East Anglia ONE North Offshore Windfarm

Chapter 14

Shipping and Navigation

Environmental Statement
Volume 1

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Glossary of Acronyms

AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
BEIS	Department of Business, Energy and Industrial Strategy
BMAPA	British Marine Aggregate Producers Association
CA	Cruising Association
COLREGs	International Regulations for Preventing Collisions at Sea
CoS	Chamber of Shipping
DCO	Development Consent Order
DML	Deemed Marine Licence
DWR	Deep Water Route
ERCoP	Emergency Response Cooperation Plan
ES	Environmental Statement
EU	European Union
FSA	Formal Safety Assessment
GLA	General Lighthouse Authority
IALA	International Association of Lighthouse Authorities
IMO	International Maritime Organization
KIS-ORCA	Kingfisher Information Service-Offshore Renewable Cable Awareness
km	kilometre
m	metre
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
Met Mast	Meteorological Mast
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
MMO	Marine Management Organisation
MoD	Ministry of Defence
MW	Megawatt
nm	Nautical mile
NPS	National Policy Statement
NRA	Navigational Risk Assessment
NSIP	Nationally Significant Infrastructure Projects
NUC	Not Under Command
OREI	Offshore Renewable Energy Installation
PEIR	Preliminary Environmental Information Report
PEXA	Practice and Exercise Areas
RAM	Restricted in Ability to Manoeuvre
REZ	Renewable Energy Zone
RNLI	Royal National Lifeboat Institution
RYA	Royal Yachting Association
SAR	Search and Rescue
SNSOWF	Southern North Sea Offshore Wind Forum
SOLAS	International Convention for the Safety of Life at Sea
SPR	ScottishPower Renewables

SPS	Significant Peripheral Structure
STS	Ship-to-Ship
TH	Trinity House
TSS	Traffic Separation Scheme
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
VHF	Very High Frequency

Glossary of Terminology

The Applicant	East Anglia ONE North Limited
As Low As Reasonably Practicable (ALARP)	The principle that the residual risk shall be reduced as far as reasonably practicable.
Allision	Contact between a moving and stationary object.
Automatic Identification System (AIS)	Automatic Identification System. A system by which vessels automatically broadcast their identity, key statistics e.g. length, brief navigation details e.g. location, destination, speed and current status e.g. survey. Most commercial vessels and European Union (EU) fishing vessels over 15 m are required to have AIS.
Baseline	The assessment of risk based on current shipping densities and traffic types as well as the marine environment.
Collision	The act or process of colliding (crashing) between two moving objects.
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 ONE North windfarm site	The offshore area within which wind turbines and offshore platforms will be located.
Formal Safety Assessment (FSA)	A structured and systematic process for assessing the risks and costs (if applicable) associated with shipping activity.
Future Case	The assessment of risk based on the predicted growth in future shipping densities and traffic types as well as foreseeable changes in the marine environment.
Inter-array cables	Offshore cables which link the wind turbines to each other and the offshore electrical platforms. These cables will include fibre optic cables.
Landfall	The area (from Mean Low Water Springs) where the offshore export cables would make contact with land, and connect to the onshore cables.
Marine Environmental High Risk Area (MEHRA)	Areas in UK coastal waters where ships' masters are advised of the need to exercise more caution than usual i.e. crossing areas of high environmental sensitivity where there is a risk of pollution from commercial shipping.
Marking buoys	Buoys to delineate spatial features / restrictions within the offshore development area.
Monitoring buoys	Buoys to monitor in situ condition within the windfarm, for example wave and metocean conditions.
Marine Guidance Note (MGN)	A system of guidance notes issued by the Maritime and Coastguard Agency (MCA) which provide significant advice relating to the improvement of the safety of shipping and of life at sea, and to prevent or minimise pollution from shipping.
Navigational Risk Assessment (NRA)	A document which assesses the overall impact to shipping and navigation of an Offshore Renewable Energy Installation (OREI) based upon formal risk assessment.
Not Under Command (NUC)	Under Part A of the International Regulations for Preventing Collisions at Sea (COLREGs), the term “vessel not under command” means a vessel which

	through some exceptional circumstance is unable to manoeuvre as required by these Rules and is therefore unable to keep out of the way of another vessel.
Offshore cable corridor	This is the area which will contain the offshore export cables between offshore electrical platforms and landfall transition jointing bays located at landfall.
Offshore development area	The East Anglia ONE North windfarm site and offshore cable corridor (up to Mean High Water Springs).
Offshore electrical infrastructure	The transmission assets required to export generated electricity to shore. This includes inter-array cables from the wind turbines to the offshore electrical platforms, offshore electrical platforms, platform link cables and export cables from the offshore electrical platforms to the landfall.
Offshore electrical platform	A fixed structure located within the windfarm area, containing electrical equipment to aggregate the power from the wind turbines and convert it into a more suitable form for export to shore.
Offshore export cables	The cables which would bring electricity from the offshore electrical platforms to the landfall. These will include fibre optic cables.
Offshore infrastructure	All of the offshore infrastructure including wind turbines, platforms, and cables.
Offshore platform	A collective term for the offshore operation and maintenance platform and the offshore electrical platforms.
Platform link cable	Electrical cable which links one or more offshore platforms. These will include fibre optic cables.
Radar	Radio Detection And Ranging – an object-detection system which uses radio waves to determine the range, altitude, direction, or speed of objects.
Regular Operator	A commercial vessel operator whose vessel(s) are observed to transit through a particular region on a regular basis.
Roll on Roll off (Ro Ro)	Vessels designed to carry wheeled cargo such as cars, trucks and trailers that are driven on and off the vessel on their own wheels or using a platform vehicle.
Safety Zone	A marine area declared for the purposes of safety around a renewable energy installation or works / construction area under the Energy Act 2004.
Scour protection	Protective materials to avoid sediment being eroded away from the base of the foundations as a result of the flow of water.

14 Shipping and Navigation

14.1 Introduction

1. This chapter of the Environmental Statement (ES) summarises the work undertaken by Anatec Limited as part of the Navigational Risk Assessment (NRA) (***Appendix 14.2***) to identify the existing vessel activity and navigational features in the vicinity of the proposed East Anglia ONE North project for the construction, operation and maintenance, and decommissioning phases. The shipping and navigation chapter considers vessels recorded transiting the sea area in proximity to the East Anglia ONE North windfarm site including commercial vessels, recreational craft and commercial fishing vessels.

2. Planning policy on offshore renewable energy Nationally Significant Infrastructure Projects (NSIPs), specifically in relation to shipping and navigation, is contained in the Overarching National Policy Statement (NPS) for Energy (EN-1; Department of Business, Energy and Industrial Strategy (BEIS), 2011a) and the NPS for Renewable Energy Infrastructure (EN-3, BEIS, 2011b). Only the NPS EN-3 includes guidance specific to shipping and navigation although the overarching principles set out in NPS EN-1 have been considered.

3. This chapter presents the shipping and navigation baseline, which has been established based on a high level review of data sources listed in ***section 14.4.4***. A detailed baseline assessment is presented as part of the NRA (***Appendix 14.2***) and is summarised in ***section 14.5***. A description of the study areas in which the baseline has primarily been established is presented in ***section 14.3.1.***

14.2 Consultation

4. Consultation is a key feature of the Environmental Impact Assessment (EIA) process, and continues throughout the lifecycle of a project, from its initial stages through to consent and post-consent. To date, consultation with regards to shipping and navigation has been undertaken through formal submission of the Scoping Report (ScottishPower Renewables (SPR) 2017), the Preliminary Environmental Information Report (PEIR) (SPR 2019) and consultation meetings, as detailed in ***Table A14.1.1*** in ***Appendix 14.1***. Feedback received through this process has been incorporated into the ES where appropriate, and this chapter has been updated for the final assessment submitted with the Development Consent Order (DCO) application.

5. The responses received from stakeholders with regards to the Scoping Report, PEIR and consultation meetings, are summarised in ***Table A14.1.1*** in

Appendix 14.1, including details of how these have been taken account of within this chapter.

6. It should be noted that regular operators that transit the shipping and navigation study area have also been consulted; details of this are presented in ***section 5.3*** and ***5.4*** of the NRA (***Appendix 14.2***).

7. Ongoing public consultation has been conducted through a series of Public Information Days (PIDs) and Public Meetings. PIDs have been held throughout Suffolk in November 2017, March 2018, June / July 2018 and February / March 2019. A series of stakeholder engagement events were also undertaken in October 2018 as part of Phase 3.5 consultation. Details of the consultation phases are discussed further in ***Chapter 5 EIA Methodology***.

8. ***Table 14.1*** shows public consultation feedback pertaining to shipping and navigation. Full details of the proposed East Anglia ONE North project consultation process are presented in the Consultation Report (document reference 5.1), which is provided as part of the DCO application.

Table 14.1 Public Consultation Responses relevant to Shipping and Navigation

Topic	Response / where addressed in the ES
Phase 1	
Turbines could be colour coded red/green to aid navigation	The windfarm would be designed and constructed to satisfy the requirements of the Civil Aviation Authority (CAA) and the Trinity House Lighthouse Service (THLS). As outlined in ***section 6.5.5*** of ***Chapter 6 Project Description***, the colour scheme for nacelles, blades and towers is typically RAL 7035 (light grey). Foundation steelwork is generally in RAL 1023 (traffic light yellow) up to the Highest Astronomical Tide (HAT) +15m or to Aids to Navigations, whichever is the highest.
Phase 2	
Effects of the project on ship to ship transfer business. Interaction between windfarms and shipping and the risk of collision and oil spills. Cruising association have concern regarding anything that may result in a not smooth bottom anywhere less than 10m in depth	• Potential impacts on commercial vessels are considered in ***section 14.6*** and the potential risks to navigation in the context of collision are considered in ***section 18.2*** of ***Appendix 14.2*** In terms of oil spill risk, this is considered within the Consequences Assessment (***Appendix 14.5).*** Anchored tankers associated with Ship to Ship (STS) off the coast of Southwold are highlighted in ***section 12.2.10*** and ***section 12.3.9*** of ***Appendix 14.2***. • Works will be undertaken in accordance with MGN 543, ensuring there are no significant changes to charted depths, while also ensuring that appropriate cable protection is used where appropriate.
Phase 3; Phase 3.4 and Phase 4	
None	n/a

14.3 Scope

14.3.1 Study Area

9. The study area is defined as a ten nautical mile (nm) buffer of the East Anglia ONE North windfarm site. This buffer has been used as it is considered best practice for the NRA (***Appendix 14.2***) and it presents a sufficient area to capture the relevant marine traffic for the project in terms of baseline data, while still remaining site specific to the East Anglia ONE North windfarm site.

10. In addition, analysis of marine traffic data and relevant navigational features has been undertaken within a 2nm buffer of the offshore cable corridor (hereafter referred to as the offshore cable corridor study area).

11. As shipping and navigational receptors can be cumulatively impacted by a number of offshore projects, the principles of the cumulative assessments have been extended to 100nm from the East Anglia ONE North windfarm site. This includes consideration of transboundary offshore windfarm projects and vessel routes. However, for a cumulative or transboundary windfarm to be considered in the cumulative routeing assessment, a vessel route needs to be impacted (route through or in proximity to) by both the screened windfarm and the East Anglia ONE North windfarm site.

14.3.2 Worst Case

12. The design of the proposed East Anglia ONE North project (including number of wind turbines, layout configuration, requirement for scour protection, electrical design, etc.) is not yet fully determined, and may not be known until sometime after the DCO has been granted. Therefore, in accordance with the requirements of the Project Design Envelope (also known as the Rochdale Envelope) approach to EIA (Planning Inspectorate 2018) (as discussed in ***Chapter 5 EIA Methodology***), realistic worst case scenarios in terms of potential effects upon shipping and navigation are adopted to undertake a precautionary and robust impact assessment.

13. ***Chapter 6 Project Description*** sets out a detailed description of the proposed offshore development area, as well as detailed information on construction, operation and decommissioning. The worst case scenarios with regard to shipping and navigation are presented by impact in ***14.3.3***. These parameters are applied in the assessment of potential impacts and ensure that it reflects the worst case scenario in every aspect.

14. For shipping and navigation impact assessment, an indicative layout has been assessed which considers the maximum deployment of wind turbines across the maximum area within the East Anglia ONE North windfarm site, causing the maximum displacement. Any alternative layouts would then lie within impacts

assessed for this worst case scenario. The NRA (***Appendix 14.2***) that underpins this assessment is based on an early 67 wind turbine layout.

15. It should be noted that when viewing ***Table 14.2*** that the minimum inter-row and in-row spacing have only been qualitatively assessed rather than modelled, given that the worst case from a shipping and navigation perspective is maximum number of structures over the greatest area. Therefore, 1,100m inter-row spacing and 2,200m in-row spacing within the 67 wind turbine indicative layout has been modelled, rather than the actual minimum spacing being considered. Further details are provided in NRA (***Appendix 14.2***).

Table 14.2 Realistic Worst Case Scenarios

Impact	Parameter	Rationale
Construction		
Impact 1: Impact on commercial vessel routeing (vessel displacement) from construction of structures and implementation of safety zones.	• Maximum number of wind turbines (67); • Minimum inter row spacing of 1200m; • Minimum in-row spacing of 800m; • Up to four offshore electrical platforms; • One construction, operation and maintenance platform; • 500m rolling construction safety zones and 50m pre commissioning safety zones; and • Offshore construction works occurring over an approximate 27-month window.	Construction area and safety zones cause maximum displacement for vessels operating on regular / main routes.
Impact 2: Impacts on Commercial Vessel Safe Navigation (allision, collision) from construction of structures and implementation of safety zones.	• Maximum number of wind turbines (67); • Minimum inter row spacing of 1200m; • Minimum in-row spacing of 800m; • Up to four offshore electrical platforms; • One construction, operation and maintenance platform; • 500m rolling construction safety zones and 50m pre commissioning safety zones; and • Offshore construction works occurring over an approximate 27-month window.	Maximum displacement of vessels causing areas of route convergence, with continuous and maximum on-site activity over the longest duration; and Largest concentration of wind turbines with continuous and maximum on-site vessel activity over the longest duration.
Impact 3: Impact on commercial fishing vessels (displacement, allision, collision) from construction of structures and	• Maximum number of wind turbines (67); • Minimum inter row spacing of 1200m; • Minimum in-row spacing of 800m; • Up to four offshore electrical platforms;	Largest concentration of wind turbines with maximum on-site vessel activity over the longest duration.

Impact	Parameter	Rationale
implementation of safety zones. *Note: does not consider gear snagging*	• One construction, operation and maintenance platform; • 500m rolling construction safety zones and 50m pre commissioning safety zones; • Offshore construction works occurring over an approximate 27-month window; and • Jacket suction caisson foundations presenting maximum allision risk.	
Impact 4: Impact on recreational vessels (displacement, allision, collision) from construction of structures and implementation of safety zones	• Maximum number of wind turbines (67); • Minimum inter row spacing of 1200m; • Minimum in-row spacing of 800m; • Up to four offshore electrical platforms; • One construction, operation and maintenance platform; • 500m rolling construction safety zones and 50m pre commissioning safety zones; and • Jacket suction caisson foundations presenting maximum allision risk.	Maximum displacement for recreational craft seeking to avoid transit through the East Anglia ONE North windfarm site; Maximum number of on-site vessels creating maximum potential over longest duration; and Largest concentration of wind turbines with continuous and maximum on-site vessel activity over the longest duration.
Impact 5: Impact on emergency response capability from increased number of vessels and personnel on site	• 74 construction vessels on site including associated support craft; • Potential pollution sources; • Increased personnel presence on site; and • Offshore construction works occurring over an approximate 27-month window	Maximum number of vessel and personnel on site with no self-help capability for emergency response.
Operation and Maintenance		
Impact 1: Impact on commercial vessel routeing (vessel displacement) from presence of	• Maximum number of wind turbines (67); • Minimum inter row spacing of 1200m; • Minimum in-row spacing of 800m;	Operational windfarm causes maximum displacement for vessels operating on regular / main routes.

Impact	Parameter	Rationale
structures	• Up to four offshore electrical platforms; • One construction, operation and maintenance platform;	
Impact 2: Impacts on Commercial Vessel Safe Navigation (allision, collision, anchor interaction) from presence of structures	• Maximum number of wind turbines (67); • Minimum inter row spacing of 1200m; • Minimum in-row spacing of 800m; • Up to four offshore electrical platforms; • One construction, operation and maintenance platform; • Maximum number of vessel round trips (647 per annum) of associated support craft; • One nautical mile separation from Deep Water Route (DWR); • Up to two export cables, length of up to 76km per cable; • Up to 200km of inter-array cables; • Up to seven platform link cables, length of 15km per cable; • Burial depth of between 1 and 3m; and • Up to 53.1km of unburied cable due to ground conditions or at cable crossings requiring additional protection	Maximum displacement of vessels and convergence of routes; East Anglia ONE North windfarm site within close proximity to main routes creating maximum exposure time to passing vessels; East Anglia ONE North windfarm site within close proximity to main routes creating maximum exposure time to vessels not under command (NUC); and
Impact 3: Impact on commercial fishing vessels (displacement, allision, collision) from presence of structures. *Note: does not consider gear snagging*	• Maximum number of wind turbines (67); • Minimum inter row spacing of 1200m; • Minimum in-row spacing of 800m; • Up to four offshore electrical platforms; • One construction, operation and maintenance platform; • Maximum number of vessel round trips (647) of associated support craft;	East Anglia ONE North windfarm site near or on fishing grounds creating maximum exposure time for fishing vessels; and Inadequate cable protection and / or burial creating a navigational hazard.

Impact	Parameter	Rationale
	• One nautical mile separation from Deep Water Route (DWR); • Up to two export cables, length of up to 76km per cable; • Up to 200km of inter-array cables; • Up to seven platform link cables, length of 15km per cable; • Target burial depth of between 1 and 3m; • Up to 53.1km of unburied cable due to ground conditions or at cable crossings requiring additional protection	
Impact 4: Impact on recreational crafts from presence of structures	• Maximum number of wind turbines (67); • Minimum inter row spacing of 1200m; • Minimum in-row spacing of 800m; • Up to four offshore electrical platforms; • One construction, operation and maintenance platform; • Maximum number of vessel round trips (647) of associated support craft; • One nautical mile separation from Deep Water Route (DWR); • Minimum blade clearance of 22m above MHWS (24.44m LAT); • Up to two export cables, length of up to 76km per cable; • Up to 200km of inter-array cables; • Up to seven platform link cables, length of 15km per cable; • Burial depth of between 1 and 3m; • Up to 53.1km of unburied cable due to ground conditions or at cable crossings requiring additional protection	Maximum operational area creating maximum displacement for recreational craft not wanting to transit through East Anglia ONE North windfarm site; Maximum vessel movements within the array, over continuous 24 hour period and over the longest duration without effective control; Minimum spacing and maximum number of wind turbines creating maximum risk of allision; and Inadequate cable protection and / or burial creating a navigational hazard.
Impact 5: Impact on emergency	• Maximum number of vessel round trips (647) of associated support craft;	Maximum number of vessel and personnel on site with no self-help capability for emergency

Impact	Parameter	Rationale
response capability from increased number of vessels and personnel	• Increased personnel presence on site; and • Potential pollution sources.	response.
Decommissioning		
Impact 1: Impact on commercial vessel routeing (vessel displacement) from safety zone	• Maximum number of wind turbines (67); • Minimum inter row spacing of 1200m; • Minimum in-row spacing of 800m; • Up to four offshore electrical platforms; • One construction, operation and maintenance platform; and • Decommissioning safety zones.	Decommissioning area and safety zones cause maximum displacement for vessels operating on regular / main routes.
Impact 2: Impacts on Commercial Vessel Safe Navigation (allision, collision) from partially decommissioned structures and safety zones	• Maximum number of wind turbines (67); • Minimum inter row spacing of 1200m; • Minimum in-row spacing of 800m; • Up to four substations; • One accommodation platform; • Maximum number of decommissioning vessels onsite; • Decommissioning safety zones; and • Jacket suction caisson foundations presenting maximum allision risk.	Maximum displacement of vessels causing areas of route convergence, with continuous and maximum on-site activity over the longest duration; and Largest concentration of wind turbines with continuous and maximum on-site vessel activity over the longest duration.
Impact 3: Impact on commercial fishing vessels (displacement, allision, collision)	• Maximum number of wind turbines (67); • Minimum inter row spacing of 1200m; • Minimum in-row spacing of 800m;	Largest concentration of wind turbines with maximum on-site vessel activity over the longest duration.

Impact	Parameter	Rationale
from partially decommissioned structures and safety zones. *Note: does not consider gear snagging*	• Up to four offshore electrical platforms; • One construction, operation and maintenance platform; • Maximum number of decommissioning vessels onsite; • Decommissioning safety zones; and • Jacket suction caisson foundations presenting maximum allision risk.	
Impact 4: Impact on recreational vessels (displacement, allision, collision) from partially decommissioned structures and safety zones	• Maximum number of wind turbines (67); • Minimum inter row spacing of 1200m; • Minimum in-row spacing of 800m; • Up to four offshore electrical platforms; • One construction, operation and maintenance platform; • Maximum number of decommissioning vessels onsite; • Decommissioning safety zones; and • Jacket suction caisson foundations presenting maximum allision risk.	Maximum displacement for recreational craft seeking to avoid transit through the East Anglia ONE North windfarm site; and Largest concentration of wind turbines with continuous and maximum on-site vessel activity over longest duration.
Impact 5: Impact on emergency response capability	• Maximum number of decommissioning vessels on-site including associated support craft; • Increased personnel presence on site; and • Potential pollution sources.	Maximum number of vessel and personnel on site with no self-help capability for emergency response.

14.3.3 Mitigation and Best Practice

14.3.3.1 Embedded Mitigation

16. The following embedded mitigation measures relevant to shipping and navigation are secured within the DCO.

- The East Anglia ONE North windfarm site will meet the applicable requirements of MGN 543 and its annexes, including requirements to facilitate SAR access;
- Lighting and marking of the East Anglia ONE North windfarm site in line with IALA guidance O-139 (2013), which will be agreed with TH and MCA post consent;
- Wind turbines will have at least 22m air clearance above Mean High Water Spring (MHWS) as per MGN 543 (MCA 2016) and RYA (RYA 2015) requirements.
- Cable protection via burial (or alternative methods where burial is not feasible), including maintenance and monitoring of the protection during the operational phase. A Cable Burial Risk Assessment will be developed post-consent;
- Marking of structures and cables on appropriately scaled navigational charts;
- Compliance from all vessels associated with the proposed East Anglia ONE North project with international regulations as adopted by the flag state (most notably International Convention for the Prevention of Collision at Sea (COLREGS) (IMO 1972) and International Convention for the Safety of Life at Sea (SOLAS) (IMO 1974));
- Dedicated Marine Coordination Centre to manage on site vessels;
- Development of an Emergency Response Cooperation Plan (ERCoP); and

14.3.3.1.1 Additional Mitigation

17. Additional mitigation measures as follow have been identified as necessary to ensure the residual significance of each impact is reduced to ALARP:

- Use of guard vessels as appropriate (e.g. during the construction period or during periods of major maintenance);
- Under keel clearance will be risk assessed against MCA and RYA guidance;
- Application through submission of the Safety Zone Statement post consent for safety zones around structures where construction or major maintenance is being undertaken;

- Relevant information promulgated via Notice to Mariners and other appropriate media.

14.3.4 Monitoring

18. Post-consent, the final detailed design of the proposed East Anglia ONE North project will refine the worst-case parameters assessed in this ES. It is recognised that monitoring is an important element in the management and verification of the actual proposed East Anglia ONE North project impacts.

19. As stated in the In-Principle Monitoring Plan (document reference 8.13), vessel traffic monitoring by AIS during construction and operation with periodic reporting to the MMO and MCA will be undertaken in accordance with the Navigation Monitoring Strategy which will be agreed post consent.

20. The outline Offshore Operations and Maintenance Plan (oOOMP) (document reference 8.12) and outline Navigation Monitoring Strategy (document reference 8.18) have been submitted with the DCO application and are relevant to shipping and navigation. These plans set out the Applicant's intentions for shipping and navigation monitoring and management. The requirement for and final design and scope of monitoring will be agreed with the regulator and relevant stakeholders and included within the relevant Management Plan, submitted for approval, prior to construction works commencing.

14.4 Assessment Methodology

21. Potential shipping and navigation impacts will be assessed for significance using the Formal Safety Assessment (FSA) process detailed by the International Maritime Organization (IMO) (2002) and as required by the MCA Methodology for Assessing the Marine Navigational Safety of Offshore Wind Farms (MCA, 2015). The FSA assigns each impact a "frequency" and "severity" ranking which are then used to assess the overall significance as either broadly acceptable, tolerable, or unacceptable, assuming embedded mitigation is in place. Where appropriate, additional mitigation is then introduced to reduce any impacts to As Low As Reasonably Practicable (ALARP) levels as necessary. Rankings will be informed by quantitative modelling results, stakeholder consultation feedback, and expert opinion. Further details of the FSA process are provided in ***section 14.4.5***.

22. The key input to the FSA is the NRA (undertaken as per MGN 543, and available in ***Appendix 14.2***), which establishes the shipping and navigation baseline in detail. The NRA uses the data sources listed in ***section 14.4.4***, and subsequently scopes out impacts not required to be carried through to the FSA.

23. Impacts will also be assessed for the potential of cumulative impact when considered with other southern North Sea offshore windfarm projects. In

particular, the impact on vessel routeing will be considered on a cumulative basis, as this has historically been raised as a key area of shipping and navigation stakeholder concern in relation to the construction of offshore windfarms within the southern North Sea.

14.4.1 Primary Guidance

24. The primary guidance documents used to inform this chapter include:

- MCA MGN 543 OREIs – Guidance of UK Navigational Practice, Safety and Emergency Response (MCA 2016);
- MCA Methodology for Assessing the Marine Navigational Safety of Offshore Wind Farms (MCA 2015); and
- IMO Guidelines for Formal Safety Assessment (FSA) (IMO 2002).

25. MGN 543 highlights issues that shall be taken into consideration when assessing the effect on navigational safety from offshore renewable energy projects, in UK internal waters, territorial sea or Renewable Energy Zones (REZ).

26. The MCA require that their methodology (MCA, 2015) is used as a template for preparing NRAs. The methodology is centred on risk management and requires a submission that shows that sufficient controls are, or will be, in place for the assessed risk (base case and future case) to be judged as broadly acceptable or tolerable with mitigation. A checklist referencing the sections in this report and the NRA which address all MCA requirements is presented in ***Appendix 14.6***.

27. As mentioned in ***section 14.1***, planning policy on offshore renewable energy NSIPs specifically in relation to shipping and navigation, is contained in the Overarching NPS for Energy (EN-1; BEIS 2011a) and the NPS for Renewable Energy Infrastructure (EN-3, BEIS 2011b). A summary of the relevant guidance from NPS EN-3 and where it has been addressed within the ES is presented in **Table 14.3**.

Table 14.3 Summary of NPS EN-3 Guidance

Summary of NPS EN-3 Guidance	Paragraph in NPS EN-3	Where addressed in the ES
Stakeholders in the navigation sector should be engaged in the early stages of the development phase and this should continue throughout construction, operation and decommissioning.	2.6.153	***Appendix 14.1*** summarises consultation undertaken with stakeholders relevant to shipping and navigation.

Summary of NPS EN-3 Guidance	Paragraph in NPS EN-3	Where addressed in the ES
Consultation should be undertaken with the Marine Management Organisation (MMO), MCA, relevant General Lighthouse Authority (GLA), relevant industry bodies and representatives of recreational users such as the Royal Yachting Association (RYA).	2.6.154	***Appendix 14.1*** summarises consultation undertaken with the organisations stated. Consultation with the MMO is ongoing at an overarching project level.
Information on internationally recognised sea lanes should be considered prior to undertaking assessments.	2.6.155	***Section 14.5.1*** provides information on IMO Routeing Measures in the vicinity of the East Anglia ONE North windfarm site. These sea lanes are considered throughout the assessment.
An NRA should be undertaken in accordance with Government guidance prepared in consultation with the MCA and the other navigation stakeholders listed above.	2.6.156	See ***Appendix14.2***.
Potential effects of safety zones around offshore infrastructure should be assessed.	2.6.158	Impacts associated with the implementation of safety zones are included within the impact assessment in ***section 14.6***.
The potential effect on recreational craft, such as yachts, should be considered in any assessment.	2.6.160	***Section 14.6.4*** considers the impacts of the East Anglia ONE North project upon recreational craft.

14.4.2 East Marine Plan

28. During consultation (see ***Appendix 14.1***), the Chamber of Shipping (CoS) requested that the East Inshore and East Offshore Marine Plans (Marine Management Organisation, 2014) be taken into consideration therefore the ports and shipping policies have been presented in ***Table 14.4*** along with where the policies have been addressed or how they have been addressed.

Table 14.4 East Marine Plan Ports and Shipping Policies

Policy Number	Description	Where Addressed in the ES
PS1	Proposals that require static sea surface infrastructure or that significantly reduce under-keel clearance should not be authorised in IMO designated routes.	The offshore development area is not situated within IMO designated routes as shown in ***section 14.5.1***.
PS2	Proposals that require static sea surface infrastructure that encroaches upon important navigation routes should not be authorised unless there are external	The identification of the East Anglia ONE North windfarm site has taken into consideration the presence of existing shipping routes and activity. Future trends of shipping in the southern North

Policy Number	Description	Where Addressed in the ES
	circumstances. Proposals should: Be compatible with the need to maintain space for safe navigation, avoiding economic impact; Anticipate and provide for future safe navigational requirements where evidence and / or stakeholder input allows; and Account for impacts upon navigation in-combination with other existing and activities.	Sea have been identified as part of the baseline of this chapter and potential impacts to navigation have been assessed in ***section 14.6***.
PS3	Proposals should demonstrate, in order of preference: That they will not interfere with current activity and future opportunity for expansion of ports and harbours; How, if the proposal may interfere with current activity and future opportunities for expansion, they will minimise this; How, if the interference cannot be minimised, it will be mitigated; and The case for proceeding if it is not possible to minimise or mitigate the interference.	No impacts on ports and harbours are anticipated due to the proposed East Anglia ONE North project as described in ***section 14.7.2.3*.**

14.4.3 Other Guidance

29. Other guidance considered in the assessment on a secondary basis is as follows:

- The Recreational Craft Directives 2013/53/European Union (EU) – implemented into UK law by the Recreational Craft Regulations 2017 No. 737 (BEIS 2016);
- IALA Recommendations O-139 on the Marking of Man-Made Structures (IALA 2013); and
- MCA MGN 372 (Merchant + Fishing) Guidance to Mariners Operating in the Vicinity of UK OREIs (MCA 2008).

14.4.4 Data Sources

30. The baseline presented within the NRA (***Appendix 14.2***) is primarily based on analysis of 28 days of marine traffic survey data as summarised below. The approach to marine traffic data collection was discussed in principle with the MCA.

- 14 days of summer AIS and Radar data recorded by an on-site survey vessel in July 2018; and
- 14 days of winter AIS data collected from the local Met Mast in November and December 2017.

31. Due to the distance of the East Anglia ONE North windfarm site from shore, the marine traffic survey data collected from within the East Anglia ONE North windfarm site did not provide coverage of the entirety of the offshore cable corridor. Therefore, the survey data has been supplemented with AIS data collected from onshore receivers to ensure comprehensive coverage of the entire offshore cable corridor.

32. In addition to the marine traffic survey data, the data sources listed below have also been used to establish the baseline and subsequently inform the FSA where appropriate.

- Marine incident data from Marine Accident Investigation Branch (MAIB) (2005 to 2014) and maritime incident data from the Royal National Lifeboat Institution (RNLI) (2005 to 2014);
- UKHO Admiralty Charts – 1406, 1408, 1504, 1610, 1630;
- British Marine Aggregate Producers Association (BMAPA) Routes (BMAPA 2018);
- Admiralty Sailing Directions – Dover Strait Pilot, NP28 United Kingdom Hydrographic Office (UKHO), 2017
- Admiralty Sailing Directions - North Sea West Pilot, NP54 UKHO (UKHO 2016); and
- UK Coastal Atlas of Recreational Boating (RYA 2016).

14.4.5 Impact Assessment Methodology

33. Following completion of the FSA and the NRA, this information was fed into the impact assessment undertaken as part of the EIA process.

34. The criteria for determining the significance of effects is a two stage process that involves defining the consequence to receptors and the frequency of the impacts. This section describes the criteria applied in this chapter to assign values to the potential impacts.

35. For the shipping and navigation assessment the following sources were taken into consideration when assigning values:

- Consultation feedback from stakeholders and Regular Operators;
- Outputs of the Hazard Workshop;

- Lessons learned and research from previous developments, especially impacts associated with visual navigation, where physical modelling is not available;
- Results of vessel to vessel collision and vessel to structure allision risk modelling in comparison with UK averages data;
- Analysis of baseline data; and
- Clear evidence of impact (i.e. deviations).

14.4.5.1 Frequency

36. ***Table 14.5*** presents the frequency of occurrence or likelihood definitions that have been assumed within the FSA.

Table 14.5 Definitions of Frequency Levels for Shipping and Navigation

Rank	Frequency	Definition
1	Negligible	<1 occurrence per 10,000 years
2	Extremely Unlikely	1 per 100 to 10,000 years
3	Remote	1 per 10 to 100 years
4	Reasonably Probable	1 per 1 to 10 years
5	Frequent	Yearly

14.4.5.2 Consequence

37. ***Table 14.6*** presents the consequence definitions that have been assumed within the FSA.

Table 14.6 Definitions of Severity Levels for Shipping and Navigation

Rank	Severity	Definition
1	Negligible	• No injury to persons. • No significant damage to infrastructure or vessel. • No significant environmental impacts. • No significant business (safety), operation or reputation impacts.
2	Minor	• Slight injury(s) to person. • Minor damage to infrastructure or vessel. • Tier 1 pollution assistance (marine pollution). • Minor business (safety), operation or reputation impacts.
3	Moderate	• Multiple moderate or single serious injury to persons. • Moderate damage to infrastructure or vessel. • Tier 2 pollution assistance (marine pollution).

Rank	Severity	Definition
		• Considerable business (safety), operation or reputation impacts.
4	Serious	• Serious injury or single fatality. • Major damage to infrastructure or vessel. • Tier 2 pollution assistance (marine pollution). • Major national business (safety), operation or reputation impacts.
5	Major	• More than one fatality. • Extensive damage to infrastructure or vessel (> £10M). • Tier 3 pollution assistance (marine pollution). • Major international business (safety), operation or reputation impacts (> £10M).

14.4.5.3 Impact Significance

38. Once 'frequency of occurrence' and 'severity of consequence' (see ***sections 14.4.5.1*** and ***14.4.5.2*** respectively) are assigned to an impact, the significance of the impact is determined as either 'Broadly Acceptable', 'Tolerable', or 'Unacceptable' via the risk matrix presented in ***Table 14.7***, assuming embedded mitigation is in place as per ***section 14.3.3.***

Table 14.7 Impact Significance Matrix

Frequency	Severity				
	Negligible	**Minor**	**Moderate**	**Serious**	**Major**
Frequent	Tolerable	Tolerable	Unacceptable	Unacceptable	Unacceptable
Reasonably Probable	Broadly Acceptable	Tolerable	Tolerable	Unacceptable	Unacceptable
Remote	Broadly Acceptable	Broadly Acceptable	Tolerable	Tolerable	Unacceptable
Extremely Unlikely	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable	Tolerable
Negligible	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable

14.4.6 Limitations and Assumptions

39. The shipping and navigation baseline and impact assessment has been carried out based on the information available and responses received at the time of preparation. The desk based data sources used are the most up to date

publicly available information. The data is therefore limited by what is available and by what has been made available at the time of writing this chapter. Assumptions for modelling and baseline assessments are noted within the NRA (***Appendix 14.2***).

14.4.7 Cumulative Impact Assessment Methodology

40. Cumulative impacts have been considered for shipping and navigation receptors, this includes other offshore projects, as well as activities associated with other marine operations. However, it should be noted that fishing, recreation and marine aggregate dredging transits have been considered as part of the project-only assessment of affected receptors given that they are derivatives of shipping and navigation.

41. Other developments which may increase the effect of impacts to shipping and navigation receptors when considered with the proposed East Anglia ONE North project were assessed, and screened in or out depending upon the outcome of the assessment. ***Appendix 14.4*** presents the developments considered and outlines which have been screened in and out of assessment and the reasoning behind this.

42. Cumulative impacts identified through the scoping report (SPR 2017) were then assessed when considered with the developments scoped in during the screening stage undertaken as part of the NRA process (***Appendix 14.2***). As raised during consultation, the key cumulative impact was considered to be vessel routeing when considered with the other southern North Sea wind farm developments, all impacts presented have been considered cumulatively and assessed where a pathway was identified.

14.4.8 Transboundary Impact Assessment

43. ***Chapter 5 EIA Methodology*** presents the methodology associated with transboundary impact assessment. For shipping and navigation, given the international nature of shipping this is as per the cumulative impacts sections. It should be noted that fishing, recreation and marine aggregate dredging impacts, although they have the potential to be internationally owned or located, have been considered as part of the project-only assessment of affected receptors given that they are derivatives of shipping and navigation

14.5 Existing Environment

14.5.1 Navigational Features

44. The navigational features baseline has been established following a review of UKHO Admiralty Charts and the Admiralty Sailing Directions (UKHO, 2016) covering the area (see ***section 14.3.1*** for more details). An overview of the key navigational features discussed in this section relative to the East Anglia ONE North windfarm site is presented in ***Figure 14.1***.

45. The key navigational features within the area are considered to be the IMO routeing measures, most notably the DWR passing through the shipping and navigation study area, passing the East Anglia ONE North windfarm site with a consistent one nautical mile separation distance.

46. There were no charted anchorages identified within the study areas, or any areas mentioned within the Admiralty Sailing Directions (UKHO 2016), however it should be noted that the marine traffic survey data recorded anchoring activity within the area. This activity was likely associated with the Southwold Oil Transhipment Area (also known as Southwold STS area), located within 0.7nm of the offshore cable corridor. Further details are provided in section 8.5 of the NRA (***Appendix 14.2***). Details of the anchoring activity recorded within the marine traffic data are summarised in ***section 14.5.2*** of this chapter.

47. There are six marine aggregate dredging areas intersecting the shipping and navigation study area (one of which also intersects the offshore cable corridor study area). However, no marine aggregate dredging areas intersect either the East Anglia ONE North windfarm site or the offshore cable corridor. Indicative BMAPA transit routes show the majority of dredger transiting to be coastal, however cross channel routes associated with mainland Europe were present, including through the East Anglia ONE North windfarm site. It is noted that frequent use of BMAPA routes is considered likely to be low, given that the dredging areas used and the delivery ports frequently change.

48. There are three other windfarm projects within the shipping and navigation study area. These are as follows:

- East Anglia ONE (under construction, < 1nm to the south);
- East Anglia TWO (pre consent, approximately 5nm to the west); and
- East Anglia THREE (consented, approximately 8nm to the north-east).

49. It is emphasised that only windfarms either under construction or in operation are considered baseline. Pre-DCO application, in examination / determination or consented projects deemed relevant are considered on a cumulative basis. Further details are provided in ***section 14.7.2***.

50. In terms of oil and gas infrastructure, the Bacton to Zeebrugge natural gas pipeline intersects the shipping and navigation study area and passes close to the western boundary of the East Anglia ONE North windfarm site (approximately 0.3nm).

51. There are no designated Ministry of Defence (MoD) Practice and Exercise Areas (PEXAs) within the sea area surrounding the East Anglia ONE North windfarm site.

52. A Marine Environmental High Risk Area (MEHRA) is an area within UK coastal waters where there are receptors of high environmental sensitivity therefore vessel masters are advised to take more caution than usual to prevent or minimise pollution from vessels. There are no Marine Environmental High Risk Areas (MEHRAs) in the immediate vicinity of the East Anglia ONE North windfarm site.

53. A total of nine sub-sea telecommunication cables intersect the shipping and navigation study area. Of these, one intersects the East Anglia ONE North windfarm site itself – the Ulysses 2 cable between Ijmuiden and Lowestoft. It is noted that the cable corridor for East Anglia ONE also intersects the East Anglia ONE North windfarm site. A total of seven sub-sea telecommunication cables intersect the offshore cable corridor study area, three of which also intersect the offshore cable corridor itself.

54. Further information on navigational features is presented in section 8 of the NRA (***Appendix 14.2***) and ***Chapter 17 Infrastructure and Other Users***.

14.5.2 Marine Traffic

55. The marine traffic baseline has been established using 14 days of Automatic Identification System (AIS) and Radar data collected by a survey vessel during July 2018 and 14 days of AIS data collected from the local Met Mast during November and December 2017. The tracks recorded during the summer and winter marine traffic surveys are presented in ***Figure 14.2*** and ***Figure 14.3*** respectively, colour coded by vessel type. It should be considered when viewing these figures that vessels were observed to largely be avoiding the East Anglia ONE windfarm site; however such deviations were not yet being utilised during the winter survey. To highlight this, ***Figure 14.2*** includes the position of the construction buoys marking the East Anglia ONE North buoyed construction area.

56. During the summer survey, an average of 116 vessels per day passed within the shipping and navigation study area, recorded on AIS and Radar. During winter, this dropped to an average of 101 vessels per day. The majority of this traffic was comprised of cargo vessels (42% during summer and 47% in winter) and tankers (30% during summer and 40% in winter). It should be noted that this includes commercial cargo ferries. Both cargo vessels and tankers have been categorised by sub type in the NRA (***Appendix 14.2***).

57. Cargo vessels were recorded transiting routes to the east and west of the East Anglia ONE North windfarm site. General cargo vessels (34%) and Ro Ro cargo vessels with container capacity (28%) were the most frequently recorded cargo vessel types transiting through the shipping and navigation study area,

followed by containerships (19%). Bulk carriers (16%) were also recorded frequently.

58. The majority of tankers were recorded transiting routes to the east and west of the East Anglia ONE North windfarm site. Combined chemical and oil tankers (36%) were the most frequently recorded tanker type transiting through the shipping and navigation study area, followed by crude oil tankers (19%) and Liquid Petroleum Gas (LPG) carriers (19%). A number of tankers were recorded within the Southwold STS area within the west of the shipping and navigation study area.

59. Passenger vessel (including ferries and cruise liners) traffic was also identified within the shipping and navigation study area. Regular passenger vessel transits were recorded to the north east, east and west of the East Anglia ONE North windfarm site. The destinations of the passenger vessels recorded throughout the summer and winter survey periods are presented in ***Table 14.8***.

Table 14.8 Passenger Vessel Destinations (28 Days Summer 2018 and Winter 2017)

Vessel Operator	Vessel	Destination
Carnival	Queen Victoria	Southampton
	Queen Elizabeth	
	Aurora	Stavanger to Southampton
	Arcadia	Southampton
	Azura	Bergen to Southampton
Crystal Cruises	Crystal Serenity	Dover
Celebrity Cruises	Celebrity Silhouette	Copenhagen and Southampton
	Celebrity Eclipse	Dover
Cruise & Maritime Voyages	Astoria	Lerwick
Fred. Olsen	Boudicca	Dover, Malmo and Rosendal
	Black Watch	Invergordon
	Braemar	Torshavn
FTI Cruises	Berlin	Zeebrugge
P&O Ferries	Pride of Rotterdam	Europoort (Rotterdam) - Hull
	Pride of Hull	
	Pride of York	Hull - Zeebrugge
	Pride of Bruges	

Vessel Operator	Vessel	Destination
	Britannia	Bergen - Southampton
Princess Cruises	Sapphire Princess	Southampton and Stavanger
	Royal Princess	Le Havre
Stena Line	Stena Transporter	Hoek van Holland (Rotterdam) - Killingholme
	Stena Transit	Hoek van Holland (Rotterdam) - Humber
V. Ships	Saga Pearl II	Kirkwall
Viking River Cruises	Viking Sea	Newhaven and Greenwich
	Viking Star	Greenwich
Voyages to Antiquity	Aegean Odyssey	London
Other	Dolly C	Grenada
	Anne	Not Available
	FS Etoile	Not Available
	Jade 959	Gibraltar
	Lord Nelson	Leith
	Pink Gin	Southampton

60. Following vessel routeing provided by DFDS Seaways, one year of AIS data (2017) was extracted from a Met Mast within the former East Anglia Zone to validate the routeing within the vicinity of the East Anglia ONE windfarm site, East Anglia ONE North windfarm site and East Anglia TWO windfarm site. Adverse weather transits for vessels with a destination of Immingham and Rotterdam were recorded transiting through the East Anglia ONE North windfarm site. The Immingham to Steenbank (Antwerp) route provided by DFDS intersected the East Anglia ONE North windfarm site. Within the AIS this route was recorded further west however vessels were still recorded intersecting the site.

61. Anchoring was observed to occur within the west of the shipping and navigation study area but not within the East Anglia ONE North windfarm site itself. The majority of anchored vessels consisted of tankers bound for Southwold (UK) with one tanker with a destination of Rotterdam (the Netherlands) and another heading to Antwerp (Belgium). This area is not charted as a designated anchorage; however there is a designated area of the UK territorial sea off the coast of Southwold where STS transfers are permitted therefore the anchored tankers may be anchored in preparation for a STS transfer.

62. Approximately six recreational vessels per day were recorded during the summer survey, with the majority of these being sailing vessels. Of these, an average of three per day transited through the East Anglia ONE North windfarm site. Activity was much lower in winter, with only one vessel recorded over the 14 day surveyed period. It should be considered that the winter survey was AIS only (and hence non-AIS recreational vessels are not accounted for). However, it is unlikely that non-AIS recreational traffic levels would be notable during winter due to the conditions being generally unfavourable to smaller vessels.

63. An average of two fishing vessels per day were recorded within the shipping and navigation study area during summer. Active fishing was observed within this summer data, primarily to the east of the East Anglia ONE North windfarm site. The vessels within the site were considered likely to be in transit rather than actively engaged in fishing based on their behaviour. During winter, four fishing vessels per day were recorded within the shipping and navigation study area. This included active fishing within both the East Anglia ONE North and East Anglia ONE windfarm sites. It should be considered that increased construction vessel activity at the East Anglia ONE windfarm site may have displaced fishing activity during the summer survey (which may explain the lower fishing vessel numbers in summer), however seasonal variations may have also factored. Further details of fishing activity are available in ***Chapter 13 Commercial Fisheries.***

14.5.3 Baseline Routeing

64. The marine traffic data was used to identify the main vessel routes within the shipping and navigation study area. The information transmitted via AIS and Radar was used to estimate the types and sizes of vessels using each route, and the origin / terminus ports. Anatec's internal UK-wide route database and the charted IMO routeing measures were then used to validate the findings, and to extend the routes beyond the 10nm threshold of the AIS and Radar data.

65. The main routes identified are presented in Figure.1 of the NRA (***Appendix 14.2***). A total of 13 main routes were identified, a summary of each is presented in ***Table 14.9***.

Table 14.9 Main Routes

Route Number	Main Destination and Origin Ports	Average Vessels per Day	Main Vessel Types	Description
1	Off Botney Traffic Separation Scheme (TSS) – Rotterdam	5	Cargo and Tanker	Traffic transiting south between the Off Botney TSS and Rotterdam.
2	Rotterdam – Off Botney TSS	4	Cargo and Tanker	Traffic transiting north and south between Rotterdam

Route Number	Main Destination and Origin Ports	Average Vessels per Day	Main Vessel Types	Description
				and the Off Botney TSS.
3	West Friesland TSS – Rotterdam	13	Cargo and Tanker	Traffic transiting south-west between the West Friesland TSS and Rotterdam.
4	Rotterdam – West Friesland TSS	7	Cargo and Tanker	Traffic transiting north-east and south-west between Rotterdam and the West Friesland TSS.
5	Humber / Rotterdam	22	Cargo	Traffic transiting north-west and south-east between Humber and Rotterdam.
6	Tees / Zeebrugge	11	Cargo	Traffic transiting north-west and south-east between Tees and Zeebrugge.
7	Humber / Antwerp	3	Cargo and Tanker	Traffic transiting north-west and south-east between Humber and Antwerp.
8	Tees / Thames	2	Dredger and Tanker	Traffic transiting south-west and north-east between Tees and the Thames.
9	Humber / Zeebrugge	1	Cargo	Traffic transiting north and south between Humber and Zeebrugge.
10	Tees / Zeebrugge	3	Cargo and Tanker	Traffic transiting north-west and south-east between Tees and Zeebrugge.
11	Dover Strait / West Friesland TSS	2	Cargo	Traffic transiting north and south between the Dover Strait and the West Friesland TSS.
12	Thames / Off Texel TSS	1	Cargo	Traffic transiting east and west between the Thames and Off Texel TSS.
13	Ipswich / Off Vlieland TSS	1	Cargo	Traffic transiting east and west between Ipswich and the Off Vlieland TSS.

14.5.4 Predicted Future Marine Traffic

66. As part of the collision and allision modelling in the NRA (***Appendix 14.2***), an indicative increase of 10% for all vessel types was assessed; in addition to an assessment of risk should traffic levels remain constant. This increase is in line

with the assessments undertaken for other UK offshore windfarms, including East Anglia ONE and Norfolk Vanguard and therefore ensures a consistent approach with existing assessments.

67. In terms of vessel routeing, the future case vessel routes which may deviate due to the presence of the East Anglia ONE North windfarm site have been assessed from a worst case modelling perspective. Based on the baseline marine traffic discussed in ***section 14.5.2***, it has been predicted that four main routes could be deviated due to the East Anglia ONE North windfarm site. It must be noted that these have been based on a worst case scenario. It is likely that vessels will plan ahead and alter their route further from the East Anglia ONE North windfarm site.

14.6 Potential Impacts

68. The following sections present the potential impacts associated with the East Anglia ONE North windfarm site and offshore cable corridor. It is noted that following consultation with the MCA in May 2017, effects on communications, navigation and Radar, normally considered within the assessment (required as part of MGN 543 (MCA, 2016)), have been scoped out of the East Anglia ONE North assessment and the NRA (***Appendix 14.2***).

69. Similarly, following the receptor scoping process undertaken within the NRA, all impacts on marine aggregate dredging have been scoped out of the impact assessment. Further details are provided in section 21.1 of the NRA (***Appendix 14.2***).

70. The impact assessment has been divided into sections dealing with the impact on shipping and navigation receptors identified and scoped into the assessment as follows:

- Commercial vessels including bulk cargo, passenger vessels, tankers and containerised traffic;
- Commercial fishing vessels;
- Recreational craft; and
- Emergency response.

71. Rather than assess each stage of development separately, as done for other chapters in this ES, the impact assessment for this chapter considers the baseline conditions for each receptor. This is then used to identify and assess the impacts individually during all phases of the East Anglia ONE North project (construction, operation and maintenance, and decommissioning phases).

72. The structure of each impact is therefore as follows:

- Discussion of pathway/impacts/baseline – windfarm site and offshore cable corridor;
- Assessment of construction impacts;
- Assessment of operation and maintenance impacts; and
- Assessment of decommissioning impacts.

14.6.1 Impact 1: Impact on Commercial Vessel Routeing

14.6.1.1 East Anglia ONE North Windfarm Site

73. Marine traffic movements within the shipping and navigation study area have been captured through dedicated vessel based traffic surveys and AIS data collection as noted in ***section 14.4.4***. The marine traffic survey data has also been considered alongside Anatec's internal long term vessel route database (Anatec ShipRoutes, 2018) to define a full and detailed picture of commercial vessel movement with the shipping and navigation study area.

74. The full marine traffic assessment for the East Anglia ONE North windfarm site and offshore cable corridor is presented in ***section 12*** and ***section 13*** of ***Appendix 14.2***, respectively.

75. The baseline, future case and adverse weather routeing for commercial vessels is discussed below with regards to the East Anglia ONE North windfarm site. This information has then been used to inform the impact assessment for the construction, operation and maintenance and decommissioning phases. The marine traffic assessment undertaken within the NRA (***Appendix 14.2***) has been used to inform the impact assessment with regards to the offshore cable corridor.

14.6.1.1.1 Baseline Routeing

76. A total of 13 main routes were identified from the marine traffic survey data. Full details of the base case routes are presented in ***section 14*** of the NRA ***(Appendix 14.2)***, with a summary of each presented in ***Table 14.9*** of this chapter.

77. Of these 13 routes, there are four routes that would require deviation as a result of the East Anglia ONE North windfarm site. These are as follows (further details are provided in the NRA, (***Appendix 14.2)***):

- Route 7: consists of cargo vessels and tankers and used by approximately two vessels per day, between Humber and Antwerp;
- Route 10: consists of cargo vessels and tankers and used by approximately one vessel per day, between Tees and Zeebrugge;
- Route 11: consists of cargo vessels and used by approximately one vessel per day between the Dover Strait and the West Friesland TSS; and

- Route 13: consists of cargo vessels and used by less than one vessel per day between Ipswich and the Off Vlieland TSS.

78. There was concern raised during consultation with CoS (see ***Appendix 14.1***) on choke points in traffic particularly entering and leaving Harwich and Felixstowe. The hazard workshop also identified that the East Anglia ONE North windfarm site may displace established commercial vessel routes and established commercial vessel adverse weather routeing.

14.6.1.1.2Future Case Routeing

79. ***Appendix 14.2*** presents the anticipated re- routes for the routes potentially impacted by the East Anglia ONE North windfarm site during all phases of the proposed East Anglia ONE North project. The increase in route distances for vessels displaced by the windfarm would be minimised by the promulgation of information (including charting) which would enable vessels to passage plan in advance of encountering the East Anglia ONE North windfarm site.

80. The East Anglia ONE North windfarm site will be charted throughout all phases and during periods of construction and maintenance, ongoing activities would be promulgated through Notice to Mariners, Kingfisher Information Service-Offshore Renewable Cable Awareness (KIS-ORCA) and other standard methods of communication to ensure that vessel Masters are able to effectively passage plan to minimise deviations and avoid current areas of activity.

14.6.1.1.3Adverse Weather

81. Any impacts on adverse weather routeing in the southern North Sea are expected to be low due to the East Anglia ONE North windfarm site. The hazard workshop (see ***section 20*** of the NRA, ***Appendix 14.2***) identified that there may be displacement of commercial vessels on established adverse weather routes but that the frequency of occurrence would be low given the small percentage of adverse weather experienced throughout a year.

82. Following consultation, information on commercial vessel routeing was provided by DFDS Seaways. Based on this information a validation of the routeing was undertaken using one year of AIS data (2017) (see *section 12.9* of ***Appendix 14.2***). Resultant of this assessment limited numbers of vessels with a destination of Felixstowe and Rotterdam were recorded on adverse weather routes intersecting the East Anglia ONE North windfarm site. These vessel tracks were recorded during the winter period therefore are assumed to be deviations due to adverse weather conditions (weather data was not assessed).

83. Other commercial ferries, in order to minimise passenger discomfort, often route on coastal courses during adverse weather and are not anticipated to be

impacted (given there is ample sea room inshore of the East Anglia ONE North windfarm site for navigation).

84. In order to mitigate the effects of adverse weather there is ample safe sea room for vessels to safely route in adverse weather without significantly increasing time or deviation distance.

14.6.1.2 Offshore Cable Corridor

85. Marine traffic assessment undertaken within the NRA (***Appendix 14.2***) showed regular routed commercial traffic crossing the offshore cable corridor.

14.6.1.3 Construction Phase

86. During the construction phase, the presence of structures, to the use of temporary construction safety zones and the buoyed construction area means that there is a potential for routes to be deviated around areas of construction.

87. Maximum deviations during the construction phase would be associated with the buoyed construction area. The location and size of the buoyed construction area would be defined by TH post consent / pre construction depending on the final layout. However, the final buoyed area would extend approximately 500m beyond the final layout. The buoyed construction area would be agreed with TH prior to deployment and is therefore assumed to be designed to minimise impacts on commercial vessel routeing. The worst case assumes that a buoyed construction area would be in place for the entire offshore construction period (approximately 27 months).

88. However, the buoyed construction area would not preclude vessels from entering the East Anglia ONE North windfarm site. Access to vessels through areas currently not being installed (which would be indicated by 500m safety zones around structures where active construction was underway or 50m around pre-commissioned structures) would be maintained, allowing greater freedom of movement through the East Anglia ONE North windfarm site. Experience at other UK windfarms shows that generally commercial vessels are likely to avoid the buoyed construction area but smaller vessels such as recreational craft and commercial fishing vessels may seek to transit though.

89. Effective promulgation of information (as per ***section 14.3.3***) would allow vessels to effectively plan their passage to ensure there would not be significant impacts on routeing during the construction phase.

90. Impacts during construction are predicted to be frequent based on the possibility that multiple deviations to multiple routes would occur. However, it is predicted that there would be no measurable negative consequence to commercial vessels. The impact has therefore been classed as **Tolerable and ALARP** (due to high frequency but low consequence), noting that promulgation

of information would enable the vessel Masters to effectively passage plan to minimise disruption.

14.6.1.3.1 Offshore Cable Corridor

91. Cable installation vessels may displace commercial vessels within the offshore cable corridor. However, due to the minimum safe passing distances (around Restricted in Ability to Manoeuvre (RAM) installation vessel(s)) being of a small surface area (likely 1,000m or less) and that installation vessels will be changing location as the cable is installed, there would be no perceptible impact on a vessel overall route noting embedded mitigation such as COLREGS (IMO, 1972) which details navigational scenarios involving RAM vessels.

14.6.1.4 Operation and Maintenance Phase

92. As noted in ***section 14.6.1.1.1***, the presence of the East Anglia ONE North windfarm site is likely to result in displacement for four main routes. A revised vessel routeing pattern following the construction of the East Anglia ONE North project has been estimated based on the vessel baseline assessment. For the purposes of this assessment a worst case 1nm passing distance (mean of the route) for routes displaced by the East Anglia ONE North windfarm site has been used. Re routeing has been undertaken giving consideration to known projects and routeing measures as well as the vessels' final destination port in section 15 of ***Appendix 14.2***.

93. Alongside the vessels main route any adverse weather route deviations are considered to be minor and remote (limited variation over the operation life) and therefore with consideration for embedded mitigations there are not expected to be any residual impacts for commercial vessel routeing during operation and maintenance.

94. The severity of consequence is considered to be negligible and the frequency of effect is considered to be remote given the limited potential for restrictions on navigation. The impact has therefore been classed as **broadly acceptable** for navigational safety during transit.

14.6.1.4.1 Offshore Cable Corridor

95. Given the cable will be buried and / or protected during the operational phase there are no perceptible impacts on commercial vessel routeing.

14.6.1.5 Decommissioning Phase

14.6.1.5.1 East Anglia ONE North Windfarm Site

96. As per the construction phase the use of temporary safety zones during decommissioning means there is potential for routes to be deviated around larger areas of decommissioning activity. Again, this impact could be mitigated

with effective promulgation of information to allow vessels to passage plan and avoid current areas of activity.

97. Given the familiarity with the development the severity of consequence is considered to be negligible and the frequency of effect is considered to be remote given the limited potential for restrictions on navigation. The impact has therefore been classed as **broadly acceptable** for navigational safety during transit.

14.6.1.5.2 Offshore Cable Corridor

98. Following decommissioning, offshore export cables would be left *in situ* however if they were to be removed, it is anticipated that the offshore cable corridor would create a negligible displacement during decommissioning (an anticipated safe passing distance around RAM installation vessel(s)). Any impacts on commercial vessels are therefore expected to be equal to or less than the construction phase.

14.6.2 Impact 2: Impact on Commercial Vessel Safe Navigation

14.6.2.1 East Anglia ONE North Windfarm Site

99. The following assesses the impact of the East Anglia ONE North windfarm site on commercial vessel safe navigation, as part of this assessment the following scenarios have been considered as part of the NRA (***Appendix 14.2***) process:

- Base case traffic levels without windfarm;
- Base case traffic levels with windfarm;
- Future case traffic levels without windfarm (assumes a 10% increase in traffic); and
- Future case traffic levels with windfarm (assumes a 10% increase in traffic).

100. As discussed in ***section 14.6.1.1.1*** there are four routes requiring deviation during the construction, operation and decommissioning of the East Anglia ONE North windfarm site. Some of these routes are dense traffic routes with the busiest route recording an average of ten vessels per day (the base case routes are presented in *section 14* of ***Appendix 14.2***). Following assessment of marine traffic data and feedback from consultation there is potential for hot spots of increased encounters or collision risk created however embedded mitigation in place should manage increased traffic levels and encounters between commercial vessels and third party vessels.

14.6.2.1.1 Increased Encounters and Collision Risk

101. As part of the modelling undertaken in the NRA (***Appendix 14.2***), an assessment of vessel to vessel encounters has been carried out by replaying at high speed the AIS and Radar data collected for the East Anglia ONE North

windfarm site. The assessment showed encounter levels to be most prominent north of the site, largely due to the busy route identified between Humber and Rotterdam (Route 5 in ***Table 14.9***). the majority of vessels involved in encounters were cargo vessels and tankers, which accounted for 44% and 38% respectively during winter and 48% and 32% respectively during summer of vessel encounter traffic. Encounters within the site mostly consisted of cargo vessels (44% in winter and 19% in summer), tankers (35% in winter and 8% in summer), recreational vessels (62% in summer) and fishing vessels (15% in winter).

102. Modelling was also undertaken for increased vessel to vessel collision risk by using the baseline routeing and encounter levels in the area as input to Anatec's CollRisk model suite, the full results of which can be found in the NRA (***Appendix 14.2*** (***section 17*** and ***section 18***)). The change in potential vessel to vessel collision frequency due to the East Anglia ONE North windfarm site was estimated to rise from one collision per 19 years pre windfarm, to one every 18 years post wind farm.

103. Embedded mitigations and good practice such as continuous compliance with COLREGs including conduct of vessel in restricted visibility, following safe speed principles and compliance for the 'give way' rules, would be complied with.

14.6.2.1.2Additional Allision Risk

104. Commercial vessels would have the potential to allide with structures associated with the East Anglia ONE North windfarm site. Modelling was undertaken for vessel allision risk following revised routeing (assuming operational and maintenance phase), the full results of which can be found in ***Appendix 14.2*** (***section 18***). Two allision scenarios were modelled, powered allision frequency and drifting allision frequency. A powered allision is the scenario whereby a vessel allides with a structure under power. A drifting vessel allision is the scenario whereby a vessel allides with a structure while not under command (NUC) due to propulsion failure.

105. It was estimated that a vessel would allide with a structure within the East Anglia ONE North windfarm site whilst under power once every 141 years (assuming no increase in baseline traffic levels). Drifting allision risk was less significant, with one incident estimated per 395 years (assuming no increase in baseline traffic levels). For powered allisions, the majority of the risk was to the structures on the western boundary of the East Anglia ONE North windfarm site, while for drifting allisions the majority of the risk was to the structures on the northern boundary. In both cases there was only a limited contribution from the DWR traffic to the east.

106. A full review of the collision and allision modelling results can be found in sections 17 and 18 of the NRA (***Appendix 14.2***).

14.6.2.1.3 Anchoring

107. Anchoring activity was recorded to the west of the East Anglia ONE North windfarm site. This activity was all from tankers, and it is considered likely that the activity was associated with the designated ship to ship transfer area off Southwold. None of the tankers anchored within 5nm of the East Anglia ONE North windfarm site.

108. "Waiting" manoeuvres from tankers was also recorded, including within the East Anglia ONE North windfarm site, however these manoeuvres do not require anchor to be deployed (though they serve a similar purpose to anchoring).

14.6.2.2 Offshore Cable Corridor

109. The anchoring activity from tankers discussed in ***section 14.6.2.2*** above (for the East Anglia ONE North windfarm site) was also reflected within the offshore cable corridor assessment, and it is noted that tankers were observed to anchor within the offshore cable corridor itself.

14.6.2.3 Construction Phase

14.6.2.3.1 East Anglia ONE North Windfarm Site

110. The presence of pre commissioned and commissioned structures could create additional allision risk and result in the displacement of commercial vessels and activities within the shipping and navigation study area and therefore increased encounters and vessel to vessel collision risk (including to / from vessels associated with the construction and installation of East Anglia ONE North).

111. During the construction phase it is estimated that up to 74 vessels could be used to construct the worst case scenario of 67 wind turbines most of which would remain within the construction area for extended periods and therefore reduce the potential for interaction with third party vessels. In total there are estimated to be 3,335 vessel trips during the construction phase.

112. All construction vessel movements will be managed by a Marine Coordinator who will ensure that construction traffic does not interact with third party vessels. No specific ports have currently been identified for use as a construction base. However, it is noted that construction and decommissioning vessels would be in contact with local vessel traffic services to aid traffic management on the approaches to a port.

14.6.2.3.1.1 Increased Encounters and Collision Risk

113. When considering experience at other constructing windfarms it is identified that commercial vessels do consider Notice to Mariners during passage planning and avoid current areas of construction. There has not been any recorded

incident within the buoyed construction area of a UK windfarm whereby a third party vessel has collided with a construction vessel. It is also likely in reality that vessels would pass clear of the edge of the buoyed construction area, meaning that, given the sea room, the number of hot spots where vessels would be likely to meet would be reduced, thus lowering the risk of encounter.

114. The frequency of potential collisions would be reduced by additional mitigation including the development, implementation and operation of works vessel coordination. This could include the development of construction corridors and / or entry and exit points for support craft to ensure that they are effectively managed and are not displaced into areas used by commercial vessels.

14.6.2.3.1.2 Additional Allision Risk

115. It is assumed that through effective promulgation of information, passing commercial vessels would be aware of the ongoing construction and operational maintenance, and would passage plan in advance. The temporary lighting and marking in place during construction would also provide an indication to passing vessels of the allision hazard, and guard vessels would be deployed where required to protect sensitive areas of construction. It is considered extremely unlikely that a commercial vessel would deliberately enter the buoyed construction area and approach ongoing construction operations, and any allision scenario is therefore likely to be due to human error or machinery failure.

116. The severity of consequence from the East Anglia ONE North windfarm site is considered to be moderate given the potential for damage to vessels. The frequency of effect is considered to be extremely unlikely given that mitigations are in place to manage the risk of collision and allision. Experience in windfarm construction for developers, their contractors and the vessel operators is now extensive, with a number of operational windfarms having been constructed within dense shipping and project areas. Consequently, standard mitigation measures, as outlined in embedded mitigation ***section 14.3.3***, are tried and tested within the industry

117. The impact has therefore been classed as **broadly acceptable** for navigational safety during transit.

14.6.2.3.2Offshore Cable Corridor

118. The presence of vessels associated with laying the offshore cables may slightly increase the risk of a collision or an encounter due to displacement however this impact would be temporary and limited to a small geographical area surrounding the installation activity. It is assumed that partially buried cables would be marked and guarded until protection was implemented as required to ensure they do not present a risk to anchoring vessels. Therefore, the impact is

considered to have no perceptible effect (with embedded mitigation such as COLREGs, promulgation of information and minimum safe passing distances and in place).

14.6.2.4 Operation and Maintenance Phase

14.6.2.4.1 East Anglia ONE North Windfarm Site

119. The presence of structures could result in the displacement of commercial vessels and activities could increase encounters, increased vessel to vessel collision and additional allision.

14.6.2.4.1.1 Increased Encounters and Collision Risk

120. During the operational phase, it is estimated that there will be a maximum of 647 windfarm vessel round trips per annum. The presence of these vessels creates a potential collision risk, however, the risk is reduced from the construction phase, when the number of vessel trips is estimated to be 3,335.

121. During the operational phase there is the potential for increased collision risk due to displacement of the four main routes mentioned previously. Displacement of vessels on these routes may create hot spots for potential encounters or collision by being displaced into areas used by other vessels such as recreational craft and commercial fishing vessels, encounters and collision modelling results are shown in sections 17 and 18 of the NRA (***Appendix 14.2***) and are considered to be **tolerable** and within ALARP parameters.

14.6.2.4.1.2 Additional Allision

122. Allision impact to commercial vessels would also directly arise from the presence of structures within the East Anglia ONE North windfarm site. This would continue throughout the operational lifetime of the East Anglia ONE North project as whilst the structures are in place, there is potential for an allision to occur. Allision modelling results are shown in ***section 18*** of the NRA (***Appendix 14.2***) and are considered to be within ALARP parameters.

123. The residual risk for commercial vessels safe navigation could be reduced by additional mitigation including works vessel coordination as defined in ***section 14.3.3***, but also consultation and consideration of the final site design including cable burial and the locations of larger offshore structures.

124. Additional aids to navigation such as buoyage could be required, following consultation with TH and MCA, to aid the displacement of traffic and prevent the creation of a high risk crossing point.

125. With regards to mitigation of drifting vessels the array is located an acceptable distance from the identified main routes to allow vessels that are NUC to take action to prevent allision with structures (i.e. by undertaking an emergency

anchor), however the Applicant would also ensure that their emergency response plan would include additional consideration for a response to vessels NUC. Its own construction, support and service vessels would include responses to this type of emergency situations within their own documented safety systems.

126. Given the largely sandy nature of the East Anglia ONE North windfarm site (see ***Chapter 9 Benthic Ecology***) it is anticipated that the majority of inter-array and platform link cables would be able to be buried in the sea bed. However, to conduct a precautionary assessment, it is estimated that up to 10% of the length of these cables may require cable protection (when burial is not possible due to ground conditions). Cables will also be required to be protected at crossings for which a conservative allowance of up to 25 for inter-array and 49 for platform link cables (see ***Chapter 6 Project Description***) has been assessed. Where protection is required, the assessment has been carried out in line with a number of factors, including marine traffic data, to ensure it does not present a risk to anchoring, emergency anchoring or under keel clearance.

127. It is also assumed that inter-array and platform cables would be effectively monitored through the lifetime of the project mitigating any potential hazards to vessels and navigation.

128. The severity of consequence from the East Anglia ONE North windfarm site is considered to be moderate given the potential for damage to vessels, the frequency of effect is considered to be similar to that of the construction phase given the location of the development and the reduced active monitoring during the operation phase. The impact is therefore considered to be remote. Standard mitigation measures, as outlined in embedded mitigation ***section 14.3.3*** will also be in place for the operational life of the East Anglia ONE North project.

129. Therefore, the impact is expected to be **tolerable** and ALARP with embedded mitigation in place (i.e. sympathetic site design and marking).

14.6.2.4.2Offshore Cable Corridor

130. Given the largely sandy nature of the offshore cable corridor (see ***Chapter 9 Benthic Ecology***) it is anticipated that the majority of the export cable would be able to be buried in the sea bed. However, to conduct a precautionary assessment, it is estimated that up to 5% of the length of export cable may require cable protection (when burial is not possible due to ground conditions). Cables will also be required to be protected at crossings for which a conservative allowance of up to 34 (see ***Chapter 6 Project Description***) has been assessed. Where protection is required, the assessment has been carried out in line with a number of factors, including marine traffic data, to ensure it

does not present a risk to anchoring, emergency anchoring or under keel clearance.

131. It is also assumed that export cables would be effectively monitored through the lifetime of the project to ensure they do not present a hazard to vessels and navigation.

132. However, given the operational life of the windfarm and the density of shipping passing over the offshore cable corridor there is potential for a vessel to anchor drag in adverse weather or be required to anchor in an emergency. The frequency of this is still considered to be extremely unlikely with the mitigations in place with the consequence ranked as minor given the potential for damage to the vessel anchor and / or the cables. The impact has therefore been classed as **broadly acceptable** for navigational safety during transit.

14.6.2.5 Decommissioning Phase

14.6.2.5.1 East Anglia ONE North Windfarm Site

133. Like the construction phase, during the decommissioning phase there is expected to be an increase in vessels on site and in the vicinity of the East Anglia ONE North windfarm site. This has potential to lead to an increase in vessel to vessel encounters as well as the potential for increased allision associated with the development's own vessels. No specific ports have been identified for use as a decommissioning base. It is noted that decommissioning vessels would be in contact with local vessel traffic services to aid traffic management on the approaches to a port, and commercial vessels would, again, be familiar with the East Anglia ONE North windfarm site. As there are no details on the decommissioning plan this impact cannot be fully assessed however considering a negligible frequency and a moderate consequence the impact is considered to be **broadly acceptable**.

14.6.2.5.2 Offshore Cable Corridor

134. Given that the vessel activity associated with the offshore cable corridor would be temporary and limited to a small spatial area (i.e. RAM vessel and minimum safe passing distance) any impact on commercial vessels is not considered to have a perceptible effect with regards to commercial vessel navigation safety.

14.6.3 Impact 3: Impact on Commercial Fishing Vessels (In Transit)

14.6.3.1 East Anglia ONE North Windfarm Site

135. As noted in the existing environment (***section 14.5***) an average of two fishing vessels per day were recorded within the shipping and navigation study area during summer, rising to four per day in winter. Active fishing was observed during both periods, including within the East Anglia ONE North windfarm site during winter (but not summer). It should be considered that increased construction vessel activity at the East Anglia ONE windfarm site may have

displaced fishing activity during the summer survey (which may explain the lower fishing vessel numbers in summer), however seasonal variations may have also factored.

136. Given the levels of fishing vessel traffic recorded within the East Anglia ONE North windfarm site during the marine traffic surveys and embedded mitigation (including guard vessels and marine traffic coordination) the risk of collision is expected to be less than that for commercial vessels.

14.6.3.1.1 Increased Encounter, Collision Risk and Additional Allision Risk

137. There is the potential for a commercial fishing vessel to allide with a structure within the East Anglia ONE North windfarm site during any phase of the project. Fishing vessels may choose to transit through the array during the construction and operation and maintenance phases (outside of active safety zones), and it is likely that this may be preferable to utilising the areas frequented by commercial vessels notably during the operations and maintenance phase. There is also potential that commercial vessels may be displaced into fishing areas, however embedded mitigations should ensure that there is not increased risk with regards to encounters and collision.

138. Based on the fishing allision assessment undertaken in the NRA (***Appendix 14.2***), it was estimated that a commercial fishing vessel would allide with a structure within the East Anglia ONE North windfarm site once every 9 years (assuming no mitigation). This value is based on the assumption that levels of fishing activity within the East Anglia ONE North windfarm site would remain consistent with the baseline activity. It should also be considered that this estimation assumes that all vessels are in transit. In reality, any allision incident would be likely to occur whilst engaged in fishing activity (should a fishing vessel have its gear deployed it may have reduced mobility compared to a transiting vessel, and would therefore have less scope for initiating avoidance manoeuvres when on an allision course). Consequently, any allision incident would likely occur at slow speed and with low energy. It is also noted that during the operation and maintenance phase vessels are likely to be more familiar with the structures within the East Anglia ONE North windfarm site (for example locations programmed into fish plotter) and therefore the frequency of allision would be lower than during the construction phase.

139. Consultation has been undertaken with the commercial fishing industry and is reported in ***Chapter 13 Commercial Fisheries***, which considers commercial fishing displacement. There were no significant comments during consultation in relation to commercial fishing vessels in transit as per ***Appendix 14.1.***

14.6.3.2 Offshore Cable Corridor

140. Active fishing was observed as occurring within the offshore cable corridor, both coastally and towards its furthest extent offshore. The majority of the central section of corridor was crossed by vessels that appeared to be in transit, rather than engaged in fishing (based on their behaviour).

141. Given that there are no surface piercing structures within the corridor, there is no associated allision risk to commercial fishing vessels.

142. ***Chapter 13 Commercial Fisheries*** considers commercial fishing gear snagging associated with the offshore cable corridor.

14.6.3.3 Construction Phase

14.6.3.3.1 East Anglia ONE North Windfarm Site

143. As noted in ***section 14.6.3.3.1*** during the construction phase and due to the use of temporary construction safety zones, there is potential for commercial fishing vessels to be displaced around or away from areas of construction.

144. From a navigational safety perspective, commercial fishing vessels would be able to transit through the buoyed construction area during construction using the embedded mitigation of promulgation of information to note areas of current construction activity. Given the smaller size of commercial fishing vessels transiting through the area (compared to commercial vessels) and their ability to navigate through the buoyed construction area, the frequency of deviations and re-routeing (of vessels in transit) is expected to be lower than that of commercial vessels.

145. Construction vessels pose a collision risk to commercial fishing vessels transiting through the buoyed construction area, noting that some such construction vessels would have RAM[1] status. However, given that such vessels are likely to be within the confines of a safety zone when engaged in construction works, and guard vessels will also be utilised, such a collision scenario is considered unlikely.

146. Standard mitigation measures, as outlined in embedded mitigation ***section 14.3.3***, are tried and tested within the industry.

147. The severity of consequence is considered to be minor given the limited potential for damage to vessels and the frequency of effect is considered to be remote given the proximity to the coast and the number of potential transits.

[1] RAM vessels are those restricted in their ability to manoeuvre (defined by COLREGS), as a result of the nature of the work they are undertaking (i.e. underwater survey or installation operations) they are unable to take avoiding action.

The impact has therefore been classed as **broadly acceptable** for commercial fishing vessel navigational safety during transit.

148. It should be noted that there is also potential for snagging of commercial fishing vessel gear on partially constructed structures and / or cables however this impact has been discussed within ***Chapter 13 Commercial Fisheries*** along with displacement from commercial fishing grounds.

14.6.3.3.2Offshore Cable Corridor

149. The presence of vessels associated with laying the offshore cables may slightly increase the risk of a collision or an encounter due to displacement however this impact would be temporary and limited to a small geographical area surrounding the installation activity. It is assumed that partially buried cables would be marked and guarded until protection was installed as required to ensure they do not present a risk to anchoring fishing vessels; particularly to smaller fishing vessels where snagging may lead to a loss of stability. Therefore, the impact is considered to have no perceptible effect with embedded mitigation such as COLREGs, promulgation of information and minimum safe passing distances in place.

14.6.3.4 Operation and Maintenance Phase

14.6.3.4.1East Anglia ONE North Windfarm Site

150. The presence of structures could result in the displacement of commercial fishing vessels in transit from the East Anglia ONE North windfarm site. Therefore, increased encounters and vessel to vessel collision risk may be experienced including with vessels engaged in operation and maintenance activities (anticipated maximum of 647 vessel round trips of associated support craft). However, as noted with the construction phase impact, the commercial fishing vessels are not anticipated to be excluded from the East Anglia ONE North windfarm site therefore reducing the likelihood of encounters and collision risk due to displacement; given impact mitigations (including maintenance safety zones and promulgation of information) encounters with operational vessels are also expected to be a low frequency event.

151. The main impact on commercial fishing vessels during the operational phase from a shipping and navigation perspective would be allision with a windfarm structure within the East Anglia ONE North windfarm site. There is the potential that fishing vessels may get close to turbines (whilst fishing) and any potential under keel allision risks would need to be effectively mitigated (i.e., through additional marking). Modelling results are detailed in ***section 18*** of the NRA (***Appendix 14.2***).

152. The impact on vessels transiting through the site to fishing grounds can be considered similar to other transiting vessels such as commercial vessels.

However, it is noted that due to the smaller size of commercial fishing vessels and the spacing between the structures, there is the likelihood that commercial fishing vessels would choose to navigate through the East Anglia ONE North windfarm site. The decision to do so lies with the Master of the vessel who would be responsible for assessing the risks associated with navigating in proximity to and through a windfarm. This decision is likely to be based on weather and sea conditions and the type and size of vessel.

153. Commercial fishing vessels exiting the East Anglia ONE North windfarm after transiting through the windfarm array have the potential to encounter commercial vessels and recreational craft navigating outside the array thus increasing the likelihood of encounters and collision risk, particularly for fishing vessels exiting the windfarm to the east given the presence of the DWR.

154. There would be some risk associated with collision or encounter with a service or support vessel working within the East Anglia ONE North windfarm site as some commercial fishing vessels may choose to transit through the site. It is estimated that there will be a maximum of 647 vessel round trips per annum associated with operation and maintenance. However, when compared to the number of vessel trips during construction (3,335), the risk is reduced.

155. The severity of consequence is considered to be minor given the limited potential for damage and the frequency of effect is considered to be remote (noting minor allisions with no notable consequence may be more frequent). The impact has therefore been classed as **broadly acceptable** with embedded mitigations for commercial fishing vessels during transit.

14.6.3.4.2 Offshore Cable Corridor

156. Anchoring is considered to be a low frequency event within the offshore cable corridor given that no fishing anchoring activity was recorded during the marine traffic surveys.

157. As with commercial vessels, anchoring impacts are expected to be mitigated by effective cable burial and protection. The impact is considered to have no perceptible effect with embedded mitigation in place.

158. The potential for snagging of commercial fishing vessel gear on cables has been discussed within ***Chapter 13 Commercial Fisheries***.

14.6.3.5 Decommissioning Phase

14.6.3.5.1 East Anglia ONE North Windfarm Site

159. Similar to the construction phase, during the decommissioning phase there is expected to be an increase in vessels in and around the East Anglia ONE North windfarm site. This has potential to lead to an increase in vessel to vessel encounters for commercial fishing vessel as well as the potential for increased

allision risk. No specific ports have been identified for use as a decommissioning base. It is noted that decommissioning vessels would be in contact with local vessel traffic services to aid traffic management on the approaches to a port and that commercial fishing vessels would again be familiar with the development. Impacts are predicted to be equal to or no greater than construction and therefore are considered to be **broadly acceptable**.

14.6.3.5.2 Offshore Cable Corridor

160. It is assumed that the offshore export cables will be removed during decommissioning rather than left in situ. Given that the offshore cable corridor decommissioning would be limited in size of decommissioning activity (i.e. RAM vessel and minimum safe passing distance) any impact on commercial fishing vessels is not considered to be equal to or less than the construction phase.

14.6.4 Impact 4: Impact on Recreational Craft

14.6.4.1 East Anglia ONE North Windfarm Site

161. For the purpose of this assessment vessels between 2.5 to 24m length (and not operating on a commercial basis) were identified as recreational. Approximately six recreational vessels per day were recorded during the summer survey, with the majority of these being sailing vessels. Activity was much lower in winter, with only one vessel recorded over the 14 days. It should be considered that the winter survey was AIS only, however it is considered unlikely that non-AIS recreational traffic levels would be notable during winter.

162. An overview plot of the recreational sailing activity and facilities in the area from the UK Coastal Atlas of Recreational Sailing (RYA 2016), relative to the East Anglia ONE North windfarm site, is presented in *Figure 14-4*.

163. Given that the high levels of recreational traffic recorded during the summer marine traffic survey are considered to be seasonal, and noting that the transit line they take is non-routine, the risk of collision is expected to be less than that for commercial vessels, assuming embedded mitigation is in place (including guard vessels and marine traffic coordination).

14.6.4.2 Construction Phase

14.6.4.2.1 East Anglia ONE North Windfarm Site

164. As with consideration of commercial vessels there would be some risk associated with service or support vessels transiting in the area. During construction, it is anticipated that the presence of the buoyed construction area (containing the active construction work and safety zones) would displace the existing recreational activity from within the East Anglia ONE North windfarm site. Due to their small vessel size, there is potential for recreational craft to transit through the buoyed construction area therefore increasing collision risk

with construction vessels. However, experience at other UK windfarm projects shows that recreational craft would transit within buoyed construction areas where no current activity is occurring, meaning that recreational craft should stay out with areas used by construction vessels.

165. Construction safety zones may displace traffic temporarily for the construction phase and would be managed through effective promulgation of information and active safety measures. Therefore, the impact on recreational vessel transits throughout the construction period would not differ greatly.

166. The physical presence of pre commissioned structures would create a vessel to structure allision risk for a recreational craft navigating within the East Anglia ONE North windfarm site. It is noted that during the construction phase, the final lighting and marking of the structures may not yet have been implemented.

167. It is expected that the majority of recreational activity would avoid the buoyed construction area altogether and promulgation of information would ensure recreational users are well informed of the East Anglia ONE North windfarm site. Embedded mitigation would ensure that recreational users are aware of ongoing construction activities (including current safety zones) although some recreational craft may still enter the buoyed construction area including accidentally. If a recreational vessel were to enter into the buoyed construction area a guard vessel (or other vessels on site) would inform the vessel of the ongoing works.

168. Experience in windfarm construction for developers, their contractors and the vessel operators is now extensive, with a number of operational windfarms having been constructed within dense shipping and project areas. Consequently, standard mitigation measures, as outlined in embedded mitigation ***section 14.3.3***, are tried and tested within the industry.

169. The severity of consequence is considered to be minor due to most likely scenario being displacement rather than any increased allision or collision risk and the frequency of effect is considered to be remote given the number of recreational vessels noted within the summer months but their adaptability to the site. The impact has therefore been classed as **broadly acceptable** for navigational safety during transit.

14.6.4.2.2Offshore Cable Corridor

170. Given that the offshore cable corridor would create negligible displacement during installation (an anticipated safe passing distance around RAM installation vessel(s)); any impact on recreational vessels is not considered to have a perceptible effect with regards to displacement.

14.6.4.3 Operation and Maintenance Phase

14.6.4.3.1 East Anglia ONE North Windfarm Site

171. The physical presence of structures could result in the displacement of recreational craft within the shipping and navigation study area and therefore increased encounters and vessel to vessel collision risk. However, as noted with recreational craft displacement, vessels are not anticipated to be excluded from the East Anglia ONE North windfarm site therefore reducing the likelihood of collision risk or encounter due to displacement.

172. The main impact on recreational craft during the operational phase would be the potential loss of recreational routes due to the presence of the East Anglia ONE North windfarm site. The RYA Coastal Atlas (RYA, 2016) indicates that offshore routes pass in close proximity north and south of the East Anglia ONE North windfarm site. However, recreational craft should be able to transit between the wind turbines in suitable conditions as well as route around the East Anglia ONE North windfarm site if preferable. It is noted that there are factors that would influence a Vessel Masters decision (including recreational sailors) to navigate through, around or avoid a windfarm and that the choice is influenced by a number of factors including the vessels characteristics, the weather and sea condition.

173. It is assumed that in adverse weather and during winter, limited recreational activity would be present within the shipping and navigation study area (an assumption supported by the findings of the marine traffic survey data assessment).

174. Similar to commercial fishing vessels, recreational craft exiting the East Anglia ONE North windfarm site after transiting through the windfarm array have the potential to encounter commercial vessels and commercial fishing vessels thus increasing the likelihood of encounters and collision risk. In particular it should be considered that vessels exiting the eastern boundary of the East Anglia ONE North windfarm site will be facing the DWR.

175. There would be some risk associated with collision or encounter with a service or support vessel working within the East Anglia ONE North windfarm site as some recreational craft may choose to transit through the site. It is estimated that there will be a maximum of 647 vessel round trips per annum associated with operation and maintenance. However, when compared to the number of vessel trips during construction (3,335), the risk is reduced.

176. Due to the physical presence of structures, there is the potential risk of recreational craft allision with a windfarm structure within the East Anglia ONE North windfarm site should a recreational craft choose to transit through the array. However, any allision is likely to be of low speed and energy due to the

smaller sizes of recreational craft compared to commercial vessels therefore a relatively low risk to crew and levels of pollution resulting from the allision.

177. Minimum row spacing of 800m between wind turbines should allow adequate sea room for recreational craft to navigate through the East Anglia ONE North windfarm site. It is noted that there are factors that would influence a mariner's decision (including recreational sailors) to navigate through, around or avoid a windfarm such as the vessels characteristics, the weather and sea conditions. The recreational sailor is likely to take due consideration for the weather conditions and passage plan accordingly to ensure safe passage. During the winter survey (November and December 2017), only one recreational craft was recorded within the shipping and navigation study area suggesting that recreational craft are unlikely to transit the area in poor weather conditions.

178. The air clearance between wind turbines rotors and sea level at MHWS would not be less than 22m, as per MGN 543 and RYA guidance therefore minimising the risk of interaction between rotor blades and yacht masts of a recreational craft transiting through the East Anglia ONE North windfarm site.

179. The severity of consequence is considered to be minor given the limited potential for damage (lower speed allision) and the frequency of effect is considered to be remote. The impact has therefore been classed as **broadly acceptable** for navigational safety during transit.

14.6.4.4 Decommissioning Phase

14.6.4.4.1 East Anglia ONE North Windfarm Site

180. Like the construction phase, during the decommissioning phase an increase in vessels in and around the East Anglia ONE North windfarm site is expected. This has potential to lead to an increase in vessel to vessel encounters as well as the potential for increased allision associated with the decommissioning vessels. No specific ports have been identified for use as a decommissioning base. It is noted that decommissioning vessels would be in contact with local vessel traffic services to aid traffic management on the approaches to a port, and that recreational vessels would again be familiar with the East Anglia ONE North windfarm site. Impacts are predicted to be equal to or no greater than construction and therefore are considered to be **broadly acceptable**.

14.6.4.4.2 Offshore Cable Corridor

181. It is assumed that the offshore export cables will be removed during decommissioning (the worst case) rather than left in-situ. Given that the spatial extent of decommissioning work associated with the offshore cable corridor would be temporary and limited in size (i.e. RAM vessel and minimum safe passing distance) any impact on recreational vessels is considered to be equal to or less than that of the construction phase.

14.6.5 Impact 5: Impact on Emergency Response Capability

14.6.5.1 East Anglia ONE North Windfarm Site and Offshore Cable Corridor

182. Under national and international law, the operators of East Anglia ONE North windfarm site would be required to comply with existing emergency response requirements, as detailed in ***Appendix 14.2***, as well as giving consideration to other response groups within the area. Owing to the increased level of activity in and around the East Anglia ONE North windfarm site there are expected to be some increased demands on SAR facilities within the area. The vessels working within the East Anglia ONE North windfarm site would also increase traffic and activity to a level that self-help emergency response would be required and consideration in the ERCoP should be given to what resources would be needed to provide a level of response that would ensure that response time and resources are not impacted.

14.6.5.2 Construction Phase

14.6.5.2.1 East Anglia ONE North Windfarm Site and Offshore Cable Corridor

183. Construction within the East Anglia ONE North offshore development area, including the increased presence of vessels and personnel within the area may increase the risk of an incident occurring, and therefore may diminish the overall ability of emergency responders, including pollution response. The total number of vessel movements for construction is predicted to be 3,335. The construction period is anticipated to last approximately 27 months.

184. Embedded mitigation includes compliance with MGN 543 and the development of an ERCoP. The operator would comply with the requirements of MGN 543 including Annex 4 'Safety and mitigation measures recommended to OREIs during construction, operation and decommissioning' and Annex 5 SAR and emergency response matters'.

185. The ERCoP would include the following but may also consider site specific parameters:

- Facilitation of SAR Responders (helicopters);
- Place of safe refuge;
- Remote monitoring and control; and
- Marking and lighting.

186. The severity of consequence is considered moderate given the level and type of activity on site and the frequency of effect is considered to be Extremely Unlikely given the mitigations in place i.e. marine coordination. The impact has therefore been classed as **broadly acceptable** for impacts on emergency response capability.

14.6.5.3 Operation and Maintenance Phase

14.6.5.3.1 East Anglia ONE North Windfarm Site and Offshore Cable Corridor

187. As with the construction phase, impacts during the operational and maintenance phase would put increased requirement on emergency response due to an increased presence of vessels and personnel within the area which may increase the risk of an incident. However, as the number of annual vessel round trips is lower (than during the construction phase) at 647, the frequency is reduced from that of the construction phase.

188. Due to the reduction in activity on site compared to the construction phase, the frequency of effect is reduced to negligible and the severity of consequence is considered to be minor (typically lower risk activities) resulting in the impact considered to be **broadly acceptable**.

14.6.5.4 Decommissioning Phase

14.6.5.4.1 East Anglia ONE North Windfarm Site and Offshore Cable Corridor

189. Given the limited information of the decommissioning activity and the likely UK resources available at the time of writing it is not possible to effectively assess the impact on emergency response ability; however it is expected to be similar to that of the construction phase.

14.6.6 Decommissioning Plan

190. A Decommissioning Plan in line with standard requirements would be developed.

191. It is expected that decommissioning will require the removal of wind turbines, offshore platforms, foundations and some of the buried cables. Other buried cables would be de-rated and left in situ, and would be notified to UKHO to remain on navigation charts.

14.7 Cumulative Impacts

14.7.1 Impact Screening

192. Each impact receptor assessed for the East Anglia ONE North windfarm site in isolation (see ***section 14.5.4***) has been screened for the potential of cumulative impact (with other projects / marine activities) above that already assessed within the project-only case. The corresponding impacts which have been screened in on a cumulative basis are then assessed and ranked as per the FSA process detailed in ***section14.3.3***.

193. The cumulative impact screening process is summarised in ***Table 14.10***.

Table 14.10 Receptor Screening – Cumulative Assessment

Receptor	Potential for Cumulative Impact	Rationale
Construction, Operation and Maintenance and Decommissioning		
Commercial vessel routeing	Yes	• The consideration of multiple projects may result in larger deviations than if the project is considered in isolation. This was raised as an issue during consultation; and • No cumulative impacts were identified for the offshore cable due to the limited area of installation and as during the operation phase there would not be any surface infrastructure requiring deviation.
Commercial vessel safe navigation	Yes	• Given the potential for increased deviations, there may be an increased collision risk when multiple projects are considered. Furthermore, allision risk would increase when cumulative projects are considered due to the increase in the number of structures; and • No cumulative impacts were identified for the offshore cable due to the limited area of installation and as during the operation phase there would not be any surface infrastructure requiring deviation and any potential for anchor dragging would be isolated.
Commercial fishing vessels	No	• Given that fishing vessels are able to enter into the East Anglia ONE North windfarm site, no additional cumulative displacement impact has been identified. Allision and collision risks are not considered to be perceptibly higher than for the East Anglia ONE North windfarm site in isolation given that interaction with more than one project is limited; and • No cumulative impacts were identified for the offshore cable due to the limited area of installation and as during the operation phase there would not be any surface infrastructure requiring deviation.
Recreational craft	No	• Given that recreational vessels are able to enter into the East Anglia ONE North windfarm site, no additional cumulative displacement impact has been identified. Allision and collision risks are not considered to be perceptibly higher than for the East Anglia ONE North windfarm site isolation given that interaction with more than one project is limited; and • No cumulative impacts were identified for the offshore cable due to the limited area of installation and as during the operation phase there would not be any surface infrastructure

Receptor	Potential for Cumulative Impact	Rationale
		requiring deviation.
Emergency response capabilities	No	• Given baseline incident levels, the consideration of multiple projects is not anticipated to have a perceptible effect on emergency response capabilities with embedded mitigations in place, i.e. marine traffic coordination and onsite vessels able to assist; and • No cumulative impacts were identified for the offshore cable due to the limited area of installation and as during the operation phase there would not be any surface infrastructure requiring deviation.

14.7.2 Project and Third Party Activity Screening

14.7.2.1 Other Wind Farms

194. ***Table 14.11*** presents the projects that are deemed to have a cumulative effect. These have also been presented in ***Figure 14.5.*** Due to the national and international nature of shipping, impacts on vessel routeing can occur a significant distance from the project being assessed. Therefore, the cumulative list for shipping and navigation includes all constructed, consented or planned wind farms within the southern North Sea that could cumulatively influence a vessel's navigational routeing. ***Appendix 14.4*** presents the list of all projects within 100nm considered for the CIA.

195. In order to assess the cumulative issues arising from the projects within the other Round Three zones in the southern North Sea (the former East Anglia Zone, former Hornsea Zone and Dogger Bank Zone) the three windfarm developers undertook a joint report as part of the Southern North Sea Offshore Wind Forum (SNSOWF) in 2013 (Anatec 2013). Cumulative routeing has primarily been assessed based on the outputs of this work.

196. It should be noted that any projects with a currently dormant status, or which are still classed as development zones, have not been included within the cumulative screening.

14.7.2.2 Oil and Gas Installations

197. Given the limited spatial extent of oil and gas platforms, and noting there are no nearby surface installations, there is not considered to be any cumulative routeing impacts and therefore collision risk associated with existing gas installations in the southern North Sea. Further details of Southern North Sea oil and gas infrastructure are provided in the NRA (***Appendix 14.2***).

198. Should any future surface gas developments be applied for within the gas fields within the area they would be subject to their own navigational risk assessments including at a cumulative level.

14.7.2.3 Port Activities

199. Given that the East Anglia ONE North windfarm site is out with the operational area or harbour limits of any ports, harbours or marinas there are not considered to be any cumulative impacts associated with the construction, operation and maintenance or decommissioning phases. Routeing to and from ports is considered in ***section 14.5.4*** (offshore development area, in isolation) and ***section 14.7*** (cumulatively).

14.7.2.4 Third Party Marine Activities

200. A number of marine activities were scoped out of the assessment with regards to vessel movement as these were considered to be part of the baseline for vessel traffic. This includes traffic associated with marine aggregate extraction areas, fishing activity and recreational craft transits.

14.7.2.5 Summary of Projects

201. ***Table 14.11*** details the projects that have been included within the cumulative assessment.

Table 14.11 Summary of Projects Included for the CIA in Relation to Shipping and Navigation

Project	Status	Distance from East Anglia ONE North windfarm site (nm)	Rationale
UK Wind Farms			
East Anglia ONE	Under construction	1	Cumulatively affects a route that has also been displaced by East Anglia ONE North windfarm site.
East Anglia TWO	Application submitted	5	
East Anglia THREE	Pre-construction	8	
Galloper	Fully commissioned	21	
Hornsea Project One	Under construction	83	
Hornsea Project Three	In determination	78	
Hornsea Project Two	Pre-construction	87	
Norfolk Boreas	In examination	27	
Norfolk Vanguard	In determination	21	
Triton Knoll	Pre Consent	75	
EU Wind Farms			

Project	Status	Distance from East Anglia ONE North windfarm site (nm)	Rationale
Ijmuiden Ver Development Zone	Development Zone	26	Route intersects Development Zone. Authorised windfarm boundaries unavailable and so routes deviated around entire Development Zone.
Hollande Kust West Development Zone	Development Zone	35	

14.7.3 Potential Cumulative Impacts

14.7.3.1 Commercial Vessel Routeing

202. Likely cumulative rerouting has been assessed within the NRA (***Appendix 14***). The assessment assumed that commercial vessels would be required to deviate due to the East Anglia ONE North windfarm site, and at least one of the other projects considered cumulatively, as listed in ***Table 14.11***.

14.7.3.1.1 East Anglia ONE North Windfarm Site

203. The key projects from a cumulative routeing perspective are East Anglia ONE directly to the south, East Anglia TWO to the southwest, and East Anglia THREE to the northeast. A natural gap forms between the East Anglia ONE North windfarm site and East Anglia TWO windfarm site and East Anglia ONE windfarm sites. It is anticipated that routes associated with Zeebrugge will utilise this gap, namely Routes 6, 11, and 12 as per ***Table 14.9***.

204. Similarly, the gap between the East Anglia ONE North and East Anglia THREE windfarm sites is anticipated to be utilised by vessels using certain routes associated with Rotterdam and Antwerp, namely Routes 5 and 7 as per ***Table 14.9***. It is noted that the likely deviation of Route 7 will also result in it utilising the DR1 Lightbuoy DWR.

205. Routes 12 and 13 are anticipated to deviate south of the East Anglia ONE windfarm site. These routes are both associated with TSS's to the north east.

206. Hornsea Project One, Hornsea Project Two and Hornsea Project Three are approximately 85nm north of the East Anglia ONE North windfarm site and are therefore located near the northern extent of the 100nm buffer considered for the CIA. Vessels displaced due to Hornsea Projects would transit the gap between Hornsea Project One and Hornsea Project Two and Hornsea Project Three, and would then likely join the DR1 Lightbuoy DWR, encompassed by the Norfolk Vanguard and Norfolk Boreas sites.

14.7.3.1.1.1 Adverse Weather

207. Impacts on adverse weather routeing in the southern North Sea may occur due to the combined presence of the East Anglia ONE North windfarm site, the East Anglia ONE windfarm site and East Anglia TWO windfarm site.

208. Following consultation, information on commercial vessel routeing was provided by DFDS Seaways. Based on this information a validation of the routeing was undertaken using one year of AIS data (2017) (see section 12.9 of ***Appendix 14.2***). Resultant of this assessment limited numbers of vessels with a destination of Felixstowe and Rotterdam were recorded on adverse weather routes intersecting the East Anglia ONE North windfarm site. These vessel tracks were recorded during the winter period therefore are assumed to be deviations due to adverse weather conditions (weather data was not assessed). Vessels with a destination of Immingham and Rotterdam were also recorded transiting through the East Anglia ONE windfarm site, East Anglia ONE North windfarm site and the East Anglia TWO windfarm site. These are also assumed to due to adverse weather conditions.

14.7.3.1.2Construction

209. Due to the required deviations, the cumulative impact of displacement is considered to be greater than that assessed for the East Anglia ONE North windfarm site in isolation during the construction phase. Overall, the frequency of displacement is considered to be frequent and the severity of consequence negligible resulting in this cumulative impact considered being **tolerable and ALARP**.

14.7.3.1.3Operation and Maintenance

210. Due to the required deviations, the cumulative impact of displacement is considered to be greater than that assessed for the East Anglia ONE North windfarm site in isolation during the operation and maintenance phase. Overall, the frequency of displacement is considered to be reasonably probable and the severity of consequence negligible, resulting in this cumulative impact considered to be **broadly acceptable**.

14.7.3.1.4Decommissioning

211. Decommissioning impacts are anticipated to be similar or less than those of construction activities, given the familiarity of commercial vessel operators with the development. However, given that decommissioning schedules are not available for any project it is not possible to rank that impact at this time.

14.7.3.2 Commercial Vessel Safe Navigation

14.7.3.2.1 East Anglia ONE North Windfarm Site

14.7.3.2.1.1 Collision Risk

212. The areas of highest collision risk (on a cumulative basis) are anticipated to be the gaps between the East Anglia ONE North and East Anglia TWO windfarm sites, and between the East Anglia ONE North and East Anglia THREE windfarm sites. Based on the vessel numbers estimated for the routes that will deviate into these gaps, it is anticipated that 15-20 vessels per day will pass between East Anglia ONE North and East Anglia TWO, with 20-25 vessels per day passing between East Anglia ONE North and East Anglia THREE. Collision risk is also likely to rise within the DR1 Lightbuoy DWR.

213. Due to the distance of other cumulative projects from the East Anglia ONE North project, there is not anticipated to be any significant associated increase in collision risk.

14.7.3.2.1.2 Allision Risk

214. Following assessment of the cumulative routeing it has been identified that the development of the East Anglia ONE windfarm site, East Anglia ONE North windfarm site, East Anglia TWO windfarm site and East Anglia THREE windfarm site has the potential to cumulatively impact upon navigational transits and thus to cumulatively increase vessel to structure allision risk. Cumulative allision is considered to affect vessels transiting within the cumulative study area that are not able to easily adapt to new routeing due to availability of sea room.

215. Cumulative lighting shall be considered in order to minimise any potential effects and avoid confusion from a proliferation of aids to navigation in a high density development of turbines. The mariner would use significant peripheral structures (SPS) lights (similar to entering a port) to navigate with, including fixing their position. Following agreement on the final layout post consent, the Applicant will identify aids to navigation, in consultation with TH, which are most appropriate.

216. A straight line edge will be maintained with the DR1 Lightbuoy DWR to the east (i.e., no isolated turbines), with a consistent one nautical mile separation. This will ensure consistency with East Anglia ONE to the south, and reduce allision risk to vessels within the DWR.

217. Due to the distance of other cumulative projects from the East Anglia ONE North windfarm site, there is not anticipated to be increased cumulative allision risk arising from these projects.

14.7.3.2.2Construction

218. During construction of the East Anglia ONE North windfarm site, collision risk would be highest in areas of maximum displacement due to buoyed construction areas. Commercial vessels would be allowed to transit through these areas where installation is not currently taking place; however this can increase the likelihood of encounters and therefore collision risk with construction vessels. It is likely that during construction the East Anglia TWO windfarm site may also be under construction while the East Anglia ONE windfarm site, Galloper Offshore Wind Farm and Greater Gabbard Offshore Wind Farm would be operational. The combined presence of construction vessels associated with the East Anglia ONE North offshore development area and the East Anglia TWO offshore development area presents a higher collision risk than the East Anglia ONE North offshore development area in isolation.

219. Allision risk would be highest in areas with partially constructed or deconstructed structures. It is likely that during construction, the East Anglia TWO windfarm site may also be under construction while the East Anglia ONE windfarm site, Galloper Offshore Wind Farm and Greater Gabbard Offshore Wind Farm would be operational. This combined presence of multiple partially constructed structures with operational structures presents a higher allision risk than the East Anglia ONE North windfarm site in isolation. Post consent discussions would include consideration of cumulative lighting effects, consideration of directly adjacent wind farm boundaries and alignment of wind turbines (in conjunction with TH) to ensure that differing design envelopes do not adversely affect shipping and navigation.

220. The impact as a whole is considered to be of moderate consequence given the increased collision risk and the potential for damage to be caused to vessels in the event of an allision and the reasonably probable frequency of occurrence. Therefore, the impact is expected to be **tolerable and ALARP** with mitigations in place (i.e. marine coordination).

14.7.3.2.3Operation and Maintenance

221. During operation of the East Anglia ONE North project, collision risk would be increased due to the displacement of commercial vessel routes. From a shipping and navigation perspective, the gaps formed between the East Anglia ONE North windfarm site and the East Anglia TWO windfarm site, and the East Anglia ONE North and East Anglia THREE windfarm sites would present the areas of highest collision risk.

222. Allision risk during operation would be due to the presence of operational structures. It is likely that both the East Anglia ONE North windfarm site and East Anglia TWO windfarm site would also be operational and therefore the gap

formed would present the area of highest allision risk due to a narrow sea area bordered by multiple structures.

223. Post consent discussions would include consideration of cumulative lighting effect, consideration of directly adjacent wind farm boundaries and alignment of wind turbines (in conjunction with TH and the MCA) to ensure that differing design envelopes do not adversely affect shipping and navigation.

224. The impact as a whole is considered to be of moderate consequence given the potential for increased collision risk and the potential for damage to be caused to vessels in the event of an allision and the extremely unlikely frequency of occurrence given the familiarity with the sites. Therefore, the impact is expected to be **broadly acceptable**.

14.7.3.2.4Decommissioning

225. Significance of decommissioning impacts are anticipated to be similar or less than that of construction activities, given the familiarity with the development. However, given that decommissioning schedules are not available for any project it is not possible to rank the impact at this time.

14.8 Transboundary Impacts

226. This section considers the potential transboundary impacts associated with international offshore renewable projects. Transboundary impacts for shipping and navigation receptors include vessels routeing from the UK to the Netherlands, Belgium, and Germany that may be impacted by projects within both UK waters and transboundary waters. Given the international nature of shipping this is covered by the cumulative routeing impact discussed in ***section 14.7.3.1***.

14.9 Inter-relationships

227. The following section identifies potential inter-relationships associated with shipping and navigation and other identified effects associated with the development of the East Anglia ONE North project. It should be noted that shipping and navigation as a receptor contains a number of marine activities that are both transient in the form of a navigating vessel as well as localised in terms of their activity, e.g. fishing vessels in transit and fishing vessels engaged in fishing. This chapter has already considered these receptors in their navigational (or transient) state and ***Table 14.12*** highlights any additional interrelationships with their localised activities.

Table 14.12 Shipping and Navigation Inter-relationships

Topic and Description	Related Chapter	Where Addressed in this Chapter
Increased collision risk for	***Chapter 13 Commercial***	Impacts on the navigational

Topic and Description	Related Chapter	Where Addressed in this Chapter
fishing vessels engaged in fishing	***Fisheries***	safety of fishing vessels are considered in ***section 14.6.3***. All navigational safety impacts are considered ALARP.
Increased snagging risk for fishing vessels engaged in fishing	***Chapter 13 Commercial Fisheries***	Navigational safety impacts for vessels in transit have already been considered within this chapter; impacts on gear snagging (which could affect their navigational status) have been considered within ***Chapter 13 Commercial Fisheries*.**

14.10 Summary

228. Following consideration of the outputs of the hazard workshop, desk based assessments and modelling ***Table 14.13*** presents a summary of the identified residual impacts and mitigations with regards to the East Anglia ONE North windfarm site.

Table 14.13 Potential Impacts Identified for Shipping and Navigation and the East Anglia ONE North Windfarm Site

Potential Impact	Consequence	Frequency	Mitigation	Residual Impact
Construction				
Commercial vessel routeing	Negligible	Reasonable Probable	n/a	**Broadly Acceptable**
Commercial vessel safe navigation	Moderate	Remote	n/a	**Tolerable and ALARP**
Commercial fishing vessels	Minor	Remote	n/a	**Broadly Acceptable**
Recreational craft	Minor	Remote	n/a	**Broadly Acceptable**
Emergency response capability	Moderate	extremely Unlikely	n/a	**Broadly Acceptable**
Operation				
Commercial vessel routeing	Negligible	Remote	n/a	**Broadly Acceptable**
Commercial vessel safe navigation	Moderate	Remote	n/a	**Tolerable and ALARP**
Commercial fishing vessels	Minor	Remote	n/a	**Broadly**

Potential Impact	Consequence	Frequency	Mitigation	Residual Impact
				Acceptable
Recreational craft	Minor	Remote	n/a	**Broadly Acceptable**
Emergency response capability	Minor	Negligible	n/a	**Broadly Acceptable**
Decommissioning				
Commercial vessel routeing	Negligible	Remote	n/a	**Broadly Acceptable**
Commercial vessel safe navigation	Moderate	Negligible	n/a	**Broadly Acceptable**
Commercial fishing vessels	Minor	Negligible	n/a	**Broadly Acceptable**
Recreational craft	Minor	Negligible	n/a	**Broadly Acceptable**
Emergency response capability	n/a	n/a	n/a	**n/a**

229. ***Table 14.14*** presents a summary of the identified residual impacts and mitigations with regards to the offshore cable corridor.

Table 14.14 Potential Impacts Identified for Shipping and Navigation and the Offshore Cable Corridor

Potential Impact	Consequence	Frequency	Mitigation	Residual Impact
Construction				
Commercial vessel routeing	n/a	n/a	n/a	**No Perceptible Effect**
Commercial vessel safe navigation	n/a	n/a	n/a	**No Perceptible Effect**
Commercial fishing vessels	n/a	n/a	n/a	**No Perceptible Effect**
Recreational craft	n/a	n/a	n/a	**No Perceptible Effect**
Emergency response capability	See impact on windfarm site			
Operation				
Commercial vessel routeing	n/a	n/a	n/a	**No Perceptible**

Potential Impact	Consequence	Frequency	Mitigation	Residual Impact
				Effect
Commercial vessel safe navigation	Minor	Extremely Unlikely	n/a	**Broadly Acceptable**
Commercial fishing vessels	n/a	n/a	n/a	**No Perceptible Effect**
Recreational craft	n/a	n/a	n/a	**No Perceptible Effect**
Emergency response capability	See impact on windfarm site			
Decommissioning				
Commercial vessel routeing	n/a	n/a	n/a	No Perceptible Effect
Commercial vessel safe navigation	n/a	n/a	n/a	No Perceptible Effect
Commercial fishing vessels	n/a	n/a	n/a	**No Perceptible Effect**
Recreational craft	n/a	n/a	n/a	**No Perceptible Effect**
Emergency response capability	See impact on windfarm site			

230. The potential cumulative impacts are summarised in ***Table 14.15.***

Table 14.15 Potential Cumulative Impacts Identified for Shipping and Navigation

Potential Impact	Consequence	Frequency	Mitigation	Residual Impact
Construction				
Commercial vessel routeing	Negligible	Frequent	n/a	**Tolerable and ALARP**
Commercial vessel safe navigation	Moderate	Reasonably Probable	n/a	**Tolerable and ALARP**
Operation and Maintenance				
Commercial vessel routeing	Negligible	Reasonably Probable	n/a	**Broadly Acceptable**
Commercial vessel safe navigation	Moderate	extremely Unlikely	n/a	**Broadly Acceptable**

Potential Impact	Consequence	Frequency	Mitigation	Residual Impact
Decommissioning				
Commercial vessel routeing	n/a	n/a	n/a	**n/a**
Commercial vessel safe navigation	n/a	n/a	n/a	**n/a**

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