East Anglia
Offshore Wind

VATTENFALL

SCOTTISHPOWER
RENEWABLES

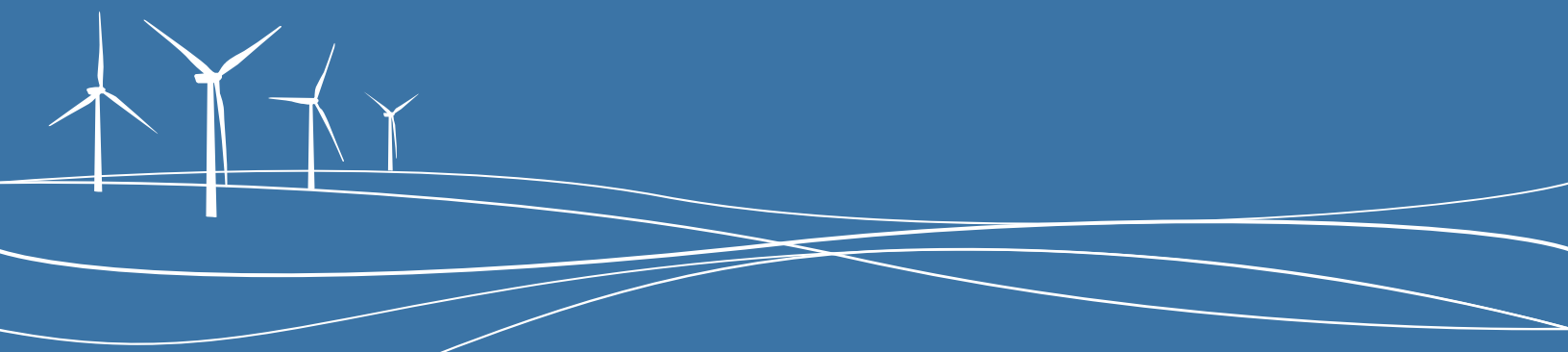
East Anglia THREE

Chapter 15

Shipping & Navigation

Environmental Statement
Volume 1
Document Reference – 6.1.15

Author – Anatec Limited
East Anglia THREE Limited
Date – November 2015
Revision History – Revision A



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Appendix number	Title
15.1	Navigational Risk Assessment (NRA).

The following abbreviations are used with this chapter.

Abbreviation	Meaning
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
ALB	All Weather Lifeboat
ARPA	Automatic Radar Plotting Aid
BMAPA	British Marine Aggregates Producers Association
CA	Cruising Association
COLREGs	International Regulations for Preventing Collisions at Sea
DECC	Department of Energy and Climate Change
DWR	Deep Water Route
ERCoP	Emergency Response and Cooperation Plan
FSA	Formal Safety Assessment
GIS	Geographical Information System
GT	Gross Tonnage
HSE	Health and Safety Executive
IALA	International Association of Lighthouse Authorities
ILB	Inshore Life Boat
IMO	International Maritime Organisation
m	Metres
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MEHRA	Marine Environmental High Risk Area
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
MOD	Ministry of Defence
MMO	Marine Management Organisation
MW	Mega Watt
nm	Nautical Miles (1 nautical mile=1,852 metres)

Abbreviation	Meaning
NOREL	Nautical Offshore Renewable Energy Liaison committee
NPS	National Policy Statement
NRA	Navigational Risk Assessment
NSIP	Nationally Significant Infrastructure Project
NUC	Not Under Command
OREI	Offshore Renewable Energy Installation
PEIR	Preliminary Environmental Information Report
PEXA	Practice and Exercise Area
RNLI	Royal National Lifeboat Institute
Ro-Ro	Roll on Roll off
RYA	Royal Yachting Association
SAR	Search and Rescue
SNSOWF	Southern North Sea Offshore Wind Farm Forum
SOLAS	Safety of Life at Sea
TCE	The Crown Estate
THLS	Trinity House Lighthouse Service
TSS	Traffic Separation Scheme
UKC	Under Keel Clearance
UKHO	United Kingdom Hydrographic Office
VHF	Very High Frequency

15 SHIPPING AND NAVIGATION

15.1 Introduction

1. This chapter summarises the work undertaken by Anatec Limited (hereby referred to as Anatec) as part of the Navigational Risk Assessment (NRA) to identify the existing vessel activity and navigational features in the vicinity of the proposed East Anglia THREE project for construction, operation and maintenance and decommissioning phases. The shipping and navigation chapter considers all vessels navigating within the waters in proximity to the area of the East Anglia THREE site including recreational craft, commercial ferries, commercial traffic, commercial fishing vessels, marine aggregate vessels, military vessel transits and emergency response activities.

2. The following chapter should be read in conjunction with *Appendix 15.1*, which is the NRA (Anatec 2015) and its associated annexes.

3. The NRA principally follows the Department of Energy and Climate Change (DECC) Risk Assessment Methodology and the Maritime and Coastguard Agency's (MCA) Marine Guidance Note 371 (MGN 371) including any subsequent updates approved by the Nautical and Offshore Renewable Energy Liaison (NOREL) committee.

4. Due to the specific methodology the NRA follows, shipping and navigation as a receptor has been assessed within this chapter under a different methodology to that used within other chapters of this Environmental Statement (ES). The methodology however is similar, centred on risk management and requiring a submission that shows that sufficient controls are, or would be, in place for the assessed risk to be reduced to As Low as Reasonably Practicable (ALARP).

5. The assessment of potential risks and impacts on shipping and navigation has been made with specific reference to the relevant National Policy Statements (NPS). These are discussed in further detail in section 15.4.1.

15.2 Consultation

6. The following section presents consultation responses in relation to shipping and navigation for the proposed East Anglia THREE project received through the

scoping process and other consultation undertaken with relevant stakeholders, including that undertaken for East Anglia ONE.

7. In addition to the consultation listed below, a meeting was held with the Southern North Sea Offshore Wind Farm (SNSOWF) group to discuss shipping and navigation however no points of concern for this chapter were discussed.

8. Following updates to the construction approach (inclusion of phasing, as summarised in Section 15.3.3) attendees of the hazard workshop were given the opportunity to re-evaluate the hazard log. Further details of the feedback received are provided in section 22 of appendix 15.1.

9. All vessel operators who regularly transit the East Anglia THREE site, as highlighted in section 15.4.2, have been contacted to discuss the project.

Table 15.1. Consultation Responses

Consultee	Date / Document	Comment	Response / where addressed in the ES
Consultation with relevant stakeholders (East Anglia ONE)			
MCA		i. Due cognisance needs to address cable burial and protection, particularly close to shore where impacts on navigable water depth may become significant. ii. Existing charted anchorage areas should be avoided. ii. It is imperative that international trade routes remain fully open and unrestricted. Any mitigation measures required must ensure that routes are not compromised. v. The potential volume of shipping that could be anchored off Southwold should be noted. It should be noted that a number of ship-to-ship incidents have been previously reported but not formally recorded. v. Many more drifting vessel incidents occur offshore than are formally reported, the realistic risk of a drifting ship allision can be assumed to be far greater than that presented. While the risk of hitting one wind turbine remains small the risk of hitting one wind turbine within a group is clearly greater, the developer will need to ensure this is addressed within its emergency response plans. vi. Coastguard Agreement on Salvage & Towing (CAST) is a tool the MCA has which may	i. Section 15.3.5 summarises embedded mitigations including cable burial and protection. Any resultant reduction in navigable water depth would be consulted on and marked with aids to navigation where necessary. ii. Section 15.5.1 summarises environmental baseline data including charted anchorage areas in proximity to the proposed East Anglia THREE project. iii. Section 15.6.2 assesses the impact of the East Anglia THREE site on commercial vessel routeing. Section 15.7 assesses cumulative effects. iv. Section 15.5.1 summarises environmental baseline data including anchoring activity in proximity to the offshore cable corridor, off Southwold. v. Noted and will be considered throughout development of the Emergency Response and Cooperation Plan (ERCoP). vi. Section 15.3.5 summarises embedded mitigations including EATL's commitment to emergency salvage and towing. It should be noted that EATL would attempt to provide salvage and towage, where immediate assistance is

Consultee	Date / Document	Comment	Response / where addressed in the ES
		be invoked in situations where there is significant risk of major pollution to the UK Pollution Control Zone (it is not something that the developer can request). CAST should not be considered by the developer as its first line of defence.	necessary, within the limits of its own vessel and crew capabilities.
Trinity House Lighthouse Services (THLS)		i. Should the required export cable burial depth not be reached, careful consideration and consultation should be given to identify the best way forward. If cable protection is required and deemed to be a hazard to navigation by Trinity House, this will need to be permanently marked with aids to navigation for as long as the danger exists.	i. Section 15.3.5 summarises embedded mitigation measures including cable burial and protection. Any resultant reduction in navigable water depth would be consulted on and marked with aids to navigation where necessary.
Royal Yachting Association (RYA)		i. The approaches to the intended cable landfall area off Bawdsey Cliff and the area for at least a mile out to the sea is seldom deeper than 6m below Chart Datum. The inshore route and general sailing area is popular with recreational boaters on this part of the coast. The RYA would therefore object to any cable protection measures that reduce the current charted depth of water in this area	i. Section 15.3.5 summarises embedded mitigation measures including cable burial and protection. Any resultant reduction in navigable water depth would be consulted on and marked with aids to navigation where necessary.
Nautical and Offshore Renewable Energy Liaison navigation sub-group (NOREL)	May 2011	i. Discussed the safety of shipping within the southern North Sea.	i. Noted and considered throughout section 15.6.1- Impacts on commercial vessel safe navigation.

Consultee	Date / Document	Comment	Response / where addressed in the ES
THLS, MCA, Department for Transport (DfT), SMart Wind & Forewind.	October 2011	i. Discussed transboundary issues and cumulative impacts across the North Sea.	i. Noted and considered throughout section 15.7 (cumulative impacts) and section 15.8 (transboundary impacts).
Forewind, SMart Wind & Maritime Transport – Belgian Federal Public service Mobility & Transport	November 2011	i. Discussed transboundary issues and cumulative impacts across the North Sea. EATL clarified that there should be no real impact to Belgian shipping by the proposed developments.	i. Noted and considered throughout section 15.7 (cumulative impacts) and section 15.8 (transboundary impacts).
Forewind, SMart Wind & Rijkswaterstaat	November 2011	i. Discussed transboundary issues and cumulative impacts across the North Sea.	i. Noted and considered throughout section 15.7 (cumulative impacts) and section 15.8 (transboundary impacts).
Forewind, SMart Wind & the German BMVBS and WSD.	January 2012	i. Discussed transboundary issues and cumulative impacts across the North Sea.	i. Noted and considered throughout section 15.7 (cumulative impacts) and section 15.8 (transboundary impacts).
Forewind, SMart Wind, MCA, DfT & Minister for Shipping.	January 2012	i. Discussed transboundary issues and cumulative impacts across the North Sea and emergency response and port development.	i. Noted and considered throughout section 15.6.5 (impact of port operations), section 15.6.6 (impact on emergency response), section 15.7 (cumulative impacts) and section 15.8 (transboundary impacts).
Scoping opinion (East Anglia THREE)			
THLS	December 2012	i. The possible cumulative and in-combination effects on shipping routes and patterns should be fully assessed.	i. Sections 15.7, 15.8 and 15.9 assess cumulative, transboundary and in-combination effects on vessel routeing

Consultee	Date / Document	Comment	Response / where addressed in the ES
			respectively.
MCA	December 2012	i. Particular consideration will need to be given to the implications of the site size and location on search and rescue (SAR) resources, and emergency Response & Co-operation Plans (ERCoP) and Guard Vessel provisions.	i. Section 15.6.6 assesses the impact on emergency response provision.
Consultation with relevant stakeholders (East Anglia THREE)			
CLdN (formerly Cobelfret)	January 2014	i. Main concern was additional fuel cost from rerouteing of ferries, rather than any safety concerns regarding the placement of wind turbines, or construction or operation and maintenance vessels.	i. Section 15.6.2 assesses the impact on commercial vessel routeing.
DFDS Ferries	February 2014 (Hazard Workshop)	i. Ferry routeing is well represented by the marine traffic survey data. ii. Due to the implementation of low sulphur fuel requirements (beginning 2015), it is possible existing (longer) routes could be removed. ii. Vessel collision / allision with a windfarm structure were identified as greatest concern. However, the four engine configuration of most ferries minimised the likelihood of a ferry drifting and alliding with a windfarm structure. v. Indicated a preference for inclusion of electronic aids to navigation to mark windfarm. v. Stated that adverse weather routeing is crucial for this area and loss of adverse weather routes could be problematic. vi. Raised concerns over the	i. Section 15.5.3 summarises maritime traffic surveys carried out and section 15.5.4 summarises commercial shipping operating in proximity to the East Anglia THREE site. ii. Noted. iii. Section 15.6.1 assesses the impact on commercial vessel safe navigation, including the risk of vessel collision / allision with a windfarm structure. iv. Section 15.3.5 summarises embedded mitigations including the requirement of aids to navigation. v. Section 15.6.2 assesses the impact on commercial vessel routeing, including consideration for adverse weather routeing (see paragraph 142).

Consultee	Date / Document	Comment	Response / where addressed in the ES
		impact of ancillary windfarm support craft on normal ferry operations i.e. the need for a passing ferry to respond to an incident involving a windfarm support vessel.	vi. Noted.
P&O Ferries	February 2014 (Hazard Workshop)	i. Ferry routeing is well represented by the marine traffic survey data. ii. It is likely that P&O vessels would route further north of current route when passing East Anglia THREE during periods of reduced visibility. iii. Vessel collision / allision with a windfarm structure were identified as greatest concern. iv. Indicated a preference for inclusion of electronic aids to navigation to mark windfarm. v. Stated that adverse weather routeing is crucial for this area and loss of adverse weather routes could be problematic.	i. Section 15.5.3 summarises maritime traffic surveys carried out and section 15.5.4 summarises commercial shipping operating in proximity to the East Anglia THREE site. ii. Noted and considered throughout section 15.6.1- Impacts on commercial vessel safe navigation. iii. Section 15.6.1 assesses the impact on commercial vessel safe navigation, including the risk of vessel collision / allision with a windfarm structure. iv. Section 15.3.5 summarises embedded mitigations including the requirement of aids to navigation. v. Section 15.6.2 assesses the impact on commercial vessel routeing, including consideration for adverse weather routeing (see paragraph 140).
Hanson Marine Aggregates	February 2014 (Hazard Workshop)	i. No concerns regarding the potential impact of East Anglia THREE on current active dredge regions. ii. No concerns regarding the risk of an emergency anchoring situation. ii. Forecasts that dredging activity in the area will be operational	i. Noted. ii. Noted. iii. Section 15.7.3 assesses the impact of cumulative offshore windfarm developments on vessel routeing. iv. Section 15.6.2 assesses the

Consultee	Date / Document	Comment	Response / where addressed in the ES
		for up to 25 years and due to increasing demand for coarse material, has significant potential to increase and therefore future vessel routeing should be considered. v. Satisfied that the current zonal scenario (East Anglia ONE, East Anglia THREE and East Anglia FOUR) was satisfactory and did not significantly impact upon dredge operations, including routeing. However, the loss of adverse weather routes and future cumulative impacts, following further zonal development, were of concern.	impact on commercial (including dredgers) adverse weather vessel routeing (see paragraph 140). It should be noted that development of the East Anglia Zone beyond East Anglia ONE and East Anglia THREE has not been considered throughout this assessment. East Anglia FOUR was previously considered throughout the hazard workshop. However East Anglia FOUR has not been included in the cumulative assessment as little is known about the project at this stage.
Royal National Lifeboat Institute (RNLI)	February 2014 (Hazard Workshop)	i. Adequate marking of wind turbines (coding and lettering) was identified to be of high importance. ii. Primary emergency response is much more likely to be by helicopter given distance offshore and likely response time of lifeboat. ii. Main concern was the creation of 'choke points' on the landward side of East Anglia THREE due to increases in construction traffic.	i. Section 15.3.5 summarises embedded mitigations including the marking of wind turbines. ii. Noted and considered throughout assessment of impact on emergency response provision (section 15.6.6). iii. Noted and considered throughout assessment of impact on commercial vessel safe navigation (section 15.6.1).
Brown & May Marine Ltd.	February 2014 (Hazard Workshop)	i. Indicated that fishing vessel gear snagging on windfarm structures would be a potential problem. ii. Highlighted the importance of ensuring final wind turbine layout is orientated with the dominant tide direction. ii. Highlighted usefulness of	i. Impacts associated with fishing activity are considered in *Chapter* 14-Commercial Fisheries. ii. Noted and will be considered throughout final layout design.

Consultee	Date / Document	Comment	Response / where addressed in the ES
		providing input data (locations of windfarm structures and cables) for fishing vessel 'plotters' as potential mitigation. iv. If deemed necessary, use of 50m safety zones during operational phase were supported. v. Stated that the likelihood of vessel-to-vessel collisions occurring within East Anglia THREE was low.	iii. Noted. iv. Noted. v. Noted and considered throughout assessment of impact on fishing vessel safe navigation (section 15.6.3).
Rederscentrale (Belgian Fisheries)	February 2014 (Hazard Workshop)	i. Stated that rock dumping as a form of cable protection is not a preferential method. ii. Highlighted usefulness of providing input data (locations of windfarm structures and cables) for fishing vessel 'plotters' as potential mitigation. ii. If deemed necessary, use of 50m safety zones during operational phase were supported. v. Stated that the likelihood of vessel-to-vessel collisions occurring within East Anglia THREE was low. Stated that larger spacing between wind turbines would lower the risk.	i. Noted. ii. Noted. iii. Noted. iv. Noted and considered throughout assessment of impact on fishing vessel safe navigation (section 15.6.3).
VisNed (Netherlands Fisheries)	February 2014 (Hazard Workshop)	i. Highlighted the need for adequate cable burial or protection given the stochastic nature of the seabed and typical penetration depths (20cm) of beam trawling. ii. Highlighted usefulness of providing input data (locations of windfarm structures and cables) for fishing vessel	i. Section 15.3.5 summarises embedded mitigations including cable burial or protection. ii. Noted. iii. Noted. iv. Noted and considered throughout assessment of impact on fishing vessel

Consultee	Date / Document	Comment	Response / where addressed in the ES
		'plotters' as potential mitigation. ii. If deemed necessary, use of 50m safety zones during operational phase were supported. iv. Stated that the likelihood of vessel-to-vessel collisions occurring within East Anglia THREE was low with fishermen likely to be more alert whilst fishing within East Anglia THREE.	safe navigations (section 15.6.3).
Cruising Association	February 2014 (Hazard Workshop)	i. Raised concerns on the potential for increased vessel-to-vessel encounters following construction of East Anglia THREE, including potential consequences of a large vessel encountering recreational craft and the risk of a recreational vessel-to-vessel collision occurring within East Anglia THREE. However it was agreed that the likelihood of such an event was low. ii. Stated that current mitigation measures were sufficient to adequately reduce the risk to recreational craft. iii. Requested that cable protection methods ensure 'no humps' over the cable route in depths of less than 10m.	i. Section 15.6.4 summarises the assessment of impacts on recreational vessels including the potential for increased vessel-to-vessel encounters and recreational vessel-to-vessel collision risk. ii. Section 15.3.5 summarises embedded mitigation measures. iii. Noted.
Preliminary Environmental Response (East Anglia THREE)			
Rijkswaterstaat Zee en Delta	July 2014 (S42 Response)	i. Stated concerns regarding the risk related to shipping movements south of East Anglia THREE. Stated that the situation on the southern boundary of East Anglia THREE is unlikely to	i. Section 15.6.1 assesses the impact on commercial vessel safe navigation, including the risk of vessel collision / allision with a windfarm structure. Section 15.10 summarises

Consultee	Date / Document	Comment	Response / where addressed in the ES
		be safe without additional measures. ii. The distance to the deep water route on the West side of East Anglia THREE is not sufficient regarding our guidelines determining safe shipping distance. These guidelines require a minimum distance of 1.87nm to an object. Though this DWR is currently of lesser interest to Dutch ports, we kindly ask you to take into account the regulations on this matter. iii. Regarding safe distance from DWR to objects, please also take into consideration the guidance: MCA MGN 371 on Offshore Renewable Energy Installations – Guidance on UK Navigation Practice, Safety and Emergency Response Issues.	potential additional mitigations. ii. NRA appendix 15.1.5 Deep Water Route (DWR) Buffer Analysis (2015). iii. Regulation and Guidance considered throughout this NRA (including MGN 371) is summarised in Section 15.4.1.
The Danish Maritime Authority	June 2014 (S42 Response)	i. The Danish Maritime Authority has no comments as East Anglia THREE is located in UK waters outside sailing routes.	i. Noted.
Norfolk County Council	July 2014 (S42 Response)	i. While no objection is proposed to the East Anglia THREE offshore wind farm, this is subject to appropriate mitigations measures being found to overcome any potential impact on shipping and navigation, which might have an impact on East Port (Great Yarmouth).	i. Section 15.3.5 summarises embedded mitigation measures and Section 15.10 summarises potential additional mitigation measures.
Trinity House	July 2014	i. Stated that the 2nm buffer	i. Noted

Consultee	Date / Document	Comment	Response / where addressed in the ES
Lighthouse Service	(S42 Response)	from the eastern boundary of East Anglia THREE to the DWR via Off Brown Ridge TSS was satisfactory. ii. Raised concerns, given the volume of traffic and the need for sea room to allow safe collision avoidance whilst manoeuvring along the western boundary within the DWR via DR1 light buoy, that the current 1nm buffer should be increased to 2nm. iii. Advised that a minimum separation distance of 6nm between East Anglia THREE and East Anglia FOUR would be satisfactory. iv. Stated structures on the wind farm boundary should be in as linear form as possible and isolated structures should be avoided. Accommodation platforms must also be at least 500m from the wind farm red line boundary to allow for the appropriate safety zone to remain inside the Rochdale envelope. v. Stated that consideration should be given to producing a through life Aids to Navigation Management Plan. vi. Stated that the UK Hydrographic Office should be consulted to ensure East Anglia THREE is charted on an appropriately scaled chart. vii. Stated that all aviation	ii. NRA appendix 15.1.5 DWR Buffer Analysis (2015). iii. Section 15.10 summarises additional mitigation measures including final site design consultation. Trinity House shall be consulted throughout this process. iv. EATL note Trinity House's comments on layout (preference for linear form of structures on boundary and avoidance of isolated structures). Following assessment of the allision risk modelling (Section 15.6.1 assesses the impact on commercial vessel safe navigation, including the risk of vessel collision / allision) EATL have made the commitment not to place additional structures on the periphery of the East Anglia THREE site in proximity to areas of high density shipping, thus avoiding any issues with the presence of 500m safety zones around permanently manned structures. v. Section 15.10 summarises additional mitigation measures including the production of an Aids to Navigation Management Plan. vi. Section 15.3.5 summarises

Consultee	Date / Document	Comment	Response / where addressed in the ES
		lighting must be synchronised and exhibit Morse code "W" light characteristics.	embedded mitigation measures including appropriately scaled charting of the East Anglia THREE site. vii. Noted and considered throughout assessment of impact on emergency response provision (Section 15.6.6).
2015 Consultation (East Anglia THREE)			
MCA	March 2015 (Written Consultation)	i. MCA is content with the volume of marine traffic survey data collected, assuming a November 2015 submission of the ES. ii. MCA request that an additional 14 day traffic survey be carried out if the ES is submitted after November 2015 in order to comply with current requirements.	i. Marine traffic survey data collected is summarised in Section 15.4.2. ii. Noted.
MCA	July 2015 (Consultation Meeting)	i. Overview of NRA changes included. ii. MCA confirmed that the 1nm buffer was acceptable of the western boundary of the East Anglia THREE site.	i. No Comment Required. ii. Noted.
Trinity House Lighthouse Service	July 2015 (Consultation Meeting)	i. Overview of NRA changes included. ii. THLS requested two lines of orientation iii. THLS noted a preference for a 2nm buffer on the western boundary of the East Anglia THREE site	i. No Comment Required. ii. Noted; MGN 371 guidance, which shall be complied with throughout final layout design,

Consultee	Date / Document	Comment	Response / where addressed in the ES
		but did not raise any navigational safety issues with 1nm. iv. Aids to Navigation Management Plan will now be required as part of the Development Consent Order (DCO).	currently indicated one clear line of alignment for SAR. iii. Noted. iv. Noted.
Royal Yachting Association	August 2015 (Consultation Meeting)	i. Overview of NRA changes included. ii. RYA noted no impacted on small craft for a 1nm DWR buffer. iii. EATL indicated that there wasn't an intention to apply for operational 50m Safety Zones at this time, other than during periods of significant maintenance which would require 500m safety zones.	i. No Comment Required. ii. Noted. iii. No Comment Required.

15.3 Scope

10. The scope of this chapter is to assess all the potential shipping and navigation impacts that may result from the development of the proposed East Anglia THREE project and its associated works, and to identify necessary mitigation measures and monitoring that may be required in accordance with the relevant guidance and best practice.

15.3.1 Definition of Study Area

11. The study area is based on a minimum 10 Nautical Mile[1] (nm) buffer around the East Anglia THREE site. Where datasets allow this has been extended to 10nm around the East Anglia Zone as shown in *Figure 15.1*. This buffer has been used as it is considered best practice for NRA and it presents sufficient area to capture

[1] 1 nautical mile is equal to 1.852km

the relevant information for the project in terms of baseline data. The study area for navigation in the wider vicinity has been extended outside of this to the wider southern North Sea area to encompass vessel routeing so that an effective picture of impacts on routes could be achieved.

12. Cumulative impacts are again considered within a 10nm buffer around the East Anglia THREE site but then extended where applicable to encompass vessel routeing. This includes consideration of transboundary offshore windfarm projects and shipping 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 proposed East Anglia THREE project.

15.3.2 Worst Case

13. For shipping and navigation impact assessment two worst case layouts have been assessed. The positions of wind turbines (172), offshore substations (five), meteorological masts (two), accommodation platform (one) and buoys (two) in two indicative layouts for risk modelling are presented in *Figure 15.3* and *Figure 15.4*.

14. It should be noted that following the modelling there were updates to the construction approach (i.e. the inclusion of phasing) and therefore potential for an additional offshore substation (increasing the total to six) for the Two Phased approach. Furthermore, an additional ten buoys (giving a total of 12) have been proposed. The layouts that were modelled within the NRA are considered worst case due to the placement of additional structures (substations, meteorological masts, accommodation platform and buoys) on the periphery of the East Anglia THREE site in proximity to passing traffic. The additional substation and ten buoys have not been considered throughout the allision risk modelling. However as required by condition 13 of the deemed marine licences in the draft DCO, EATL will consult with the statutory maritime regulators who have final sign off on construction phase layouts and buoyage. In addition EATL have committed to placing no additional structures within 1km (0.54nm) of the southern boundary where the greatest risk to shipping and navigation is present due to their proximity to passing traffic.

15. The layouts modelled include a 100% fill of the East Anglia THREE site with 7MW wind turbines, and a partial fill of the East Anglia THREE site with 7MW wind

turbines. *Figure 15.3* shows the maximum number of wind turbines envisaged for the East Anglia THREE site (172 x 7MW wind turbines) with the maximum spacing between wind turbines (1,250 x 1,250m separation) and therefore a maximum reduction in available sea room. *Figure 15.4* shows a layout with the same number of wind turbines and a minimum spacing (675 x 900m) increasing the amount of sea room compared to the 100% fill, but concentrating wind turbines on the southern boundary in proximity to traffic routes. It is noted that these layouts are realistic worst case and intended to test navigational safety principles within the NRA. Final layouts, including peripheral wind turbines and irregular boundaries, will require sign off by the Marine Management Organisation (MMO) in consultation with MCA and THLS prior to construction.

16. Both layouts have been assessed with the largest foundation size, which presents the greatest allision risk to shipping and navigation, the jacket suction caisson foundation. For the worst case collision risk assessment, the maximum wind turbine foundation size (38 x 38m) has been assumed (largest jacket suction caisson foundation). The dimensions of jacket foundations would be dependent on water depths.

17. It should be noted that all additional structures within the East Anglia THREE site: converter stations (two), collector stations (three), accommodation platform (one), meteorological masts (two) and the buoys (two) considered throughout allision risk modelling (see paragraph 14), have been positioned on the periphery of the indicative boundary, for both layouts, where the greatest risk to shipping and navigation is present due to their proximity (and therefore allision risk) to passing traffic, however EATL have committed to placing no additional structures within 1km of the southern boundary.

18. There will also be inter-array, interconnector and export cables associated with the proposed East Anglia THREE project. The inter-array cables would run between the final wind turbine positions and the substations, where the export cables would run in the offshore cable corridor which routes from the East Anglia THREE site to a landfall at Bawdsey (Suffolk). The proposed interconnector cable corridor runs south from the western boundary of the East Anglia THREE site to East Anglia ONE. A high level review of the offshore cable corridor has been completed as part of the NRA (*Appendix 15.1*) however a cable burial index study would be required to ensure the final cable route is suitably protected for the

local conditions. Any protection methods used would be consulted on with key maritime stakeholders to ensure that they do not impact on navigation safety, e.g. Under Keel Clearance (UKC). The offshore cable corridor is shown in *Figure 15.1*.

15.3.3 Construction Phasing

19. EATL are considering constructing the proposed East Anglia THREE project using a Single Phase or a Two Phased approach. It should be noted that the NRA has only modelled a full 1.2GW build out and partial sites have not been quantified.

15.3.3.1 Single Phase

20. The key elements of the Single Phase approach are as follows:

- A single build period (up to 1200MW installed in a single construction period);
- It is expected that the construction period would commence at some point between 2020 and 2025; and
- Overall construction would be 41 months including:
    - Offshore construction including cable laying for approximately 43 months;
    - Onshore substation and cable installation for approximately 14 months.

15.3.3.2 Two Phased

21. The key elements of the Two Phased approach are as follows:

- Two phases of construction, of up to 600MW each;
- The start of Phase 1 would be separated from the start of Phase 2 by no more than 18 months (from commencement of Phase 1 onshore works to the commencement of Phase 2 onshore works);
- It is expected that the construction period would commence at some point between 2020 and 2025;
    - The total construction period for Phase 1 and Phase 2 would span approximately 45 months (based on two overlapping construction periods of approximately 28 months and 23 months).

22. The Two Phased approach to construction has implications in terms of infrastructure, even though the final proposed East Anglia THREE project capacity would remain the same. For the Two Phased approach the maximum number of offshore electrical platforms and vessel movements increases to a total of six platforms and 7,600 vessel movements compared to a total of five platforms and 5,700 vessel movements throughout the Single Phase approach.

23. It should be noted that the proposed wind turbine layouts considered (Figure 15.3 and Figure 15.4) throughout the allision and collision risk modelling, have only taken account of the five offshore electrical platforms throughout the Single Phase approach. See paragraph 14.

15.3.4 Worst Case Scenario

22. Chapter 5 Description of the Development sets out a detailed description of the proposed East Anglia THREE project, as well as detailed information on construction, operation and decommissioning. The worst case scenarios with regard to the Shipping and Navigation are represented by the potential impacts in *Table 15.2* below. These parameters are applied in the assessment of potential impacts and ensure that it reflects the worst case scenario in every aspect, noting that the worst case alters depending on the receptor and impact.

23. The Two Phased approach to construction has implications in terms of infrastructure, even though the final installed windfarm capacity would remain the same. For the Two Phased approach the maximum number of offshore electrical platforms and vessel movements increases to a total of six platforms and 7,600 vessel movements compared to a total of five platforms and 5,700 vessel movements throughout the single phase approach.

24. For the Two Phased approach the number of vessel movements (7,600) increases compared to the Single Phase approach (5,700). However, the total number of construction vessels (total of 55) remains consistent for both the Single Phase and Two Phased approach (and the same as originally assessed within the initial NRA undertaken in 2014). For the purposes of this assessment the increase in the total number of vessel movements for the Two Phased approach is assumed to increase the overall risk. However, the overall risk is assumed to remain within the same risk ranking due to the implementation of embedded mitigation measures such as designation of construction traffic corridors and entry / exit points to the East Anglia THREE site. Furthermore, all works traffic shall be under

the control of the EATL marine traffic coordinator. Therefore the increase in vessel movements for the Two Phased approach is assumed not to alter the final outcomes of the impact assessment.

Table 15.2. Worst Case Assumptions

Impact	Key design parameters forming the worst case scenario	Rationale
Construction & Decommissioning		
Commercial Vessels (Safe Navigation and Routeing)		
Impact 1: Commercial vessel to vessel collision or encounter risk	Maximum number of wind turbines 172 (7MW) 100% fill of the East Anglia THREE site Maximum spacing of 1250x1250m Maximum of six substations (Two Phased construction approach) within the array(*Note: this is an increase of one structure from the scenario that was modelled within the (NRA One accommodation platform Two meteorological masts 12 buoys (+Note: this is an increase of ten buoys from the scenario that was modelled within the NRA- see paragraph 14) 55 construction vessels on site including associated support craft Construction and Decommissioning Safety Zones	Maximum displacement of vessels causing areas of route convergence, with continuous and maximum on-site activity over the longest duration.
Impact 2: Vessel allision with partially constructed or deconstructed structures	Maximum number of wind turbines 172 Minimum spacing of 675x900m Indicative partial fill within the East Anglia THREE site due to concentration of wind turbines Maximum of six substations (Two Phased construction approach) within the array* One accommodation platform Two meteorological masts 12 buoys+	Largest concentration of wind turbines with continuous and maximum on-site vessel activity over the longest duration.

	Jacket suction caisson foundations presenting maximum allision risk	
Impact 3: Commercial vessel deviations	Maximum spacing of 1250x1250m Maximum of six substations (Two Phased construction approach) within the array* One accommodation platform Two meteorological masts 12 buoys+ 100% fill of the East Anglia THREE site Maximum spacing of 1250x250m 500m safety zones	Construction area and safety zones cause maximum displacement for vessels operating on regular / main routes.
Fishing Vessels (Safe Navigation and Routeing)		
Impact 4: Fishing vessel allision with partially constructed or deconstructed structures *Note: Does not consider gear snagging*	Maximum number of wind turbines 172 Minimum spacing of 675 x 900m Indicative partial fill within the East Anglia THREE site due to concentration of wind turbines Maximum of six substations (Two Phased construction approach) within the array* One Accommodation platform Two meteorological masts 12 buoys+ Jacket suction caisson foundations presenting maximum allision risk	Largest concentration of wind turbines with maximum on-site vessel activity over the longest duration.
Recreational Craft(Safe Navigation and Routeing)		
Impact 5: Recreational craft	Minimum spacing of 675 x 900m	Causing maximum displacement for

routeing	Maximum of six substations (Two Phased construction approach) within the array* One accommodation platform Two meteorological masts 12 buoys+ 100% fill of the East Anglia THREE site Maximum spacing of 1250x1250m 500m safety zones and 50m pre commissioning safety zones	recreational craft seeking to avoid transit through the proposed project.
Impact 6: Recreational craft allision with partially constructed and deconstructed structures	Maximum number of wind turbines 172 Minimum spacing of 675 x 900m Indicative partial fill within the East Anglia THREE site due to concentration of wind turbines Maximum of six substations (Two Phased construction approach) within the array* One Accommodation platform Two Meteorological masts 12 buoys+ Jacket suction caisson foundations presenting maximum allision risk	Largest concentration of wind turbines with continuous and maximum on-site vessel activity over the longest duration.
Impact 7: Recreational craft collision with another vessel within East Anglia THREE windfarm array	55 construction vessels on site including associated support craft Minimum spacing 675x900 m	Maximum number of on-site vessels creating maximum potential over longest duration.
Port Operations		
Impact 8: Impacts on operations within ports	55 construction vessels on site including associated support craft	Maximum vessel movements, over continuous 24 hour period and over the longest duration without effective control.

Emergency Response Provision (Marine Based)		
Impact 9: Reduced emergency response capability / oil spill response owing to the presence of East Anglia THREE	55 construction vessels on site including associated support craft Increased personnel presence on site Potential pollution sources Lack of clear search patterns	Maximum number of vessel and personnel on site with no self-help capability for emergency response.
Operation & Maintenance		
Commercial Vessels (Safe Navigation and Routeing)		
Impact 10: Commercial vessel (powered) allision with East Anglia THREE windfarm structure	Maximum number of wind turbines 172 Indicative partial fill due to concentration of wind turbines Minimum spacing 675x900 m Maximum of six substations (Two Phased construction approach) within the array* One accommodation platform Two meteorological masts 12 buoys+ 2nm separation from eastern Deep Water Route (DWR) 1nm separation from western DWR	Development within close proximity to main routes creating maximum exposure time.
Impact 11: Commercial vessels to vessel collision or encounter risk	Maximum number of wind turbines 172 100% fill of the East Anglia THREE site Maximum of six substations (Two Phased construction approach) within the array* One accommodation platform Two meteorological masts	Maximum displacement of vessels and convergence of routes.

	12 buoys+ 55 construction vessels on site and associated support craft	
Impact 12: Commercial vessel (drifting) allision with East Anglia THREE windfarm structure	Maximum number of wind turbines 172 Indicative partial fill due to concentration of wind turbines Minimum spacing 675x900 m Maximum of six substations (Two Phased construction approach) within the array One accommodation platform Two meteorological masts 12 buoys+ 2nm separation from eastern DWR 1nm separation from western DWR No additional self-help emergency response capability in place	Development within close proximity to main routes creating minimum response time for vessels not under command.
Impact 13: Vessel anchoring on or dragging over subsea equipment or cables	Lack of monitoring of installed cables Cable protection method inadequate for traffic within the area	Inadequate protection and or burial creating a navigational hazard.
Impact 14: Commercial vessel deviations including adverse weather routeing	100% fill of the East Anglia THREE site Maximum spacing 1250x1250 m	Operational windfarm causes maximum displacement for vessels operating on regular / main routes.
Fishing Vessels (Safe Navigation and Routeing)		
Impact 15: Fishing vessel allision with East Anglia THREE windfarm structure	Maximum number of wind turbines 172 Indicative partial fill due to concentration of wind turbines Minimum spacing 675x900 m	Development near or on fishing grounds creating maximum exposure time for fishing vessels. Windfarm aggregation may also

	Maximum of six substations (Two Phased construction approach) within the array* One accommodation platform Two meteorological masts 12 buoys+ 2nm separation from eastern DWR 1nm separation from western DWR	see an increase in fishing vessels numbers.
Recreational Craft (Safe Navigation and Routeing)		
Impact 16: Recreational craft routeing	Maximum number of wind turbines 172 100% fill of the East Anglia THREE site Maximum spacing 1250x1250m Maximum of six substations (Two Phased construction approach) within the array* One accommodation platform Two meteorological masts 12 buoys+ 2nm separation from eastern DWR 1nm separation from western DWR	Maximum operational development area creating maximum displacement for recreational craft not wanting to transit through the proposed project.
Impact 17: Recreational craft allision with East Anglia THREE windfarm structure	Maximum number of wind turbines 172 Indicative partial fill due to concentration of wind turbines Minimum spacing 675x900m Maximum of six substations (Two Phased construction approach) within the array* One accommodation platform Two meteorological masts	Minimum spacing and maximum number of wind turbines creating maximum risk of allision.

	12 buoys+ Minimum blade clearance of 22m	
Impact 18: Recreational craft collision with another vessel within East Anglia THREE windfarm array	Up to 4,000 windfarm support vessel movements and 52 service vessel movements per annum (Two Phased construction approach) 2nm separation from eastern DWR 1nm separation from western DWR	Maximum vessel movements within the array, over continuous 24 hour period and over the longest duration without effective control.
Port Operations		
Impact 19: Impacts on operations within ports	Up to 4,000 windfarm support vessel movements and 52 service vessel movements per annum (Two Phased construction approach)	Maximum vessel movements, over continuous 24 hour period and over the longest duration without effective control.
Emergency Response Provision (Marine Based)		
Impact 20: Reduced emergency response capability / oil spill response owing to the presence of East Anglia THREE	Up to 4,000 wind farm support vessel movements and 52 service vessel movements per annum (Two Phased construction approach) Increased personnel presence on site Potential increased pollution sources Lack of clear search patterns Lack of self-help capability on site	Maximum number of vessel and personnel on site with no self-help capability for emergency response.

15.3.5 Embedded Mitigation

24. The mitigation measures provided in *Table 15.3* are considered to be standard industry practices or legal requirements and therefore this assessment has considered them embedded and significance assessed accordingly. Only residual impacts following consideration of these mitigations are shown within the impact assessment.

Table 15.3. Embedded Mitigation

Mitigation	Mandatory or Standard Industry Practice	Description
Marked on Admiralty Charts	Requirement	The proposed East Anglia THREE project would be charted by the UK Hydrographic Office (UKHO). This would include wind turbines, offshore cable corridor (specific location of export cables), interconnector cables and inter-array cables for the appropriate scale charts.
Promulgation of Information	Requirement	Appropriate liaison and dissemination of information and warnings through Notices to Mariners and other appropriate media, (e.g., Admiralty Charts and fishermen's awareness charts) would enable vessels to effectively and safely passage plan around the East Anglia THREE site and the offshore cable corridor.
Navigational Marking and Lighting	Requirement	Structures within the East Anglia THREE site would be marked and lit in accordance with International Association of Lighthouse Authorities (IALA) Recommendation O-139 on the Marking of Man-Made Offshore Structures (IALA, 2008), but may also include the use of other visual and sounds aids to navigation as agreed with Trinity House Lighthouse Service.
Minimum Blade Clearance	Standard Industry Practice	Wind turbines would be constructed to ensure that the minimum rotor blade clearance (air draught) is at least 22m above mean high water springs (MHWS).
Inter-array, interconnector and export cable protection	Standard Industry Practice	Inter-array, interconnector and export cables would be protected appropriately taking into account fishing and anchoring practices and an appropriate burial protection index study. Positions of cables would be promulgated and charted by appropriate means.
Compliance with MCA's Marine Guidance Notice (MGN) 371 including Annex 5	Requirement	Annex Five specifies 'standards and procedures for generator shutdown and other operational requirements in the event of a Search and Rescue, counter pollution or salvage incident in around an Offshore Renewable Energy Installations (OREI)'.
Application and Use of rolling safety zones of up to 500m during Construction, operations & maintenance and Decommissioning	Standard Industry Practice	Where required 500m rolling safety zones would be used around current areas of constructions, major maintenance and decommissioning. Further information is defined in the Safety Zone Statement - document reference 7.2.

Mitigation	Mandatory or Standard Industry Practice	Description
Pre-commissioning safety zones	Standard Industry Practice	Additionally a 50m safety zone may also be applied for around the structures where construction works have been completed but prior to the windfarm being commissioned. Further information is defined in the Safety Zone Statement - document reference 7.2.
Development and implementation of an Emergency Response and Cooperation Plan (ERCoP)	Requirement	An ERCoP would be developed and implemented for the construction, operational & maintenance and decommissioning phases. The ERCoP would be based on the standard MCA template and would consider the potential for self-help capability as part of the ongoing process.
Guard vessels during construction and decommissioning	Standard Industry Practice	Guard vessels would be used during construction, decommissioning and significant maintenance to both protect the installations and workers on the wind turbines, particularly in areas in proximity to main traffic routes. Their role would be to both alert vessels to the East Anglia THREE activity and provide support in the event of an emergency situation. This includes adequate protection for any partially buried or unprotected cables.
Monitoring	Requirement	Active monitoring of development to ensure that the structures and / or cables would not become a hazard to navigation over time, for example, export or inter-array cables becoming exposed.
AIS Carriage on Support Vessels	Standard Industry Practice	All support craft associated with the proposed East Anglia THREE project would carry an Automatic Identification System (AIS).
A minimum of one single line of orientation required with the final agreed layout.	Requirement	Recent changes to marine guidance (MGN 371) require all offshore windfarm sites to maintain at least one single direction of orientation to assist surface craft navigation and also used as search and rescue corridors. Phased development will also be required to consider cumulative impacts of alignment.
Identification (ID) Marking	Requirement	Individual OREI marking should conform to a spread sheet layout, i.e. lettered on the horizontal axis, and numbered on the vertical axis. The detail of this will depend on the shape, geographical orientation of the final sites. Again cumulative considerations with phasing shall also be considered
Construction and	Requirement	As per schedules 10 and 11 of the development

Mitigation	Mandatory or Standard Industry Practice	Description
Post Construction Navigational Monitoring		consent order, EATL will monitor marine traffic for assessment purposes, in line with the Outline Navigational Monitoring Strategy (document number 8.11), to ensure the conclusions of the NRA and ES were correct and mitigation measures are adequate.

15.4 Assessment Methodology

25. The NRA follows a different assessment process from the Environmental Impact Assessment (EIA), although the approaches are very similar. The result is an assessment of the risk posed by the proposed project to navigation and the mitigation required to minimise those risks. As such, the approach does not follow the assessment methodology laid out in in Chapter 6 Environmental Impact Assessment Methodology. The MCA require that the DECC Methodology (DECC 2013) is used as a template for preparing an NRA.

26. The NRA has a baseline data gathering phase broadly similar to the EIA, which included marine traffic surveys, desk-based research and consultation to allow the identification of higher risk areas. This phase is followed by a Formal Safety Assessment (FSA) in line with the International Maritime Organisation (IMO) Formal Safety Assessment (FSA) Process (IMO 2002) and DECC guidance (DECC 2013).

27. A shipping and navigation receptor can only be sensitive if there is a pathway through which an impact could be transmitted between the source and the receptor. When a receptor is exposed to an impact, the overall 'severity of consequence' to the receptor is determined and the process incorporates a degree of subjectivity and professional judgement. Consequence assessments for shipping and navigation receptors use the following criteria, in line with baseline data and expert opinion, to assess:

- Outputs of the hazard workshop (see *Annex 15.1.1* to *Appendix 15.1.*);
- Level of stakeholder concern;
- Vessel type (including persons / cargo on board) and routes proximity to structures; and

- Lessons learnt from existing developments.

28. Following completion of the NRA, impacts that have a clear pathway of effect on receptors have been considered as part of the FSA process and are therefore detailed within this chapter. Impacts which do not have a pathway have then been scoped out at this stage but are covered within the baseline section of the NRA (Anatec 2015).

29. Issues scoped out included communications and position fixing (Very High Frequency (VHF) Direction, AIS, NAVTEX (Navigational Telex) and Global Positioning Systems (GPS)).

15.4.1 Guidance Documents

30. The primary guidance documents used during the assessment were:

- MCA Marine Guidance Note 371 (MGN 371 M+F) Offshore Renewable Energy Installations Guidance on UK Navigational Practice, Safety and Emergency Response Issues (MCA 2008a). This also includes subsequent and ongoing amendments made at the Nautical Offshore Renewable Energy Liaison (NOREL) group; and
- DECC Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms (DECC 2013);

31. Other guidance used in this assessment are as follows:

- IMO Guidelines for Formal Safety Assessment (IMO 2002);
- MCA Marine Guidance Notice 372 (MGN 372 M+F) OREIs Guidance to Mariners Operating in the Vicinity of UK OREIs (MCA 2008b);
- DECC Guidance Notes on Safety Zones (DECC 2007 as updated);
- SAR Framework Chapter 1 MCA and Chapter 4 Royal National Lifeboat Institution (RNLI) (MCA 2002);
- IMO Guidelines for Formal Safety Assessment (FSA) (IMO 2002);
- RYA – The RYA's Position on Offshore Energy Developments: Paper 1 – Wind Energy (RYA 2013); and

- IALA – O-139 The Marking of Man-Made Offshore Structures (IALA 2008).

32. The assessment of potential risks and impacts on shipping and navigation has been made with specific reference to the relevant NPS. These are the principal policy documents for Nationally Significant Infrastructure Projects (NSIP). Those relevant to shipping and navigation are:

- Overarching NPS for Energy (EN-1) (July 2011); and
- NPS for Renewable Energy Infrastructure (EN-3) (July 2011).

33. The following (*Table 15.4*) provides a summary of those NPS relevant to shipping and navigation, and where they have been assessed within for the proposed East Anglia THREE project.

Table 15.4. Summary of NPS-EN1 and EN3 Guidance

NPS-EN1 and EN3 Guidance	Where Addressed in the ES
Overarching National Policy Statement for Energy (EN-1)	Does not specifically refer to Shipping and Navigation but the overarching guidance principles in general have been considered.
NPS EN-3 2.6.153 Applicants should establish stakeholder engagement with interested parties in the navigation sector early in the development phase of the proposed offshore windfarm and this should continue throughout the life of the East Anglia THREE development including during the construction, operation and decommissioning phases. Such engagement should be taken to ensure that solutions are sought that allow offshore windfarms and navigation uses of the sea to successfully co-exist.	Stakeholders have been identified through the assessment process and the responses are noted in section 15.2.
NPS EN-3 2.6.154 Assessment should be underpinned by consultation with the Marine Management Organisation (MMO), Maritime and Coastguard Agency (MCA), the relevant General Lighthouse Authority, the relevant industry bodies (both national and local) and any representatives of recreational users of the sea, such as the Royal Yachting Association (RYA), who may be affected.	Key marine stakeholders have been identified through the assessment process and the responses are noted in section 15.2. EATL have consulted with other Member States and the responses are noted in section 15.2.
NPS EN-3 2.6.155 Information on internationally recognised sea lanes is publicly available and this should be considered by applicants prior to undertaking assessments. The assessment should	The baseline data section of this chapter and its technical appendix - Appendix 15.1 (NRA) and its associated annexes.

NPS-EN1 and EN3 Guidance	Where Addressed in the ES
include reference to any relevant, publicly available data available on the Maritime Database.	
NPS EN-3 2.6.156 Applicants should undertake a NRA in accordance with relevant Government guidance prepared in consultation with the MCA and the other navigation stakeholders listed above	Guidance documents and data sources used within this chapter are described in section 15.4.
NPS EN-3 2.6.157 The navigation risk assessment will for example necessitate: • A survey of vessels and operations in the vicinity of the proposed wind farm; • A full NRA of the likely impact of East Anglia THREE on navigation in the immediate area of the wind farm in accordance with the relevant marine guidance; and • Cumulative risks associated with the development of East Anglia THREE and other developments (including other wind farms) in the same area of sea.	The methodology for the Navigation Risk Assessment is described in the assessment methodology - section 15.4.
NPS EN-3 2.6.158 Where there is a possibility that safety zones would be sought around offshore infrastructure, potential effects should be included in the assessment on navigation and shipping.	Safety zones are discussed within section 15.3.5. Further information is defined in the Safety Zone Statement - document reference 7.2.
NPS EN-3 2.6.159 Where the precise extents of potential safety zones are unknown a realistic worst case scenario should be assessed. Applicants should consult the MCA and refer to the Government guidance on safety zones.	Safety zones are discussed within section 15.3.5. Further information is defined in the Safety Zone Statement - document reference 7.2.
NPS EN-3 2.6.160 The potential effect on recreational craft, such as yachts, should be considered in any assessment.	The effects on recreational craft have been assessed in 15.5.7and 15.6.4.
NPS EN-3 2.6.174 Mitigation measures will include site configuration, lighting and marking of projects to take account of any requirements of the General Lighthouse Authority and also the provision of an acceptable Active Safety Management System.	Embedded Mitigation is detailed in section 15.3.5.

15.4.2 Data Sources - Site Specific Surveys

34. Four vessel based AIS and radar surveys (supplemented by visual observations to obtain information, where it was not available from AIS) were carried out at the East Anglia THREE site (three baselines and one validation). Each of the surveys had an effective duration of ten days, giving a combined data set of 40 days. This data was used for the main baseline assessment within *Appendix 15.1* and the impact assessment within this chapter.

35. The first, an autumn survey, was carried out from the *Shemarah II* survey vessel from 27th August to 6th September 2012. The second survey took place in spring and was carried out from the survey vessel *Northern Viking* from 12th to 21st May 2013. The third, a summer survey, was carried out from the same *Northern Viking* vessel between 24th July and 3rd August 2013.

36. The fourth survey, which was a data validation survey and took place in winter (2014) again using the *Northern Viking* survey vessel and had an effective duration of ten days. The fourth survey began on 23rd January and concluded on 2nd February 2014. This survey is being considered separately and as a validation to ensure that any changes to routeing since the 2012 and 2013 surveys are clearly identified including changes to the Dutch routeing measure (August 2013) as noted in *Appendix 15.1*.

37. Both AIS and radar track data (non-AIS) on vessel movements was gathered. The objective of the surveys was to identify the vessel activity both within, and adjacent to, the East Anglia THREE site.

38. AIS is required to be fitted aboard all ships engaged on international voyages of 300 gross tonnage (GT) and upwards, cargo ships of 500GT and upwards not engaged on international voyages and passenger ships (carrying 12 or more passengers) irrespective of size built on or after 1st July 2002. During the surveys the length at which fishing vessels were required to carry AIS changed from 24m, before the 31st May 2013 to 18m. Current requirements, since May 31st 2014, state that AIS must be fitted on fishing vessels more than or equal to 15m in length.

39. Non-AIS vessels were recorded during the surveys by Automatic Radar Plotting Aids (ARPAs). This radar track data was supplemented by manual observation of vessels within visual range to obtain information on type and size, where the

information was not available from AIS. Non-AIS vessels tended to be smaller craft (i.e. recreation and fishing vessels).

15.4.3 Data Sources – Other Information Sources

40. In addition, the other data sources used to inform the description of the baseline environment are listed below:

- Maritime Incident Data from the Maritime Accident Investigation Branch (MAIB) (2004 to 2013) and RNLI (2001 to 2010);
- Marine aggregates dredging data (licence areas and active areas) from The Crown Estate (TCE 2014) and dredger transit routes from the British Marine Aggregate Producers Association (BMAPA 2013);
- Ministry of Defence (MOD) Exercise Areas and Explosives Dumping Grounds (charted information);
- Existing locations of oil and gas platforms (charted information) and other infrastructure such as pipelines and wells from UK Deal website (January 2014);
- Oil and gas fields, 28th Oil and Gas Licences from UK Deal; see Appendix 15.1 NRA section 7.6 for further information.
- Anchorage areas (charted information);
- Cables from the Kingfisher Information Services (2013);
- Marine Environmental High Risk Areas (MEHRA) from MCA;
- IMO Routeing Measures (charted information);
- Admiralty Sailing Directions (NP 54/NP 28);
- UK Admiralty Charts issued by UKHO; and
- UK Coastal Atlas of Recreational Boating (2009) and Geographical Information Systems (GIS) Shape Files.

15.4.4 Data Limitations

41. The range of both the AIS and radar systems varied depending on a number of factors, including the weather and atmospheric conditions. For the majority of

the time, the radar tracked targets up to 12nm from the survey location and some targets beyond 20nm. The radar range during the survey period may have resulted in under-representation in terms of non-AIS vessel activity at the edge of the East Anglia THREE site, with the area of comprehensive coverage dependent on the survey vessel's location. The AIS range was typically at least 20nm during the survey periods.

15.4.5 Severity of Consequence and Frequency of Occurrence

42. The following tables show the consequence and frequency bands used within the assessment.

Table 15.5. Consequence Bands

Rank	Description	Definition
1	Negligible	• No injury to persons • No significant damage to infrastructure or vessel • No environmental impacts (marine pollution) • No significant operational impacts
2	Minor	• Slight injury(s) to person • Minor damage to infrastructure or vessel • Tier 1 pollution assistance (marine pollution) • Minor operation impacts
3	Moderate	• Multiple moderate or single serious injury to persons • Moderate damage to infrastructure or vessel • Tier 2 pollution assistance (marine pollution) • Considerable operational impacts
4	Serious	• Serious injury or single fatality • Major damage to infrastructure or vessel • Tier 2 pollution assistance (marine pollution) Major national business, operation or reputation impacts
5	Major	• More than one fatality • Extensive damage to infrastructure or vessel • Tier 3 pollution assistance (marine pollution) • Major international business, operation or reputation impacts

Table 15.6. Frequency Bands

Rank	Description	Definition
1	Negligible	Only likely to happen in exceptional circumstances
2	Extremely Unlikely	Unlikely to happen but not exceptional throughout all phases of the project
3	Remote	Likely to happen throughout phases of the project
4	Reasonably Probable	Extremely likely to happen throughout phases of the project
5	Frequent	Would occur at some point throughout phases of the project

15.4.6 Risk Ranking

43. Consequences have then been assessed against frequency to identify overall tolerability ranking for the impact. The risk matrix and associated rankings are noted in *Table 15.7* and *Table 15.8.*

Table 15.7.Risk Matrix

Frequency						
	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
		Negligible	**Minor**	**Moderate**	**Serious**	**Major**
		Consequence				

44. Following assessment and risk ranking, further mitigation (beyond the embedded mitigations) may be required to reduce the impact and bring it within ALARP parameters. As noted below risks that are ranked tolerable or unacceptable will require additional mitigation or monitoring to reduce the residual risk.

Table 15.8. Risk Rankings

	Broadly Acceptable	Risk ALARP with no additional mitigations or monitoring required above embedded mitigations.
	Tolerable	Risk acceptable but may require additional mitigation measures and monitoring in place to control and reduce to ALARP.
	Unacceptable	Significant risk mitigation or design modification required to reduce to ALARP.

15.4.7 Cumulative Impact Assessment Methodology

45. Cumulative impacts have been considered for shipping and navigation receptors; this includes other offshore developments, as well as in combination 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 baseline assessment.

46. Cumulative impacts have been considered for an extended study area as noted in section 15.3.1. Cumulative projects have been considered within 10nm of the East Anglia THREE site; however due to the nature of international shipping routeing to and from ports outside of this study area has also been considered but not quantified.

15.4.8 Transboundary Impact Assessment

47. Similar to the cumulative impacts this section will consider transboundary offshore wind developments with regards to vessel routeing and international ports. Again 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 baseline assessment.

15.4.9 Limitations and Assumptions

48. The shipping and navigation impacts assessment has been undertaken on information available at the time. Assumptions for modelling and baseline assessments are noted within *Appendix 15.1*.

15.5 Environmental Baseline

15.5.1 Navigational Features

49. A chart overview of the East Anglia THREE site, relative to key navigation features in the area, is presented in *Figure 15.2.*

50. Key navigational features in the vicinity of the East Anglia THREE site include two DWRs, which are designated IMO routeing measures. The East Anglia THREE site is located between the two IMO adopted DWRs. The DWR via the DR1 light-buoy passes 1nm to the west and the DWR via the Traffic Separation Scheme (TSS) Off Brown Ridge passes 2nm to the east of the East Anglia THREE site. These two DWRs merge towards the southern boundary of the East Anglia THREE site and continue to the North Hinder Junction. The 1nm (west) and 2nm (east) clearance distances from the DWRs are discussed within Chapter 5 Description of the Development.

51. As part of the East Anglia ONE examination, consultation and internal analysis were undertaken to assess the impacts of a 1nm separation distance between the edge of the DWR to the west of the East Anglia site. The analysis looked at the traffic density (see *Figure 15.9* showing 8 to 10 vessels per day), 90th percentiles and the impacts on Radar as noted in MGN 371 and the shipping template. Following this, it was agreed that 1nm was an ALARP distance and was carried forward through the examination process. Therefore, in order to be consistent and maintain a straight line edge between both arrays (East Anglia ONE and the East Anglia THREE site) and the DR-1 DWR, the buffer for East Anglia THREE will remain at 1nm on the west (see *Annex 15.1.5 which contains additional assessment of the navigational safety implications of the 1nm buffer*). However, having given consideration to analysis undertaken on the traffic (*Figure 15.9* shows 10 to 11 vessels per day) within the Off Brown Ridge DWR, the buffer is 2nm as per the principles of MGN 371 and based on the outcomes of Annex 15.1.5, for the eastern edge of the East Anglia THREE site.

52. The Off Brown Ridge TSS is the nearest TSS to the East Anglia THREE site, located approximately 13nm northeast. The North Hinder North TSS (including Maas West Outer and Inner) and associated North Hinder Junction are located approximately 21nm southeast of the site. The Off Botney Ground TSS and West Friesland TSS are located at a distance of 36nm and 40nm respectively, north of

the East Anglia THREE site with the outer limits of the Sunk TSS measuring approximately 43nm from the south west corner.

53. Other navigational features in proximity to the proposed East Anglia THREE project are listed below. Further detail on these is provided in Chapter 18 Infrastructure and Other Users.

- The "North Galloper" and "Outer Gabbard" military Practice and Exercise Areas (PEXAs);
- A number of charted anchorages, as well as a ship-to-ship oil transfer location, off Southwold, where anchoring activity takes place;
- Disused explosives dumping areas to the north of the East Anglia THREE site, and adjacent to the offshore cable corridor;
- A number of oil fields in various stages of development;
- The Zeebrugge to Bacton gas pipeline approximately 6.5nm to the north of the East Anglia THREE site, running parallel to the northern boundary; and
- The nearest Marine Environmental High Risk Areas approximately 59.4nm from the site.

15.5.2 Offshore Cable Corridor

54. The offshore cable corridor (*Figure 15.1*) runs for approximately 70nm west and south from the western boundary of the East Anglia THREE site making landfall to the north of Felixstowe, at Bawdsey (Suffolk). In addition, a proposed interconnector cable, linking the proposed East Anglia THREE project and East Anglia ONE, runs from the western boundary of the East Anglia THREE site to East Anglia ONE.

15.5.3 Marine Traffic Surveys

55. Plots of the survey data recorded during three 2012 and 2013 ten day survey periods are presented in *Figures 15.5, 15.6* and *15.7*. The data is colour-coded by vessel type (in each case the tracks of the survey vessel have been excluded).

56. Overview of vessel tracks recorded during the validation survey in January to February 2014 is presented in *Figure 15.8*. This validation survey has been

considered separately, in order to take into account the new Dutch Routeing measures (see section 15.4.2).

57. Excluding the *Shemarah II* and *Northern Viking* survey vessels, there was an average of 14 unique vessels per day passing through the East Anglia THREE site during the three marine traffic surveys in 2012 and 2013 (based on the effective combined survey duration of thirty days).

58. Approximately 63% of vessels recorded intersecting the East Anglia THREE site during the combined 30 days of survey were cargo vessels, fishing vessels (15%) and recreational vessels (9%). General cargo, chemical tankers and specialised carriers were the most frequently recorded cargo types passing through the East Anglia THREE site.

59. Excluding the survey vessel tracks, there was an average of 12 unique vessels per day passing through the East Anglia THREE site during the winter validation survey in 2014. The majority of tracks were recorded on AIS (92%) as opposed to non-AIS radar tracks (8%). It is noted that this is the lowest activity recorded of all surveys performed at the East Anglia THREE site. This could be in part due to the poor weather conditions, which were recorded throughout the winter validation survey.

60. During the validation survey approximately 67.5% of vessels recorded intersecting the East Anglia THREE site were cargo vessels, fishing vessels made up for 19% of traffic within the site and 'other' operational vessels accounted for 9.5%.

61. Of the 40 days of survey 98.6% of the traffic recorded by radar were carrying AIS; indicating that a limited number of non AIS vessels operate in the area.

15.5.4 Commercial Shipping

62. A number of busy shipping routes pass in proximity to the East Anglia THREE site, with a large number of vessels recorded using the DWRs, passing to the east and west of the site. On average, four to five vessels per day transit the DWR via the DR1 light-buoy in each direction. Approximately 10 to 11 vessels per day use the DWR via the TSS 'Off Brown Ridge', travelling southbound and six vessels per day transit this DWR northbound.

63. Cargo vessels were recorded most frequently within the East Anglia THREE site, accounting for 63% of traffic. Within the cargo category, general cargo vessels (27% of all traffic), chemical tankers (17%) and specialised carriers (5%) were the most common.

64. In terms of the commercial vessel routes passing through the East Anglia THREE site, a number of vessels passed north-west or south-east through the site, generally between UK ports in the north east and ports in the Netherlands and Belgium. These routes included Stena Line's regular service between Killingholme and Hook of Holland, DFDS's route between Immingham and Vlaardingen and P&O freight and passenger ferry routes to Rotterdam.

65. The identification of main shipping lanes was undertaken on a zonal level, based on the AIS shipping surveys. The 90% lane boundaries identified in the vicinity of the East Anglia THREE site are presented in *Figure 15.9*.

66. The 90th percentiles were first identified using the 30 days of survey data from 2012 and 2013. They were then validated against the survey data collected in February 2014 where it was noted that the routes passing through the site transit further south than they had originally to align with the Dutch Routeing Measures. This meant that route 15 now transits slightly further south in the site decreasing the deviation. Route 13 and 14 now pass, in the majority, clear of the East Anglia THREE site but may require a small deviation to pass a safe distance.

15.5.5 Marine Aggregate Dredgers

67. *Figure 15.10* represents the active, licensed and application aggregate dredging areas in proximity to the East Anglia THREE site. The closest active dredging area to the site is Area 401 / 2A Yarmouth, which is operated by Hanson Aggregates Marine Ltd, located approximately 23nm to the west of the East Anglia THREE site.

68. The marine aggregate extraction areas are generally located approximately 10 to 13nm west of the export cable corridor. However, marine aggregate dredgers operating in the vicinity of the extraction areas frequently intersect the offshore cable corridor whilst on transit from active dredging sites to the Netherlands and vice versa.

69. BMAPA indicative passage plans are shown *Figure 15.10* and indicate transit routes used by marine aggregate dredgers in the vicinity of the East Anglia

THREE site. Several dredger tracks intersect the site transiting from Ijmuiden and other ports in the Netherlands to the UK.

15.5.6 Fishing Vessel Activity

70. Fishing vessel activity was monitored during the four site-specific surveys with 93% of the activity recorded using AIS and 7% recorded using radar. Where possible, the vessels tracked by radar were identified by manual observation. In most cases it was possible to identify the type of vessel but not the vessel name. Those that were visually identified were primarily beam trawlers.

71. Vessels were tracked steaming on passage through the site as well as engaged in fishing. The fishing vessels tracked during the four maritime traffic surveys are plotted in *Figure 15.11.*

72. Overall, 67 unique fishing vessels were tracked within 10nm of the East Anglia THREE site. An average of six unique fishing vessels per day was recorded within 10nm of the East Anglia THREE site throughout the combined 40 day survey period. The level of fishing vessel activity recorded in the area was higher during the August to September 2012 and July to August 2013 surveys, when an average of seven to eight fishing vessels were tracked per day, compared with the May 2013 survey when an average of two fishing vessels were recorded per day. Looking at the validation separately during the January to February 2014 winter validation survey an average of five unique fishing vessels per day were recorded within 10nm of the East Anglia THREE site.

73. In terms of fishing vessels within the East Anglia THREE site itself, the greatest level of activity was recorded during the August to September 2012 and July to August 2013 surveys with an average of four fishing vessels per day logged within the East Anglia THREE site. During the May 2013 survey and January to February 2014 surveys a lower level of fishing was recorded within the site boundary, with an average of two fishing vessels per day and two to three vessels per day respectively recorded. The greatest density of fishing vessel activity was recorded within the northern section of the East Anglia THREE site.

74. It should be noted that a proportion of the unidentified vessels tracked on radar (non-AIS) are also likely to be fishing vessels.

15.5.7 Recreational Vessel Activity

75. An overview plot of the recreational sailing activity and facilities in the area from the UK Coastal Atlas of Recreational Sailing (RYA 2010), relative to the East Anglia THREE site, is presented in *Figure 15.12*.

76. Based on the RYA published data, there are three cruising routes passing through the East Anglia THREE site, two of which are medium use and one of which is light use. The medium use route that passes through the southern end of the site is headed for Ostend in Belgium and the medium use route that passes through the northern part of the site is headed to Amsterdam. The light use route which intersects the centre of the site is bound for Den Helder (Netherlands). A further medium use route passes approximately 2nm to the south of the site which is also headed for Amsterdam.

77. There are a number of clubs, training centres and marinas for recreational vessels located on the East Anglia coast line. Those closest to the East Anglia THREE site are located on the Suffolk coast at Lowestoft, Winterton Ness area and Great Yarmouth, approximately 39 to 45nm west of the site.

78. During the combined 40 day survey period, a total of 56 unique recreational vessels were recorded within 10nm of the East Anglia THREE site, an average of between one and two vessels per day. Of these, 33 recreational vessels were recorded within the site itself. It is noted that 91% of vessel tracks had AIS and 9% were recorded on radar.

79. The vast majority of recreational vessels recorded in the area during the survey were sailing yachts, with three tall ships transiting the DWR Off Brown Ridge TSS and one unspecified recreational vessel.

80. A relatively low level of recreational activity was recorded during the 30 days of survey in 2012 and 2013. It should be noted that the radar range may have resulted in under-representation, in terms of recreational craft activity. However, given the seasonal surveys and the good coverage (due to high pressures) noted during the more popular sailing periods this is expected to be limited under representation with a high data confidence overall for recreational traffic baseline.

15.5.8 Ports

81. The nearest ports to the East Anglia THREE site are Lowestoft and Great Yarmouth, located approximately 42nm and 43nm west of the site respectively. It is noted that ports for construction or operation and maintenance of the proposed East Anglia THREE project are not yet defined, but would result in an increase in traffic to or from the chosen port. It is noted that Ijmuiden and Rotterdam are the closest transboundary ports and are both located over 50nm from the site.

15.5.9 Maritime Incidents (MAIB and RNLI Data)

82. The locations of accidents, injuries and hazardous incidents reported to the MAIB within 10nm of the East Anglia THREE site between January 2004 and December 2013 are presented in *Appendix 15.1 (Figure* 9.1), colour-coded by type.

83. A total of five unique incidents involving five vessels were reported in the area within 10nm, corresponding to an average of less than one incident per year (0.5 per year). One of the incidents was recorded within the 10nm buffer, involving a hazardous incident on board a fishing vessel on 6th October 2005. There were no collision incidents reported in the area during the ten year period.

84. Data on RNLI lifeboat responses within the study area in the 10 year period between 2001 and 2010 have been analysed. A total of 11 launches to 10 unique incidents were recorded by the RNLI (excluding hoaxes and false alarms). *Appendix 15.1 (Figure* 9.2), presents the RNLI incidents by casualty type.

85. There was one incident recorded within the East Anglia THREE site over the ten year period analysed. This incident involved a large merchant vessel that was affected by adverse conditions. The Gorleston all-weather Lifeboat (ALB) responded first, followed by the Cromer ALB.

86. There was an average of one incident per year reported to the RNLI within 10nm of the East Anglia THREE site between 2001 and 2010. All incidents within 10nm of the East Anglia THREE site were responded to by ALBs, with the majority of these (45%) being responded to by the Lowestoft ALB. The East Anglia THREE site is outside the operational range of Inshore Lifeboats (ILBs) and is approaching the maximum practical range for ALB response. Therefore it is likely that all incidents would be responded to by ALBs.

87. Based on the review of incidents, it can be seen that the East Anglia THREE site and its immediate vicinity has experienced a relatively low rate of incidents in recent years. However, this may to an extent, result from the limitations within the data used, as RNLI responses tend to be more coastal and MAIB data, while it covers all vessels within 12nm of the UK coast, will only record UK vessels beyond the 12nm limit reliably.

88. It is noted that there are limitations with incident data. RNLI only respond to incidents within 100nm (generally) and MAIB are only required to record UK registered vessels incidents beyond the 12nm limit. This means that foreign waters are not adequately covered and there are no universal data sets to improve this.

15.6 Potential Impacts

89. The impact assessment has been divided into sections dealing within the impact on different shipping and navigation receptors. The following receptors have been identified as potentially being impacted during the construction, operation and maintenance, and decommissioning phases of the proposed East Anglia THREE project:

- Commercial Vessels Safe Operation:
- Commercial Vessels Routeing;
- Fishing Vessel (impacts on navigation);
- Recreation Vessels;
- Port Operations; and
- Emergency Response.

90. As defined in section 15.6 impacts that have been mitigated to ALARP with embedded mitigation have not been highlighted and only details of residual impacts are described.

15.6.1 Impacts on Commercial Vessel Safe Navigation

91. The following assesses the impact of the proposed East Anglia THREE project on commercial vessel safe navigation as noted in *Table 15.2* worst case assumptions

(impacts 1, 2, 10, 11, 12 and 13). As part of this assessment the following scenarios have been considered as part of the NRA (*Appendix 15.1)* process:

- Base case without windfarm;
- Base case with windfarm;
- Future case without windfarm (assuming 10% increase in traffic); and
- Future case with windfarm (assuming 10% increase in traffic) Vessel to Vessel only.

92. Modelling was undertaken for both increased vessel to vessel and vessel allision risk, the full results of which can be found in *Appendix 15.1* (sections 23-26). It should be noted that throughout the allision and collision risk modelling undertaken as part of the NRA only five offshore electrical platforms and 2 buoys were taken into account - see paragraph 14.

93. The change in potential vessel-to-vessel collision frequency due to the construction of the East Anglia THREE site was estimated to be $1.18x10^{-02}$ per year for the partial fill build scenario and $4.01x10^{-03}$ for the 100% fill build scenario. This represents a 0.63% increase (partial fill build scenario) and 0.21% increase (100% fill build scenario) from the pre windfarm vessel-to-vessel collision risk for the area considered. Phased development has not been modelled.

94. It is anticipated that the vessel to vessel collision risk would not significantly alter (overall development spread and hence degree of vessel re-routeing required would not increase significantly) given the additional offshore electrical platform considered throughout the Two Phased construction approach. It can therefore be concluded that the vessel to vessel collision frequency results reported are representative of the worst case.

95. It was noted that risk of vessel to vessel collisions may increase in the high density areas noted to the north or south of the East Anglia THREE site due to routes altering from their base case routes, which currently intersect, to deviate north or south (relevant to both 100% and partial fill designs). With consideration for the deviations and accumulation of traffic, increases in collision risk are expected to be negligible overall, due to the lower densities of traffic on the deviated routes, and mitigated by embedded mitigations and good practice

such as continuous compliance with the International Regulations for Preventing Collisions at Sea (COLREGs) including conduct of vessel in restricted visibility, following safe speed principles and compliance for the 'give way' rules.

96. Based on modelling of the revised routeing following the complete installation and commissioning of the proposed East Anglia THREE project the frequency of a passing powered vessel allision is estimated to be $2.97x10^{-02}$ per year for the partial fill build scenario (one allision every 34 years) and $1.67x10^{-02}$ for the 100% fill build scenario (one allision every 60 years). The allision return period is higher than the historical average of $5.3x10^{-04}$ (one in 1,900 years) per installation-year for offshore installations on the UK Continental Shelf (Health and Safety Executive (HSE) 2010).

97. It is noted that an additional structure on the periphery of the site would alter the allision return period due to the increase in geometric surface area. However given EATL's commitment to not place additional structures (accommodation platforms, collector substations, converter stations, meteorological masts and Lidar buoys) within 1km of the southern boundary, it is anticipated that the additional offshore electrical platform considered throughout the Two Phased construction approach would result in a small increase to the overall powered vessel allision risk for the proposed East Anglia THREE project. It can therefore be concluded that the powered vessel allision frequency results reported are representative of the worst case.

98. The majority of this risk was noted on the southern site boundary and was to some degree due to the inclusion of larger structures (substations) on the peripheral boundary and the convergence of a number of deviated routes (combination of routes 13 and 14 could see approximately 13 to 14 vessels per day transiting past the southern boundary). Following assessment of these allision modelling results the structures would now be located inter row within the array which would reduce the overall allision risk for the East Anglia THREE site. It is also noted that in practice it is likely that vessels would increase their passing distance due to the available sea room and not route on the worst case passing distances (2nm) as used within the model.

99. Also, following assessment work already undertaken at a zonal level, the East Anglia THREE site has been designed (see section 15.3.2 Worst Case) to take consideration of both DWRs and the traffic using them and agreement has been

reached with stakeholders of a 2nm buffer to the east and 1nm to the west (see *Annex 15.1.5*) of the site allowing sufficient sea room for the routes to be safely used. These distances should also prevent crossing encounters or collisions associated with east to west traffic and the DWRs by allowing sufficient sea room for vessels to visually and electronically acquire targets before crossing the DWR. It is considered unlikely that larger commercial vessels would transit through the array although it is noted that it is not prohibited under United Kingdom legislation.

100. As discussed in sections 15.6.3 and 15.6.4 it may be likely that commercial fishing vessels or recreational craft may be displaced from their current area of operation or transits by the East Anglia THREE site, increasing the potential risk of encounters or collision risk for commercial vessels. However, due to low levels of activity for fishing vessels and recreational craft combined with considerations in site design (including separation from DWR as noted in paragraph 50) for small vessel navigation, this is not considered to be a significant risk.

101. A full review of collision and allision modelling results can be found in *Appendix 15.1*, of which details are noted by receptor type in *Annex 15.1.2. Annex 15.1.2* also presents outcomes in terms of fatalities on-board and oil pollution from the vessel. This is based on research into historical collision incidents (MAIB International Tanker Owners Pollution Federation Limited). Results showed the incremental increases in risk to both people and the environment caused by the East Anglia THREE site but are considered to be minor in terms of consequence.

102. Following assessment, it was noted that the majority of the Not Under Command (NUC) vessel allision frequency is associated with the more westerly structures and those on the southern boundary which produced the worst case results. This was related to the currents in the area which run in a generally south-west to north-east direction on the ebb. The frequency of a drifting vessel allision is estimated to be 2.07×10^{-03} per year for the partial fill build scenario (one allision every 483 years) and 1.14×10^{-03} for the 100% fill build scenario (one allision every 879 years).

103. It is noted that an additional structure on the periphery of the site would alter the allision return period due to the increase in geometric surface area. However given EATL's commitment to not place additional structures

(accommodation platforms, collector substations, converter stations, meteorological masts and Lidar buoys) within 1km of the southern boundary in proximity to the areas of high density shipping, it is anticipated that the additional offshore electrical platform considered throughout the Two Phased construction approach would result in a small increase to the overall powered vessel allision risk for the proposed East Anglia THREE project. It can therefore be concluded that the powered vessel allision frequency results reported are representative of the worst case.

104. The majority of encounters in the area occurred to the south and east of the East Anglia THREE site within the DWR via Off Brown Ridge TSS and at the meeting point of north-west / south-east traffic crossing the DWR via Off Brown Ridge TSS and the DWR via DR1 Light Buoy. In comparison, there were relatively few encounters within the East Anglia THREE site. The majority of vessels involved in encounters were cargo vessels, with chemical tankers, general cargo vessels, oil tankers and container vessels representing 23%, 21%, 13% and 8% of vessel encounter traffic respectively. The majority of encounters recorded within the site were fishing vessels who were actively engaged in fishing and encountering transiting vessels.

105. At the onset of offshore wind development both the MCA and the British Wind Energy Association undertook trials at the North Hoyle (2004) and Kentish Flats (2005) windfarms to determine any impact of wind turbines on marine communication and navigation systems. MGNs 275 and later 371 were then developed by the MCA using the outcomes of the assessment and now MGN 371 requires developers to comply with the parameters for the design of arrays within it so as to minimise the impacts associated with wind turbines and marine radar operation. The results of the North Hoyle and Kentish Flats trials indicated that the onset range from the wind turbine structures of significant false returns is about 1.5nm, with a progressive increase in the impact of effect as the boundary is approached. For the mariner it was noted that careful adjustment of the radar controls can, within limitations, supress some of the effects but that they should operate within and in proximity to the East Anglia THREE site with caution and based on the guidance provided to them in MGN 372 (MCA 2008b).

106. It is also noted radar interference is mainly a problem during hours of darkness including night-time and adverse weather. AIS monitoring is an effective mitigation, in particular as of May 31 2014, since when all fishing vessels greater

than or equal to 15min length must carry AIS systems. This represents a significant proportion of the traffic noted in the East Anglia THREE site which showed a limited number of small craft and vessels in the area. It is also assumed that onsite support vessels will carry AIS class B systems as a minimum.

107. Having complied fully with the MCA's guidance in MGN 371 (MCA 2008a), considering the site location and traffic in the area, the results of consultation and the NRA note there are no significant adverse impacts on marine radar due to the construction of the East Anglia THREE site.

108. In order to inform vessel routeing in proximity of the offshore cable corridor, 20 days of AIS data collected from coastal survey stations has been analysed. The 20 day survey period is congruent with the second and third surveys carried out by the *Northern Viking* survey vessel and therefore covers a period between the 12th to 21st of May 2013 and the 24th July to 3rd August 2013.

109. General cargo vessels were the most frequently recorded vessel type throughout the 20 day survey period, representing 24% of marine traffic. Other significant vessel types recorded include chemical tankers and bulk carriers, representing 15% and 12% of marine traffic respectively. A higher proportion of recreational vessels (7% sailing vessels and 0.03% motor boats) were recorded throughout the survey period in comparison to surveys carried out in the vicinity of East Anglia THREE site. This is due to the higher density of recreational vessels typically found closer to shore.

110. Anchoring activity recorded within 5nm of the offshore cable corridor was constrained to designated anchorage areas (Cork and Bawdsey) within the limits of Harwich Haven Port Authority and to an area north of the proposed offshore cable corridor in proximity to the Southwold Oil Cargo Transhipment Area. No vessels were recorded at anchor directly over the proposed offshore cable route corridor. Throughout consultation with the UKHO and MCA it was stated that the Sledway anchorage, currently marked on Admiralty Charts in close proximity to the export cable corridor, was an anchorage with no recorded source. Harwich and Felixstowe harbour authorities also confirmed that the area is only very occasionally used by larger vessels. Therefore the UKHO have agreed to remove the anchorage symbol from Admiralty Charts throughout the November 2015 edition. Harwich and Felixstowe harbour authorities indicated they were content with this decision.

111. It is estimated as a minimum 90% of the export, interconnector and inter-array cables would be buried and where protection is required, assessment 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. It is assumed that partially buried cables would be marked and guarded as required to ensure they do not present a risk to anchoring vessels.

15.6.1.1 Construction

112. During the construction phase there is expected to be an increase in vessels (approximately 55 vessels including drilling rigs throughout both the Single Phase and Two Phased construction approach) in the vicinity of the East Anglia THREE site. This has potential to lead to an increase in vessel to vessel encounters and potentially collisions for the area, as well as the potential for increased allision associated with the proposed East Anglia THREE project's own vessels. The construction period is scheduled to span a total of 41 months, with a total of 5,700 vessel movements, for the Single Phase construction approach or 45 months, with a total of 7,600 vessel movements, for the Two Phased construction approach. The extended construction period (additional 4 months) and vessel movements (additional 1,100 vessel movements) throughout the Two Phased construction approach increases the potential for vessel to vessel encounters and potentially collisions, when compared to the Single Phase construction approach. However, the increased duration and vessel movements will not alter the significance of effects, given the embedded mitigations in place throughout the construction period.

113. Phased development layouts are not available at this stage but it is assumed that this layout would be agreed in advance with the MMO (in conjunction with the MCA and THLS) as per the DCO requirements already in place.-

114. No specific ports have been identified for use as a construction base. 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. The project is also considering maintaining on site facilities which would reduce the number of transits.

115. The presence of personnel and vessels on-site, information available during the construction and decommissioning phases, safety zones and guard vessels are expected to mitigate the allision risk associated with the East Anglia THREE site.

116. However, it is noted that there would be an increased level of activity on site that could increase the potential for vessel to vessel collisions with commercial, support or construction craft operating in and around the East Anglia THREE site as well as transiting to bases. As there are no details on the construction plan this impact cannot not be fully assessed but has the potential to present a moderate but remote risk to commercial vessels.

117. Potential residual impacts identified following consideration of embedded mitigation include commercial vessels to support / construction vessel collision and encounter risk.

118. In order to reduce this residual risk to **broadly acceptable** (for both the Single Phase and Two Phased construction approach) 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.

15.6.1.2 Operation and Maintenance

119. During operation and maintenance there would be both service and support vessels working on the site with an estimated 52 service vessel movements and a maximum of 4,000 support vessel movements per annum.

120. As with the construction period there is potential for increased collision and encounters for commercial vessels with support or service craft as well as the potential for allision risk associated with the site design and proximity to routes, resulting in a moderate and reasonably probable frequency due to increased vessel movements to and from site and density of routes transiting in the area (in particular routes running south of the proposed project).

121. Through baseline data and risk modelling of commercial vessel allision and collision risk, there is expected to be a moderate increase in encounters and collision as well the potential for allision risk due to the development of the proposed East Anglia THREE project. It is noted that following consideration of structures on the southern boundaries and associated collision risk EATL have removed the potential for these larger structures to be on the periphery and moved them into the array reducing the allision risk.

122. It is assumed that both inter-array and export and interconnector cables would be effectively monitored through the lifetime of the project to ensure they do not present a hazard to vessels and navigation. See section 15.6.7 for additional information on cable decommissioning.

123. Potential residual impacts identified following consideration of embedded mitigation include:

- Commercial vessels to support / service vessel collision and encounter risk;
- Commercial vessel (powered) allision with windfarm structure;
- Commercial vessels to vessel collision or encounter risk; and
- Commercial vessel (drifting) allision with windfarm structure.

124. The residual risk for commercial vessels (navigation safety) could be reduced to **broadly acceptable** by additional mitigation including works vessel coordination as defined in section 15.10, but also consultation and consideration of the final site design including cable burial and the locations of larger offshore structures. It is also noted that the southern convergence of routes presents an increased allision risk on the southern boundary of the site. Additional aids to navigation such as buoyage could be required, following consultation with THLS and MCA, to aid the displacement of traffic and prevent the creation of a high risk crossing point.

125. With regards to drifting vessels, site design has ensured that the East Anglia THREE site is an effective distance from shipping lanes to allow vessels NUC sea room and therefore time to take action to prevent drifting (such as emergency anchoring). However EATL 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 situation within their own documented safety systems.

15.6.1.3 Decommissioning

126. Similar to the construction phase, during the decommissioning phase there is expected to be an increase in vessels on site and in the vicinity of the proposed East Anglia THREE project. This has potential to lead to an increase in vessel to vessel encounters as well as the potential for increased allision associated with East Anglia THREE'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. It is noted that commercial vessels will be familiar with the proposed East Anglia THREE project and the information promulgation process, after the operational life which will limit the frequency of occurrence. As there are no details on the decommissioning plan this impact cannot be fully assessed but has the potential to present a moderate but remote risk to commercial vessels.

127. The presence of personnel and vessels on-site, information available during the decommissioning phases, safety zones and guard vessels are expected to mitigate the allision risk associated with the decommissioning of the proposed East Anglia THREE project.

128. Potential residual impacts identified following consideration of embedded mitigation include commercial vessels to support / decommissioning vessel collision and encounter risk.

129. As with the construction phase, in order to reduce this residual risk to **broadly acceptable** the frequency of potential collisions would be reduced by additional mitigation including the development, implementation and operation of works vessel coordination. This would include the development of decommissioning traffic 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.

15.6.2 Impact on Commercial Vessel Routeing

130. The following assesses the impact of the proposed East Anglia THREE project on commercial routeing as noted in *Table 15.2* worst case assumptions (impacts 3 and 14).

131. The physical presence of the East Anglia THREE site is likely to result in deviations for a number of routes (generally bound between UK ports the Netherlands, Belgium and Denmark); however none of the displaced routes are heavily trafficked in comparison to other routes around the southern North Sea area. A revised vessel routeing pattern following the construction of the proposed project has been estimated based on the vessel baseline assessment. For the purposes of this assessment a worst case 2nm passing distance (mean of the route) for routes displaced by the proposed project has been used. Re routeing

has been undertaken giving consideration to known developments and routeing measures as well as the vessel's final destination port. The 100% fill of the site area (*Figure 15.3*) presents the worst case risk to deviation due to the largest use of the sea area.

132. It should also be noted that due to the number and density of routes within the southern North Sea, the study area for commercial vessels with regards to the development of the East Anglia THREE site has been extended to include routeing outwith the site and the zone giving consideration to the overall base case within the area.

133. Currently three main routes fully pass through the site (routes 15, 17 and 19) and have approximately one to two vessels per day on each route. Route 14 and 16 also partially intersect the site with route 16 showing one to two vessels per day and route 14 being a denser route with five vessels per day which includes north west to south-east traffic bound from the north east UK and ports to the Netherlands including Ro-Ro (Roll on Roll Off) route between Killingholme and Hoek Van Holland. The majority of the traffic on these routes is cargo (including liquid and gas tankers) with DECC vessel types showing the majority to be general cargo (34%) and chemical tankers (14%). There are not anticipated to be any significant impacts on the minor deviations associated with route 14 and 16.

134. Route 17 is also transited by Ro-Ro vessels bound between Teesport and Rotterdam and operated by P&O Ferries. The most common vessel type to transit the East Anglia THREE site on route 17 were chemical tankers (47%) followed by general cargo vessels (36%). The Ro-Ro cargo vessel *Norsky*, operating on the P&O Teesport to Europort, was the most frequently recorded vessel. It should be noted that this vessel has since been replaced by the Ro-Ro cargo vessel *Wilhelmine*.

135. Route 21 was previously used by DFDS's *Sirena Seaways* Ro-Ro cargo vessel bound between Harwich and Esbjerg. This route ceased operations on the 28th September 2014. However, due to the potential for the usage of Route 21 to increase in the future, and the need to ensure comprehensive assessment of the impact on vessel routeing, the impact of the East Anglia THREE site on this route has been assessed. The median of this route does not pass through the East Anglia THREE site but a minor deviation may be required to maintain a safe distance. *The Sirena Seaways* was the only vessel to operate on this route.

136. Full details on the individual routes are shown within *Appendix 15.1* (Section 14).

137. *Appendix 15.1* shows anticipated re-routes for the routes potentially impacted by the development of the East Anglia THREE site including deviations following the changes to the Dutch Routeing measures in 2013 which on their own displaced routes 13, 14, and 15 slightly south of their previous mean position (*Appendix 15.1 Section 11*). *Figure 19.2* in the NRA shows the deviated routes post the construction of the East Anglia THREE site where the maximum deviation at a 100% fill (*Figure 15.3*) creates an estimated 3.63% (3.38nm for route 17 outbound) increase on overall journey length compared to 1.7% (1.63nm for route 15 inbound) for a indicative partial fill of the East Anglia THREE site (*Figure 15.4*).

138. The increase in route distances for vessels displaced by the East Anglia THREE site would be minimised by the promulgation of information (including charting) which would enable vessels to passage plan in advance of encountering the East Anglia THREE site.

139. *Table 15.9* summarises the current commercial ferry operations in proximity of the East Anglia THREE site.

140. It should be noted the DFDS Harwich – Esbjerg route ceased on the 28th September 2014 due to increased running costs. This service has not currently been replaced, however in order to ensure comprehensive assessment of the impact of the East Anglia THREE site on vessel routeing (if this route were to be re-instated) the potential deviation of vessels operating on this route has been assessed; therefore no changes have been made to the modelling within the NRA.

Table 15.9. Commercial Ferry Routes

Operator	Vessel	Route	Vessels Per Day
Stena Line	*Stena Transit*	Killingholme – Hook of Holland (Route 14)	1 every 2 days
	Stena Transporter		1 every 2 days
DFDS Seaways	*Sirena Seaways*	Harwich – Esbjerg (Route 21) (Ceased operation since the NRA modelling and traffic assessments were undertaken)	1 every 2 days
Cobelfret	*Palatine*	Killingholme – Rotterdam (Route 14)	2 every day
	Vespertine		
	Amandine		
	Opaline		
P&O Ferries	*Pride of Rotterdam*	Hull – Europort (Routes 13 & 14)	1 every day
	Pride of Hull		
	Wilhelmine	Teesport – Rotterdam (Route 15)	1 every 2 days
Mann Lines	*Estraden*	Bremerhaven – Harwich – Cuxhaven	1 every 7 days

141. Looking at individual ferry types there are two displaced routes (route 14 and route 15) that are transited by regular ferry operators. Vessels operating on route 14 operated by regular ferry operators include; the Stena Line passenger vessels *Stena Transporter* and *Stena Transit* operating between Killingholme and Hook of Holland; the Cobelfret RoRo cargo vessels *Palatine*, *Vespertine*, *Amandine* and *Opaline* operating between Killingholme and Rotterdam and the P&O Ferries passenger vessels *Pride of Rotterdam* and *Pride of Hull* operating between Hull and Europort. The only regular ferry operator to transit on route 15 is the P&O Ferries RoRo cargo vessel *Wilhelmine* operating between Teesport and Rotterdam.

142. It is noted that the mean of route 14 does not pass through the East Anglia THREE site therefore deviations are estimated to be minor and less than 0.1nm and associated with increasing its safe passing distance. As the mean of route 15 passes through the centre of the East Anglia THREE site, a worst case deviation

of approximately 1.6nm is anticipated for vessels whilst transiting north of the East Anglia THREE site in the partial fill build scenario and bound for Rotterdam. It is possible that vessels would route south of the East Anglia THREE site also resulting in a worst case deviation of approximately 1.1nm for vessels transiting to Teesport.

143. The *Estraden,* operated by Mann Lines, was recorded transiting through the East Anglia THREE site on five occasions throughout the 40 day survey period whilst on the Bremerhaven to Harwich leg of its journey. The return leg (Harwich to Cuxhaven) of the journey passes approximately 6nm south of the East Anglia THREE site. It is therefore anticipated that only the Bremerhaven to Harwich leg would be impacted by the development of the proposed East Anglia THREE site resulting in a deviation of approximately 1.0nm.

144. Adverse weather routeing in the southern North Sea is not expected to be impacted by the development of the proposed East Anglia THREE project. In order to mitigate the effects of adverse weather there is ample safe sea room for vessels to safely distance themselves from the East Anglia THREE site without increasing time or deviation distance. However, no evidence of adverse weather through the site has been identified from consultation or baseline data. Commercial ferries, in order to minimise passenger discomfort, often route on coastal courses during adverse weather and therefore are not anticipated to be impacted.

145. Following the hazard workshop (*Annex 15.1.1* to *Appendix 15.1*), the marine aggregate representative noted that the majority of dredgers transit from dredge areas to the west of the East Anglia Zone to the Thames Estuary in the south, but on occasion dredgers also transit east to Ijmuiden and Amsterdam. Vessels currently transit eight to ten loads, transporting approximately 50,000 tonnes of dredge material per week and estimated to be operational for up to 25 years (plus) due to increasing demand for coarse material from mainland Europe. However, following consideration of the baseline, current development levels within the East Anglia Zone and in this case looking specifically at the proposed East Anglia THREE project, there are not expected to be adverse impacts on routes for dredgers bound from UK east coast dredge sites to Amsterdam. Following review of the marine traffic survey data a 90th percentile could not be established due the low levels and infrequency of traffic.

146. Commercial vessels on a number of routes passing in proximity to the East Anglia THREE site, including vessels in the DWRs are likely to pass within the 1.5nm range from a wind turbine at which significant radar interference could be experienced (see section 27.1 of the NRA – *Appendix 15.1*).

15.6.2.1 Construction

147. During the construction phase and due to use of temporary construction safety zones there is potential for routes to be deviated around larger areas of construction. It is assumed that the overall construction area (and hence degree of vessel re-routeing required) will be broadly similar throughout both the Single Phase construction approach and Two Phased construction approach. Therefore, the impact on commercial vessel routeing throughout the construction period (regardless of the construction phase adopted) will not differ greatly and has been assessed as such throughout the following subsection.

148. This impact could be mitigated with proactive promulgation of information to allow vessels to passage plan and avoid current areas of activity. Therefore, although deviations are likely to be frequent (frequently varied) they would be of a negligible level of consequence.

149. Potential residual impacts identified following consideration of embedded mitigation include commercial vessel deviations during the varying construction activities.

150. With promulgation of information vessels would be able to effectively passage plan to ensure that there are not significant impacts on routeing during the construction and decommissioning phase. Also, as these phases are considered temporary (43 months for Single Phase and 45 months for Two Phased construction approach) this impact is considered to be **tolerable and ALARP.**

15.6.2.2 Operation and Maintenance

151. Apart from periods of significant maintenance, once the windfarm is constructed deviations would be permanent and fixed, allowing vessels to effectively passage plan. 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.

15.6.2.3 Decommissioning

152. 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 proactive promulgation of information to allow vessels to passage plan and avoid current areas of activity. Therefore, although deviations are likely to be frequent (frequently varied) they would be of a negligible level of consequence. It is noted that vessels are likely to be familiar with the East Anglia THREE site following the operational life thus reducing the frequency of occurrence.

153. Potential residual impacts identified following consideration of embedded mitigation include commercial vessel deviations during the varying and decommissioning activities.

154. With promulgation of information, vessels would be able to effectively passage plan to ensure there are not significant impacts on routeing during the decommissioning phase and this impact is considered to be **tolerable and ALARP.**

155. Further consideration to cumulative and transboundary routeing is given in sections 15.7 and 15.8.

15.6.3 Impact on Fishing Vessels (Safe Navigation)

156. The following assesses the impact of the proposed East Anglia THREE project on fishing vessels as noted in *Table 15.2* worst case assumptions (impacts 4 and 15).

157. Fishing vessels were recorded on AIS (93%) and radar (7%). Overall 67 unique fishing vessels were tracked during the combined survey period. An average of six unique fishing vessels per day was recorded within 10nm of the East Anglia THREE site throughout the combined 40 day survey period. The number of fishing vessels recorded in the area was higher during August and September 2012 and July and August 2013 surveys when an average of seven to eight unique fishing vessels were tracked per day, compared with the May 2013 survey when an average of two fishing vessels were recorded per day. From the tracks it can be noted that there was both a combination of vessels engaged in fishing and vessels transiting to and from fishing grounds and ports.

158. Results of the fishing allision model show that the frequency of a fishing vessel allision is estimated to be 6.76×10^{-02} per year (one allision every 15 years). The

additional offshore electrical platform considered throughout the Two Phased construction approach would also result in a small increase to the overall fishing vessel allision risk given in the increase in geometrical surface area. However, the increase in fishing vessel allision risk is not deemed to be significant enough to alter the reported frequency bands throughout the following subsections. It is likely that smaller fishing vessels operating in the area would be able to navigate around the proposed project including during the construction and decommissioning phases as well as navigate safely within the array (outwith the current area of operation) however this would be at the vessel skipper's discretion. There is potential that larger vessels may be displaced from the East Anglia THREE site especially during construction. It is noted that fishing vessels are primarily local to the area (regular users) and would be familiar with the current phase of operation and likely areas of activity, especially during the construction and decommissioning phases.

159. As discussed in section 15.6.1, there is potential that commercial vessels may be displaced into fishing areas, however embedded mitigations should ensure that there is no increased risk with regards to navigational safety.

160. As with commercial vessels, anchoring impacts are expected to be mitigated by effective cable burial and protection. Operational impacts associated with fishing activity and commercial impacts are considered in Chapter 14 Commercial Fisheries.

15.6.3.1 Construction

161. During the construction phase and due to use of temporary construction safety zones, there is potential for routes and vessels' activity to be deviated around or away from areas of construction. It is assumed that the overall construction area (and hence degree of vessel re-routeing required) will be broadly similar throughout both the Single Phase construction approach and Two Phased construction approach. Therefore, the impact on the safe navigation of fishing vessels throughout the construction period (regardless of the construction phase adopted) will not differ greatly and has been assessed as such throughout the following subsection.

162. This impact should be mitigated with proactive promulgation of information as well as ongoing consultation with the fishing community. The safety zones and guard vessels would also ensure that fishing vessels are safely displaced from

areas that may present a risk to them. Risk to fishing vessels during construction is a moderate level of consequence but because of embedded mitigation measures, including the proactive promulgation of information, the frequency is considered to be extremely unlikely and therefore has no residual impacts.

15.6.3.2 Operation and Maintenance

163. There is potential for fishing activity to be impacted by the East Anglia THREE site during the operation phase. The worst case fishing allision risk is one allision every 15 years (defined by the maximum number of installations and the maximum target area) and impacts are considered to be of moderate consequence with the allisions when considering that allisions are likely to be slow speed and therefore low energy with a remote frequency (due to the local and familiar nature of the vessels but lack of active mitigations present during construction and decommissioning).

164. As with consideration of commercial vessels, there would be some risk associated with service or support vessels transiting in the area.

165. Radar impacts are considered similar to those noted for commercial vessels, section 15.6.1; therefore potential residual impacts identified following consideration of embedded mitigation include fishing vessel allision with a windfarm structure.

166. The risk or frequency of fishing vessels allision can be reduced to **broadly acceptable** by consultation with the MMO on final site design (including cable burial and the locations of larger offshore structures) to ensure it allows fishing vessels to safely transit and navigate within the site and marine traffic coordination to ensure that service or support vessels do not present a risk to fishing vessels.

167. There may also be a requirement for additional aids to navigation to assist fishing vessels transiting within or in proximity to the East Anglia THREE site but this would depend on final site design and agreement with THLS and MCA.

15.6.3.3 Decommissioning

168. As with the decommissioning phase, due to use of temporary safety zones (500m) there is potential for routes and vessels' activity to be deviated around or away from areas of decommissioning. However, this impact should be mitigated with embedded mitigation including proactive promulgation of information as

well as ongoing consultation with the fishing community. It is also noted that over the operational life of the proposed East Anglia THREE project, vessels will become familiar with the presence of the structures and its information promulgation processes thus reducing the frequency of occurrence. Risk to fishing vessels during construction is a moderate level of consequence but because of embedded mitigation measures, including the proactive promulgation of information, the frequency is considered to be extremely unlikely and therefore has no residual impacts.

15.6.4 Impact on Recreational Vessels

169. The following assesses the impact of the proposed East Anglia THREE project on recreational vessels as noted in *Table 15.2* worst case assumptions (impacts 5, 6, 7, 16, 17 and 18).

170. When considering the RYA Cruising Atlas (2010) it can be seen that there are three routes (one low and two medium) running in an approximate east to west direction transiting from the UK coast to mainland Europe. The combined 40 days of AIS and radar data from the marine traffic surveys showed similar results but low levels of one to two per day. It was noted that approximately 91% of the recreational craft recorded, in the study area, were carrying AIS. The vast majority of recreational craft were sailing vessels on transit.

171. Again minimum spacing would be 675m between wind turbines in a row and 900m between rows which should allow adequate sea room for recreation craft to navigate through the East Anglia THREE site, especially as the majority of the vessels in the area will be equipped for longer navigational transit. 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 and that the choice is influenced by a number of factors including the vessels characteristics, the weather and sea condition. The MCA's MGN 372 (MCA 2008b) concluded that "Although offshore renewable energy installations present new challenges to safe navigation around the UK coast, proper voyage planning, taking into account all relevant information, should ensure a safe passage and the safety of life and the vessel should not be compromised". The recreational sailor is likely to take due consideration for the weather conditions and passage plan accordingly to ensure safe passage. It is assumed that in adverse weather and winter periods limited recreational activity would be present within the East Anglia THREE site.

172. The air clearance between wind turbines rotors and sea level at MHWS would not be less than 22m, as per guidance, and minimises the risk of interaction between rotor blades and yacht masts.

173. Radar impacts are considered similar to those noted for commercial vessels section 15.6.1.

15.6.4.1 Construction

174. As with consideration of commercial vessels there would be some risk associated with service or support vessels transiting in the area (*Table 15.2*). However, given the low levels of recreational traffic this is not expected to be significant.

175. Construction safety zones may displace traffic temporarily for the construction phase and would be managed through proactive promulgation of information and active safety measures. It is assumed that the overall construction area (and hence degree of vessel re-routeing required) will be broadly similar for both the Single Phase construction approach and Two Phased construction approach. Therefore, the impact on recreational vessel transits throughout the construction period (regardless of the construction approach adopted) will not differ greatly and has been assessed as such throughout the following subsection. These impacts are expected to be of extremely unlikely frequency of risk and of a minor level of consequence given the low energy and low speed of any allisions. Following consideration of embedded mitigation there is no residual risk.

15.6.4.2 Operation and Maintenance

176. As with construction impacts, given the low level of recreational activity in the vicinity of the East Anglia THREE site, there is expected to be a low frequency of occurrence with a minor consequence resulting in no residual risk.

15.6.4.3 Decommissioning

177. As with consideration of construction impacts there would be some risk associated with service or support vessels transiting in the area (*Table 15.2*). However, given the low levels of recreational traffic this is not expected to be significant.

178. Safety zones would displace traffic temporarily for the decommissioning phase but would be managed through proactive promulgation of information and active safety measures. These are expected to be of extremely unlikely

frequency of risk and of a minor level of consequence given the low energy and low speed of any allisions. Following consideration of embedded mitigation there is no residual risk.

15.6.5 Impact of Port Operations

179. The following assesses the impact of the proposed East Anglia THREE project on ports as noted in *Table 15.2* worst case assumptions (impacts 8 and 19).

180. The nearest ports to the East Anglia THREE site are Lowestoft and Great Yarmouth, located approximately 42nm and 43nm west of the site respectively. These distances are considered large enough that there are not any direct impacts on port operations including associated impacts on port operations such as pilotage. Similar ports to the east are located over 50nm away (Ijmuiden and Rotterdam located 68nm and 66nm from the East Anglia THREE site respectively); transboundary impacts are considered in section 15.8.

181. It is noted that construction, decommissioning and maintenance activities would increase the levels of marine traffic in the vicinity of the array. This could include daily operation of windfarm support vessels to the use of jack up barges located on-site for several weeks or months. Therefore, when construction and operational port(s) are selected, further internal assessments may be required to assess the level of impact associated with the increase in traffic. For the purposes of a future case assessment a set value of 10% vessel traffic increase has already been considered for traffic modelling (with and without the proposed East Anglia THREE project) in the area.

182. There are not anticipated to be any impacts associated with the development of the export cable route as it is clear of any port operations.

15.6.5.1 Construction

183. During the construction phase there is expected to be an increase in vessels on site (approximately 55 vessels on site associated with the project throughout and a total of 5,700 vessel movements throughout the Single Phase and a total of 7,600 vessel movements throughout the Two Phased construction approach) and in the vicinity of the proposed East Anglia THREE project. This has potential to lead to increased congestion within port limits. It is assumed that the overall construction area and subsequent levels of congestion will be broadly similar for both the Single Phase and Two Phased construction approach. Therefore, the impact on port operations throughout the construction period (regardless of the

construction approach adopted) will not differ greatly and has been assessed as such throughout this subsection. It is anticipated, although cannot be quantified at this stage, that this could be managed locally with standard mitigations. (It is assumed that this traffic combined with construction or operational traffic could be effectively managed by vessel traffic services associated with the selected port). It is also noted that construction activities may be based offshore and therefore not transit daily to a shore base. Due to the extremely unlikely level of frequency and minor impacts there are not considered to be any residual risks.

15.6.5.2 Operation and Maintenance

184. During operation and maintenance there would be both service and support vessels working on the site with an estimated 52 service vessel movements and a maximum of 4,000 support vessel movements per annum. As with the construction phase this has the potential to increase congestion within port limits but should be mitigated by local management. It is noted that service and support vessels may operate from an offshore base which would reduce nearshore vessel movements. Due to the extremely unlikely level of frequency and minor impacts there are not considered to be any residual risks.

15.6.5.3 Decommissioning

185. During the decommissioning phase there is expected to be an increase in vessels on site and in the vicinity associated with the proposed East Anglia THREE project. This has potential to lead to increased congestion within port limits. However, it is anticipated, although cannot be quantified at this stage, that this could be managed locally with embedded mitigation as per the construction impact in section 15.6.1. Due to the extremely unlikely level of frequency and minor impacts there are not considered to be any residual risks.

15.6.6 Impact on Emergency Response Provision

186. The following assesses the impact of the proposed East Anglia THREE project on emergency response as noted in *Table 15.2* worst case assumptions (impacts 9 and 20).

187. Under national and international law the operators of the East Anglia THREE site would be required to comply with existing emergency response requirements, as detailed in *Appendix 15.1*, as well as giving consideration to other response groups within the area. Owing to the increased level of activity in and around the proposed project there are expected to be some increased demands on

search and rescue facilities within the area. The proposed East Anglia THREE project 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 required to provide a level of response that would ensure that response time and resources are not impacted.

188. The following impacts were assessed at the hazard workshop (the output of which can be found in *Annex 15.1.1*):

- Man Overboard;
- Unauthorised mooring to and / or deliberate damage to device;
- Unauthorised access to and / or deliberate damage to device;
- Access to structure in an emergency situation; and
- Restricted emergency response in the East Anglia THREE site in an emergency situation.

189. Embedded mitigation includes compliance with MGN 371 and the development of an ERCoP. EATL would comply fully with the requirements of MGN 371, including Annex 5 'Standards and procedures for generator shutdown and other operational requirements in the event of a search and rescue, counter pollution or salvage incident around an OREI'.

190. An ERCoP should include the following list but may also consider site specific parameters:

- Consideration for air rescue response i.e. (dots for visual orientation when hovering);
- Place of safe refuge;
- Remote monitoring and control; and
- Marking and lighting.

191. Lighting and marking for search and rescue will need to be in line with THLS, MCA and Civil Aviation Authority (CAA) requirements which are likely to include red aviation lights flashing Morse 'W' on the periphery structures. THLS have stated throughout consultation that all aviation lighting must be synchronised

and exhibit Morse code "W" light characteristics. EATL shall consult with the CAA to seek agreement on this along with the other aviation requirements. It is also noted that the MCA are currently considering having remote controlled internal lights for SAR; at present it is too early in the development process for this to be defined.

192. Those sectors of emergency response in which EATL considers it could directly cooperate and contribute (as well as self-help capability) include:

- Search and rescue as defined by the SAR Convention of 1979 and subsequent amendments;
- The rendering of assistance to vessels in distress as detailed in the Safety of Life at Sea (SOLAS convention) 1988 and in subsequent amendments;
- First response as described in the Salvage Convention of 1989; and
- First response in respect of the National Contingency Plan for Marine Pollution for shipping and offshore installations (2006).

15.6.6.1 Construction

193. The construction period is scheduled to span a total of 41 months, with a total of 5,700 vessel movements, for the Single Phase construction approach or 45 months, with a total of 7,600 vessel movements, for the Two Phased construction approach. The extended construction period (additional four months) and vessel movements (additional 1,100 vessel movements) throughout the Two Phased construction approach increases the potential for vessel to vessel encounters and potentially collisions, when compared to the Single Phase construction approach. However, the increased duration will not alter the significance of effects.

194. Due to the increased level of personnel and vessels on site during the construction phase, and therefore an increased risk of an incident occurring, this would diminish the overall ability of the current level of emergency response facilities, including pollution response. The higher frequency of occurrence during this phase is considered to be reasonably probable with a moderate consequence resulting in a level of risk requiring additional mitigation.

195. Potential residual impacts identified following consideration of embedded mitigation include reduced emergency response capability / oil spill response owing to the presence of the proposed East Anglia THREE project.

196. For emergency response, EATL would undertake a gap analysis to identify what resources may be required. This may include the establishment of a self- help capability as part of its ERCoP and Safety Management Systems. It is possible that EATL would also generally increase facilities in the area for the wider receptors. This would reduce the level of risk to **broadly acceptable.**

15.6.6.2 Operation and Maintenance

197. As with the construction impacts the operational and maintenance phase would put increased requirement on emergency response, although as a maximum number of personnel is considered lower, at 400, the frequency is remote and overall consequence considered minor resulting in a level of risk that requires additional mitigation to reduce to ALARP parameters.

198. Potential residual impacts identified following consideration of embedded mitigation include reduced emergency response capability / oil spill response owing to the presence of the proposed East Anglia THREE project.

199. As with the construction and decommissioning phase the risk could be reduced to **broadly acceptable** with the consideration of self-help facilities.

15.6.6.3 Decommissioning

200. As with the construction phase, due to the increased level of personnel and vessels on site during the decommissioning phase and therefore an increased risk of an incident occurring this would diminish the overall ability of the current level of emergency response facilities, including pollution response. The higher frequency of occurrence during this phase is considered to be reasonably probable with a moderate consequence resulting in a level of risk requiring additional mitigation.

201. Potential residual impacts identified following consideration of embedded mitigation include reduced emergency response capability / oil spill response owing to the presence of the proposed East Anglia THREE project. It is noted that facilities should be already adapted for the area following the operational phase of the proposed East Anglia THREE project.

202. For emergency response, EATL would undertake a gap analysis to identify what resources may be required. This may include the establishment of a self- help capability as part of its ERCoP and Safety Management Systems. It is possible that EATL would also generally increase facilities in the area for the wider receptors. This would reduce the level of risk to **broadly acceptable.**

15.6.7 Decommissioning Plan

203. A Decommissioning Plan in line with standard requirements would be developed and should consider the scenario where on decommissioning and on completion of removal operations, an obstruction attributable to the proposed East Anglia THREE project is left on-site which is considered to be a danger to navigation and which it has not proved possible to remove.

204. It is expected that buried cables would be de-rated and left in situ, and would be notified to UKHO to remain on navigation charts.

15.7 Cumulative Impacts

205. Projects and proposed developments were screened in to the assessment only where potential overlap between activities and receptors was identified and as defined in section 15.4.7.

206. A number of projects and 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 aggregate extraction areas, fishing activity and recreational craft transits. The following table noted developments within a 10nm buffer around the East Anglia THREE site.

Table 15.10. Cumulative Screening (10nm around the East Anglia THREE site)

Development	Distance (nm)	Status	Data Confidence	Screened In
Future East Anglia Zonal Offshore Windfarm Developments (UK)	0	Early Planning	Low	No- Future zonal development uncertain and therefore cannot fully be assessed.

Development	Distance (nm)	Status	Data Confidence	Screened In
Balgzand Bacton Gas Pipeline	6.8	Fully Commissioned	High	No- No cumulative impact anticipated.
Wissey Gas Production Pipeline	8.8	Fully Commissioned	High	No- No cumulative impact anticipated.
Future Ijmuiden Zone Offshore Windfarm Developments (Netherlands) * Further information on specific developments can be found in *Table 15.11*	10.0	Early Planning	Low	No – Due to current scoped projects. A large number of projects within the area are currently dormant.
27th Round Oil & Gas Current License Blocks: 53/10, 53/14, 53/15, 53/19a, 53/20a, 53/3a, 53/4a, 53/4b, 53/4d, 53/5c, 53/8, 53/9, 54/11a, 54/1b, 54/6a.	All within 10nm	Licensed	Medium	No- No scoping work yet been carried out and therefore cannot fully be assessed.
28th Round Oil & Gas Conditional - Awarded License Blocks: 54/6b, 54/11b, 54/16.	All within 10nm	Early Planning	Medium	No- No cumulative impact anticipated.
28th Round Oil & Gas Offered License Blocks: 53/13, 53/18, 53/19b, 53/20b, 54/1a,.	All within 10nm	Early Planning	Medium	No- No cumulative impact anticipated.

Development	Distance (nm)	Status	Data Confidence	Screened In
Ministry of Defence Marine Activities	Various	On Going	Medium	No- No cumulative impact anticipated.

207. It is noted that a zonal approach is also being considered with Netherlands territorial waters, the outer edge of which is within 10nm of the East Anglia THREE site, but as a number of the sites are dormant or unscreened they have not been considered cumulatively apart from *Breeveertien II Offshore Windfarm Development* (Dutch) which is 21.8nm miles away and considered further in cumulative routeing in section 15.8.

208. The following section identifies receptors which have the potential to create a cumulative effect with shipping and navigation receptors. This is considered in conjunction with work undertaken by The Crown Estate into cumulative (and in combination) impacts associated with offshore wind developments in (TCE 2012).

15.7.1 Reduction in available sea room for oil and gas exploration and infrastructure

209. Although it is noted in *Appendix 15.1* that licenced oil and gas blocks overlap with the East Anglia THREE site, no scoping work has yet been carried out by the licence holders (at time of writing) so as to allow assessment of cumulative impacts to be undertaken. For further information please see Chapter 18 Infrastructure and Other Users.

15.7.2 Cumulative Emergency Response

210. With both developments within the UK waters and transboundary developments there is likely to be a collective increase on emergency response within the southern North Sea. However, it is likely that each individual development would require its own self-help capability and therefore should be considered within the project specific impacts as per section 15.6.6. Potentially there may be some overlap in resources but this would be considered at a commercial and local level between project developers. The impact as a whole is considered to be moderate and reasonably probable however with each project defining and

developing its own ERCoP and self-help capability the cumulative impact on emergency response is expected to be **broadly acceptable.**

15.7.3 Increased Deviations Associated with Offshore Windfarm Developments

211. As shipping and navigational receptors can route and therefore be cumulatively impacted by a number of offshore developments the principles of the cumulative assessments have been extended to 100nm. The routes passing through the East Anglia THREE site have been assessed with the results presented in *Table 15.11.*

Table 15.11. Cumulative Screening (Routeing)

Development	Distance (nm)	Status	Screened In
Future East Anglia Zonal Offshore Windfarm Developments (UK)	0	Early Planning	No
Future Ijmuiden Zone Offshore Windfarm Developments (Netherlands)	10.0	Early Planning	No
East Anglia ONE Offshore Windfarm Development (UK)	12.0	Consent Authorised	Yes
Brown Ridge Oost Offshore Windfarm Development (Netherlands)	14.6	Dormant	No
Tromp Binnen Offshore Windfarm Development (Netherlands)	15.0	Dormant	No
Breeveertien II Offshore Windfarm Development (Netherlands)	21.8	Dormant	Yes*
Den Helder I Offshore Windfarm Development (Netherlands)	21.9	Dormant	No
Future Hollandse kust Zone Offshore Windfarm Developments (Netherlands)	23.9	Early Planning	No
West-Rijn Offshore Windfarm Development (Netherlands)	32.0	Dormant	No
Scroby Sands Offshore Windfarm Development (UK)	35.0	Fully Commissioned	No
Galloper Offshore Windfarm Development (UK)	39.9	Consent Authorised	No – no interaction on routeing with the proposed East Anglia THREE project.

Development	Distance (nm)	Status	Screened In
Beaufort (formerly Katwijk) Offshore Windfarm Development (Netherlands)	40.7	Dormant	No
Q4 West Offshore Windfarm Development (Netherlands)	41.5	Dormant	No
Greater Gabbard Offshore Windfarm Development (UK)	43.1	Fully Commissioned	No
Prinses Amaliawindpark (Netherlands)	43.3	Fully Commissioned	No
Future Borssele Zone Offshore Windfarm Developments (Netherlands)	43.4	Early Planning	No
Q4 Offshore Windfarm Development (Netherlands)	43.8	Dormant	No
Eneco Luchterduinen Offshore Windfarm Development (Netherlands)	45.6	Under Construction	No - no interaction on routeing with the proposed East Anglia THREE project.
Belwind Phase 2 Offshore Windfarm Development (Belgium)	47.6	Consent Authorised	No
Belwind Phase 1 Offshore Windfarm Development (Belgium)	48.0	Fully Commissioned	No
Egmond aan Zee Offshore Windfarm Development (Netherlands)	48.6	Fully Commissioned	No
Belwind Alstom Haliade Demonstration Offshore Windfarm Development (Belgium)	48.9	Fully Commissioned	No
Seastar Offshore Windfarm Development (Belgium)	50.5	Consent Authorised	No
Northwind Offshore Windfarm Development (Belgium)	51.8	Fully Commissioned	No
Future Hornsea Zonal Offshore Windfarm Developments (UK)	51.9	Early Planning	No
RENTEL Offshore Windfarm Development (Belgium)	53.6	Consent Authorised	No
Dudgeon Offshore Windfarm Development (UK)	54.2	Consent Authorised	Yes

Development	Distance (nm)	Status	Screened In
Norther Offshore Windfarm Development (Belgium)	56.4	Consent Authorised	No
Thornton Bank Phases I Offshore Windfarm Development (Belgium)	57.3	Fully Commissioned	No
Sheringham Shoal Offshore Windfarm Development (UK)	59.5	Fully Commissioned	Yes
Hornsea Project One Offshore Windfarm Development (UK)	67.3	Consent Authorised	No
Race Bank Offshore Windfarm Development (UK)	72.7	Consent Authorised	Yes
Triton Knoll Offshore Windfarm Development (UK)	74.9	Consent Authorised	Yes
Hornsea Project Two Offshore Windfarm Development (UK)	76.2	Application	No
Lincs Offshore Windfarm Development (UK)	84.4	Fully Commissioned	No
Lynn Offshore Windfarm Development (UK)	85.1	Fully Commissioned	No
Inner Dowsing Offshore Windfarm Development (UK)	86.7	Fully Commissioned	No

*Given future potential for development to be constructed and potential cumulative impact on vessel routeing development considered throughout cumulative assessment.

212. Of the assessment undertaken Triton Knoll, Dudgeon, Sheringham Shoal, Race Bank, in UK waters, and Breeveertien II in Dutch waters were considered to have a cumulative routeing impact. It should be noted that the development of the Breeveertien II wind farm is currently dormant given a recent change in ownership. However, given the future potential for the development to be constructed and potential cumulative impact on vessel routeing, the development has been considered throughout the cumulative vessel routeing impact assessment.

213. Triton Knoll, Race Bank, Dudgeon and Sheringham Shoal are over 50nm from the East Anglia THREE site of which vessels are required to navigate on distinct routes (due to water depths) through sand banks prior to reaching them, the

East Anglia THREE site or vice versa. This, combined with the size of the projects and minimum deviation associated with Triton Knoll, Race Bank, Dudgeon and Sheringham Shoal, is not expected to result in any cumulative impacts.

214. In order to assess the cumulative issues arising from the proposed developments within the other Round 3 zones in the southern North Sea (Hornsea and Dogger Bank) the three developers undertook a joint report as part of the SNSOWF.

215. Overall, given the separation distance from rounds 1 and 2 windfarms and consideration of cumulative routeing with regards to other round three zones, cumulative impacts are considered to be broadly acceptable for the East Anglia THREE site and therefore within ALARP parameters and **no residual impacts**.

15.8 Transboundary Impacts

216. This section considers the potential transboundary impacts associated with international offshore renewable developments. When considering the impact of the East Anglia THREE site, most routes transit in an approximate east west direction, with the majority of the north to south traffic already constraining itself to the DWRs. Vessels routeing east to west (and vice versa) from the UK to the Netherlands, Belgium and Denmark may be impacted by developments within both UK waters and transboundary waters. However, when considering the East Anglia THREE site, the routes that are impacted by transboundary developments as noted in *Table 15.11* and shown in *Appendix 15.1*, are routes 16 and 19. These routes are cumulatively impacted by the East Anglia THREE site and Breeveertien II development as are shown in Figure *15.18*.

217. Throughout the 100% fill build scenario of the East Anglia THREE site it is likely that vessels would transit to the south of the East Anglia THREE site resulting in a worst case deviation of approximately 3.43nm (2.70% of route length) for Route 19 vessels on passage outbound from Amsterdam. This is a minor (0.01nm) increase from the East Anglia THREE site 100% fill scenario considered in the NRA due to the need to remain 2nm from the Breeveertien II windfarm. A deviation of 2.53nm (1.98% of route length) is anticipated for Route 19 inbound transiting vessels passing south of the East Anglia THREE site throughout the 100% fill build scenario.

218. For vessels operating on Route 16, it is likely that vessels would transit to the south of the East Anglia THREE site resulting in a worst case deviation of

approximately 10.30nm (10.57% of route length) for vessels on passage outbound from Amsterdam. A deviation of 8.25nm (8.30% of route length) is anticipated for inbound transiting vessels passing south of the East Anglia THREE site throughout the 100% fill build scenario. It is also possible that vessels on this route may pass to the north of the East Anglia THREE site resulting in a deviation of approximately 0.50nm (0.52% of route length) for vessels transiting outbound from Amsterdam and 2.18nm (2.19% of route length) for vessels transiting inbound to Amsterdam.

219. Throughout the partial fill build scenario of the East Anglia THREE site it is likely that vessels on Route 19 would transit south of the Breeveertien II windfarm. For vessels operating on Route 16, it is likely that vessels transiting from Amsterdam would pass north of the Breeveertien II windfarm whilst vessels transiting to Amsterdam would pass to the south. This results in a deviation of approximately 0.37nm (0.38% of route length) for vessels transiting from Amsterdam and 0.50nm (0.50% of route length) for vessels transiting to Amsterdam throughout the partial fill build scenario of the East Anglia THREE site.

220. Other routes which transit through the East Anglia THREE site are bound for the Dutch routeing measures and do not interact with any transboundary developments.

221. It is noted that a number of transboundary routes stay within the DWRs and therefore are not impacted by the proposed East Anglia THREE project. There is potential for transboundary ports to be impacted by offshore developments, however due to the distance from the coastline and the assessment of routes transiting through the East Anglia Three site, impacts are considered to be within tolerable limits and therefore ALARP.

15.9 Inter-relationships

222. The following section identifies potential inter-relationships associated with shipping and navigation and other identified effects associated with the development of the proposed East Anglia THREE 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 on transit and fishing vessels engaged in fishing. This chapter has already considered these receptors in their navigational

(or transient) state and the following table highlights any additional interrelationships with their localised activities.

Table 15.12. Shipping and navigation inter-relationships

Topic and description	Related Chapter	Where addressed in this Chapter
Changes to wave and tidal currents	Chapter 7 Physical Processes	Effects of wave and tidal are considered within the NRA (*Appendix 15.1*). There are not expected to be any additional effects associated with interrelationships and impacts on wave and tidal currents associated with the proposed East Anglia THREE project.
Increased collision risk for fishing vessels engaged in fishing	Chapter 14 Commercial Fisheries	Impacts on the navigation safety of fishing vessels are considered in section 15.6.3. All navigational safety impacts are considered ALARP. Allision and collision risk modelling has not differentiated between vessels engaged in or not engaged in fishing.
Increased snagging risk for fishing vessels engaged in fishing	Chapter 14 Commercial Fisheries	Navigational safety impacts for vessels on transit have already been considered within this chapter; impacts on gear snagging (which could affect their navigational status) have been considered within Chapter 14 Commercial Fisheries.
Impacts on aggregate dredging activities	Chapter 18 Infrastructure and Other Uses	Impacts on the navigational safety of marine aggregate dredgers are considered within section 15.6.1. All navigational safety impacts are considered ALARP; marine aggregate dredgers are not within close proximity to the East Anglia THREE site.

15.10 Additional Mitigation

223. *Table 15.13* shows the additional mitigation required to reduce the impacts noted in section 15.6 to ALARP.

Table 15.13. Additional Mitigation

Mitigation	Description
Works Vessel Coordination	Development, implementation and operation of works vessel coordination which could include the development of construction corridors between port and the East Anglia THREE site, and entry / exit points for the East Anglia THREE site for support craft, to ensure that they are effectively managed and are not displaced into areas used by commercial craft.
Final Site Design	Although parameters of design have been detailed within the NRA, the final design is still unknown the Development Consent Order

Mitigation	Description
	will require that the final site, once defined, is agreed with the MMO in consultation with the MCA and THLS. This will ensure that any risks remaining due to the extent of the design envelope are fully mitigated to ALARP before construction commences.
Additional Aids to Navigation	Additional aids to navigation such as buoyage could be required following consultation with THLS and MCA to aid the displacement of traffic and prevent the creation of a high risk crossing point on the southern boundary. There may also be a requirement for additional aids to navigation to assist fishing vessels transiting within or in proximity to the East Anglia THREE site but this would depend on final site design and requirement agreement with THLS and MCA A through life aids to navigation management plan shall be agreed by the Marine Management Organisation, in consultation with Trinity House, prior to construction as per updated Development Consent Order conditions.
Additional and Specific Promulgation of Information	Promulgation of Information to ensure vessels are aware of ongoing construction or decommissioning activities and can passage plan effectively.
Mitigation resulting from gap analysis relating to self-help capability	A gap analysis would be undertaken to assess the level of self-help capability required to mitigate the increase in emergency response required by the proposed project through each development phase.

15.11 Summary

224. Following consideration of the outputs of the hazard workshop, desktop assessments and modelling, six different receptors were identified within this chapter that had the potential to be impacted by the development of the proposed East Anglia THREE project. The following tables identify the residual impacts and mitigations identified.

Table 15.14. Residual Impacts

Potential Impact	Receptor	Consequence	Frequency	Mitigation	Residual Impact
Construction and Decommissioning					
Commercial vessels to support or construction vessel collision and encounter risk	Commercial Vessel Safe Navigation	Moderate	Remote	Works Vessel Coordination	**Broadly Acceptable**
Commercial vessel deviations during varying construction activities	Commercial Vessel Routeing	Negligible	Frequent	Proactive Promulgation of Information	**Tolerable and ALARP**
Reduced emergency response capability / oil spill response owing to the presence of the East Anglia THREE site	Emergency Response Provision (Marine Based)	Moderate	Reasonably Probable	Gap Analysis and consideration of self-help capability within the ERCoP	**Broadly Acceptable**
Operation					
Commercial vessels to support/service vessel collision and encounter risk	Commercial Vessel Safe Navigation	Moderate	Reasonably Probable	Works Vessel Coordination Consultation on Final Site Design Additional Aids to Navigation ERCoP to include vessels NUC Larger Structures Not Placed within 1km of the southern boundary	**Broadly Acceptable**
Commercial vessel (powered) allision with windfarm structure	Commercial Vessel Safe Navigation	Moderate	Reasonably Probable		**Broadly Acceptable**
Commercial vessels to vessel collision or encounter risk	Commercial Vessel Safe Navigation	Moderate	Reasonably Probable		**Broadly Acceptable**
Commercial vessel (drifting) allision with windfarm structure	Commercial Vessel Safe Navigation	Moderate	Reasonably Probable		**Broadly Acceptable**
Fishing vessel allision with windfarm structure	Fishing Vessels (Safe Navigation)	Moderate	Remote	Consultation on Final Site Design Works Traffic	**Broadly Acceptable**

Potential Impact	Receptor	Consequence	Frequency	Mitigation	Residual Impact
				Coordination Additional Aids to Navigation	
Reduced emergency response capability / oil spill response owing to the presence of the East Anglia THREE site	Emergency Response Provision (Marine Based)	Minor	Remote	Gap Analysis and consideration of self-help capability within the ERCoP	**Broadly Acceptable**
Decommissioning					
Commercial vessels to support or decommissioning vessel collision and encounter risk	Commercial Vessel Safe Navigation	Moderate	Remote	Works Vessel Coordination	**Broadly Acceptable**
Commercial vessel deviations during varying decommissioning activities	Commercial Vessel Routeing	Negligible	Frequent	Proactive Promulgation of Information	**Tolerable and ALARP**
Reduced emergency response capability / oil spill response owing to the presence of the East Anglia THREE site	Emergency Response Provision (Marine Based)	Moderate	Reasonably Probable	Gap Analysis and consideration of self-help capability within the ERCoP	**Broadly Acceptable**
Cumulative					
Reduced emergency response capability / oil spill response owing to the presence of cumulative developments	Emergency Response Provision (Marine Based)	Moderate	Reasonably Probable	Gap Analysis and consideration of self-help capability within the ERCoP for each project would cumulatively	**Broadly Acceptable**

Potential Impact	Receptor	Consequence	Frequency	Mitigation	Residual Impact
				mitigate the impact and it is assumed that this will be done industry wide.	

15.12 References

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Chapter 15 Ends Here