

Norfolk Boreas Offshore Wind Farm

Appendix 15.5

Hazard Log

Environmental Statement

Volume 3

Applicant: Norfolk Boreas Limited
Document Reference: 6.3.15.5
Pursuant to APFP Regulation: 5(2)(a)

Date: June 2019
Revision: Version 1
Author: Anatec Limited

Photo: Ormonde Offshore Wind Farm

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Appendix 15.5 Norfolk Boreas Hazard Log

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Presented to Norfolk Boreas Ltd
Date 15/05/2019
Revision Number 01
Document Reference A4053-NBL-NRA-2

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Revision Number	Date	Summary of Change
00	31/07/2018	Initial Draft
01	15/05/2019	Environmental Statement

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Abbreviations Table

Abbreviation	Definition
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
COLREGS	International Regulations for the Preventing Collisions at Sea
ERCoP	Emergency Response Cooperation Plan
FSA	Formal Safety Assessment
IALA	International Association of Lighthouse Authorities
KIS-ORCA	Kingfisher Information Service – Offshore Renewable Cable Awareness
MCA	Maritime and Coastguard Agency
MGN	Marine Guidance Note
NRA	Navigation Risk Assessment
NUC	Not Under Command
SAR	Search and Rescue
SOLAS	Safety of Life At Sea

1 Introduction

This appendix presents the Hazard Log, which has been created for the purposes of identifying hazards associated with the construction, operation, and decommissioning of the Norfolk Boreas offshore wind farm. The assessment has primarily been based on the outputs of Hazard Consultation meetings held with key marine stakeholders including regular operators. Further details are provided in section 23 of the Navigation Risk Assessment (NRA).

The Hazard Log provides the list of hazards identified, and includes the following additional details for each:

- Relevant phase(s) (construction, operation, decommissioning);
- Relevant receptors;
- Potential hazard causes;
- Embedded mitigation;
- Most likely consequences;
- Worst case consequences;
- Preliminary consequence and frequency rankings based on a Formal Safety Assessment (FSA) approach; and
- Additional mitigation (where required to reduce risks to As Low As Reasonably Practicable (ALARP)), again on a preliminary basis.

The Hazard Log forms a key input to the impact assessment undertaken in Chapter 15 Shipping and Navigation, however it is emphasised that other inputs are considered within the Chapter, including further consultation, allision and collision modelling, impact screening within the NRA, and the baseline assessment.

2 Significance

Each impact within the Hazard Log has been ranked in terms of significance based on an FSA approach. This approach assigns each impact a “Frequency of Occurrence” and “Severity of Consequence” ranking, with a significance matrix used to determine the impact as either “Broadly Acceptable”, “Tolerable”, or “Unacceptable”. Further mitigation is then identified where necessary to bring impacts to within ALARP parameters.

Full details of this process are provided in section 15.4 of Chapter 15 Shipping and Navigation.

3 Hazard Log

The Hazard Log is included below for reference.

Phase (C, O, D)	Impact	Receptor	Hazard Title	Hazard Detail	Possible Causes	Embedded Mitigation	Most Likely Consequences	Realistic Worst Case Consequences	Most Likely						Worst Case						Other Potential Risk Reduction Measures	Remarks / Questions	
									Consequences						Consequences								
									People	Environment	Property	Business	Average	Frequency	People	Environment	Property	Business	Average	Frequency			
Commercial Vessels																							
C, O, D	Deviation	Commercial Vessels	Activities or infrastructure within the Norfolk Boreas site and offshore export cable corridor could cause commercial vessels to be deviated.	Established vessel routes are displaced, leading to increased journey time and potentially disruption to timetabled services (e.g., delayed port entry)	Location of site in proximity to shipping routes.	Promulgation of Information. Consultation with vessel operators.	Increased journey time and distance.	Increased journey time and distance affecting operational schedules.	1	1	1	1	1	4	Broadly Acceptable	1	1	1	2	1	3	Broadly Acceptable	Scotline noted the project may impact upon journey times with business/cost implications.
C, O, D	Restriction of Adverse Weather Routeing	Commercial Vessels	Activities or infrastructure within the Norfolk Boreas site may block existing adverse weather routes used by commercial	Established adverse weather routes are blocked, leading to delays as vessels must either deviate further or await more favourable	Buildout of entire site leading to restriction of adverse weather routeing options for commercial operators.	Promulgation of Information. Consultation with vessel operators.	Deviations required to ensure safe passage in adverse conditions.	Delays in crossing North Sea through necessity to await favourable transit conditions.	1	1	1	2	1	3	Broadly Acceptable	4	4	4	4	4	2	Tolerable	

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									Consequences							Consequences										
									People	Environment	Property	Business	Average	Frequency	People	Environment	Property	Business	Average	Frequency						
			operators.	transit conditions.																						
C, D	Allision (powered and NUC)	Commercial Vessels	Presence of infrastructure within the Norfolk Boreas array area may cause increased allision risk for commercial vessels (including vessels NUC)	During the construction and decommissioning stages, there could be an increased risk of vessels alliding with the turbines due to the fact that navigational aids (e.g. lights and markings) may not all be present.	Presence of newly installed infrastructure within the Norfolk Boreas array area poses an allision risk to vessels. The risk could be associated with lack of or failure of navigational marking, human error, adverse weather, navigational error.	Buoyed construction area, safety zones, temporary navigational marks, marine coordination, monitoring by AIS, promulgation of information	Near miss or entrance into safety zone by third party vessel.	Vessel allides with a newly installed structure.	3	1	3	4	3	1	Broadly Acceptable	5	5	5	5	5	1	Tolerable				
O	Allision (powered)	Commercial Vessels	Presence of infrastructure located	Oil Tanker General Cargo	Presence of infrastructure within the	Compliance with international	Near miss of structure by third party	Allision with structure by third party	2	1	3	4	3	1	Broadly Acceptable	5	5	5	5	5	1	Tolerable	Consideration for adverse weather			
									3	1	3	4	3	1	Broadly	5	3	5	4	4	1	Broadly				

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									Consequences						Consequences										
									People	Environment	Property	Business	Average	Frequency	People	Environment	Property	Business	Average	Frequency					
			within the Norfolk Boreas array area may increase vessel to structure allision risk external to the array for commercial vessels.	Passenger Gas Carrier Coaster	Norfolk Boreas array area poses an allision risk to vessels. The risk could be associated with lack of or failure of navigational marking, human error, adverse weather, navigational error.	and flag state regulations, MGN 372, MGN 543, promulgation of information, marine coordination, monitoring by AIS, permanent aids to navigation, marine pollution contingency planning, IALA 0-139	vessel on the periphery of the site.	vessel on the periphery of the site.							Acceptable							Acceptable	routing		
									4	1	3	4	3	1	Broadly Acceptable	5	3	5	5	5	1	Broadly Acceptable			
									3	1	3	4	3	1	Broadly Acceptable	5	4	5	5	5	1	Broadly Acceptable			
									2	1	2	2	2	1	Broadly Acceptable	5	5	5	5	5	1	Tolerable			
O	Allision (NUC)	Commercial Vessels	Presence of infrastructure within the Norfolk Boreas array area may increase	Oil Tanker General Cargo Passenger	Presence of infrastructure within Norfolk Boreas array area poses an allision risk to vessels NUC	Compliance with international and flag state regulations, MGN 372, MGN 543,	Vessel NUC is on a closing point of approach with a structure but no allision occurs due to	NUC vessel is on a closing point of approach with a structure and an allision occurs	2	1	2	4	2	1	Broadly Acceptable	5	5	5	5	5	1	Tolerable	Consideration for self help and advanced emergency response capabilities.		
									3	1	3	4	3	1	Broadly Acceptable	5	3	5	4	4	1	Broadly Acceptable			
									2	1	2	4	2	1	Broadly Acceptable	5	3	5	4	4	1	Broadly Acceptable			

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									Consequences							Consequences								
									People	Environment	Property	Business	Average	Frequency	People	Environment	Property	Business	Average	Frequency				
			vessel to structure collision risk external to the array for NUC vessels in an emergency situation (including machinery related problems or navigational system errors).	Gas Carrier	caused by engine failure; navigational equipment failure, machinery failure; steering gear failure	promulgation of information, marine coordination, monitoring by AIS, permanent aids to navigation, marine pollution contingency planning.	the vessel regaining power or other evasive action.	potentially resulting in pollution.	2	1	2	4	2	1	Broadly Acceptable	5	4	5	5	5	1	Broadly Acceptable		
				Coaster					2	1	2	2	2	1	Broadly Acceptable	5	5	5	5	5	1	Tolerable		
C, O, D	Collision	Commercial Vessels	Activities within the Norfolk Boreas array and export cable route cause commercial vessels to be deviated,	Displaced traffic increases congestion outside of the array area. This can lead to an increase in vessel-to-vessel	Presence of construction, operation or decommissioning activities including buoyed construction area and safety zones will	Compliance with international and flag state regulations, MGN 372, promulgation of information	Increased encounters and therefore more collision avoidance action required by vessels as per COLREGS but does not	Vessel to vessel collision resulting in major injury to persons and major damage to vessel	3	2	4	3	3	1	Broadly Acceptable	5	5	5	5	5	1	Tolerable	Site design giving consideration to navigation, consideration for self help and advanced emergency response capabilities,	

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									Consequences						Consequences								
									People	Environment	Property	Business	Average	Frequency	People	Environment	Property	Business	Average	Frequency			
			increasing encounters and thus the risk of vessel to vessel collision including with project vessels.	encounters and potentially collisions.	cause commercial vessels to be deviated creating new areas of high density traffic or congestion points for third party vessels and thus increasing risk of collision. This impact could also include causes associated with navigational error, human error or adverse weather		result in a collision													consideration for adverse weather routes			
C, O, D	Snagging	Commercial Vessels	Presence of cables and other subsea infrastructure	Vessel drops anchor over subsea equipment or	Presence of installed cables could pose a risk to vessels	Cable burial risk assessment, compliance	A vessel anchors on an area of buried / protected	A vessel anchors on an area of exposed or	1	2	3	3	2	1	Broadly Acceptable	5	4	5	4	5	1	Broadly Acceptable	

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									Consequences						Consequences								
									People	Environment	Property	Business	Average	Frequency	People	Environment	Property	Business	Average	Frequency			
			will present an anchor snagging risk for commercial vessels	a nearby vessel drags anchor over a subsea cable. Vessel may drop anchor over cable(s) in an emergency, i.e. machinery failure.	anchoring. This could be associated with human error, navigational equipment error or adverse weather.	with international and flag state regulations, promulgation of information (charting)	cable or floating foundation mooring but no interaction occurs	partially buried cable or subsurface structure resulting in damage to the cable and/or anchor.															
Emergency Response																							
C, O, D	Access	Third Party	Unauthorised mooring to and/or deliberate damage to device	Vessels moor to the structure without the authority to do so and/or with the intention to cause damage to the device	Act of Protest or Vandalism	ERCoP	Potential for considerable operational impacts but unlikely to result in injury	Could result in serious injury to person, damage to property and operational impacts	1	1	1	3	2	1	Broadly Acceptable	4	1	2	3	3	1	Broadly Acceptable	
C, O, D	Access	Third Party	Unauthorised access to and/or	People access the structure without the	Act of Protest or Vandalism	ERCoP	Potential for considerable operational	Could result in serious injury to person,	1	1	1	3	2	1	Broadly Acceptable	4	1	2	3	3	1	Broadly Acceptable	

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									Consequences						Consequences								
									People	Environment	Property	Business	Average	Frequency	People	Environment	Property	Business	Average	Frequency			
			deliberate damage to device	authority to do so and/or with the intention to cause damage to the device			impacts but unlikely to result in injury	damage to property and operational impacts															
C, O, D	Access	Third Party	Access to structure in an emergency situation	During emergency situations, a vessel may have to moor/secures itself to a wind farm structure	Emergency response incident	MGN 543	Moderate potential for damage to a structure but limited potential for a minor injury and potential operational impacts	Person becomes stranded and unable to be recovered resulting in injury, moderate damage to structure and potential operational impacts	1	1	2	1	1	1	Broadly Acceptable	4	1	2	2	2	1	Broadly Acceptable	
C, O, D	SAR	Emergency Response Resources	Diminishment of emergency resources arising from an increase in incident rate	Increases in vessel and personnel levels on site leading to an increase in incident rates,	Increased vessel and personnel on site.	ERCOP	Negligible increase in incident rates, with limited impact on emergency response	Significant incident on-site, with response levels such that standby resources are	1	1	1	1	1	1	Broadly Acceptable	5	3	4	5	4	1	Broadly Acceptable	Self help facilities will be in place.

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									People	Environment	Property	Business	Average	Frequency	People	Environment	Property	Business	Average	Frequency				
				impacting on emergency response resources.			resources.	insufficient.																
C, O, D	SAR	Third Party	Restricted emergency response in the array in an emergency situation	Access to the wind farm for search and rescue operations or other emergency may be affected by the presence of the wind farm structures	Restricted sea room and air space, Ineffective industry wide Emergency Response	MGN 543, SOLAS, ERCoP, Layout agreed with the MCA	Restricted but not ineffective emergency response capability	Loss of life due to restricted emergency response access	2	1	1	3	2	3	Broadly Acceptable	5	1	4	5	4	2	Broadly Acceptable		
Fishing Vessels																								
C, O, D	Allision	Commercial Fishing Vessels (in transit/mobile gear)	Presence of Norfolk Boreas array may increase vessel to structure	Fishing vessel allides with wind farm structure whilst fishing in the area or in transit.	Human error, adverse weather, emergency scenario, uncharted cables/	Compliance with international and flag state regulations, MGN 372, promulgation	Commercial fishing vessel allides with a structure.	Vessel allides with structure resulting in the potential major consequence for persons	3	1	2	2	2	2	Broadly Acceptable	5	2	3	4	4	1	Broadly Acceptable		

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									Consequences						Consequences									
									People	Environment	Property	Business	Average	Frequency	People	Environment	Property	Business	Average	Frequency				
			collision risk for commercial fishing vessels.		equipment on seabed; navigational equipment failure, engine failure/blackout, Dragged anchor, Sediment transport exposing and lifting cables	of information, marine coordination, monitoring by AIS, permanent aids to navigation, marine pollution contingency planning.		and moderate damage to vessel and infrastructure.																
C, O, D	Snagging	Commercial Fishing Vessels (mobile gear)	Presence of cables and other subsea infrastructure within the array (including foundations and mooring lines) will present an increased gear snagging	There is the potential for fishing gear to interact with the subsea infrastructure within the array (including the inter-array cables).	Presence of partially installed or completed cables and structures could pose a risk to vessels fishing in areas of operation. This could be	Cable burial risk assessment, compliance with international and flag state regulations, use of guard vessels or temporary marks, promulgation		A vessel fishes (trawls) close to an area of exposed cable or subsurface structure but no snagging interaction occurs.	1	1	2	2	2	3	Broadly Acceptable	5	2	5	4	4	3	Tolerable	Chart Markings; of abandoned gear/dropped objects.	

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									Consequences							Consequences							
									People	Environment	Property	Business	Average	Frequency	People	Environment	Property	Business	Average	Frequency			
			risk for commercial fishing vessels.		associated with human error or navigational equipment error.	of information (charting and KISORCA).																	
C, O, D	Snagging	Commercial Fishing Vessels (mobile gear)	Presence of export cables will present an increased gear snagging risk for commercial fishing vessels.	Fishing vessel drags gear over export cable, e.g. scallop dredger or trawler	Uncharted obstruction on seabed, Lack of Awareness; sediment transport exposing / lifting cables; Human error	Cable burial risk assessment, compliance with international and flag state regulations, use of guard vessels or temporary marks, promulgation of information (charting and KISORCA).	A vessel fishes (trawls) close to an area of partially installed or exposed cable but no snagging interaction occurs.	A vessel fishes (trawls) on an area of exposed or partially buried cable. This results in damage to the cable, gear or foundering of vessel.	1	1	2	2	2	3	Broadly Acceptable	5	2	5	5	4	3	Tolerable	Chart Markings; of abandoned gear/dropped objects.
C, O, D	Displacement	Commercial Fishing Vessels (mobile gear)	Activities within the Norfolk Boreas site and export	Established vessel routes and fishing areas are displaced	Location of site in proximity to fishing vessel routes and grounds, plus	Promulgation of Information. Consultation with fishing	Increased distance to fishing grounds	Exclusion from fishing grounds	1	1	1	1	1	3	Broadly Acceptable	1	1	1	5	2	3	Broadly Acceptable	

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									Consequences							Consequences										
									People	Environment	Property	Business	Average	Frequency	People	Environment	Property	Business	Average	Frequency						
			cable route could cause fishing vessels to be deviated.		the use of floating foundations.	vessels operators,																				
Wind Farm Support																										
C, O, D	Allision	Wind Farm Construction, Operational or Maintenance Vessels	Support vessel allision with wind farm structure	Vessels will be working in proximity to the structures, e.g., during construction and maintenance. Misjudgement weather or equipment failure could lead to an allision	Poor Visibility; Manoeuvring error; Machinery Failure; Lack of Passage Planning; Lack of experience; Lack of awareness; Human error; Fatigue; Engine Failure/ Blackout; Bad weather.	Compliance with international and flag state regulations, IALA 0-139, MGN 543, MGN 372, standard template ERCoP, standard marine practices such as notice to mariners	Minor damage to vessel and potential for minor injury	High speed impact that results in major damage to vessels and consequences for personnel. Could also lead to major damage to vessel.	2	1	2	2	2	4	Broadly Acceptable	5	2	4	4	4	2	Broadly Acceptable				
C, O, D	Man Overboard	Wind Farm Construction, Operational	Man Overboard	Man overboard scenario	Recovery of person/s from the water	MGN 543, SOLAS and ERCoP	Man overboard from support	Multiple persons in the water from a	1	1	1	1	1	1	Broadly Acceptable	4	1	4	1	3	1	Broadly Acceptable				

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									Consequences							Consequences								
									People	Environment	Property	Business	Average	Frequency	People	Environment	Property	Business	Average	Frequency				
		or Maintenance Vessels		within the wind farm from either a wind farm work craft or a third party vessel.	during man overboard incident		/wind farm operational vessels within the wind farm resulting in no injury	large vessel with the potential for serious injury to persons from an inability to adequately undertake SAR.																
Oil and Gas																								
C, O, D	Displacement	Oil and Gas Support Vessels	Displacement of oil and gas vessels working within or around the array area	Oil and gas vessels working within or near the site are displaced	Location of site in proximity to oil and gas assets and routes.	Promulgation of Information. Consultation with vessel operators.	Increased journey time and distance.	Oil and gas vessels unable to access their required destination	1	1	1	1	1	2	Broadly Acceptable	1	1	1	3	2	2	Broadly Acceptable		
Recreation																								
C, O, D	Deviation	Recreational Vessels (2.5 to 24 m)	Activities within the Norfolk Boreas site and export	Established recreational vessel routes/areas are displaced	Location of Norfolk Boreas in proximity to known recreational	Promulgation of Information. Consultation with	Increased distance and time	Increased journey time and distance affecting passage	1	1	1	1	1	2	Broadly Acceptable	2	1	1	1	1	1	Broadly Acceptable		

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									Consequences							Consequences								
									People	Environment	Property	Business	Average	Frequency	People	Environment	Property	Business	Average	Frequency				
			cable route could cause recreational vessels to be displaced.		routes.	recreational stakeholders		planning																
C, O, D	Allisions	Recreational Vessels (2.5 to 24 m)	Presence of infrastructure within the Norfolk Boreas array may cause increased allision risk for recreational vessels.	Recreational vessel allides with wind turbine or offshore substation.	Human error, adverse weather/poor visibility, Aid to Navigation failure, communication or navigational equipment failure, fatigue	Compliance with international and flag state regulations, MGN 372, MGN 543, promulgation of information, marine coordination, monitoring by AIS, permanent aids to navigation, RYA guidance	Near miss by recreational vessel.	Vessel allides with structure	2	1	2	2	2	2	2	Broadly Acceptable	5	1	2	2	3	1	Broadly Acceptable	
O, D	Collision	Recreational Vessels (2.5 to 24 m)	Presence of infrastructure within the	Recreational vessels collides with	Human error, adverse weather/poor	Compliance with international	Near miss between a recreational	Collision between a recreational	2	1	2	2	2	1	Broadly Acceptable	5	1	4	2	3	1	Broadly Acceptable		

