Order (as amended)**	**DCO/DML Reference**	**Proposed Change from Consented Parameters**
Maximum number of WTGs fixed to the seabed on gravity base foundations	172	100	Schedule 10 and 11 DMLs - Generation Assets Part 1, Paragraph 3(1)(a)	No change
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	Schedule 1, Part 3, Requirement 5 Paragraph 3(1)(a) Schedule 10 and 11, DML Generation Assets, Part 1 Activity 3 (1)(a) and Part 2 Condition 4	No change (including with dimensions and number of piles of foundations)
Turbine rotor diameter	154 – 220 m	Must not exceed 220 m	Schedule 1, Part 3, Requirement 2(1)(c) Schedule 10 and 11 DMLs - Generation Assets, Part 2 Condition1(1)(c)	Must not exceed 230 m
Maximum hub height Mean Sea Level (MSL)	150m	Must not exceed 150.6 m	Schedule 1, Part 3, Requirement 2(1)(b) Schedule 10 and 11 DMLs - Generation Assets, Part 2 Condition1(1)(b)	No change
Maximum tip height (LAT)	247m	Must not exceed 247 m	Schedule 1, Part 3, Requirement 2(1)(a) Schedule 10 and 11 DMLs - Generation Assets, Part 2 Condition1(1)(a)	Must not exceed 262 m
Minimum clearance above sea level (MHWS)	22 m	Minimum draught height of 22 m. The number of WTGs with a draught height of less than 24m must not exceed 52 turbines	Schedule 1, Part 3, Requirement 2(1)(e) Schedule 10 and 11 DMLs - Generation Assets, Part 2 Condition1(1)(e) and Condition 1 (2)	Increase to minimum draught height of 24 m for 100% of WTGs
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	Schedule 1, Part 3, Requirement 2(d) Schedule 10 and 11 DMLs - Generation Assets, Part 2 Condition1(1)(d)	No change

Relevant Parameter	Consented Parameters: As stated in the ES Project Description	Consented Parameters: 2017 Order (as amended)	DCO/DML Reference	Proposed Change from Consented Parameters
Maximum inert material disposed (WTGs)	3,010,000 m^3	3,010,000 m^3	Schedule 10 and 11, DMLs - Generation Assets, Part 1, Activity 2(d)(ii) and Part 2, Condition 6 (1)(a)(ii)	No change
Maximum scour protection area (WTGs, accommodation platform and meteorological masts)	2,572,460 m^2	2,572,460 m^2	Schedule 10 and 11, DMLs, - Generation Assets, Part 2 Condition 6 (1)(f)	No change
OSS				
Maximum number of OSSs	Up to two converter stations and four HVAC collector stations	6	Schedule 1, Part 1, Work No. 2 and Part 3, Requirement 3 (1). Schedule 12 and 13 DMLs Transmission Assets, Part 1, Activity 3 (1) and Part 2, Condition 6 (1) (b)	1
OSS foundation type options	Gravity Base or Jackets (piles or suction caisson)	Gravity Base or Jackets (piles or suction caisson)	Schedule 1, Part 3, Requirement 7 Schedule 12 and 13, DMLs Transmission Assets, Part 1, Activity 3 (1) and Part 2, Condition 4 (3)	No change
Maximum number of legs per OSS Jacket Foundation	4	4	Schedule 1, Definitions, 'Jacket Foundations' and Part 3, Requirement 7 Schedule 10, 11, 12 and 13 Definitions. 'Jacket Foundations' and Schedule 12 and 13 Part 2, Condition 4	Up to 6 *
OSS jacket foundation number of piles per leg	1	1	Schedule 1, Part 3, Requirement 7 (2)(b) Schedule 12 and 13, DMLs Transmission Assets, Part 1, Activity 3 (1) and Part 2, Condition 4 (b)	Up to 4
Maximum inert material disposed (OSS)	439,350 m^3	439,350 m^3	Schedule 12 and 13, DMLs - Transmission Assets, Part 1, Activity 2 (d)(ii) and Part 2 Condition 6 (1)(a)(ii)	No change

Consented Parameters				
Relevant Parameter	**As stated in the ES Project Description**	**2017 Order (as amended)**	**DCO/DML Reference**	**Proposed Change from Consented Parameters**
Maximum scour protection area for OSSs	100,800 m^2	100,800 m^2	Schedule 12 and 13, DMLs - Transmission Assets, Part 2 Condition 6 (1)(b)	No change
*See Section 2.1.1 below for further details on the proposed amendment to the definition associated with this change.				

2.1.1. Jacket foundation definition

14 The 2017 Order (as amended) includes a definition which refers to 'discrete foundation types' and includes reference to the number of legs associated with the relevant jacket foundation designs. The term 'discrete foundation types' is not used in the DCO; this definition is therefore not required and it has been deleted accordingly. However, in order to ensure that the relevant parameters associated with the OSS (as described in Table 2-1 above) are secured in the DCO, a new requirement has been added into the DCO and the relevant DML conditions amended accordingly (see Requirement 7(2)(c) and Schedule 12 and 13 Part 2, Condition 4).

15 Details on the materiality of this change are considered in Section 3.

2.2. Correction changes

16 In addition to the proposed amendments EATL request a correction to a typographical error within the 2019 Variation 1 DMLs. In the transmission asset DMLs, Schedule 12 and Schedule 13, Condition 6 (1)(d) refers to:

"*up to 100,800 m^2 of scour protection for the wind turbine generators, accommodation platform and meteorological masts.*"

17 This condition should refer to the transmission assets associated with Schedule 12 and 13, and not the generation assets which are licensed separately under Schedule 10 and Schedule 11; proposed, revised wording is provided below:

"*up to 100,800 m2 of scour protection for the offshore electrical station.*"

18 The maximum area of scour protection for the generations assets (i.e. the wind turbine generators, accommodation platform and meteorological masts) is already secured in Schedule 10 and Schedule 11 at Condition 6 (1)(f), with the overall maximum areas of scour protection secured in Requirement 9. Therefore, this is simply an administrative change to the correct asset reference (i.e. the transmission assets within the transmission licences) with no amendments to the associated scour allowance, as per Table 2-1. EATL request the wording is updated to correct this error. The proposed wording is provided in the draft, amended DMLs which accompany this application.

19 No further consideration is provided in this report with regard to this correction.

3. MATERIALITY OF CHANGES

3.1. Background

20 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).

21 Paragraphs 9-16 of this document sets 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.

22 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."

23 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).

24 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.

25 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.

- No impacts relating to cable installation have been considered as there is no change in the parameters relating to the installation/operation and decommissioning of cables;
- The amendment to the maximum number of legs associated with the OSS jacket foundation is not applicable to the WTG jacket foundations, which will remain as defined in the consent (a maximum of four legs);
- The amendment to increase the number of pin piles per OSS jacket foundation leg is not applicable to WTG jacket foundations which will remain as one pile per leg;
- The 2017 Order (as amended) includes limitations on maximum disposal volume and maximum scour protection areas which are not subject to amendment as part of this non-material change (see Table 2-1). These limitations have been secured in the DCO to ensure that there is no exceedance in the worst-case assumptions assessed within the EIA and therefore, the consented parameters. These limitations will be maintained and complied with during the development process as required; and
- The consent limitation in the 2017 Order (as amended) on the maximum number of gravity base foundations to be installed is to be maintained.

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

EIA Topic	Impacts as Described in the ES Chapter	Change in Impact Significance
Marine Geology, Oceanography and Physical Processes	Relevant potential effects assessed within the EA THREE 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 OSSs (under the two phased approach) in relation to SSC and tidal/wave/sediment regime effects; and • 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.	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 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

EIA Topic	Impacts as Described in the ES Chapter	Change in Impact Significance
		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.**
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

EIA Topic	Impacts as Described in the ES Chapter	Change in Impact Significance
		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 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 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).
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	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

EIA Topic	Impacts as Described in the ES Chapter	Change in Impact Significance
	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; • 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.	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 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 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; • Underwater noise; and	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

EIA Topic	Impacts as Described in the ES Chapter	Change in Impact Significance
	• 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; • 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.	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 that 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). • 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 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 significant effects from those described in the original ES.**

EIA Topic	Impacts as Described in the ES Chapter	Change in Impact Significance
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) 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.	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 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 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;	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

EIA Topic	Impacts as Described in the ES Chapter	Change in Impact Significance
	• 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 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.	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. The total number of structures will be reduced to 121 WTGs and one OSSs 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 appendix provides annual collision estimates calculated using the Band (2012[2]) CRM using parameters for the consented turbine models and a proposed alternative turbine model which reflects the amended parameters as outlined in Table 2-1. 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 results in a reduced collision risk of between 18% (kittiwake) and 11% (herring gull and black blacked gull) compared with the consented design.

[2] 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	Change in Impact Significance
		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 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 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	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) (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	Change in Impact Significance
	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 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.	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) (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 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.	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

EIA Topic	Impacts as Described in the ES Chapter	Change in Impact Significance
	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.	(PD) modelling exercise has been completed and is presented in Appendix B. With regard to the MOD Trimingham radar, the modelling concludes that the principle of the mitigation remains appropriate to mitigate significant effects, albeit that a minor amendment of DCO Requirement 33 and an updated Radar Line of Sight Coverage Plan is required to refer to the increase in tip height to 262 m and the eastward shift of the 203 m, 223 m and 247 m tip height RLoS contours. The revised Radar Line of Sight Coverage Plan is referenced in Appendix B and included separately in Appendix C, and the amendments to DCO Requirement 33 have been made accordingly. With regard to the NATS Cromer radar, the modelling confirms that the increased tip height results in a small number of WTGs (up to 10) being 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;	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

EIA Topic	Impacts as Described in the ES Chapter	Change in Impact Significance
	• Indirect disturbance of archaeological receptors and/or their physical setting from changes to hydrodynamic and sedimentary regimes; and • Changes to historic seascape character. 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.	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) 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). • 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). **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.**
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;	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).

EIA Topic	Impacts as Described in the ES Chapter	Change in Impact Significance
	• 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.	**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 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.	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 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.

EIA Topic	Impacts as Described in the ES Chapter	Change in Impact Significance
		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.

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."

26 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.

27 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. There will be no impacts beyond those assessed in the HRA, as evidenced by the CRM modelling (Appendix A) and detail provided in Section 3.2.1.

28 Therefore, the amended parameters will not introduce the need for a new, or revised, HRA.

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.".

29 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."

30 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 on and offshore stakeholders.

4. PRE-SUBMISSION STAKEHOLDER CONSULTATION

31 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.

32 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

33 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	29th April 2020	Phone call	Notification of the proposed NMC application.	✓
	10th June 2020	Email	Confirmed that MMO should be included in list of consultees.	
	24th June 2020	Email	Notification of submission of Rule 7 letter to BEIS.	
	3rd July 2020	Email	Notification and request of electronic submission.	
BEIS	12th - 13th May 2020	Phone calls and emails	Notification of the proposed NMC application. Agreement on the consultation and submission process.	N/A
	5th June 2020	Email	Regulation 7 request sent. Notification of the preparation of a Regulation 6 letter.	
Environment Agency	21st May 2020	Phone call	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

Consultee	Date of Consultation	Consultation Format	Summary of Consultation	Confirmed Consultee
Suffolk County Council	22nd – 24th May 2020	Email	Notification of the proposed NMC application. Confirmed Suffolk County Council to be included in list of consultees.	✓
	24th June 2020	Email	Notification and request of electronic submission.	
Mid Suffolk Council	21st May 2020	Phone Call	Notification of the proposed NMC application. Confirmation that Mid Suffolk Council would not require consultation as the proposed changes will not alter any of the onshore 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 Mid Suffolk Council that they do not wish to be consulted in relation to the NMC application.	X
East Suffolk Council	22nd May 20202	Email	Notification of the proposed NMC application. Confirmed East Suffolk County Council to be included in list of consultees.	✓
	24th June 2020	Email	Notification and request of electronic submission.	
CAA	28th May 20202	Email	Notification of the proposed NMC application. Confirmed CAA to be included in list of consultees.	✓
	22nd June 2020	Email	Notification and request of electronic submission.	

Consultee	Date of Consultation	Consultation Format	Summary of Consultation	Confirmed Consultee
The Crown Estate	28th May 2020	Email	Notification of the proposed NMC application. Confirmed The Crown Estate to be included in list of consultees.	✓
	22nd June 2020	Email	Notification and request of electronic submission.	
Historic England	29th May 2020	Email	Notification of the proposed NMC application. Confirmed Historic England to be included in list of consultees.	✓
	24th June 2020	Email	Notification and request of electronic submission.	
Natural England	3rd March 2020	Phone call	High level briefing about the proposed NMC application.	✓
	29th May 2020	Email	Notification of the proposed NMC application. Confirmed Natural England to be included in list of consultees.	
	24th June 2020	Email	Notification and request of electronic submission.	
RSPB	29th May 2020	Email	Notification of the proposed NMC application. Confirmed RSPB to be included in list of consultees.	✓
	24th June 2020	Email	Notification and request of electronic submission.	
WDC	29th May 2020	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	✓

Consultee	Date of Consultation	Consultation Format	Summary of Consultation	Confirmed Consultee
			included in the list of consultees.	
	24th June 2020	Email	Notification and request of electronic submission.	
Wildlife Trusts	29th May 2020	Email	Notification of the proposed NMC application. Confirmed the Wildlife Trusts to be included in list of consultees.	✓
	24th June 2020	Email	Notification and request of electronic submission.	
MCA	28th May 2020	Email	Notification of the proposed NMC application. Confirmed the MCA to be included in list of consultees.	✓
	22nd June 2020	Email	Notification and request of electronic submission.	
MoD	28th May 2020	Email	Notification of the proposed NMC application. Confirmed the MoD to be included in list of consultees.	✓
	22nd June 2020	Email	Notification and request of electronic submission.	
NATS	28th May 2020	Email	Notification of the proposed NMC application. Confirmed that NATS are to be included in list of consultees.	✓
	22nd June 2020	Email	Notification and request of electronic submission.	

Consultee	Date of Consultation	Consultation Format	Summary of Consultation	Confirmed Consultee
NFFO	28th May 2020	Email	Notification of the proposed NMC application. Confirmed that NFFO are to be included in list of consultees.	✓
	22nd June 2020	Email	Notification and request of electronic submission.	
Trinity House	28th May 2020	Email	Notification of the proposed NMC application. Confirmed that Trinity House are to be included in list of consultees.	✓
	22nd June 2020	Email	Notification and request of electronic submission.	

4.2. Post-Application Process

34 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.

35 In light of the restrictions imposed as a result of the Covid-19 pandemic, the limitations concerning access for interested parties to the Application are recognised and as such, in addition to the standard consultation approaches, EATL intends to publicise the Application by the following additional means:

- Notice on local Parish websites and online platforms, including:
  - Shottisham;
  - Great Bealings;
  - Swilland and Witnesham;
  - Tuddenham St Martin; and
  - Little Bealings.
  - Woodbridge (Facebook page)
- The nominated Parish contacts will also be provided with an electronic copy of the application directly, with confirmation that a hard copy can be provided upon request;
- EATL will publicise the Application notice on the ScottishPower Renewables website and will provide access to electronic copies of the Application documents. A contact email address

(eastangliathree@scottishpower.com) and contact number will be provided. Hard copies will be available on request via these contact details;

- Placement of a hard copy at the OrbisEnergy Building in Lowestoft for public review upon appointment only;
- Distribution of the Application 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.

36 In addition, EATL has publicised the intention to submit an application for a non-material change in advance to the formal application via the ScottishPower Renewables website and an e-mail to all interested parties, as collated from registered users of the website. This pre-consultation process allows potentially interested parties to register to receive a copy directly upon formal application (either electronic or hard copy).

37 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.

38 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

39 EATL is seeking to amend the 2017 Order (as amended) for the EA THREE offshore wind farm to allow the Project to take advantage of advancing technologies and realise efficiencies to deliver a reduction in levelised energy costs. The proposed amendments to the Project relate to increasing the size of the WTGs, including tip height, rotor diameter and hub height as well as refining the parameters associated with the OSS including reduction in the number of structures, increase in jacket foundation legs and number of piles per leg. Furthermore, EATL requests a correction to the Variation 1 DMLs.

40 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

MacArthur Green

East Anglia THREE

Collision Risk Modelling for Alternative Turbine Model

Date:	8th April 2020
Tel:	0141 342 5404
Web:	www.macarthurgreen.com
Address:	93 South Woodside Road |Glasgow | G20 6NT

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CONTENTS

LIST OF TABLES

1 INTRODUCTION

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

The estimates have been calculated using the Band (2012[1]) Collision Risk Model (CRM) using parameters for the consented turbine models and a proposed alternative turbine model to consider the change to collision risk predictions arising from the proposed alternative turbine model. 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 Environmental Statement (ES) (APEM 2015[2]), and in MacArthur Green (2016[3]).

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 Wind Farm design comprised 172 turbines, 52 (30%) of which had a lower rotor tip height of 22m from Mean Sea level (MSL) with the remaining 120 (70%) with a lower rotor tip height of 24m.

The alternative wind farm design modelled here has a lower rotor tip height of 24m for all turbines.

Table 2-1 Wind turbine parameters.

Parameter	Consented turbine	Alternative turbine
No. turbines	172	121
Rotation speed (RPM)	11	8.2
Rotor radius (m)	77	115
Hub height (m) *	99 / 101	139
Max blade width (m)	5	7
Blade pitch (°)	15	15
Tidal offset (m)	0	0
Wind farm width (km)	33.25	33.25
Latitude (°)	52.67	52.67

* note that in the ES a hub height of 99m (from MSL) was used for all turbines in the consented design. 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.

[1] Band, B. (2012). Using a Collison Risk Model to Assess Bird Collision Risks for Offshore Windfarms.
[2] APEM (2015). East Anglia THREE Appendix 13.3 Collision Risk Modelling Methodology and Predictions. Environmental Statement Volume 3 Document Reference - 6.3.13 (3)
[3] MacArthur Green (2016). East Anglia THREE Offshore Ornithology East Anglia THREE Revised CRM for Increase in Draft Height, East Anglia ONE Revised CRM for Final Wind Farm Design & Updated Cumulative CRM Tables Project Update Information for Deadline 5 Document Reference – Deadline 5/ Revised CRM/the Applicant

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[4]	Band model option
				Lower tip 22m above MSL	Lower tip 24m above MSL			
Gannet	0.94	1.72	14.9	0.0677	0.0558	gliding	2	1
Kittiwake	0.39	1.08	13.1	0.1009	0.0673	flapping	3	1
Lesser black-backed gull	0.58	1.42	13.1	0.2391	0.2105	flapping	3	2
Herring gull	0.6	1.44	12.8	0.2773	0.2476	flapping	3	2

[4] Garthe S. and Hüppop O. (2004). Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index. Journal of Applied Ecology. 41, Issue 4 Pages 724–734

Species	Body length (m)	Wingspan (m)	Flight speed (ms-1)	Proportion at collision height		Flight type	Nocturnal activity score[4]	Band model option
				Lower tip 22m above MSL	Lower tip 24m above MSL			
Great black-backed gull	0.71	1.58	13.7	0.2997	0.2693	flapping	3	2

3 RESULTS

The estimated collision mortalities for the consented wind farm design are presented alongside those for the alternative turbines in Table 3-1.

Table 3-1 Comparison of annual collision mortalities for the East Anglia THREE consented design (172 turbines) and the alternative design (121 turbines).

Species	Consented design	Alternative design	Ratio of consented annual to alternative annual
Gannet	49.0	41.8	0.85
Kittiwake	112.2	92.3	0.82
Lesser black-backed gull	9.51	8.5	0.89
Herring gull	23.99	21.4	0.89
Great black-backed gull	38.85	34.4	0.88

Collision risks for the alternative turbine design are reduced by between 18% (kittiwake) and 11% (herring gull and lesser black-backed gull) compared with the consented design.

Monthly collision mortalities are presented in Table 3-2 for the alternative design.

Table 3-2 Monthly collision mortalities for the East Anglia THREE alternative design (121 turbines).

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Gannet	0.0	0.0	1.6	2.1	0.0	1.3	1.0	0.4	2.4	0.7	25.4	6.8	41.8
Kittiwake	11.9	11.1	3.4	4.3	1.9	3.0	0.0	0.0	0.0	1.3	16.8	38.5	92.3
Lesser black-backed gull	0.6	0.0	0.0	0.7	0.9	0.7	0.0	3.1	1.6	0.0	0.9	0.0	8.5
Herring gull	3.7	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	10.3	21.4
Great black-backed gull	7.8	9.8	0.0	2.3	0.0	0.0	1.8	0.0	0.0	1.6	2.7	8.3	34.4

APPENDIX B

Radar Modelling Assessment

Radar Modelling Assessment

East Anglia THREE – Non-Material Change

14 July 2020

CL-5499-RPT-002 V2.0

www.cyrrus.co.uk

info@cyrrus.co.uk

Executive Summary

A non-material change (NMC) to the consent for the East Anglia THREE offshore windfarm is proposed which includes an increase of turbine tip height from 247m to 262m and a reduction in the maximum 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 initial project application, have changed with the revised turbine parameters and whether such change modifies the conclusion of the original Environmental Statement (ES). To that end an indicative turbine layout, representing a realistic worst case for radar modelling purposes, is utilised in this report.

Radar Line of Sight (RLoS) modelling indicates that:

- 77 of the 121 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
- 54 of the 121 turbines in the indicative layout will be visible to Cromer radar.

A discrepancy in the antenna aperture height for Trimingham radar, as supplied by the MOD, means that RLoS contours for turbine tip heights of 207m, 223m and 247m, as modelled in the original ES, have moved slightly eastward.

Radar Probability of Detection (PD) modelling indicates that:

- All but the closest 10 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, albeit that a minor amendment of DCO Requirement 33 and an updated Radar Line of Sight Coverage Plan is required to refer to the increase in tip height to 262m and the eastward shift of the 207m, 223m and 247m tip height RLoS contours (to reflect the updated Antenna Aperture height).

For NATS Cromer radar the assessment concludes that:

- Up to 10 turbines of 262m 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.

Abbreviations

AGL	Above Ground Level
AMSL	Above Mean Sea Level
ATC	Air Traffic Control
DCO	Development Consent Order
DTM	Digital Terrain Model
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

Contents

List of figures

List of tables

1. Radar Modelling

1.1. Introduction

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

1.1.3. An application for a non-material change (NMC) to the project's Development Consent Order (DCO) is proposed which includes the following changes that are relevant to this assessment:

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

1.1.4. In light of these revised parameters, a radar modelling assessment is required to establish whether the predicted impacts on Ministry of Defence (MOD) and NATS radars assessed for the initial East Anglia THREE Environmental Impact Assessment (EIA) would change.

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

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 2 October 2017;
- 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 Antenna Aperture above is 2.95m higher AGL than that stated in Appendix 16.1 of the Environmental Statement (ES). The Antenna Aperture height used in Appendix 16.1 was also supplied to Cyrrus by the MOD air defence subject matter expert in 2013 (thought to be correct at the time). The MOD in reviewing Appendix 16.1 and agreeing Requirement 33 of the DCO did not remark on this discrepancy. The corrected Antenna Aperture has been used for this assessment and this discrepancy means that RLoS contours for turbine tip heights of 207m, 223m and 247m, as modelled in the ES have moved slightly eastward (see section 1.6 below).

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

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

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

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

1.4.4.1. The boundary of the East Anglia THREE windfarm site was provided as a geo-referenced Shapefile:

- BDFP_EA3_SiBdry_v06_140204rs.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
262m	230m	121

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 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 the NMC, and was provided as a geo-referenced Shapefile:

- EA3_Aviation_Layout_20200513.shp.

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

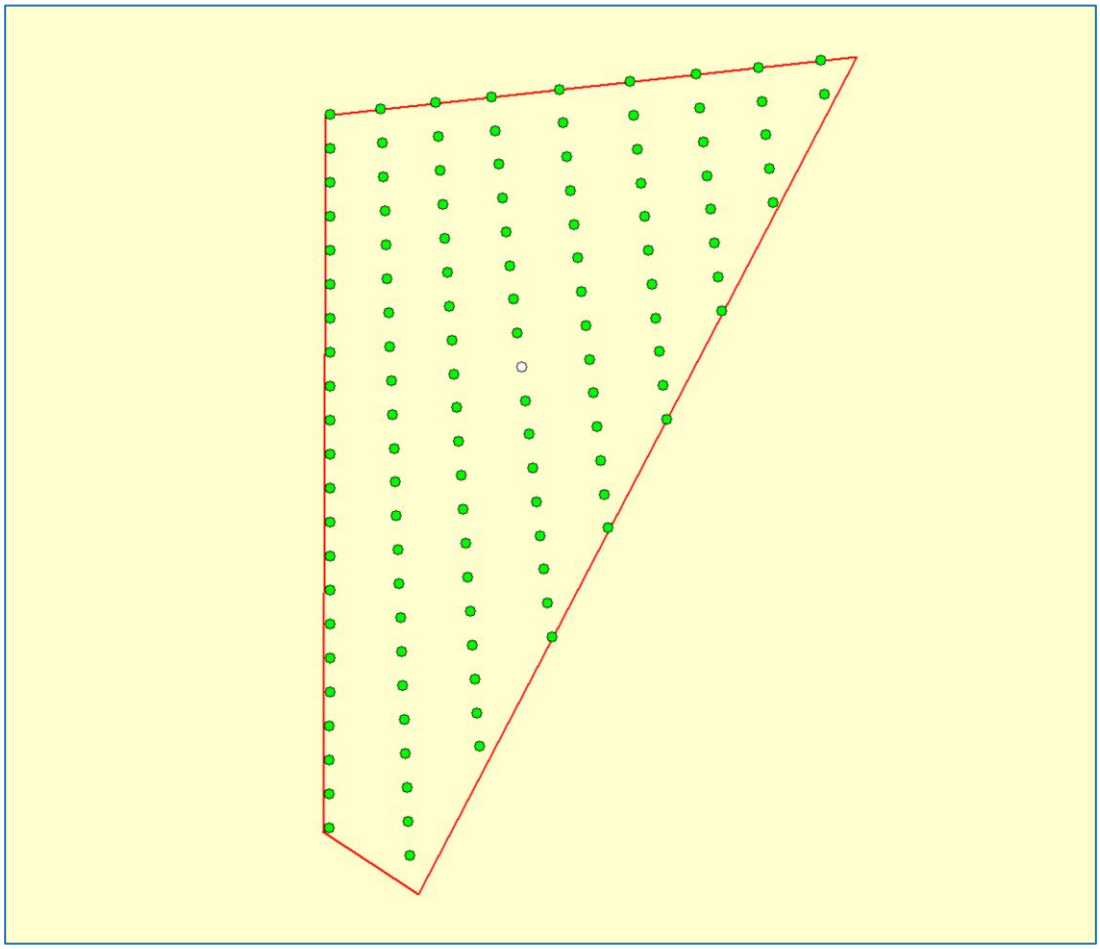

Figure 1: 262m Tip Height Turbine Model Indicative Layout – 121 Turbines (Plus 1 Offshore Substation)

1.4.5.5. 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 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 ICS telecom EV version 15.5.3 x64 release 1429 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.

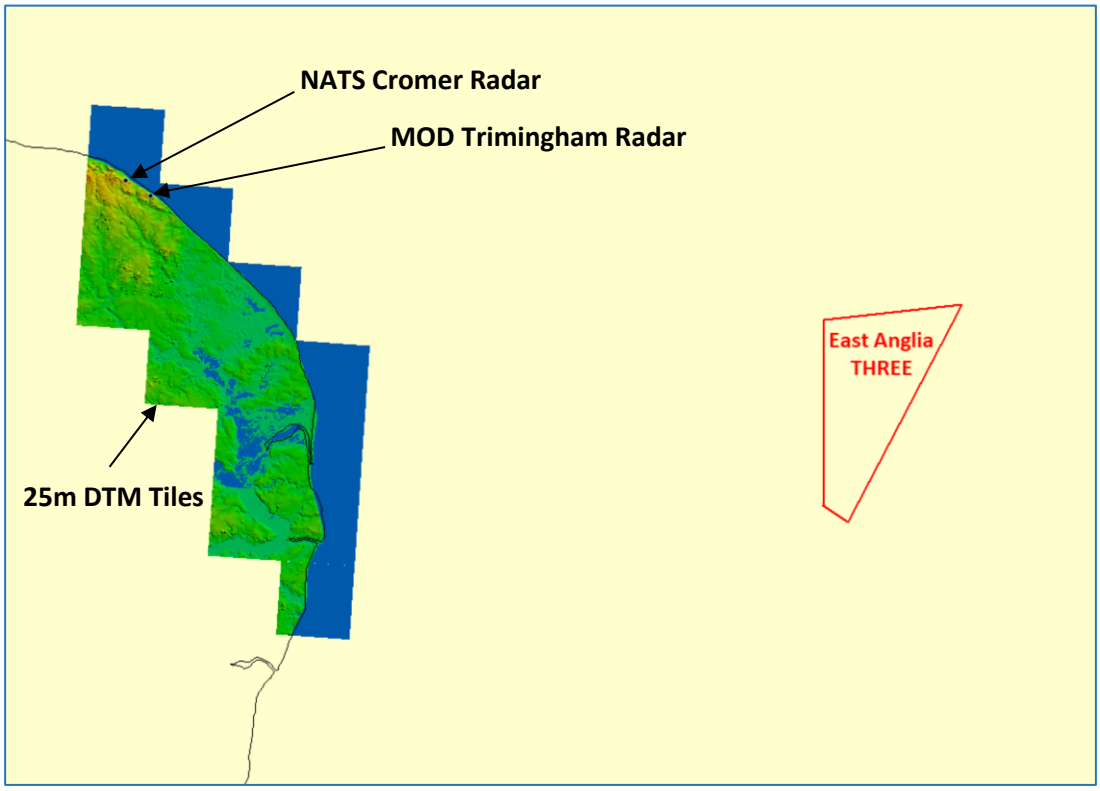

Figure 2: High Resolution DTM in Vicinity of Radars

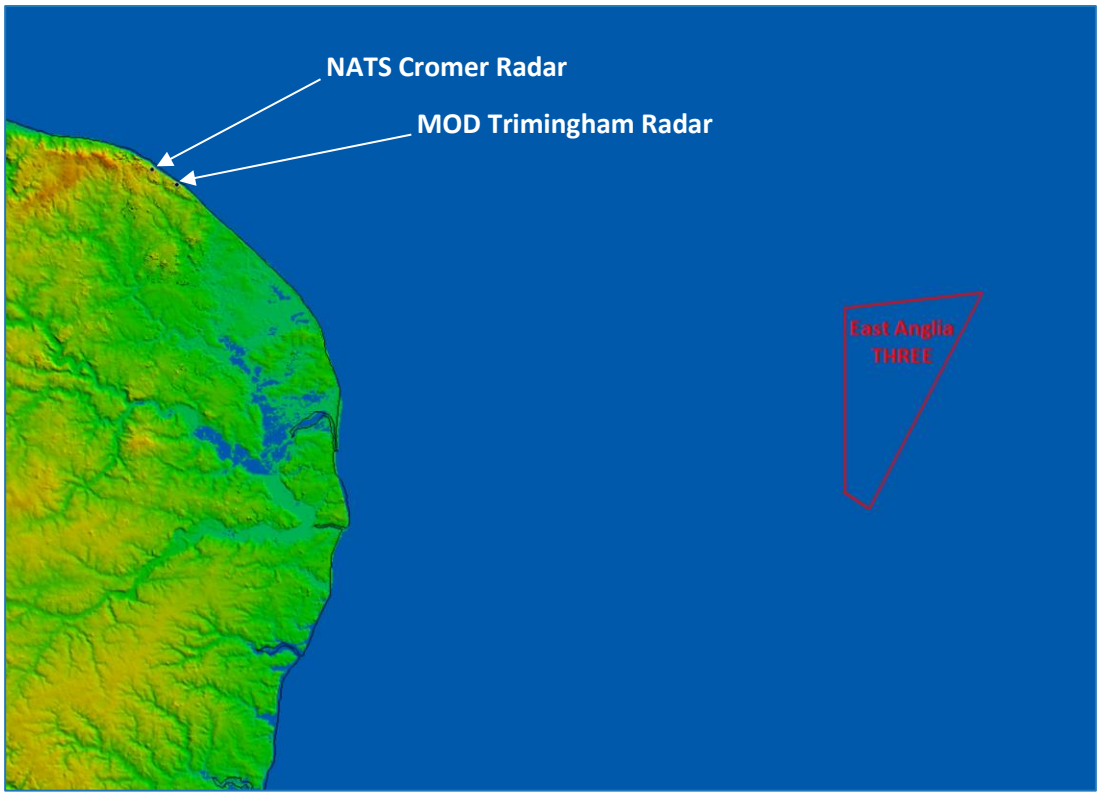

Figure 3: DTM with SRTM background

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 ICS telecom, a radio propagation model.

1.6. MOD Trimingham Radar

1.6.1. Topography

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

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

1.6.2. Radar Line of Sight

1.6.2.1. An initial assessment established RLoS to turbines with a tip height of 262m across the East Anglia THREE windfarm site, as shown in Figure 4 where RLoS is indicated by the magenta shading.

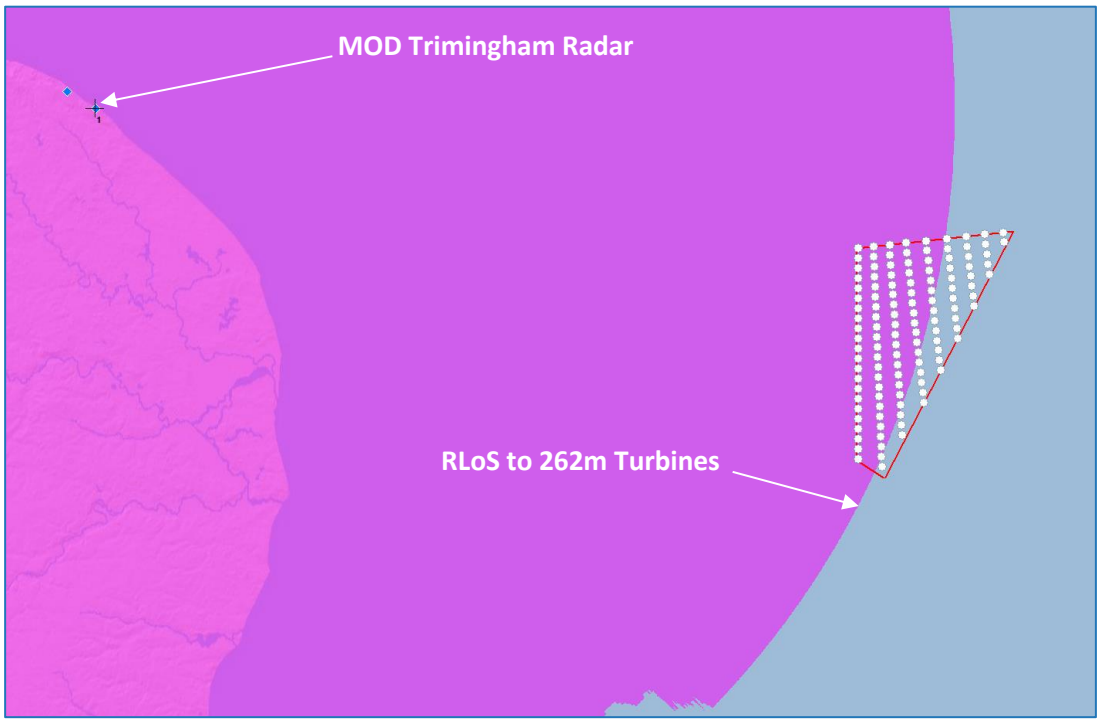

Figure 4: Trimingham Radar RLoS to 262m Tip Height Turbines

1.6.2.2. The calculated RLoS contour from Trimingham radar to 262m tip height turbines at the East Anglia THREE windfarm site is depicted in more detail in Figure 5.

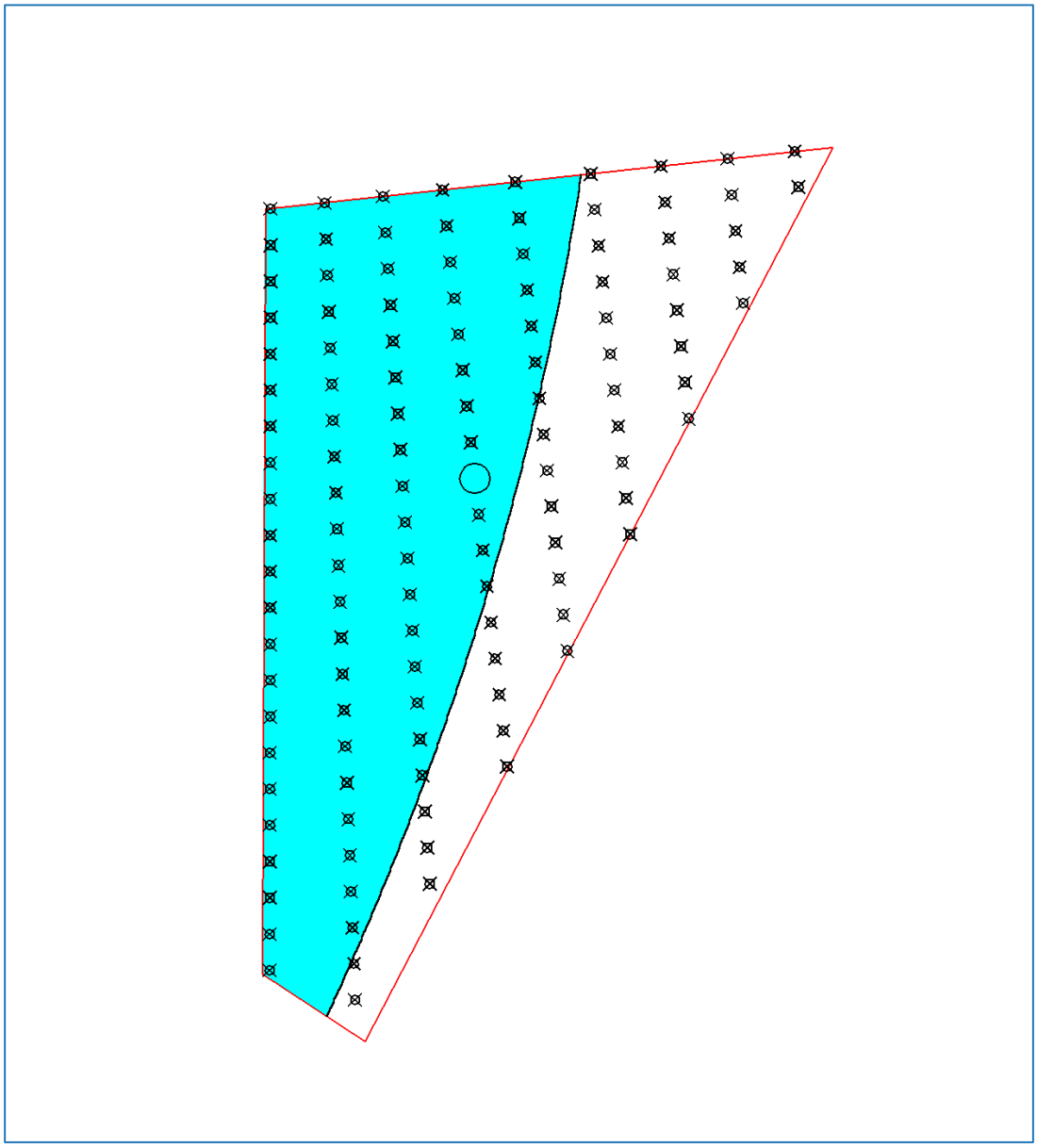

Figure 5: Trimingham Radar RLoS 262m Contour across East Anglia THREE Site

1.6.2.3. The cyan shaded area depicts where Trimingham radar has RLoS to 262m turbines. 77 of the 121 turbines in this indicative visualisation layout are in RLoS of Trimingham radar.

1.6.2.4. For comparison with the results of Appendix 16.1 of the Environmental Statement, RLoS to turbines with tip heights of 207m, 223m and 247m was also assessed.

1.6.2.5. The magenta shading in Figure 6 illustrates RLoS from the Trimingham PSR to 207m tip height wind turbines.

Figure 6: Trimingham Radar RLoS to 207m Tip Height Turbines

1.6.2.6. The magenta shading in Figure 7 illustrates RLoS from the Trimingham PSR to 223m tip height wind turbines.

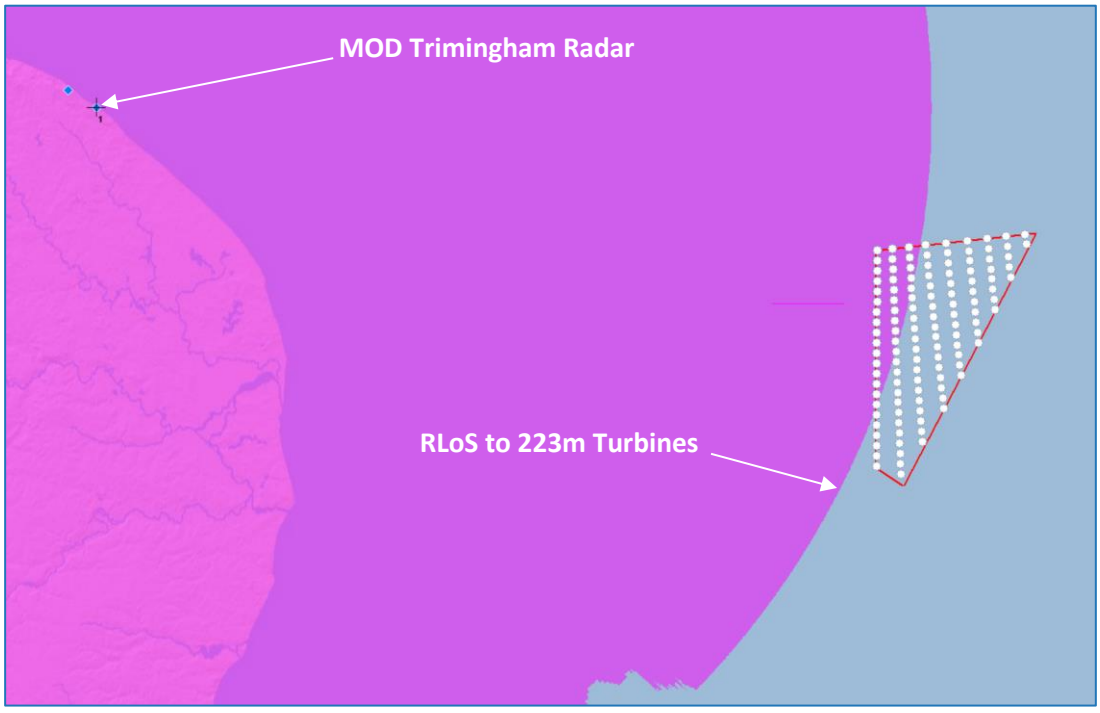

Figure 7: Trimingham Radar RLoS to 223m Tip Height Turbines

1.6.2.7. The magenta shading in Figure 8 illustrates RLoS from the Trimingham PSR to 247m tip height wind turbines.

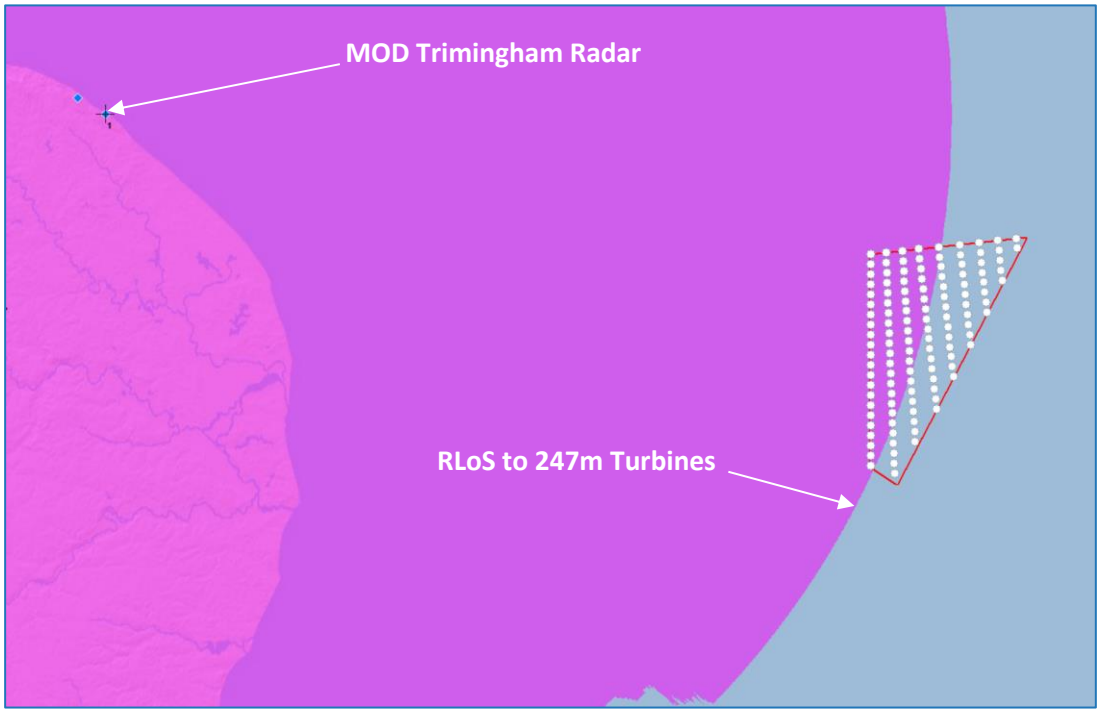

Figure 8: Trimingham Radar RLoS to 247m Tip Height Turbines

1.6.2.8. The RLoS contours from Trimingham radar to 207m, 223m, 247m and 262m tip height turbines at the East Anglia THREE windfarm site are depicted in more detail in Figure 9.

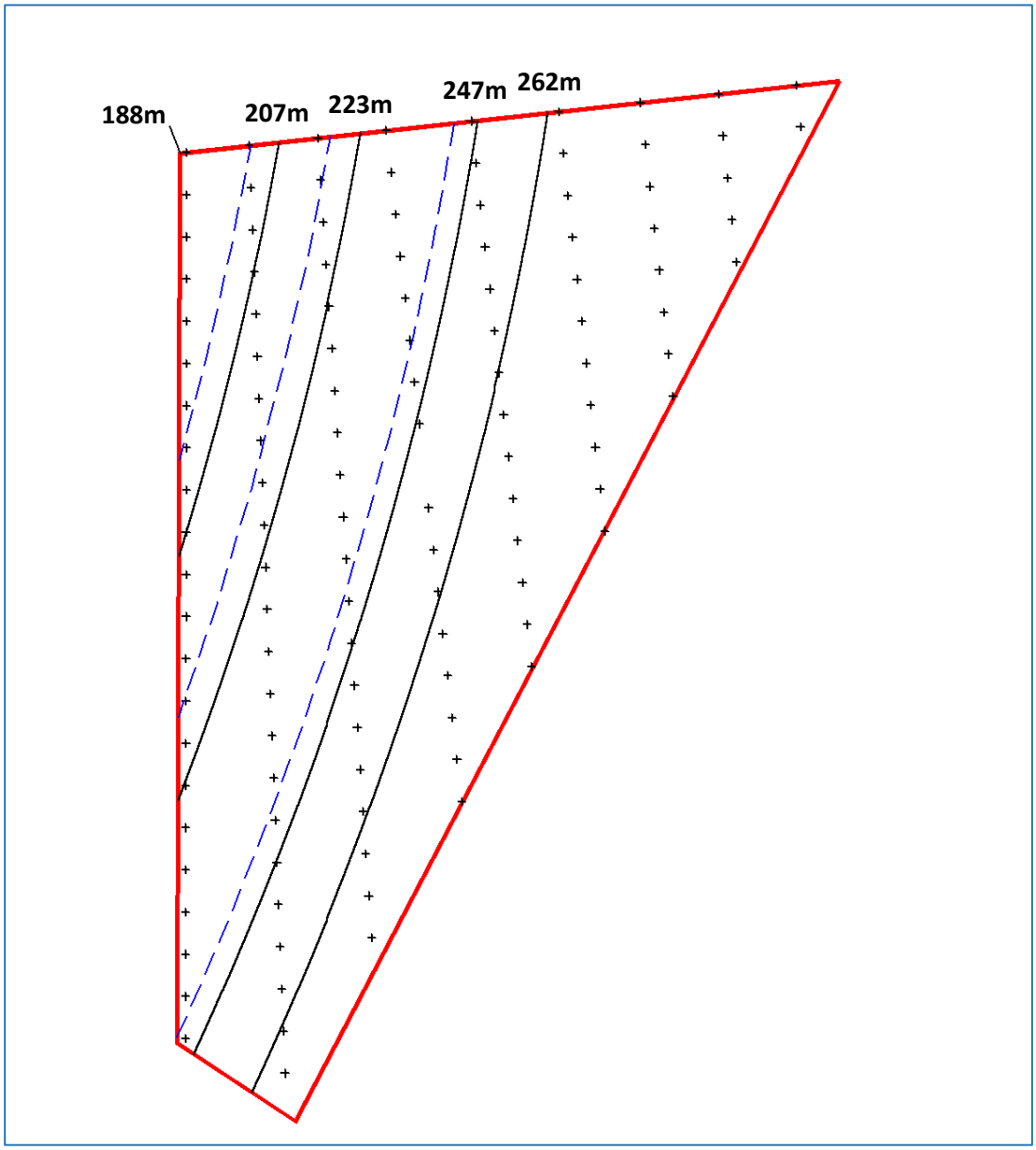

Figure 9: Trimingham Radar RLoS Contours across East Anglia THREE Site

1.6.2.9. To aid comparison, the 207m, 223m and 247m contours from Appendix 16.1 of the Environmental Statement are also depicted in Figure 9, as blue dashed lines. It can be seen that the newly assessed RLoS contours extend further eastwards. This is due to the increased Trimingham radar antenna aperture height, as corrected by DIO, which results in a slightly greater RLoS range for a given turbine tip height.

1.6.2.10. The increased antenna aperture height also reduces the RLoS to the north-western corner point of the East Anglia THREE site from 193m AMSL, as quoted in Appendix 16.1, to 188m AMSL.

1.6.3. Closest Turbine

1.6.3.1. A radar propagation model was used to determine the maximum turbine height for the closest turbine point in the indicative layout (Turbine 22) that would not be visible to Trimingham radar.

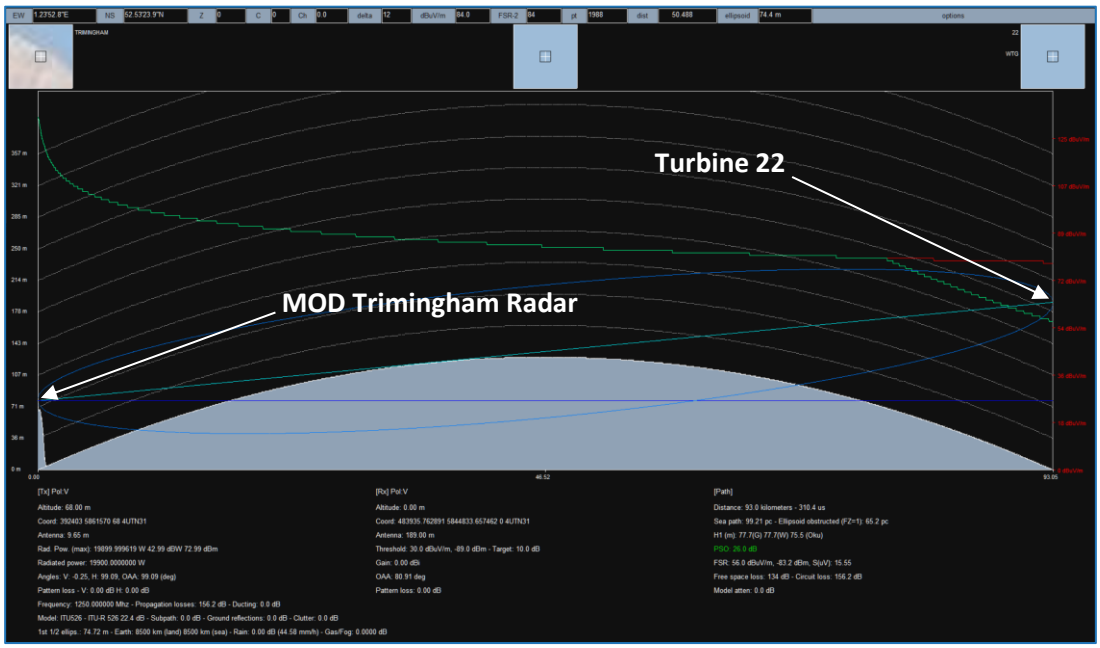

Figure 10: Trimingham Radar Propagation Model to Turbine 22 of East Anglia THREE Indicative Layout

1.6.3.2. The maximum turbine height for Turbine 22 of the East Anglia THREE indicative layout that would not be visible to Trimingham radar is 189m AMSL.

1.6.3.3. Visibility of a 189m tip height turbine at the East Anglia THREE windfarm site from Trimingham radar is shown in Figure 11.

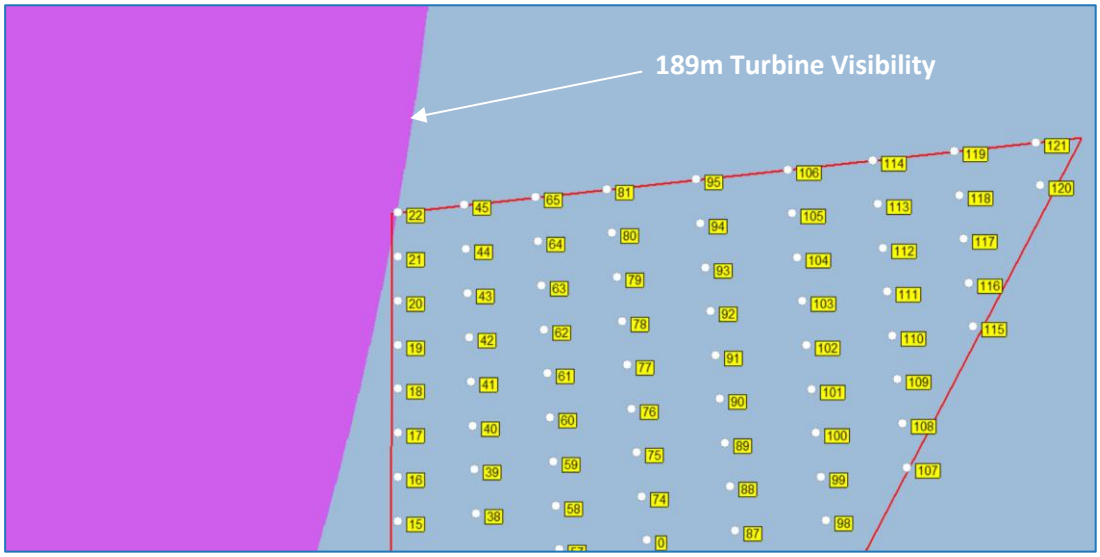

Figure 11: Trimingham Radar Visibility to 189m Turbine

1.6.4. Radar Probability of Detection

1.6.4.1. 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.

1.6.4.2. 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 189m 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 9 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. DCO Requirement 33 provides for such mitigation, albeit a minor amendment is required to reflect Figure 12 below. The Radar Line of Sight Coverage Plan (document 2.11, as certified under the DCO) also requires revision so as to reflect Figure 12 below.

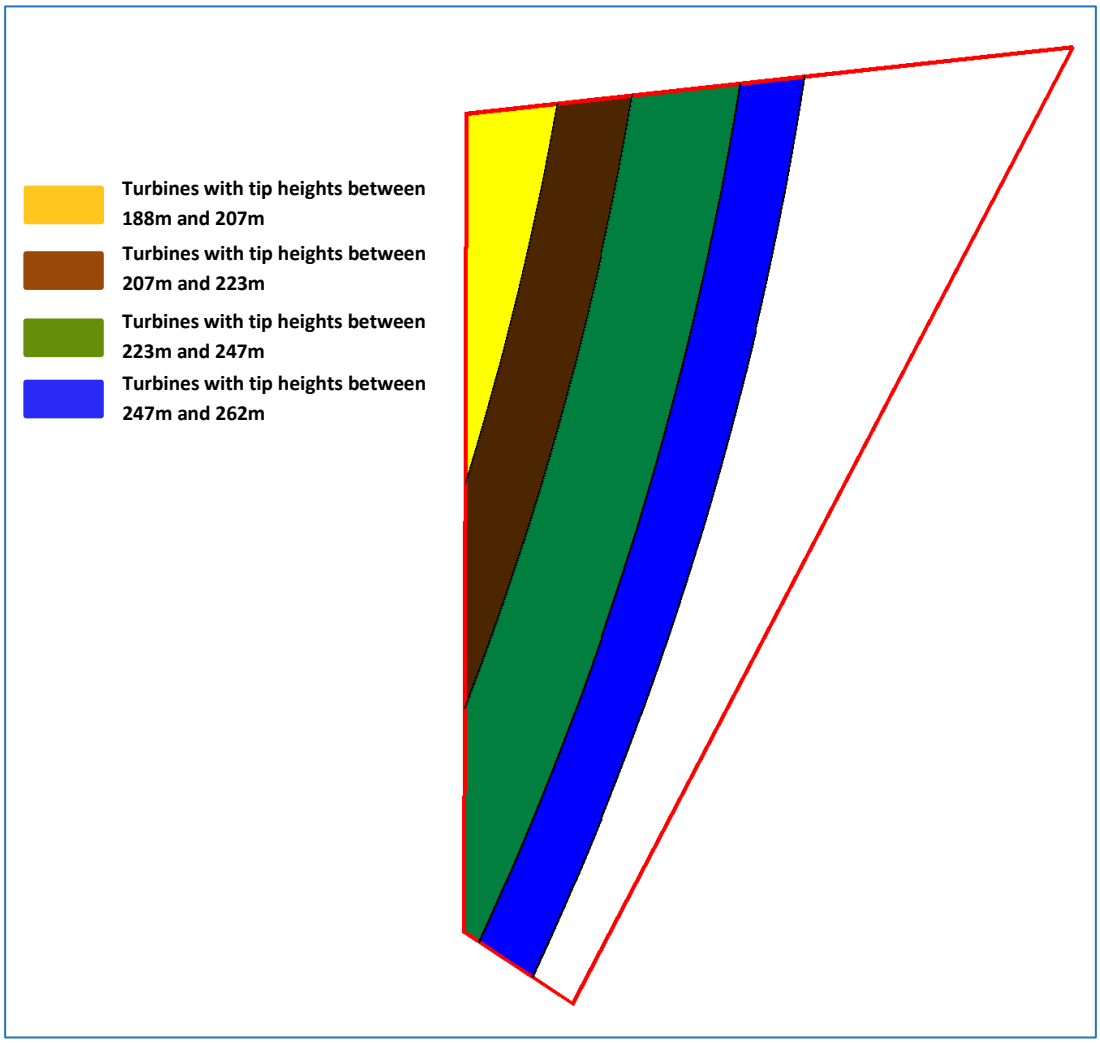

Figure 12: Revised Radar Line of Sight Coverage Plan

1.7. NATS Cromer Radar

1.7.1. Topography

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

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

1.7.2. Radar Line of Sight

1.7.2.1. An initial assessment established RLoS to turbines with a tip height of 262m across the East Anglia THREE windfarm site, as shown in Figure 13 where RLoS is indicated by the magenta shading.

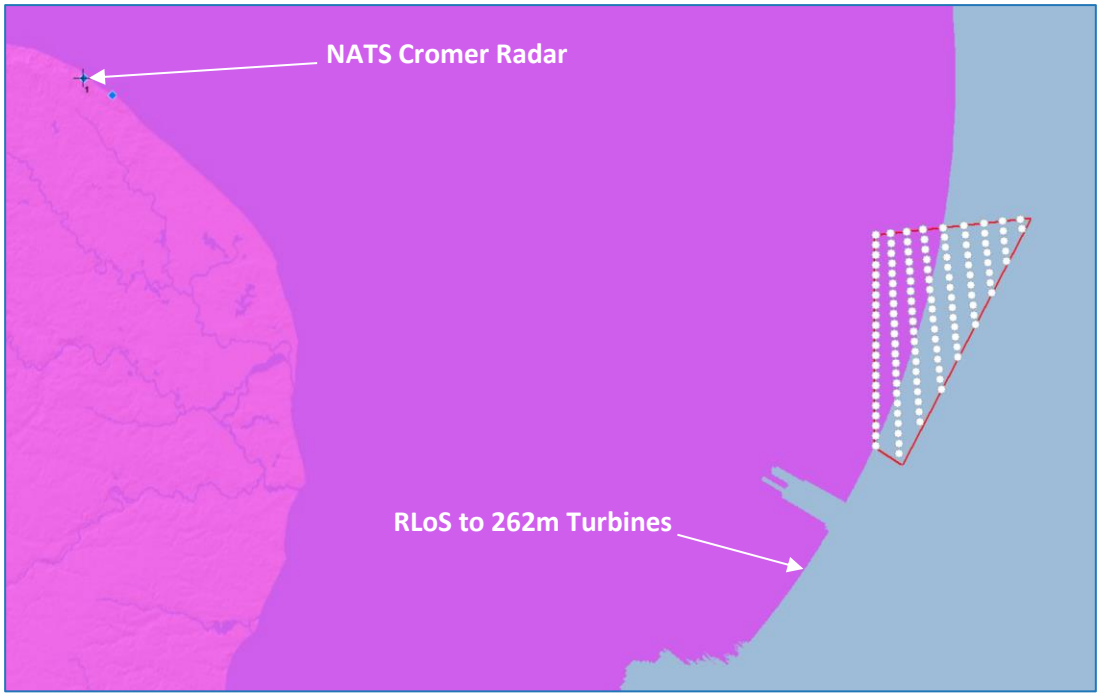

Figure 13: Cromer Radar RLoS to 262m Tip Height Turbines

1.7.2.2. The calculated RLoS contour from Cromer radar to 262m tip height turbines at the East Anglia THREE windfarm site is depicted in more detail in Figure 14.

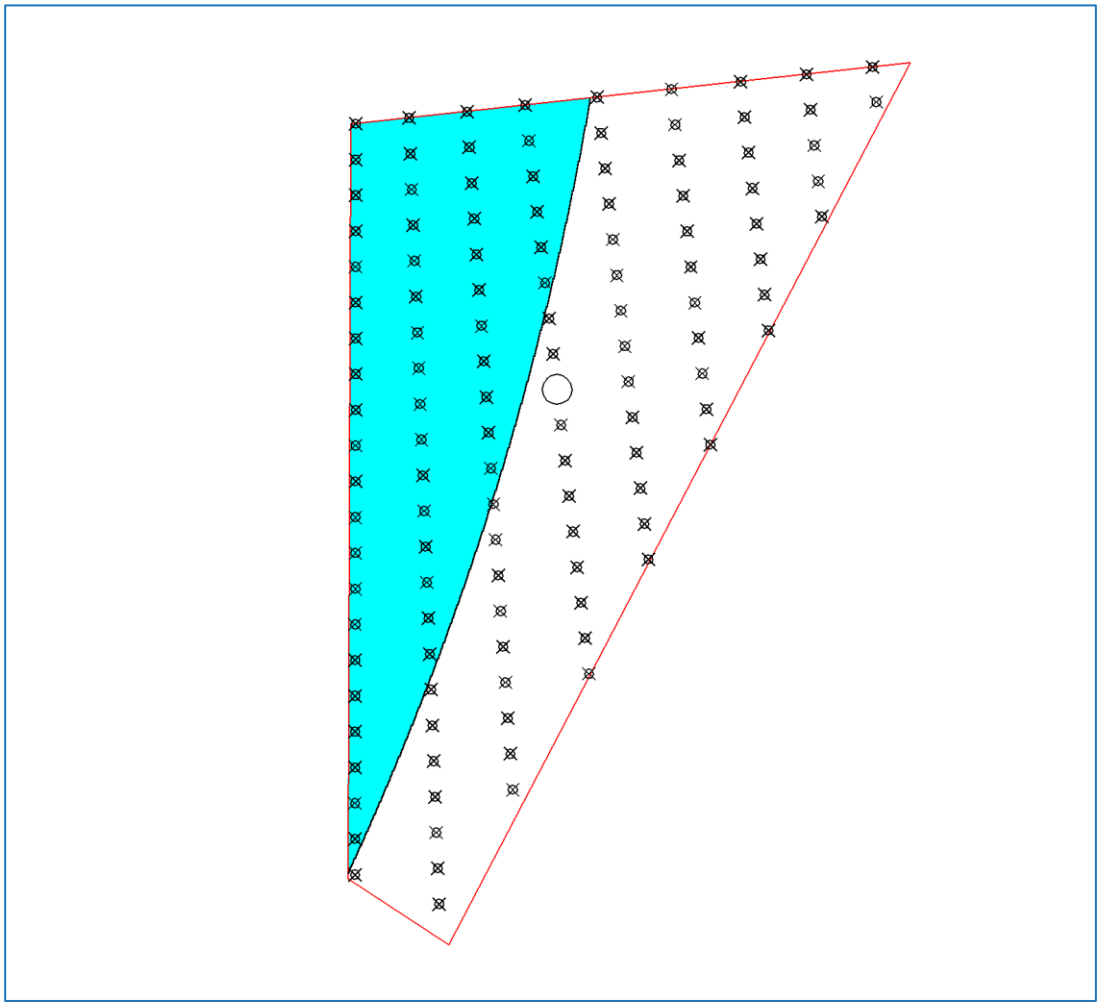

Figure 14: Cromer Radar RLoS 262m Contour across East Anglia THREE Site

1.7.2.3. The cyan shaded area depicts where Cromer radar has RLoS to 262m turbines. 54 of the 121 turbines in this indicative visualisation layout are in RLoS of Cromer radar. As the technical parameters of the Cromer radar have not changed since the ES (in contrast to the Trimingham Antenna Aperture issue), the RLoS coverage maps from the ES at 207m, 223m and 247m are unchanged (see Appendix 16.1, Diagrams 16.1.22 – 16.1.24).

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

1.7.3. Closest Turbine

1.7.3.1. A radar propagation model was used to determine the maximum turbine height for the closest turbine point in the indicative layout (Turbine 22) that would not be visible to Cromer radar.

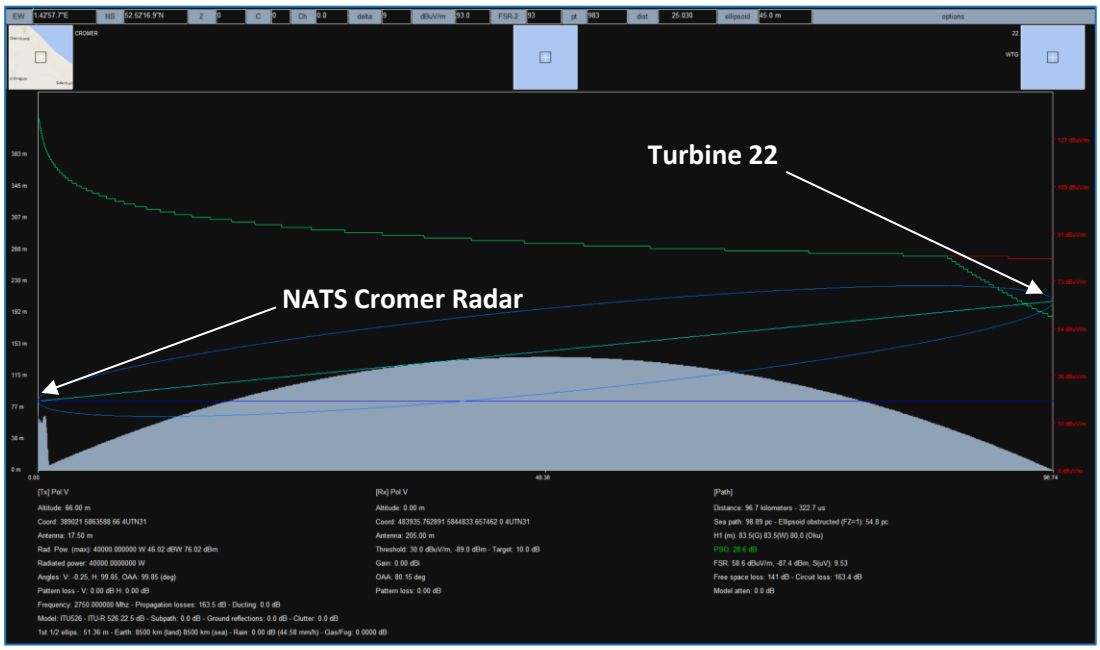

Figure 15: Cromer Radar Propagation Model to Turbine 22 of East Anglia THREE Indicative Layout

1.7.3.2. The maximum turbine height for Turbine 22 of the East Anglia THREE indicative layout that would not be visible to Cromer radar is 205m AMSL.

1.7.3.3. Visibility of a 205m tip height turbine at the East Anglia THREE windfarm site from Cromer radar is shown in Figure 16.

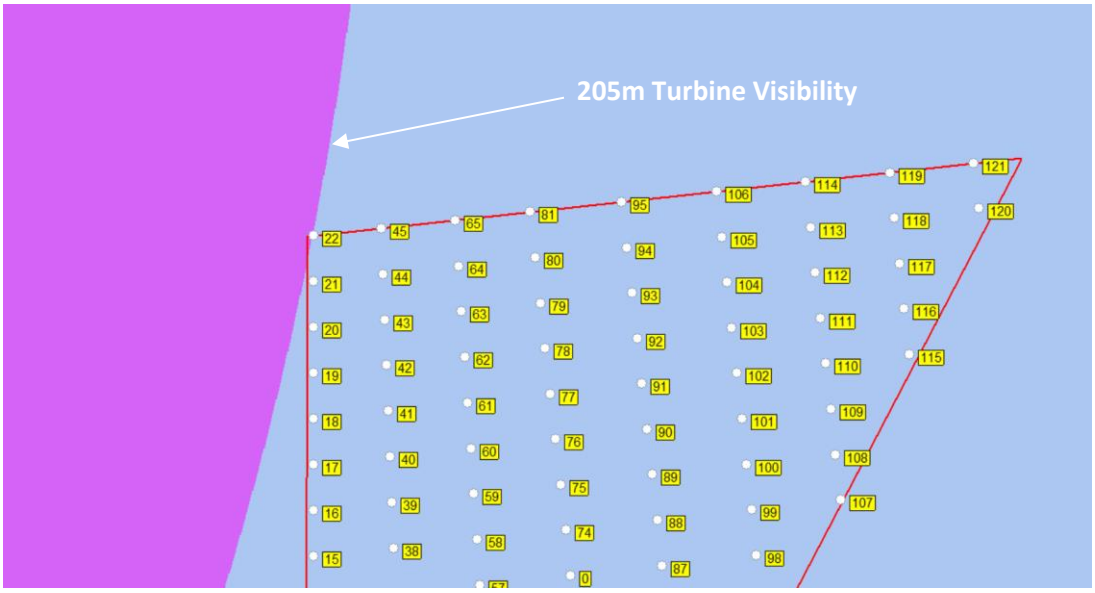

Figure 16: Cromer Radar Visibility to 205m Turbine

1.7.4. Radar Probability of Detection

1.7.4.1. 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.

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

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

1.7.4.4. 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 site.

1.7.4.5. The following analysis examines the impact of increasing the maximum turbine tip height from 247m to 262m AMSL.

1.7.4.6. Path loss calculations are made to a selection of turbines within the 262m 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.

1.7.4.7. The turbines and their associated location IDs selected for modelling are indicated in Figure 17. In order to establish the correlation between RLoS and PD, the turbine locations chosen are within RLoS of Cromer radar.

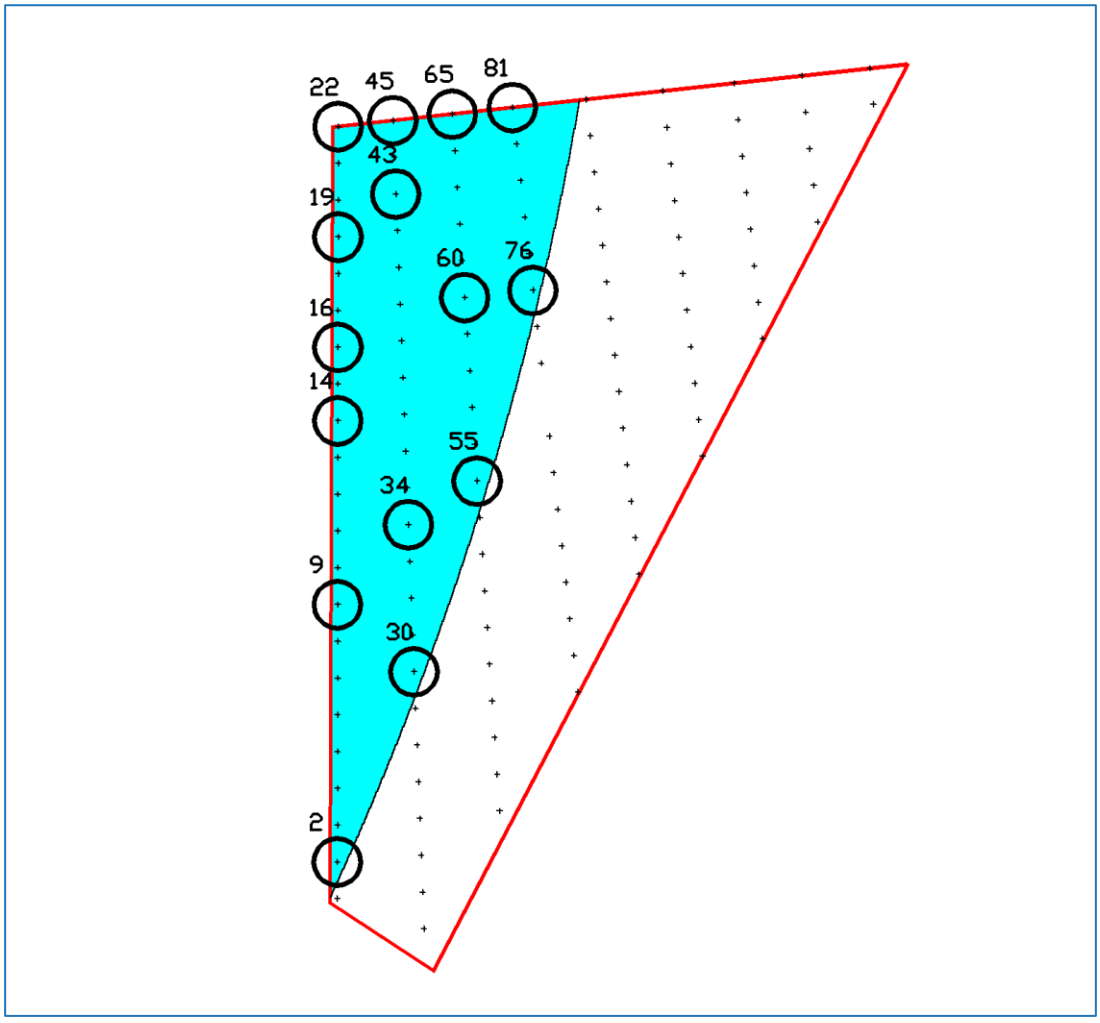

Figure 17: 262m Turbine IDs Selected for Modelling

1.7.4.8. 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 – 262m 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	141.6	163.6	175.2	184.0
9	141.3	157.1	170.7	180.8
14	141.2	152.7	167.7	178.7

16	141.1	151.1	166.5	178.0
19	141.0	148.9	165.0	176.9
22	141.0	147.0	163.6	176.0
30	141.6	163.5	175.2	184.0
34	141.4	160.0	172.7	182.2
43	141.2	152.7	167.6	178.7
45	141.1	151.3	166.7	178.0
55	141.5	163.4	175.1	183.9
60	141.4	159.4	172.3	181.9
65	141.3	155.8	169.8	180.2
76	141.6	163.7	175.2	184.1
81	141.4	159.9	172.6	182.2

Table 2: 262m Turbine Path Loss Calculations

1.7.4.9. Path loss is greatest to the turbines closest to the 262m RLoS contour: turbine IDs 2, 30, 55, 76.

1.7.4.10. 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 230m, turbine blades of 115m are assumed. For 115m blades a nominal RCS of 120m^2 is used to determine the energy reflected from each of the three points on the turbine (tip, mid-point and nacelle).

1.7.4.11. 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 -0.25°.

1.7.4.12. The parameters used for the PD calculations are shown in Figure 18.

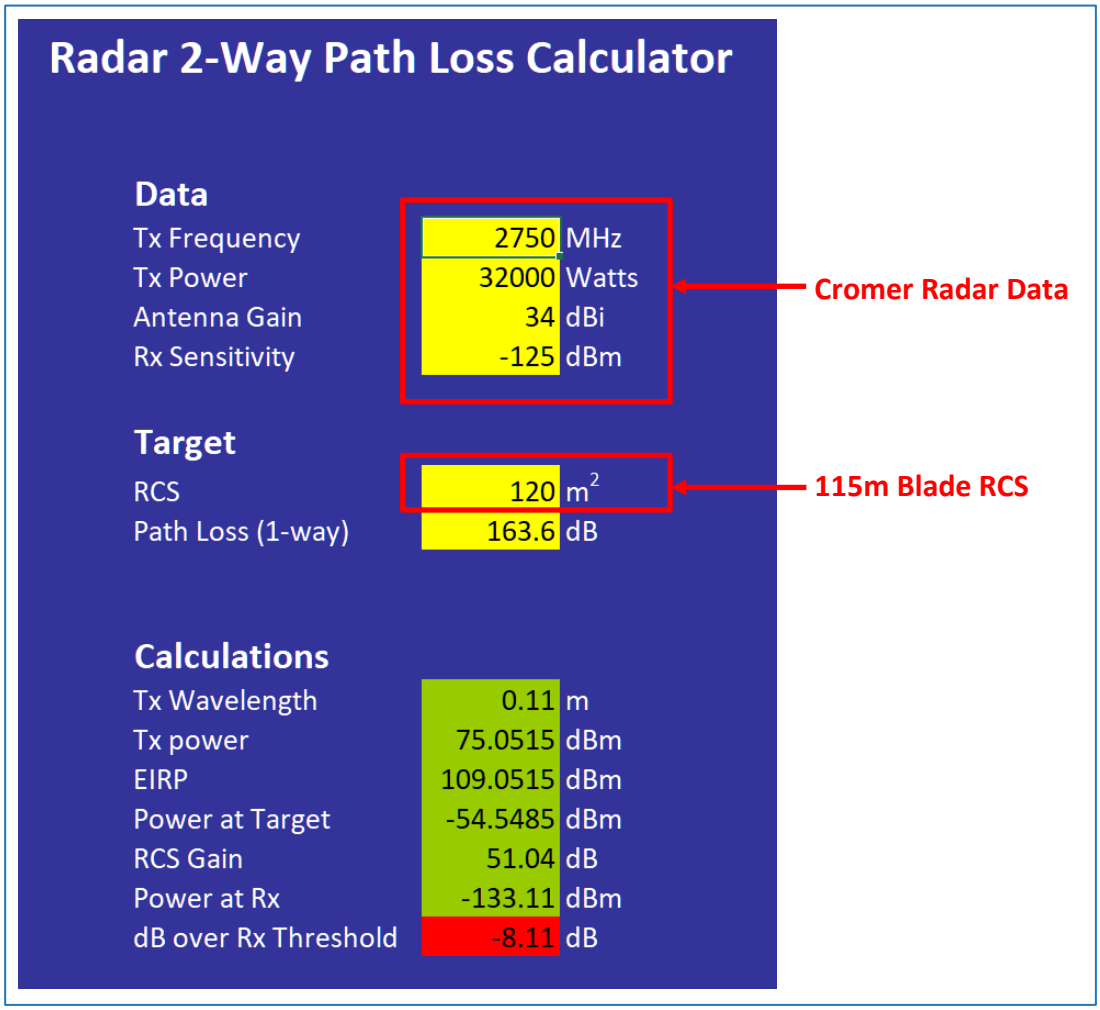

Figure 18: Cromer Radar PD Calculation for 262m Turbines

1.7.4.13. The results of the PD calculations for 262m turbines are presented in Table 3.

Cromer: Probability of Detection – 262m 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	141.6	163.6	**-8.09**
9	141.3	157.1	**4.90**
14	141.2	152.7	**13.69**
16	141.1	151.1	**16.89**
19	141.0	148.9	**21.29**
22	141.0	147.0	**25.09**
30	141.6	163.5	**-7.89**

Cromer: Probability of Detection – 262m 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)
34	141.4	160.0	**-0.90**
43	141.2	152.7	**13.69**
45	141.1	151.3	**16.49**
55	141.5	163.4	**-7.69**
60	141.4	159.4	**0.30**
65	141.3	155.8	**7.50**
76	141.6	163.7	**-8.29**
81	141.4	159.9	**-0.70**

Table 3: Cromer Radar – 262m Turbine PD

1.7.4.14. 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.

1.7.4.15. Cromer radar is unlikely to detect turbine IDs 2, 30, 55 and 76.

1.7.4.16. The results in Table 3 represents 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.

1.7.4.17. 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 -0.25°) is expected to be significantly lower than the on-axis gain.

1.7.4.18. 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 – 262m 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	141.6	163.6	**-28.09**
9	141.3	157.1	**-15.10**
14	141.2	152.7	**-6.31**
16	141.1	151.1	**-3.11**

Cromer: Probability of Detection – 262m 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)
19	141.0	148.9	**1.29**
22	141.0	147.0	**5.09**
30	141.6	163.5	**-27.89**
34	141.4	160.0	**-20.90**
43	141.2	152.7	**-6.31**
45	141.1	151.3	**-3.51**
55	141.5	163.4	**-27.69**
60	141.4	159.4	**-19.70**
65	141.3	155.8	**-12.50**
76	141.6	163.7	**-28.29**
81	141.4	159.9	**-20.70**

Table 4: Cromer Radar – 262m Turbine PD with Reduced Antenna Gain

1.7.4.19. With a 10dB reduction in antenna gain, Cromer radar is additionally unlikely to detect turbine IDs 9, 14, 34, 43, 60, 65 and 81.

1.7.4.20. 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.

1.7.4.21. The colour-coded results are illustrated in Figure 19 and suggest that all but the closest 10 of the 121 turbines in the 262m indicative layout are unlikely to be detected by Cromer radar. This represents an impact not experienced in the original ES, where, as noted in paragraph 1.7.4.4 above, NATS concurred with the ES conclusion that no turbines at 247m would be detected by Cromer PSR.

1.7.4.22. Although up to 10 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 required.

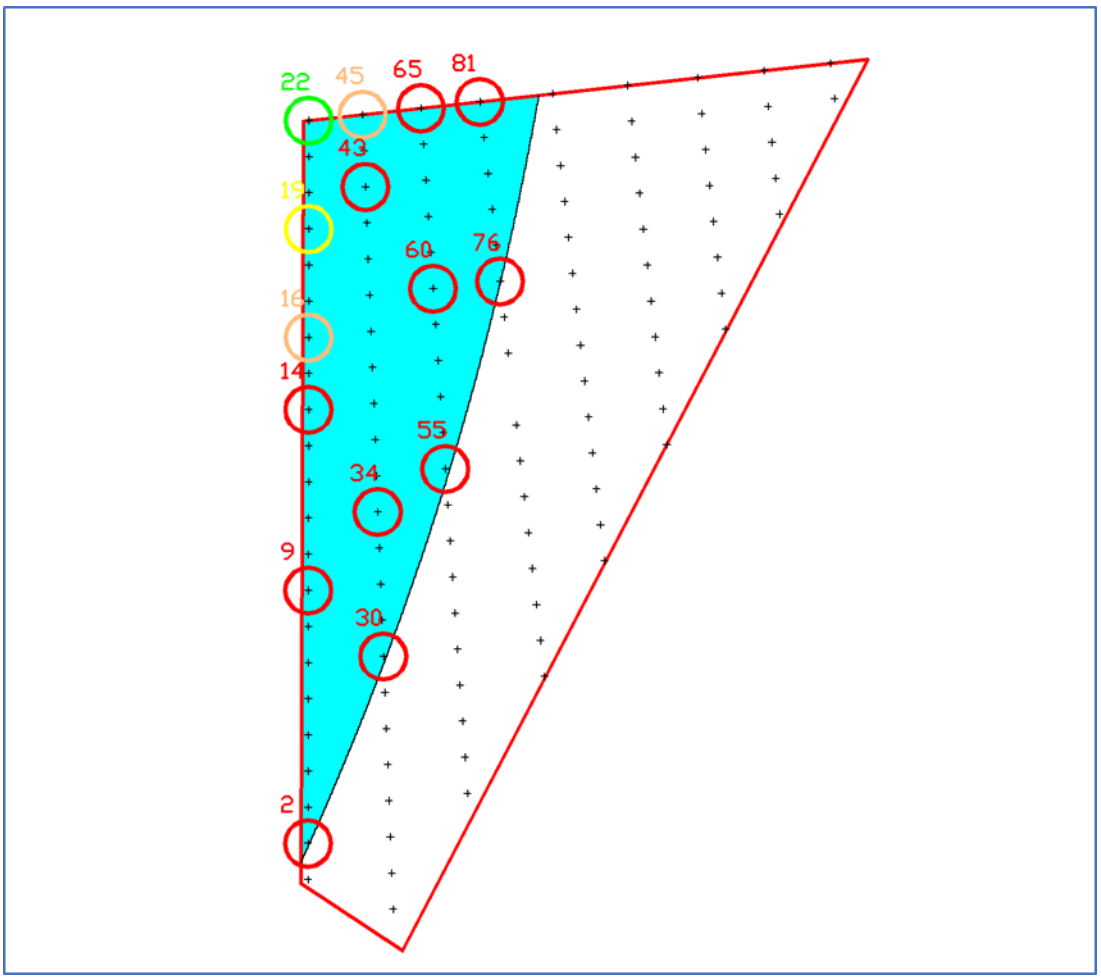

Figure 19: Cromer Radar PD of 262m Turbines with Reduced Antenna Gain

1.8. Conclusion

1.8.1. For MOD Trimingham radar, the modelling concludes that the principle of the mitigation remains appropriate to mitigate significant effects, albeit that a minor amendment of DCO Requirement 33 and an updated Radar Line of Sight Coverage Plan is required to refer to the increase in tip height to 262m and the eastward shift of the 207m, 223m and 247m tip height RLoS contours (to reflect the updated Antenna Aperture height).

1.8.2. For NATS Cromer radar, 247m tip turbines are unlikely to be detected. However, with an increase in tip height to 262m, PD analysis shows that there may be a small impact in terms of radar detection. 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

Radar Line of Sight Coverage Plan

East Anglia Zone

East Anglia THREE Site

Area in which turbines of the following heights may require MoD air defence radar mitigation (see DCO Requirement 33)

- Turbines with tip heights between 188m and 207m: Area A
- Turbines with tip heights between 207m and 223m: Area B
- Turbines with tip heights between 223m and 247m: Area C
- Turbines with tip heights between 247m and 262m: Area D

2°20'0"E 2°40'0"E 3°0'0"E 3°20'0"E

52°50'0"N 52°40'0"N 52°30'0"N

N

Doc Reference	2.11
APFP Regulation	5(2)(o)
Date	July 2020
Author	East Anglia THREE Limited
Revision History	B

SCOTTISHPOWER RENEWABLES

Rev	Date	By	Comment
1	13/07/2020	HAH	For Information

Prepared: HAH
Checked: RB
Approved: CB

1:250,000 Scale @ A3

km 0 2.5 5

Nautical Miles 0 1.5 3

East Anglia THREE

Radar Line of Sight Coverage Plan
Sheet Number: Sheet 1 of 1

Drg No	EA3-GEN-GIS-DRG-IBR-000302		
Rev	1	Datum: WGS 1984 Projection: UTM Zone 31N	
Date	16/07/2020		
Figure	N/A		

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