East Anglia ONE North Offshore Windfarm

Offshore Commitments

Applicant: East Anglia ONE North Limited
Document Reference: ExA.AS-21.D3.V1
SPR Reference: EA1N-DWF-ENV-REP-IBR-000538

Date: 15th December 2020
Revision: Version 01
Author: ScottishPower Renewables

Applicable to East Anglia ONE North

Revision Summary				
Rev	**Date**	**Prepared by**	**Checked by**	**Approved by**
01	15/12/2020	Paolo Pizzolla	Ian Mackay	Rich Morris

Description of Revisions			
Rev	**Page**	**Section**	**Description**
01	n/a	n/a	For issue into the Examination

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Glossary of Acronyms

AEZ	Archaeological Exclusion Zone
AEoI	Adverse Effect on Integrity
CfD	Contract for Difference scheme
DCO	Development Consent order
DML	Deemed Marine Licence
EIA	Environmental Impact Assessment
HRA	Habitats Regulation Assessment
IMO	International Maritime Organisation
LAT	Lowest Astronomical Tide
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
MW	Megawatts
NMC	Non-Material Change
OET SPA	Outer Thames Estuary Special Protection Area
RSPB	Royal Society for the Protection of Birds
SAR	Search and Rescue
SLVIA	Seascape Landscape and Visual Impact Assessment
SPA	Special Protection Area
SPR	ScottishPower Renewables
UXO	Unexploded Ordnance
ZAP	Zonal Appraisal and Planning process

Glossary of Terminology

Applicant	East Anglia ONE North Limited
Air draught	The space between the sea surface and the lowest point of the wind turbine rotor tip
East Anglia Hub	The delivery programme for East Anglia THREE, East Anglia TWO and East Anglia ONE North projects
East Anglia TWO project	The proposed project consisting of up to 75 wind turbines, up to four offshore electrical platforms, up to one construction operation and maintenance platform, inter-array cables, platform link cables, up to one operational meteorological mast, up to two offshore export cables, fibre optic cables, landfall infrastructure, onshore cables and ducts, onshore substation, and National Grid infrastructure.
East Anglia ONE North project	The proposed project consisting of up to 67 wind turbines, up to four offshore electrical platforms, up to one construction operation and maintenance platform, inter-array cables, platform link cables, up to one operational meteorological mast, up to two offshore export cables, fibre optic cables, landfall infrastructure, onshore cables and ducts, onshore substation, and National Grid infrastructure.
East Anglia TWO / East Anglia ONE North windfarm site	The offshore area within which wind turbines and offshore platforms will be located.
Generation Deemed Marine Licence (DML)	The deemed marine licence in respect of the generation assets set out within Schedule 13 of the draft DCO.
Transmission DML	The deemed marine licence in respect of the transmission assets set out within Schedule 14 of the draft DCO.

1 Introduction

1.1 Purpose of this Document

1. This document presents East Anglia ONE North Limited's (the Applicant) commitments made to reducing the potential for impacts from infrastructure in the East Anglia ONE North project (the Project) windfarm site on ornithological resources and SLVIA in response to stakeholder concerns.

2. In addressing stakeholder concerns and making these commitments, the Applicant has consulted internally with their engineering, foundations and wind turbines teams in addition to external engagement with the supply chain, achieved principally through early works for the East Anglia Hub.

2 Commitments

2.1 Changes to Wind Turbines

2.1.1 Increase in Air Draught

3. The Applicant submitted a revised collision risk assessment at Deadline 1 (REP1-047) that demonstrated how the air draught commitment, alongside a non-material change (NMC) for the consented East Anglia THREE[1] project (accepted July 2020) and a NMC application for the constructed East Anglia ONE[2] project (to be submitted in early 2021) has reduced the potential cumulative / in-combination impact of the Projects. However, it should be noted that the Applicants' case does not rely on the NMCs, as the Applicants maintain the position from the Application that the effects of the Projects are minimal and well below those considered *de minimis* by the Secretary of State in recent decisions. Rather, the NMCs are provided to reduce uncertainty in the in-combination position.

4. In considering the implementation of air draught mitigation, the Applicant has engaged internally with their wind turbine and foundations teams and externally with the supply chain in combination with early works for the procurement of East Anglia Hub. Increases in air draught from 22m (the base case) to 35m over

[1] The NMC for the East Anglia THREE project reduces the maximum number of wind turbines from 172 to 121 by removing the smallest wind turbines from the project envelope. It is anticipated that the NMC will be decided by Q2 2021, which could be after the end of the Examination. However, the decision would be made within the Project's determination period

[2] The NMC for the East Anglia ONE will revise the number of turbines from the consented maximum of 150 to 102, the latter being the number which have been installed. The NMC for East Anglia ONE will be submitted specifically to address previous comments from statutory nature conservation bodies that developers should be submitting 'as-built' NMCs to free up environmental headroom. As the NMC will simply update the consent to reflect the 'as-built' windfarm, it is anticipated that it will be decided within the Examination period.

MHWS[3] were considered against the following parameters; practicality of foundation and wind turbine installation, implications on foundation weight and fabrication and annual energy production.

5. The results found that a 30m air draught is the practical limit of wind turbine installation based on the vessels currently available but greater air draughts could be feasible with the new class of vessels expected to be available in the future.

6. A more significant issue however, was found in the relationship between tower weight and the implications on foundations as a result of increasing air draught. This is further exacerbated by the lack of detailed site investigation data and the relatively deep nature of both windfarm sites (98% of East Anglia ONE North lies in water depths of 40 – 57m below LAT and 85% of East Anglia TWO in water depths of 40 - 67m below LAT).

7. Given the water depths, air draught increases above 24m were found to carry significant cost and, subject to ground conditions, restrict flexibility in foundation options by reducing the ability to deploy monopiles and increasing the need to rely on jacket foundations with resulting impacts on commercial viability.

8. The Natural England Written Representation (REP1-171) has queried why the Applicant cannot commit to a greater air draught increase as other offshore wind projects have done. In response, the Applicant notes that circumstances at other recent projects in the Southern North Sea may be different in relation to the following:

    - Site conditions may be more favourable with shallower water depths. For example, water depth at Norfolk Boreas ranges between 20.4m and 42.8m below LAT (Norfolk Boreas Limited, 2019)[4] (with only 4.8% of the site at water depths of 40m or greater, by the Applicant's calculation using GIS). This suggests that Norfolk Boreas could accommodate a greater air draught increase in comparison to the Project where a longer transition piece will be required between the seabed and wind turbine tower. Other differences in site conditions may relate to underlying seabed geology and seabed morphology, such as the occurrence of mobile sand waves; and

    - Layout constraints including the occurrence of archaeology and reefs or differences in windfarm site area that allow for greater spatial flexibility to manage these issues. For example, the pre-construction capacity density

[3] This was the largest air draught height commitment made by Vattenfall for the Norfolk Vanguard project (for turbine models of 11.55MW to 14.6MW capacity)
[4] Norfolk Boreas Limited (2019). Norfolk Boreas Offshore Wind Farm, Chapter 5, Project Description. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-000391-6.1.5%20Environmental%20Statement%20Chapter%205%20Project%20Description.pdf

(target capacity at the onshore connection point divided by the area of the windfarm site) is much higher for the Project in comparison to other recent Southern North Sea projects as shown in ***Table 1*** below. A project with a higher capacity density has lower resilience (spatial flexibility) to mitigate known and unknown layout constraints.

Table 1 A comparison of capacity density of East Anglia ONE North and East Anglia TWO with other Southern North Sea windfarms

Project	Windfarm area (km^2)	Capacity target (MW)	Capacity density (MW/km^2)
Norfolk Boreas[5]	725	1800	2.4
Norfolk Vanguard[6]	592	1800	3.0
Hornsea Project 3[7]	696	2400	3.4
East Anglia ONE North	203	800	3.9
East Anglia TWO	213	900	4.2

2.2 Reduction in the size of the East Anglia ONE North windfarm site to increase the distance to the Outer Thames Estuary SPA

9. Natural England highlighted a significant concern in their relevant representation (RR-059) relating to the location of the East Anglia ONE North windfarm site relative to the boundary of the Outer Thames Estuary SPA. Natural England stated[8]:

"Natural England considers that the most critical issue concerning offshore ornithology is the impact of displacement on red-throated diver from the Outer Thames Estuary Special Protection Area (OTE SPA). Specifically, Natural England is concerned that the location of the EA1N array, which abuts the SPA boundary, will through displacement effects result in a long-lasting reduction in the availability of diver habitat in part of the SPA and a change of the distribution of divers within the SPA, and therefore conclude that there would be an adverse

[5] Norfolk Boreas Limited (2019). Norfolk Boreas Offshore Wind Farm, Chapter 5, Project Description. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-000391-6.1.5%20Environmental%20Statement%20Chapter%205%20Project%20Description.pdf
[6] Norfolk Vanguard Limited (2018). Norfolk Vanguard Offshore Wind Farm, Chapter 5, Project Description. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-001493-Chapter%2005%20Project%20Description%20Norfolk%20Vanguard%20ES.pdf
[7] Orsted (2018). Hornsea Project THREE Offshore Wind Farm, Chapter 3, Project Description. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010080/EN010080-000528-HOW03_6.1.3_Volume%201%20-%20Ch%203%20-%20Project%20Description.pdf
[8] Natural England relevant representation (RR-059), Appendix A – Offshore Ornithology, Summary of key consenting issues (https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010077/EN010077-001670-Natural%20England%20RR%201.pdf)

effect on site integrity, both alone and in-combination with other plans and projects. To address the risk of adverse impacts on the SPA, Natural England recommends that the proposed array is reconfigured such that no part of it is within 10km to the SPA boundary"

10. The Natural England advice for a 10km 'buffer' was not made formally to the Applicant pre-application.

11. In considering what buffer commitments could be made to reduce the potential for impact, the Applicant reviewed the constraints on relocation of the wind farm site and constraints within the windfarm site, and further detail on each of these is set out below.

2.2.1 Constraints on relocation of the East Anglia ONE North windfarm site

12. The East Anglia ONE North windfarm site boundary as defined by Works No 1,2,3 and 4 (see ***Works Plans (Offshore)*** (APP-010)) has been selected on the basis of the ZAP process (see ***chapter 4 Site Selection and Assessment of Alternative*** (APP-052) and further consideration of development potential carried out by the Applicant.

13. The boundary of the windfarm site is defined by the following constraints:

- To the east: IMO shipping deep-water route (see ***Figure 14.1*** (APP-235) and ***chapter 14 Shipping and Navigation*** (App-042));
- To the north: Cables and pipelines (see ***Figure 17.2*** (APP-248) and ***chapter 17 Infrastructure and Other Users*** (App-065));
- To the south: The constructed East Anglia ONE windfarm (see ***Figure 17.1*** (APP-247) and ***chapter 17 Infrastructure and Other Users*** (App-065)); and
- To the west: The Outer Thames Estuary SPA.

14. The windfarm site boundary is drawn from consideration of these constraints, it is effectively a space within the combined constraints.

15. Additionally, the ornithological assessment for the Application, with respect to the potential displacement from wind turbines, has been carried out on the windfarm site.

16. Relocation of the windfarm site is therefore, not a viable option.

2.2.2 Constraints within the windfarm site

17. The East Anglia ONE North windfarm site occupies a relatively small area of 208km^2 when compared to other recent Southern North Sea windfarms such as

Hornsea Project 3 (696km^2), Norfolk Vanguard (592km^2) and Norfolk Boreas (725km^2) as described in ***section 2.1***. Within the windfarm site there are a number of constraints that will affect the layout of wind turbines, which are described below.

18. The windfarm site is relatively deep ranging between 35m to a maximum depth of 57m below LAT with 98% of the windfarm site between 40 and 57m below LAT. There is a relationship between water depth, foundation requirements and cost, where deeper water sites have implications for foundation type, for example in restricting the use of a monopile and carry a greater cost. Moreover, water depth sets a limit at which the technical requirements of types of foundations become commercially unviable at this location. This limit is approximately 50m below LAT for East Anglia ONE North, which is conservative in the absence of detailed site investigation data on the underlying geology and more likely to lie at approximately 48m below LAT.

19. The windfarm site also features areas of mobile seabed and sand waves, which are to be avoided where possible as they pose limits on foundation installation and affect the stability of cable burial and scour protection.

20. The separation distance between the southern boundary of the windfarm site and East Anglia ONE is 1km as shown in ***Figure 17.1*** (APP-247) and ***chapter 17 Infrastructure and Other Users*** (App-065). Search and rescue (SAR) lanes on East Anglia ONE run north south between the rows of wind turbines. Subject to the findings of the pre-construction site investigation, wind turbine layout design and proximity of wind turbines to the southern boundary of the windfarm site, it may be necessary to align wind turbines rows within the East Anglia ONE North windfarm site with East Anglia ONE in order to meet the requirements of Marine Guidance Note (MGN) 543.

21. The Ulysses 2 cable and consented EA3 export cable cross the EA1N site. An exclusion zone of 500m either side of each cable is required to follow best practice[9,10]. The area of seabed constrained by these cables is 36.6km^2, which represents approximately 17% of the windfarm area.

22. In addition to the known constraints on the wind turbine layout discussed above, it is likely that the pre-construction site investigation will identify the presence of further archaeological resources beyond the known resources documented in ***Chapter 16 – Marine Archaeology and Cultural Heritage*** (APP-064). Depending on the nature of these resources and based on the experience gained

[9] European Subsea Cables Association (2016) Guideline No.6 – The Proximity of Offshore Renewables Energy installations & Submarine Cable Infrastructure in UK Waters (website)
[10] Red Penguin Associates Ltd (2012) Submarine Cables and Offshore Energy Installations – Proximity Study Report. The Crown Estate (website)

at East Anglia ONE, it is likely that a number of them will require implementation of Archaeological Exclusion Zone (AEZ) as set out in the ***Outline WSI (Offshore)*** (APP-583), which may further constrain the wind turbine layout.

23. Reefs formed by *Sabellaria spinulosa* are also likely to be identified through the site investigation and subsequent ground-truthing, to which the Applicant has made a commitment to avoid where practicable, secured through an ***Outline Sabellaria Reef Management Plan*** (REP1-044) submitted at Deadline 1 and revisions to the dDCO to be submitted at Deadline 3. Due to the ephemeral nature of *Sabellaria* reefs and experience gained through the aforementioned East Anglia ONE project, it is anticipated that *Sabellaria* reefs may have developed since pre-application surveys were undertaken which would further constrain the wind turbine layout.

24. Finally, Unexploded Ordnance (UXO) may also constrain the wind turbine layout. However, due to the ability to clear UXO, as secured through the dDCO, the influence of potential UXO on the wind turbine layout is lower.

2.2.3 2km buffer commitment

25. Given the constraints within the windfarm site discussed above, the Applicant has undertaken a number of analyses against potential wind turbine layouts to determine what impact adoption of buffers on the Outer Thames Estuary SPA would have on the Project between 0 – 10km. In undertaking these analyses, the known layout constraints were considered, but the unknown constraints, which were initially considered, were omitted on the basis that it would be difficult to make accurate predictions on the impact that *Sabellaria* reefs, archaeology and (to a lesser extent) UXO could have on the availability of space within the windfarm site. The analyses therefore focused on the impact of the following parameters on target capacity and commercial viability:

- Water depth;
- Known areas of mobile seabed and sand waves;
- Cables;
- MGN543 requirements; and
- Buffers on the Outer Thames estuary SPA between 0 – 10km

26. The results of the analyses have determined that a whilst a 2km buffer is likely to have a commercial impact on the project and would reduce spatial flexibility, the impact is considered tolerable. A commitment to a buffer of greater than 2km however, would reduce the remaining spatial flexibility and jeopardise the

Project's ability to meet the target capacity in addition to impacts on commercial viability, principally through loss of viable wind turbine locations.

27. Whilst the commitment to the 2km buffer does not completely remove the potential for displacement of red-throated diver, it does further reduce the number that may be potentially displaced and resulting ecological consequence, which the Applicant has judged to be negligible in EIA terms and of no Adverse Effect on Integrity (AEoI) in HRA terms. The updated red-throated diver assessment, which will be submitted at Deadline 3 has concluded that the commitment to the 2km buffer has reduced displacement by 8%.

3 Other Relevant Changes

3.1 Reduction in wind turbine generator maximum tip height parameter

28. Engagement internally with the wind turbine team and externally with the supply chain in combination with early works for the procurement of East Anglia Hub and recognising the SLVIA concern expressed by Natural England and other stakeholders, has determined that the maximum tip height of wind turbines that will be available within the construction timeframes of the Project is 282m above Lowest Astronomical Tide (LAT). Accordingly, the wind turbine maximum tip height parameter has been reduced by 18m from the previous maximum of 300m to assist in reducing SLVIA concerns.

29. This commitment will be secured in the updated draft DCO (DCO) submitted at Deadline 3.

4 Summary

30. This document presents the Applicant's commitments made to reducing the potential for impacts from infrastructure in the windfarm site on ornithological resources and SLVIA in response to stakeholder concerns. This has been achieved through commitments to increasing wind turbine air draught by 2m, implementing a 2km buffer from the Outer Thames Estuary SPA and by reducing the maximum wind turbine tip height by 18m from 300m to 282m over LAT.

31. In addressing stakeholder concerns and making these commitments, the Applicant has consulted internally with their engineering, foundations and wind turbines teams in addition to external engagement with the supply chain.

32. Studies to determine the air draught commitment considered practicality of foundation and wind turbine installation, implications on foundation weight and fabrication and annual energy production. It was found that water depth was a

key factor limiting increases in air draught to 24m above MHWS. Greater air draughts were found to carry significant cost and, subject to ground conditions, restrict flexibility in foundation options by reducing the ability to deploy monopiles and increasing the need to rely on jacket foundations with resulting impacts on commercial viability.

33. Studies to determine the buffer commitment for East Anglia ONE North considered relocation of the windfarm site, which was not found to be a viable option, and constraints within the windfarm site. When assessing the impact of water depth, known areas of mobile seabed and sand waves, cables and the requirements of MGN543 alongside buffers between 0 and 10km, it was found that the impact of a 2km buffer on the windfarm site was tolerable and target capacity can be maintained. A buffer of greater than 2km, however, would reduce the remaining spatial flexibility and jeopardise the Project's ability to meet the target capacity in addition to impacts on commercial viability, principally through loss of viable wind turbine locations.