Norfolk Boreas Offshore Wind Farm

Appendix 15.2

MGN 543 Checklist

Environmental Statement

Volume 3

Applicant: Norfolk Boreas Limited
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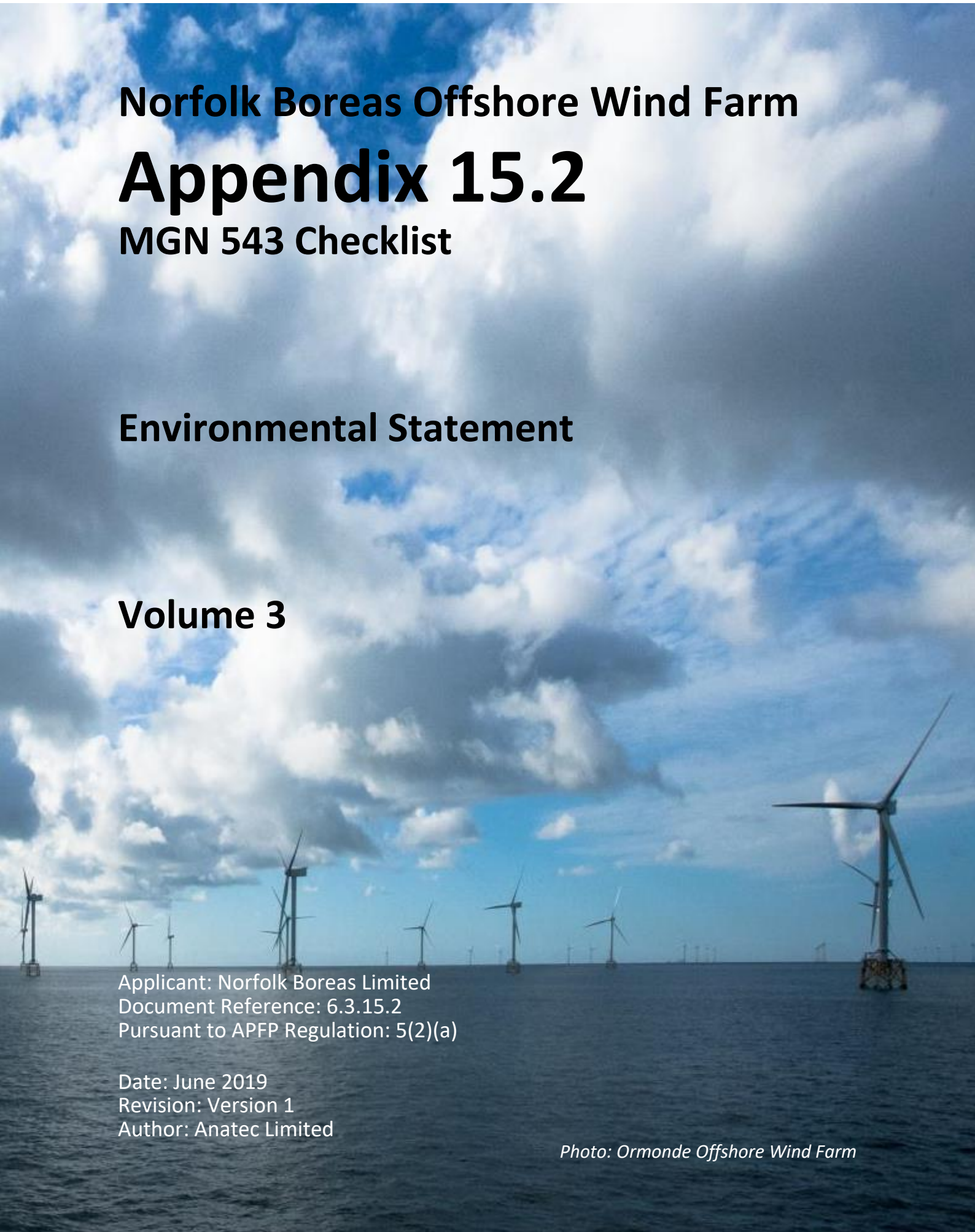

Photo: Ormonde Offshore Wind Farm

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Appendix 15.2
Norfolk Boreas
MGN 543 Checklist

Prepared by	Anatec Limited
Presented to	Norfolk Boreas Ltd
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Revision Number	Date	Summary of Change
00	31/07/2018	Initial Draft
01	20/02/2019	Environmental Statement Update

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Abbreviations Table

Abbreviation	Definition
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
ATBA	Area to be Avoided
AtoN	Aid to Navigation
CAA	Civil Aviation Authority
CCTV	Closed Circuit Television
CoS	Chamber of Shipping
DSC	Digital Selective Calling
ERCoP	Emergency Response Cooperation Plan
ES	Environmental Statement
FSA	Formal Safety Assessment
GLA	General Lighthouse Authority
IALA	International Association of Lighthouse Authorities
IMO	International Maritime Organization
MCA	Maritime and Coastguard Agency
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
NRA	Navigation Risk Assessment
OREI	Offshore Renewable Energy Installation
PEIR	Preliminary Environmental Impact Report
SAR	Search and Rescue
SOLAS	Safety of Life at Sea
TH	Trinity House
TOA	Technical and Operational Analysis
VTS	Vessel Traffic Service

1 Introduction

This Appendix to Chapter 15 Shipping and Navigation of the Norfolk Boreas Environmental Statement (ES) provides a completed Maritime and Coastguard Agency (MCA) Marine Guidance Note (MGN) 543 (MCA, 2016a) checklist. This checklist demonstrates that the Navigation Risk Assessment (NRA) and subsequent impact assessment undertaken in Chapter 15 Shipping and Navigation is compliant with the MCA requirements for Offshore Renewable Energy Installations (OREIs).

A template checklist is provided by the MCA (2016b), which has been used as the basis of this document. The template provides tables containing the requirements of MGN 543, and the requirements of the MCA Methodology for Assessing Navigational Safety and Emergency Response Risks of OREIs (MCA, 2015). These are provided in sections 2 and 3 of this document respectively.

Each point raised within the checklist has been referenced to where it has been addressed within either Chapter 15 Shipping and Navigation, or the supporting appendices, in particular the NRA (Appendix 15.1). It should be noted that in certain cases the points raised will be specifically addressed post consent – any such cases have been made clear in the text within the completed checklist.

2 MGN 543 Checklist

Issue: OREI Response	Yes/No	Comments
Annex 1: Consideration on Site Position, Structures, and Safety Zones		
1. Site Installation and Coordinates		
Developers are responsible for ensuring that formally agreed co-ordinates and subsequent variations of site perimeters and individual OREI structures are made available, on request, to interested parties at relevant project stages, including application for consent, development, array variation, operation and decommissioning. This should be supplied as authoritative Geographical Information System data, preferably in Environmental Systems Research Institute format. Metadata should facilitate the identification of the data creator, its date and purpose, and the geodetic datum used. For mariners' use, appropriate data should also be provided with latitude and longitude coordinates in WGS84 (ETRS89) datum.	✓	Norfolk Boreas Limited will make the formally agreed coordinates, and any subsequent variations, available to interested parties at the relevant project stages.
2. Traffic Survey		
All vessel types	✓	The marine traffic data includes all vessel types recorded within the marine traffic surveys. The surveys included Radar recordings to ensure non Automatic Identification System (AIS) traffic was accounted for.
At least 28 days duration, within either 12 or 24 months prior to submission of the Environmental Statement (ES)	✓	Data covers 28 days (combined effective survey period). Data is within the required timeframe of the PEIR, however an additional summer 2018 survey has been undertaken to refresh the marine traffic analysis within the ES stage to ensure compliance with MGN 543.

Issue: OREI Response	Yes/No	Comments
Multiple data sources	✓	Multiple data sources have been considered, as listed in section 6 of the NRA.
Seasonal variations	✓	Two surveys were undertaken to account for seasonal variations. Further details are provided in section 6.1 of the NRA.
MCA Consultation	✓	The approach to marine traffic data was agreed with the MCA. The consultation undertaken with the MCA is summarised in section 5 of the NRA.
General Lighthouse Authority (GLA) Consultation	✓	The approach to marine traffic data was agreed with the Trinity House (TH). The consultation undertaken with the TH is summarised in section 5 of the NRA.
Chamber of Shipping (CoS) Consultation	✓	The consultation undertaken with the CoS is summarised in section 5 of the NRA.
Recreational and fishing vessel organisations consultation	✓	The consultation undertaken is summarised in section 5 of the NRA.
Port and navigation authorities consultation, as appropriate	✓	The consultation undertaken is summarised in section 5 of the NRA.
Assessment of Cumulative and Individual Effects of (as appropriate):		
i. Proposed OREI site relative to areas used by any type of marine craft	✓	The marine traffic assessment in section 12 of the NRA considers all vessel types identified.
ii. Numbers, types and sizes of vessels presently using such areas	✓	The marine traffic baseline is established in section 12 of the NRA. This includes assessment of vessel numbers, types and sizes.
iii. Non-transit uses of the areas, e.g., fishing, day cruising of leisure craft, racing, aggregate dredging, etc.	✓	Establishment of the marine traffic baseline in section 12 of the NRA includes fishing vessels, recreational vessels, and dredgers.

Issue: OREI Response	Yes/No	Comments
		The use of Radar data ensured non-AIS traffic was accounted for.
iv. Whether these areas contain transit routes used by coastal or deep-draught vessels on passage.	✓	Draught analysis was undertaken in sections 12.2.3 (Norfolk Boreas site) and 13.4.2 (offshore cable corridor) of the NRA. Routeing of these vessels is assessed in sections 18 and 19.
v. Alignment and proximity of the site relative to adjacent shipping lanes	✓	Baseline routeing is assessed in section 18 of the NRA.
vi. Whether the nearby area contains prescribed routeing schemes or precautionary areas	✓	Established International Maritime Organization (IMO) Routing Measures are presented in section 8.2 of the NRA.
vii. Whether the site lies on or near a prescribed or conventionally accepted separation zone between two opposing routes	✓	Established IMO Routing Measures are presented in section 8.2 of the NRA, including the associated separation zones.
viii. Proximity of the site to areas used for anchorage, safe haven, port approaches and pilot boarding or landing areas.	✓	Anchorage is discussed in section 8.4 of the NRA. There are no major ports within the vicinity of the cable landfall, no relevant pilot boarding stations or port approaches were identified.
ix. Whether the site lies within the jurisdiction of a port and/or navigation authority.	✓	Ports are covered in section 8.5 of the NRA.
x. Proximity of the site to existing fishing grounds, or to routes used by fishing vessels to such grounds.	✓	Fishing activity is assessed in section 15 of the NRA.
xi. Proximity of the site to offshore firing/bombing ranges and areas used for any marine military purposes.	✓	Military practice areas are assessed in section 8.6 of the NRA. No such areas were identified within the area studied.
xii. Proximity of the site to existing or proposed offshore oil / gas platform, marine aggregate dredging, marine archaeological sites or wrecks, Marine Protected Area or other exploration/exploitation sites	✓	Included in the NRA as follows: ▪ Oil and gas: section 8.7; ▪ Marine aggregate dredging: section 8.8; ▪ Wrecks: section 8.12; and ▪ Marine protected areas: section 8.11.

Issue: OREI Response	Yes/No	Comments
xiii. Proximity of the site to existing or proposed OREI developments, in co-operation with other relevant developers, within each round of lease awards.	✓	Included in section 8.9 of the NRA. It is noted that only consented, constructing, or operational wind farms have been considered baseline, however all projects have been considered cumulatively.
xiv. Proximity of the site relative to any designated areas for the disposal of dredging spoil or other dumping ground	✓	No such areas were identified within the area studied.
xv. Proximity of the site to aids to navigation (AtoN) and/or Vessel Traffic Services (VTS) in or adjacent to the area and any impact thereon.	✓	AtoNs are included in section 8.3 of the NRA. No VTS relevant to Norfolk Boreas were identified.
xvi. Researched opinion using computer simulation techniques with respect to the displacement of traffic and, in particular, the creation of 'choke points' in areas of high traffic density and nearby or consented OREI sites not yet constructed.	✓	The potential increases in vessel to vessel collision rates have been assessed within section 21.2.1 of the NRA, using computer software modelling.
xvii. With reference to xvi. above, the number and type of incidents to vessels which have taken place in or near to the proposed site of the OREI to assess the likelihood of such events in the future and the potential impact of such a situation.	✓	Historic maritime incidents within the study areas are assessed in section 11 of the NRA.
3. OREI Structures – the following should be determined:		
a. Whether any feature of the OREI, including auxiliary platforms outside the main generator site, mooring and anchoring systems, inter-device and export cabling could pose any type of difficulty or danger to vessels underway, performing normal operations, including fishing, anchoring and emergency response.	✓	Impacts on navigation associated with the wind turbines and auxiliary platforms are assessed in Chapter 15 Shipping and Navigation.
b. Clearances of wind turbine blades above the sea surface are not less	✓	As per embedded mitigation (section 25 of the NRA), blade clearance of the

Issue: OREI Response	Yes/No	Comments
than 22 metres above Mean High Water Springs (MHWS).		turbines will be at least 22m above MHWS.
c. Underwater devices i. changes to charted depth ii. maximum height above seabed iii. Under Keel Clearance	✓	Changes to charted depth, and associated under keel clearance issues will be assessed post consent as part of the assessment of cable protection (see section 25 of the NRA, embedded mitigation).
d. The burial depth of cabling and changes to charted depths associated with any protection measures.	✓	Changes to charted depth, and associated under keel clearance issues will be assessed post consent as part of the assessment of cable protection (see section 25 of the NRA, embedded mitigation).
4. Assessment of Access to and Navigation Within, or Close to , an OREI To determine the extent to which navigation would be feasible within the OREI site itself by assessing whether:		
a. Navigation within or close to the site would be safe: i. by all vessels ii. by specified vessel types, operations, and/or sizes iii. in all directions or areas iv. in specified directions or areas v. in specified tidal, weather or other conditions	✓	Impacts on navigational safety are assessed within Chapter 15 Shipping and Navigation. The modelling undertaken in the NRA takes account of tidal and weather conditions.
b. Navigation in and/or near the site should be: i. prohibited by specified vessels types, operations and/or sizes ii. prohibited in respect of specific activities iii. prohibited in all areas or directions iv. prohibited in specified areas or directions v. prohibited in specified tidal or weather conditions, or simply vi. recommended to be avoided.	✓	As per section 25.2 of the NRA, the application for construction and major maintenance safety zone is considered embedded mitigation. Vessels would be free to transit the Norfolk Boreas site assuming any active safety zones were avoided.

Issue: OREI Response	Yes/No	Comments
c. Exclusion from the site could cause navigational, safety or routeing problems for vessels operating in the area e.g. by preventing vessels from responding to calls for assistance from persons in distress	✓	Impacts on vessel displacement and emergency response are assessed within Chapter 15 Shipping and Navigation. The modelling undertaken in the NRA takes account of tidal and weather conditions.
Relevant information concerning a decision to seek a safety zone for a particular site during any point in its construction, extension, operation or decommissioning should be specified in the ES accompanying the development application	✓	As per section 25.2 of the NRA, the application for construction and major maintenance safety zone is considered embedded mitigation. The application will be submitted post consent in consultation with key marine stakeholders, including the MCA.
Annex 2: Navigation, collision avoidance and communications **1. The Effect of Tides and Tidal Streams : It should be determined whether:**		
a. Current maritime traffic flows and operations in the general area are affected by the depth of water in which the proposed installation is situated at various states of the tide i.e. whether the installation could pose problems at high water which do not exist at low water conditions, and vice versa.	✓	The allision modelling undertaken in the NRA considers local tidal data. As per section 9.4 of the NRA, no tidal height is expected to have unique impacts.
b. The set and rate of the tidal stream, at any state of the tide, has a significant effect on vessels in the area of the OREI site.	✓	The allision modelling undertaken in the NRA (section 21.2.2) considers local tidal data.
c. The maximum rate tidal stream runs parallel to the major axis of the proposed site layout, and, if so, its effect.	✓	Tidal conditions are assessed within section 9.4 of the NRA.
d. The set is across the major axis of the layout at any time, and, if so, at what rate.	✓	Tidal conditions are assessed within section 9.4 of the NRA.
e. In general, whether engine failure or other circumstance could cause vessels to be set into danger by the tidal stream.	✓	The allision modelling undertaken in the NRA (section 21.2.2) considers local tidal data and engine failure scenarios.

Issue: OREI Response	Yes/No	Comments
f. The structures themselves could cause changes in the set and rate of the tidal stream.	✓	No effects found, as per section 9.4 of the NRA.
g. The structures in the tidal stream could be such as to produce siltation, deposition of sediment or scouring, affecting navigable water depths in the wind farm area or adjacent to the area	✓	Given water depths in the area of the Norfolk Boreas site, no under keel clearance impacts associated with siltation, sediment or scour are anticipated (see section 14.4.2.2).
2. Weather It should be determined whether:		
a. The site, in normal, bad weather, or restricted visibility conditions, could present difficulties or dangers to craft, including sailing vessels, which might pass in close proximity to it.	✓	The allision and collision modelling process (section 21 of the NRA) considers the potential for poor visibility in the vicinity of the Norfolk Boreas site.
b. The structures could create problems in the area for vessels under sail, such as wind masking, turbulence or sheer.	✓	As per section 14.4 of the NRA, no such impacts are anticipated.
c. In general, taking into account the prevailing winds for the area, whether engine failure or other circumstances could cause vessels to drift into danger, particularly if in conjunction with a tidal set such as referred to above.	✓	The allision modelling undertaken in the NRA (section 21) considers local tidal data and engine failure scenarios.
3. Collision Avoidance and Visual Navigation It should be determined whether:		
a. The layout design will allow safe transit through the OREI by Search and Rescue (SAR) helicopters and vessels.	✓	The turbines will maintain at least one line of orientation, with minimum spacing of four rotor diameters length (680m) (see section 4 of the NRA, Project Description).
b. The MCA's Navigation Safety Branch and Maritime Operations branch will be consulted on the layout design and agreement will be sought.	✓	The layout will be agreed with the MCA post consent. Consultation has been ongoing with MCA to date as per section 5 of the NRA.
c. The layout design has been or will	✓	The layout will be agreed with the MCA

Issue: OREI Response	Yes/No	Comments
be determined with due regard to safety of navigation and SAR.		post consent, with due consideration given to SAR concerns.
d) i. The structures could block or hinder the view of other vessels under way on any route. ii. The structures could block or hinder the view of the coastline or of any other navigational feature such as aids to navigation, landmarks, promontories, etc.	✓	This is considered within section 22.15 of the NRA. No such impacts were identified.
4. Communications, Radar and Positioning Systems - To provide researched opinion of a generic and, where appropriate, site specific nature concerning whether:		
a. The structures could produce radio interference such as shadowing, reflections or phase changes, and emissions with respect to any frequencies used for marine positioning, navigation and timing or communications, including the Global Maritime Distress and Safety System and AIS, whether ship borne, ashore or fitted to any of the proposed structures, to: i. Vessels operating at a safe navigational distance ii. Vessels by the nature of their work necessarily operating at less than the safe navigational distance to the OREI, e.g. support vessels, survey vessels, SAR assets. iii. Vessels by the nature of their work necessarily operating within the OREI.	✓	Impacts on communications, radar, and other positioning systems are assessed within section 22 of the NRA.
b. The structures could produce radar reflections, blind spots, shadow areas or other adverse effects:	✓	Impacts on vessel radar are assessed within section 22.8 of the NRA.

Issue: OREI Response	Yes/No	Comments
i. Vessel to vessel ii. Vessel to shore iii. VTS radar to vessel iv. Racon to/from vessel		
c. The structures and generators might produce sonar interference affecting fishing, industrial or military systems used in the area	✓	Impacts associated with sonar interference are assessed within section 22.11 of the NRA.
d. The site might produce acoustic noise which could mask prescribed sound signals	✓	Acoustic noise impact is assessed within section 22.12 of the NRA.
e. Generators and the seabed cabling within the site and onshore might produce electro-magnetic fields affecting compasses and other navigation systems	✓	Effects associated with electromagnetic interference are assessed within section 22.7 of the NRA.
5. Marine Navigational Marking It should be determined:		
a. How the overall site would be marked by day and by night throughout construction, operation and decommissioning phases, taking into account that there may be an ongoing requirement for marking on completion of decommissioning, depending on individual circumstances.	✓	Lighting and marking is discussed within section 25.3 of the NRA. As per embedded mitigation final lighting and marking will be agreed with TH, the MCA, and the Civil Aviation Authority (CAA) post consent.
b. How individual structures on the perimeter of and within the site, both above and below the sea surface, would be marked by day and by night.	✓	Lighting and marking is discussed within section 25.3 of the NRA. As per embedded mitigation final lighting and marking will be agreed with TH, the MCA, and the CAA post consent.
c. If the specific OREI structure would be inherently radar conspicuous from all seaward directions (and for SAR and maritime surveillance aviation	✓	Any associated marking requirements will be agreed with TH and the MCA post consent, as per section 25 of the NRA (embedded mitigation).

Issue: OREI Response	Yes/No	Comments
purposes) or would require passive enhancers.		
d. If the site would be marked by additional electronic means e.g. Racons	✓	Any associated marking requirements will be agreed with TH and the MCA post consent, as per section 25 of the NRA (embedded mitigation).
e. If the site would be marked by an AIS transceiver, and if so, the data it would transmit.	✓	Any associated marking requirements will be agreed with TH and the MCA post consent, as per section 25 of the NRA (embedded mitigation).
f. If the site would be fitted with audible hazard warning in accordance with International Association of Lighthouse Authorities (IALA) recommendations	✓	Any associated marking requirements will be agreed with TH and the MCA post consent, as per section 25 of the NRA (embedded mitigation).
g. If the structure(s) would be fitted with aviation lighting, and if so, how these would be screened from mariners or guarded against potential confusion with other navigational marks and lights.	✓	Any associated marking requirements will be agreed with TH, the MCA, and the CAA post consent, as per section 25 of the NRA (embedded mitigation). This will include measures to avoid light confusion.
h. Whether the proposed site and/or its individual generators complies in general with markings for such structures, as required by the relevant GLA in consideration of IALA guidelines and recommendations.	✓	Lighting and marking will be agreed post consent with TH, the MCA and the CAA, and will be in line with IALA-O139.
i. The aids to navigation specified by the GLAs are being maintained such that the 'availability criteria', as laid down and applied by the GLAs, is met at all times.	✓	All AtoNs will be monitored and maintained to ensure the required availability criteria are met. The monitoring and response procedures will be agreed with TH post consent.
j. The procedures that need to be put in place to respond to casualties to the aids to navigation specified by the GLA, within the timescales laid down and specified by the GLA.	✓	Monitoring and response procedures will be agreed with TH post consent.
k. The ID marking will conform to a spreadsheet layout, sequential,	✓	The ID marking system used will be agreed with the MCA, TH, and CAA post

Issue: OREI Response	Yes/No	Comments
aligned with SAR lanes and avoid the letters O and I.		consent, once a layout has been chosen.
l. Working lights will not interfere with AtoN or create confusion for the Mariner navigating in or near the OREI.	✓	The potential for light confusion will be taken into account as part of the lighting and marking plan, which will be agreed with TH, the MCA and the CAA post consent.
6. Hydrography - In order to establish a baseline, confirm the safe navigable depth, monitor seabed mobility and to identify underwater hazards, detailed and accurate hydrographic surveys are included or acknowledged for the following stages and to MCA specifications:		
i. Pre-consent: The site and its immediate environs extending to 500m outside of the development area shall be undertaken as part of the licence and/or consent application. The survey shall include all proposed cable route(s).	✓	Survey results will be provided by Norfolk Boreas Ltd.
ii. Post-construction: Cable route(s)	✓	Survey results will be provided by Norfolk Boreas Ltd.
iii. Post-decommissioning of all or part of the development: Cable route(s) and the area extending to 500m from the installed generating assets area.	✓	Survey results will be provided by Norfolk Boreas Ltd.
Annex 3: MCA template for assessing distances between wind farm boundaries and shipping routes		
"Shipping Route" template and Interactive Boundaries – where appropriate, the following should be determined:		
a. The safe distance between a shipping route and turbine boundaries.	✓	Likely deviations post wind farm are shown in section 19 of the NRA. These consider the MGN 543 Shipping Route template.
b. The width of a corridor between sites or OREIs to allow safe passage of shipping.	✓	Section 17 of the NRA provides assessment of the corridor between Norfolk Boreas, Norfolk Vanguard and East Anglia THREE.
Annex 4: Safety and mitigation measures recommended for OREI during construction, operation and decommissioning.		
Mitigation and safety measures will be	✓	Embedded mitigation measures are

Issue: OREI Response	Yes/No	Comments
applied to the OREI development appropriate to the level and type of risk determined during the Environmental Impact Assessment. The specific measures to be employed will be selected in consultation with the Maritime and Coastguard Agency and will be listed in the developer's ES. These will be consistent with international standards contained in, for example, the Safety of Life at Sea (SOLAS) Convention - Chapter V, IMO Resolution A.572 (14)3 and Resolution A.671(16)4 and could include any or all of the following:		provided in section 25 of the NRA. Where necessary to reduce risks to As Low As Reasonably Practicable (ALARP), additional mitigation (i.e., measures above those considered embedded) are presented in Chapter 15 Shipping and Navigation.
i. Promulgation of information and warnings through notices to mariners and other appropriate maritime safety information dissemination methods.	✓	See section 25 of the NRA (embedded mitigation).
ii. Continuous watch by multi-channel Very High Frequency, including Digital Selective Calling.	✓	Marine coordination will be in place, as per section 25 of the NRA (embedded mitigation).
iii. Safety zones of appropriate configuration, extent and application to specified vessels	✓	See section 25.2 of the NRA (embedded mitigation), which details the safety zones that will be applied for.
iv. Designation of the site as an area to be avoided (ATBA).	✓	The Norfolk Boreas site will not be marked as an ATBA, however safety zones will be implemented during construction and periods of major maintenance.
v. Provision of AtoN as determined by the GLA	✓	See section 25.3 of the NRA (embedded mitigation).
vi. Implementation of routeing measures within or near to the development.	✓	No new routeing measures are proposed. Existing routeing measures are shown in section 8.2 of the NRA.
vii. Monitoring by Radar, AIS, Closed Circuit Television (CCTV) or other agreed means	✓	The site will be monitored via onshore marine coordination and by on site vessels. CCTV is not proposed.
viii. Appropriate means for OREI	✓	Such details will be provided within

Issue: OREI Response	Yes/No	Comments
operators to notify, and provide evidence of, the infringement of safety zones.		Norfolk Boreas Ltd's safety zone application, to be submitted post consent.
ix. Creation of an Emergency Response Cooperation Plan (ERCoP) with the MCA's SAR Branch for the construction phase onwards.	✓	See section 25 of the NRA (embedded mitigation). The ERCoP will be agreed with the MCA post consent.
x. Use of guard vessels, where appropriate	✓	See section 25 of the NRA (embedded mitigation).
xi. Any other measures and procedures considered appropriate in consultation with other stakeholders.	✓	Embedded mitigation measures are provided in section 25 of the NRA. Where necessary to reduce risks to ALARP, additional mitigation (i.e., measures above those considered embedded) is presented in Chapter 15 Shipping and Navigation.
Annex 5: Standards, procedures and operational requirements in the event of SAR, maritime assistance service counter pollution or salvage incident in or around an OREI, including generator/installation control and shutdown.		
The MCA, through Her Majesty's Coastguard, is required to provide SAR and emergency response within the sea area occupied by all OREIs in UK waters. To ensure that such operations can be safely and effectively conducted, certain requirements must be met by developers and operators.		
a. An ERCoP will be developed for the construction, operation and decommissioning phases of the OREI.	✓	See section 25 of the NRA (embedded mitigation). The ERCoP will be agreed with the MCA post consent.
b. The MCA's guidance document Offshore Renewable Energy Installation: Requirements, Advice and Guidance for SAR and Emergency Response for the design, equipment and operation requirements will be followed.	✓	The MCA guidance has been followed to date, and will be utilised post consent.

3 Methodology for Assessing the Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations

Section	Yes/No	Comments
A1: Reference Sources - Lessons learned.	✓	Section 7 of the NRA.
B1: Base case traffic densities and types.	✓	Section 12 of the NRA.
B2: Future traffic densities and types.	✓	Section 15.6.7 of Chapter 15 Shipping and Navigation.
B3: The marine environment :		
B3.1 Technical & operational analysis (TOA)	✓	See section 4 of the NRA and Chapter 5 Project Description.
B3.2 Generic TOA	✓	See section 4 of the NRA and Chapter 5 Project Description.
B3.3 Potential accidents	✓	Hazards have been identified as part of the NRA screening process (notably as part of the Hazard Log process, see Appendix 15.5).
B3.4 Affected navigational activities	✓	Shipping and navigation receptors have been identified as part of the NRA screening process.
B3.5 Effects of OREI structures	✓	Impacts associated with the structures within the Norfolk Boreas site are assessed within Chapter 15 Shipping and Navigation.
B3.6 Development phases	✓	Impacts have been assessed separately by construction, operational and decommissioning phases in Chapter 15 Shipping and Navigation.
B3.7 Other structures & features	✓	See section 4 of the NRA and Chapter 5 Project Description.
B3.8 Vessel types involved	✓	Vessel types within the area are identified in section 12 of the NRA. This assessment has been used to identify shipping and navigation receptors.

Section	Yes/No	Comments
B3.9 Conditions affecting navigation	✓	Local metocean conditions are assessed in section 9 of the NRA, which have been taken into account within the collision and allision modelling (NRA, section 21). The existing environment in terms of navigational features is assessed in section 8 of the NRA. Impacts are then assessed in Chapter 15 Shipping and Navigation.
B3.10 Human actions	✓	Regular vessel routeing is assessed in sections 18 and 19 of the NRA, with other third party vessel activity assessed in section 12.
C1: Hazard Identification	✓	Hazards have been identified as part of the NRA screening process (notably as part of the Hazard Log process, see Appendix 15.5).
C2: Risk Assessment	✓	Impacts have been assessed in Chapter 15 Shipping and Navigation.
C3: Influences on level of risk	✓	Risk influences have been considered as part of the creation of the Hazard Log (Appendix 15.5), and during the impact screening process undertaken within the NRA. These have been considered in the impact assessment undertaken in Chapter 15 Shipping and Navigation.
C4: Tolerability of risk	✓	Tolerability definitions (using a Formal Safety Assessment (FSA) approach) are provided in Chapter 15 Shipping and Navigation.
D1 : Appropriate risk assessment	✓	Impacts are assessed in Chapter 15 Shipping and Navigation, as per the methodology described in section 3 of the NRA (using the FSA approach as required under the MCA methodology (MCA, 2015)).
D2 : MCA acceptance for assessment	✓	The approach to impact assessment

Section	Yes/No	Comments
techniques and tools		(section 3 of the NRA) is the standard methodology used for shipping risk assessments, and has been agreed with the MCA.
D3: Demonstration of results	✓	The results of the impact assessment are presented in Chapter 15 Shipping and Navigation. The key inputs to this assessment are provided in the NRA.
D4 : Area traffic assessment	✓	Marine traffic analysis within the area is provided in section 12 of the NRA.
D5 : Specific traffic assessment	✓	Section 12 of the NRA considers marine traffic within the Norfolk Boreas site itself.
E1 : Risk control log	✓	The Hazard Log is provided in Appendix 15.5.
E2 : Marine stakeholders	✓	A summary of consultation and engagement with marine stakeholders is provided in section 5 of the NRA.
F1 : Hazard identification checklist	✓	Hazards were initially identified within the Hazard Log (Appendix 15.5), with impact screening then undertaken in the NRA.
F2 : Risk control checklist	✓	Risk control measures above those considered embedded (where necessary) are identified within Chapter 15 Shipping and Navigation.

4 References

IMO (1974) *Convention on the Safety of Life at Sea (SOLAS).* London: IMO.

MCA (2015) *Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms*. Southampton: MCA.

MCA (2016) *MGN 543 (Merchant and Fishing) Safety of Navigation Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response.* Southampton: MCA.

MCA (2016a) *OREI MGN543 Checklist.* Southampton: MCA.
(Accessed 18/07/2018: https://www.gov.uk/government/publications/mgn-543-mf-safety-of-navigation-offshore-renewable-energy-installations-oreis-uk-navigational-practice-safety-and-emergency-response)