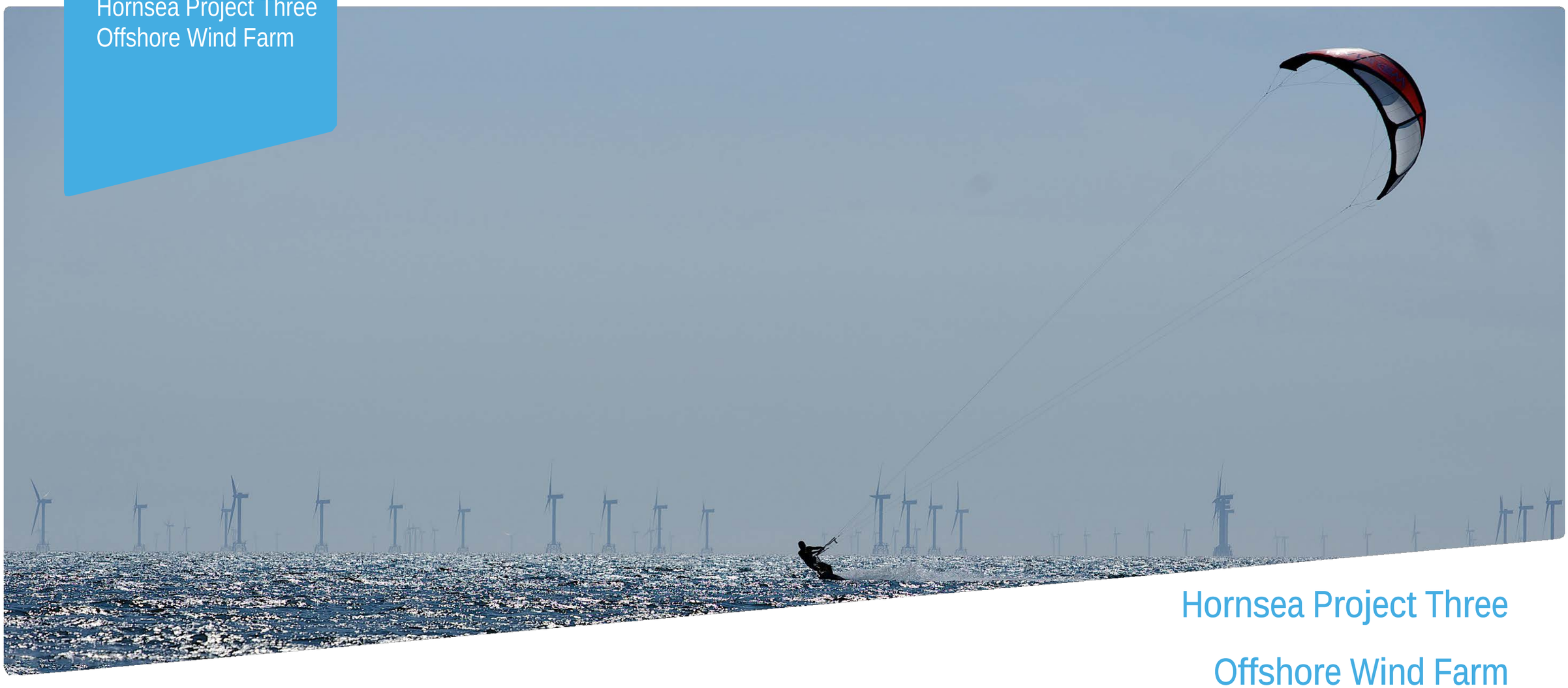
Hornsea Project Three
Offshore Wind Farm



Hornsea Project Three

Offshore Wind Farm

Preliminary Environmental Information Report:
Chapter 7 – Shipping and Navigation

Date: July 2017

Hornsea 3
Offshore Wind Farm

DONG energy

Environmental Impact Assessment

Preliminary Environmental Information Report

Volume 2: Offshore

Chapter 7: Shipping and Navigation

Report Number: P6.2.7

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This report is also downloadable from the Hornsea Project Three offshore wind farm website at:
www.dongenergy.co.uk/hornseaproject3

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Front cover picture: Kite surfer near one of DONG Energy's UK offshore wind farms © DONG Energy Hornsea Project Three (UK) Ltd., 2016.

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Glossary

Term	Definition
Allision	The act of striking or collision of a moving vessel against a stationary object.
Automatic Identification System (AIS)	Automatic Identification System. A system by which vessels automatically broadcast their identity, key statistics e.g. length, brief navigation details e.g. location, destination, speed and current status e.g. survey. Most commercial vessels and EU fishing vessels over 15m are required to have AIS.
Base Case	The assessment of risk based on current shipping densities and traffic types as well as the marine environment.
Collision	The act or process of colliding (crashing) between two moving objects.
Deep Water Route (DWR)	A route in a designated area within defined limits which has been accurately surveyed for clearance of sea bottom and submerged articles. They are of particular use to vessels restricted in their ability to manoeuvre due to their draught size.
Environmental Statement	A document reporting the findings of the Environmental Impact Assessment and produced in accordance with the EIA Directive as transposed into UK law by the Environmental Impact Assessment Regulations.
Formal Safety Assessment (FSA)	A structured and systematic process for assessing the risks and costs (if applicable) associated with shipping activity.
Future Case	The assessment of risk based on the predicted growth in future shipping densities and traffic types as well as foreseeable changes in the marine environment.
Global Maritime Distress and Safety System (GMDSS) Sea Area A2	GMDSS sea areas serve two purposes: to describe areas where GMDSS services are available, and to define what radio equipment GMDSS ships must carry (carriage requirements). Hornsea Three array area is within Sea Area A2 which is within the radiotelephone coverage of at least one medium frequency coast station in which continuous Digital Selective Calling (2187.5 kilohertz) alerting and radiotelephony services are available. For planning purposes, this area typically extends to up to 180 nautical miles (330 kilometres) offshore during daylight hours, but would exclude any A1 designated areas. In practice, satisfactory coverage may often be achieved out to around 150 nautical miles (280 kilometres) offshore during night time.
IMO Routeing	Predetermined shipping routes established by the International Maritime Organization.
Marine Environmental High Risk Area (MEHRA)	Areas in UK coastal waters where ships' masters are advised of the need to exercise more caution than usual i.e. crossing areas of high environmental sensitivity where there is a risk of pollution from merchant shipping.
Marine Guidance Note (MGN)	A system of guidance notes issued by the Maritime and Coastguard Agency which provide significant advice relating to the improvement of the safety of shipping and of life at sea, and to prevent or minimise pollution from shipping.
Not Under Command (NUC)	Under Part A of the International Regulations for Preventing Collisions at Sea (COLREGS), the term “vessel not under command” means a vessel which through some exceptional circumstance is unable to manoeuvre as required by these Rules and is therefore unable to keep out of the way of another vessel.

Term	Definition
Offshore Renewable Energy Infrastructure (OREI)	Offshore Renewable Energy Installations (OREIs) as defined by Guidance on UK Navigational Practice, Safety and Emergency Response Issues, MGN 543. For the purpose of this report and in keeping with the consistency of the Environmental Impact Assessment, OREI can mean offshore wind turbines and the associated electrical infrastructures such as offshore HVAC collector substations, offshore HVDC substations, accommodation platforms and offshore HVAC booster stations.
Radar	Radio Detection And Ranging – an object-detection system which uses radio waves to determine the range, altitude, direction, or speed of objects.
Safety Zone	A marine zone demarcated for the purposes of safety around a possibly hazardous installation or works/ construction area under the Energy Act 2004.
Traffic Separation Scheme	A Traffic Separation Scheme (TSS) is a traffic-management route-system ruled by the International Maritime Organization. The traffic-lanes (or clearways) indicate the general direction of the vessels in that zone; vessels navigating within a TSS all sail in the same direction or they cross the lane in an angle as close to 90 degrees as possible.

Acronyms

Acronym	Description
AC	Alternating Current
AfL	Area for Lease
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
BMAPA	British Marine Aggregate Producers Association
CA	Cruising Association
CBA	Cost Benefit Analysis
CGOC	Coastguard Operations Centre
COLREGs	The International Regulations for Preventing Collisions at Sea 1972
CTV	Crew Transfer Vessel
DC	Direct Current
DCO	Development Consent Order
DfT	Department for Transport
DSC	Digital Selective Calling
DWR	Deep Water Route
EEA	European Economic Area
EIA	Environmental Impact Assessment
ERCoP	Emergency Response and Cooperation Plan
EU	European Union
FSA	Formal Safety Assessment
GIS	Geographical Information System
GMDSS	Global Maritime Distress and Safety System
GPS	Global Positioning System
HMCG	HM Coastguard
HSE	Health, Safety and Environment
HVAC	High Voltage Alternating Current

Acronym	Description
HVDC	High Voltage Direct Current
IALA	International Association of Lighthouse Authorities
IMO	International Maritime Organization
LAT	Lowest Astronomical Tide
LOA	Lengths Overall
MAIB	Maritime and Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MetOcean	Meteorological Ocean
MF	Medium Frequency
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
MMO	Marine Management Organisation
MOD	Ministry of Defence
MSC	Maritime Safety Council
MMSI	Mobile Maritime Safety Information
NOREL	Nautical Offshore Renewable Energy Liaison
NRA	Navigational Risk Assessment
NUC	Not Under Command
OREI	Offshore Renewable Energy Installation
OSV	Offshore Support Vessel
PEIR	Preliminary Environmental Information Report
PEXA	Practice and Exercise Areas
PINS	Planning Inspectorate
PLB	Personal Locator Beacons
PPE	Personal Protection Equipment
QHSE	Quality, Health, Safety and Environment
Radar	Radio Detecting and Ranging
RNLI	Royal National Lifeboat Institute

Acronym	Description
Ro Ro	Roll on roll off
RYA	Royal Yachting Association
SAR	Search and Rescue
SCADA	Supervisory Control and Data Acquisition
SNSOWF	Southern North Sea Offshore Windfarm Forum
SOLAS	Safety of Life at Sea
SPS	Significant Peripheral Structures
TCE	The Crown Estate
TH	Trinity House
TSS	Traffic Separation Scheme
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
VHF	Very High Frequency

Units

Unit	Description
£	Great British pounds (currency)
ft	Feet (distance)
GW	Gigawatt (power)
GRT	Gross Registered Tonnes (displacement)
km	Kilometre (distance)
m	Metres (distance)
mph	Miles per hour (speed)
MW	Megawatt (power)
nm	Nautical miles (distance)

7. Shipping and Navigation

7.1 Introduction

7.1.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) presents the findings to date of the Environmental Impact Assessment (EIA) for the potential impacts of the Hornsea Project Three offshore wind farm (hereafter referred to as Hornsea Three) on shipping and navigation. Specifically, this chapter considers the potential impact of Hornsea Three seaward of Mean High Water Springs (MHWS) during its construction, operation and maintenance, and decommissioning phases.

7.1.1.2 This chapter summarises information contained within technical reports, which are included at volume 5, annex 7.1: Hornsea Three Array Area, Offshore Cable Corridor and Offshore HVAC Booster Station Search Area Navigational Risk Assessment (hereby referred to as the NRA).

7.2 Purpose of this chapter

7.2.1.1 The primary purpose of the Environmental Statement is to support the Development Consent Order (DCO) application for Hornsea Three under the Planning Act 2008 (the 2008 Act). This PEIR constitutes the Preliminary Environmental Information for Hornsea Three and sets out the findings of the EIA to date to support pre-application consultation activities required under the 2008 Act. The EIA will be finalised following completion of pre-application consultation and the Final Environmental Statement will accompany the application to the Secretary of State for Development Consent.

7.2.1.2 The PEIR will form the basis for Phase 2 Consultation which will commence on 27 July and conclude on 20 September 2017. At this point, comments received on the PEIR will be reviewed and incorporated (where appropriate) into the Environmental Statement, which will be submitted in support of the application for Development Consent scheduled for the second quarter of 2018.

7.2.1.3 In particular, this PEIR chapter:

- Presents the existing environmental baseline established from desk studies, and consultation;
- Presents the potential environmental effects on shipping and navigation arising from Hornsea Three, based on the information gathered and the analysis and assessments undertaken to date;
- Identifies any assumptions and limitations encountered in compiling the environmental information; and
- Highlights any necessary monitoring and/or mitigation measures which could prevent, minimise, reduce or offset the possible environmental effects identified in the Environmental Impact Assessment process.

7.3 Study Areas

7.3.1 Hornsea Three array area shipping and navigation study area

7.3.1.1 A 10 nautical mile (nm) buffer was applied around the Hornsea Three array area. This study area has been defined in order to provide local context to the analysis of risks by capturing the relevant routes and traffic movements within and near the proposed Hornsea Three array area. This 10 nm study area has been used within the majority of UK wind farm NRAs including Hornsea Project One and Hornsea Project Two.

7.3.2 Hornsea Three offshore cable corridor shipping and navigation study area

7.3.2.1 AIS survey data has been sourced for the Hornsea Three offshore cable corridor; however in order to provide local context a minimum 1 nm buffer (outside of the landfall area) has been applied to either side of the offshore cable corridor (dependant on where data was available) in order to capture relevant receptors and their movements within and near the Hornsea Three offshore cable corridor. The Hornsea Three offshore cable corridor shipping and navigation study area runs between the Mean Low Water Springs (MLWS) and the boundary of the Hornsea Three array area.

7.3.3 Hornsea Three offshore HVAC booster station search area shipping and navigation study area

7.3.3.1 A 5 nm buffer has been applied around the offshore HVAC booster station search area shipping and navigation study area within the Hornsea Three offshore cable corridor shipping and navigation study area. This search area overlaps with the Hornsea Three offshore cable corridor because of a regulator requirement for a marine traffic survey (AIS, visual and Radar data) to be undertaken where surface structures are proposed and to identify relevant receptors that may be affected.

7.3.4 Hornsea Three cumulative study area

7.3.4.1 It should be noted that due to the national and international nature of shipping, navigational risks have been considered within a wider southern North Sea perspective (where relevant) for vessels routeing as per the NRA; however changes to routeing have only been shown in detail within a 10 nm buffer around the Hornsea Project One, Hornsea Project Two and the Hornsea Three array areas.

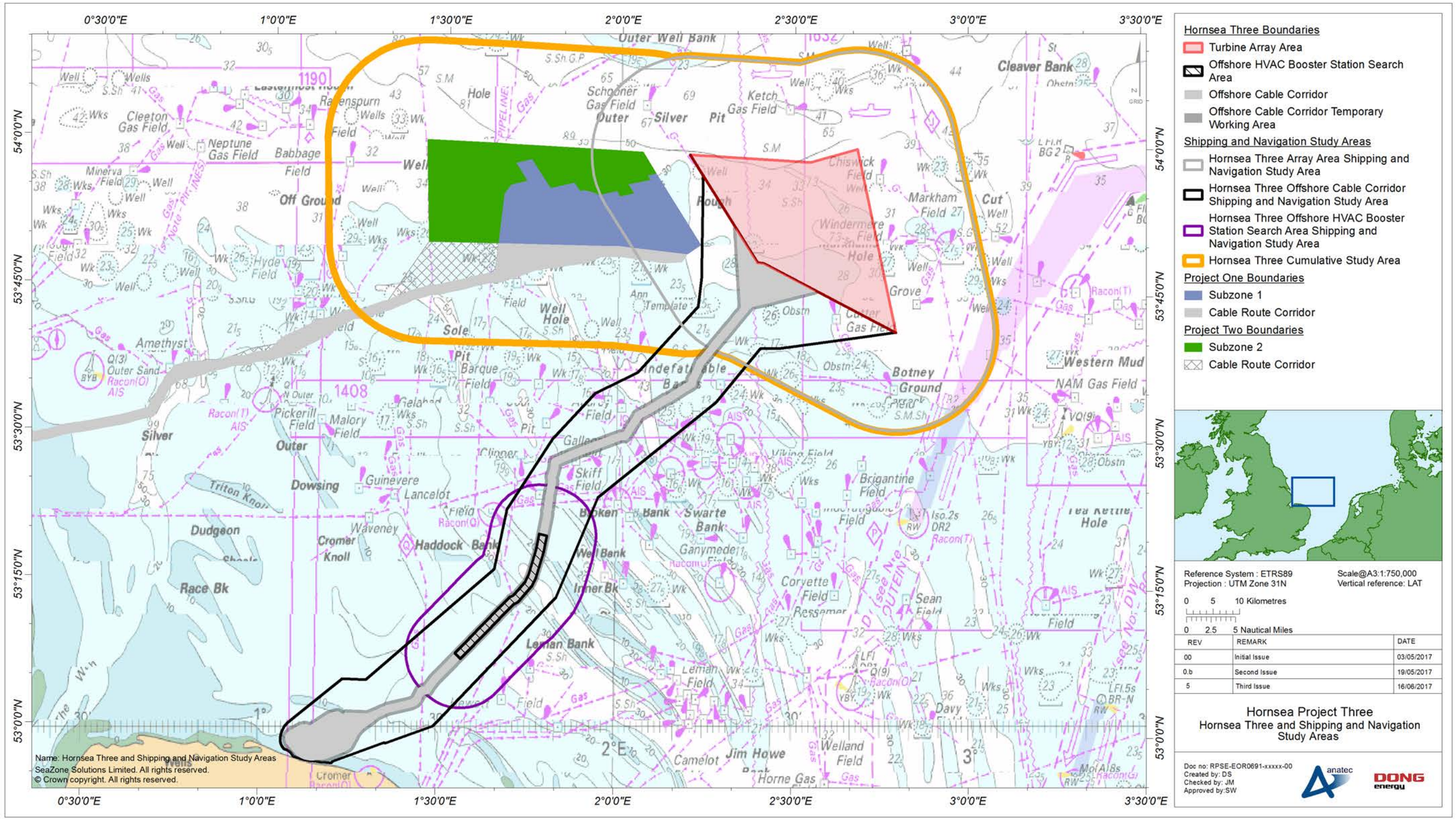

Figure 7.1: Hornsea Three and shipping and navigation study areas.

7.4 Planning policy context

7.4.1.1 Guidance on the issues to be assessed for offshore renewable energy developments are set out in the Overarching National Policy Statement (NPS) for Energy (EN-1; DECC, 2011a) and the NPS for Renewable Energy Infrastructure (EN-3, DECC, 2011b). These are summarised in Table 7.1 and Table 7.2 below.

7.4.1.2 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.

7.4.1.3 NPS EN-3 includes guidance on what matters are to be considered in the assessment.

Table 7.1: Summary of NPS EN-3 provisions relevant to shipping and navigation.

Summary of NPS EN-3 provision	How and where considered in the PEIR
Stakeholders in the navigation sector should be engaged in the early stages of the development phase and this should continue throughout construction, operation and decommissioning (paragraph 2.6.153 of NPS EN-3).	Section 7.3 summarises key issues raised during consultation specific to shipping and navigation.
Consultation should be undertaken with the Marine Management Organisation (MMO), Maritime and Coastguard Agency (MCA), relevant General Lighthouse Authority (GLA), relevant industry bodies and representatives of recreational users (paragraph 2.6.154 of NPS EN-3).	The consultation summarised in section 7.3 includes issues raised by the organisations stated.
Information on internationally recognised sea lanes should be considered prior to undertaking assessments (paragraph 2.6.155 of NPS EN-3).	Section 7.7.1 provides information on International Maritime Organization (IMO) Routeing measures within the vicinity of Hornsea Three.
A NRA should be undertaken in accordance with Government guidance (paragraph 2.6.156 of NPS EN-3).	See the NRA.
Impacts on recreational craft, such as yachts, should be considered (paragraph 2.6.160 of NPS EN-3).	Section 7.11 and section 7.11 consider the impacts of Hornsea Three, and cumulatively with other projects, plans and activities, on recreational craft respectively. Recreational activity including recreational fishing has also been considered in volume 2, chapter 10: Infrastructure and Other Users

7.4.1.4 NPS EN-3 also highlights a number of factors relating to the determination of an application and in relation to mitigation. These are summarised in Table 7.2 below.

Table 7.2: Summary of NPS EN-3 policy on decision making relevant to shipping and navigation.

Summary of NPS EN-3 policy on decision making (and mitigation)	How and where considered in the PEIR
Consent shall not be granted to the construction or extension of an offshore wind farm if the development is likely to interfere with the use of recognised sea lanes essential to international navigation (paragraph 2.6.161 of NPS EN-3).	Section 7.7.1 provides information on International Maritime Organization (IMO) Routeing measures within the vicinity of Hornsea Three.
Site selection should have been made with a view to avoiding or minimising disruption or economic loss to the shipping and navigation industries (paragraph 2.6.162 of NPS EN-3).	The impact of Hornsea Three, and cumulatively with other projects, plans and activities, are considered in section 7.11 and section 7.11respectively and includes an analysis of the disruption and economic loss to the shipping and navigation industries. See also volume 1 chapter 4: Site Selection and Consideration of Alternatives in relation to the original definition of Hornsea Three
Negative impacts on less strategically important shipping routes should be reduced to As Low as Reasonably Practicable (ALARP) (paragraph 2.6.163 of NPS EN-3).	Section 7.7.2 and 7.7.3 undertakes an analysis of all shipping including main routes in proximity to the Hornsea Three array area and offshore cable corridor.
A detailed Search and Rescue (SAR) Response Assessment should be undertaken prior to the commencement of construction (paragraph 2.6.164 of NPS EN-3).	See appendix C of the NRA.
Applications which pose unacceptable risks to navigational safety after all possible mitigation measures have been considered will not be consented (paragraph 2.6.165 of NPS EN-3).	The impact of Hornsea Three, and cumulatively with other projects, plans and activities, are considered in section 7.11 and section 7.11 respectively and includes consideration of further mitigation where appropriate and provides residual significance.
The scheme must be designed to minimise the effects on recreational craft (paragraph 2.6.166 of NPS EN-3).	Section 7.10 summarises measures adopted as part of Hornsea Three, which include measures designed to minimise the effect on recreational craft. Recreational activity including recreational fishing has also been considered in volume 2, chapter 10: Infrastructure and Other Users
The extent and nature of any obstruction of or danger to navigation which is likely to be caused by the development will be considered (paragraph 2.6.168 of NPS EN-3).	The impact of Hornsea Three, and cumulatively with other projects, plans and activities, are considered in section 7.11 and section 7.11 respectively and includes an analysis of the risk posed to navigation due to Hornsea Three.
Cumulative effects of the development with other relevant proposed, consented and operational wind farms will be considered (paragraph 2.6.169 of NPS EN-3).	Section 7.11 considers the cumulative impact of Hornsea Three, alongside other projects, plans and activities within the Hornsea Three cumulative study area.

7.5 Consultation

7.5.1.1 A summary of the key issues raised during consultation specific to shipping and navigation is outlined below, together with how these issues have been considered in the production of this PEIR.

7.5.2 Hornsea Project One and Hornsea Project Two consultation

7.5.2.1 Hornsea Three has similarities, both in terms of the nature of the development and its location, to Hornsea Project One and Hornsea Project Two. The matters relevant to Hornsea Three, which were raised by consultees during the pre-application and examination phases of Hornsea Project One and Hornsea Project Two on shipping and navigation matters, are set out in volume 4, annex 1.1: Hornsea Project One and Hornsea Project Two Consultation of Relevance to Hornsea Three.

7.5.3 Hornsea Three consultation

7.5.3.1 Table 7.3 below summaries the issues raised relevant to shipping and navigation, which have been identified during consultation activities undertaken to date. Table 7.3 also indicates either how these issues have been addressed within this PEIR or how the Applicant has had regard to them.

Table 7.3: Summary of key consultation issues raised during consultation activities undertaken for Hornsea Three relevant to shipping and navigation.

Date	Consultee and type of responses	Issues raised	Response to issue raised and/or where considered in this chapter
July 2016	MCA and TH – consultation meeting	Agreement on consultation methodology for the NRA, PEIR and Environmental Statement process. Marine traffic survey method was discussed and agreed. An initial discussion on the proposed navigational corridor (cumulative impact) was undertaken.	The NRA methodology is contained within section 3. The marine traffic survey methodology is within section 7.6 and 15 of the NRA. The outcomes of the proposed navigational corridor assessment are in section 22.10 of the NRA
September 2016	MCA and TH – consultation meeting	The proposed navigational corridor was discussed and it was agreed that a separate technical note to cover the corridor width would be provided. MCA, TH and Hornsea Three agreed that safe navigation was key to design of the proposed navigational corridor. MCA, TH and Hornsea Three did not reach agreement on a definition of a corridor and whether the navigational activity of vessels on the approaches to and from the navigational corridor should or should not be considered when defining the navigational corridor length. Hornsea Three noted that the corridor length/width guidance was one of many assessment methods to be used and that the 20 degree approach only related to the area considered to be a corridor and not to vessels on the approach to it. Following definition of the navigational corridor the NRA would then take all other factors into account, separately but as part of the FSA, and assess the risks in the areas to the north and south of the area. The design of a corridor should not prevent compliance, or give reason for a vessel not complying, with COLREGS (narrow channels and overtaking).	The outcomes of the proposed navigational corridor assessment are in section 22.10 of the NRA. Technical note - Anatec, 2016. Assessment of Marine Traffic and Corridor Design Hornsea Project 3. *Aberdeen: Anatec* and cumulative collision risk associated with the navigational corridor is assessed in section 7.13.
November 2016	MCA and TH – consultation meeting	TH noted that Hornsea Three may wish to consider applying for permanent 500 m safety zones. MCA SAR noted that the MCA may ask for additional detail on SAR resources and may also ask for additional features (such as 406 Megahertz (MHz) Persons on Board (POB) and Direction Finding (DF) equipment) to aid SAR requirement in the area. MCA confirmed they were content with the proposed NRA method and should follow the usual process, noting the additional supporting information that will be required for the floating foundations. MCA noted the project's own vessels should also be considered within the NRA. Hornsea Three confirmed that minimum spacing of infrastructure would be 1,000 m centre point to centre point, and that there was no maximum spacing. MCA SAR indicated this was acceptable. The NRA methodology and matrix were shown and agreed.	Measures adopted as part of Hornsea Three are outlined in section 7.10 and include 500 m safety zones for manned platforms during the operation and maintenance phase of Hornsea Three. The NRA methodology is contained within section 3. The marine traffic survey methodology is detailed within section 7.6 and 15 of the NRA. Indicative project vessel numbers are in Table 7.8 and section 9.8 of the NRA.

Date	Consultee and type of responses	Issues raised	Response to issue raised and/or where considered in this chapter
November 2016	TH – Scoping Opinion	Require comprehensive vessel traffic analysis as per Marine Guidance Note (MGN) 543. Any proposed layout should conform to MGN 543 and any structure out with the actual wind farm should have additional risk assessments undertaken. The separation between the Hornsea Three array area and Hornsea Project One and Hornsea Project Two array areas should be individually risk assessed and the final proposed separation should be submitted to both the MCA and TH for review. TH will require the wind farm array and obstructions within the Hornsea Three offshore cable corridor to be marked as per IALA-O-139. Any possible national trans-boundary issues should be assessed and consultation should be undertaken with the Dutch authorities. A decommissioning plan which includes a scenario where obstructions are left on site should be considered.	Measures adopted as part of Hornsea Three are outlined in section 7.10 and section 23 of the NRA and include aids to navigation. The marine traffic survey methodology is within section 7.6 and 15 of the NRA. Rijkwaterstraat will be issued the PEIR as part of the section 42 consultation but have not yet responded to invitations for feedback. The outcomes of consultation on the proposed navigational corridor and assessment are in section 22.10 of the NRA. A decommissioning plan is considered in section 25 of the NRA.
November 2016	MCA – Scoping Opinion	The NRA and Environmental Statement should comply with MGN 543. The NRA should consider routeing particularly in heavy weather so that vessels can make safe passage without significant larger scale deviations. They require that a Cable Burial Protection Index study should be undertaken in respect to export cabling. Reductions in water depth, particularly nearshore should be assessed. Any application for safety zones would need to be carefully assessed and supported by experience at the development and construction stages. Assessment of impacts on SAR capability within the region must be undertaken. An Emergency Response and Cooperation Plan (ERCoP) will be required within the draft DCO. Hydrographic data (International Hydrographic Organisation Order 1a) should be supplied to the MCA as per MGN 543.	The NRA methodology is contained within section 3 of the NRA and has had regard to MGN 543. Adverse weather is considered within section 16 of the NRA and assessed within section 7.11 and section 22.5 of the NRA. Measures adopted as part of Hornsea Three are outlined in section 7.10 and section 23 of the NRA. They include aids to navigation and commitment to a Cable Burial Risk Assessment and ERCoP. Hornsea Three SAR impacts are considered in section 22.16 and appendix C of the NRA and assessed within section 7.11 The project shall comply with MGN 543 hydrographic requirements as per section 23 of the NRA.
November 2016	MMO – Scoping Opinion	The MMO agrees with the approach and data sources outlined by the applicant regarding navigation and other sea users. We would expect due consideration of all navigation and sea user issues to be included within the Environmental Impact Assessment process. We understand that the applicant will be holding a number of public consultation events to involve, engage and communicate with consultees prior to submission of the proposal to PINS. Iterative discussions with consultees upon the requirement and feasibility of any mitigation measures are expected to provide a robust assessment of the proposed development.	Noted, consultation feedback is within Table 7.3.

Date	Consultee and type of responses	Issues raised	Response to issue raised and/or where considered in this chapter
December 2016	PINS- Scoping Opinion	The Environmental Statement should assess the impacts on ports and harbours. The layout of the turbine array will not be fixed at the point of the application and therefore the maximum design scenario should be considered within the NRA. The proposed navigational corridor should be considered in consultation with the MCA and TH. The MCA require that a Cable Burial Protection Index study should be undertaken in respect to export cabling. The marine traffic survey must "include non-AIS traffic". The NRA must be in line with MGN 543. Consultation will be undertaken with the MCA on SAR capability within the region. An ERCoP will be required within the draft DCO. The Environmental Statement must consider phasing of the development.	Ports assessment is considered in section 10.2 of the NRA; however no impacts were identified. The NRA methodology is contained within section 3 of the NRA. The marine traffic survey methodology is within section 7.6 and 15 of the NRA. Hornsea Three SAR impacts are considered in section 22.16 and appendix C of the NRA and assessed within section 7.11. Section 22 of the NRA considers the impact of phasing.
January 2017	Regular Operator consultation – consultation letters issued to the identified regular operators. Responses received are summarised here.	• P&O Ferries: ideal location for the Hornsea Three offshore HVAC booster stations would be between the Lehman and Haddock Bank, but to avoid vessel routeing should stay north of 53°11.0'N. • Marine Aggregate Industries: requested attendance at the Hazard Workshop. • KESS: noted that there were small but manageable deviations for their vessels that operated east – west. • Subsea 7: as their vessel routeing was governed by specific projects they were working on they could not confirm specifics but did not raise any notable impacts. Subsea 7 noted that as with any other navigational hazard, as long as the development is chartered, details available via notices to mariners, charts etc., then they did not have any specific concerns. • DFDS Seaways: noted that increases in distance and time would be required for their Cuxhaven to Immingham track. This route also raised concerns about adverse weather routeing and agreed to provide more information. No notable impacts for Hornsea Three were noted for the Newcastle to Amsterdam route. The Esbjerg to Immingham route noted no changes to the crossing time but noted adverse weather concerns including compliance with COLREGS.	Final location of the Hornsea Three offshore HVAC booster stations has not yet been agreed but maximum design scenario locations for shipping and navigation have been assessed in section 18.4 and section 22 of the NRA. Marine Aggregate Industries attended the Hazard Workshop – see section 7.9.2 and section 20 of the NRA. Vessel deviations are reported in section 18.2.2 and section 23 of the NRA. Commercial ferry impacts are assessed in section 7.11 and section 22 of the NRA.
February 2017	MCA and TH – consultation meeting	MCA and TH confirmed that they were content with the marine traffic survey and that it met with the requirements of MGN 543 (MCA, 2016). TH confirmed that any navigational corridor would be assessed on a case by case basis and that given the location of the Hornsea Three array area and the volume of traffic, they were content with the red line boundary and thus corridor width. TH and MCA were clear that MGN 543 states that developers should plan for two lines of orientation unless they can clearly demonstrate that fewer are acceptable and safe for SAR helicopter operations. TH indicated that, using the experience of the oil and gas industry, and the approach taken for wrecks, any sub surface structures would need a 30 m vertical clearance distance or require additional marking on the surface. As the water depths in the offshore HVAC booster station search area are less than 30 m surface marking will therefore be required.	Outcomes of the proposed navigational corridor assessment are in section 22.9 of the NRA. Sub surface impacts are considered in section 7.11 and section 22 of the NRA. Internal navigation impacts are considered in section 7.11 and section 22 of the NRA.

Date	Consultee and type of responses	Issues raised	Response to issue raised and/or where considered in this chapter
February 2017	RYA – consultation meeting	RYA mentioned that, from a recreational perspective, HOW03 array area did not present any significant problems. This is largely based on the fact that there is very little recreational activity that far offshore and anyone who is transiting that far offshore would be very experienced and well equipped. The RYA's main concern would be relating to the cable landfall where the cable comes within the 10 m contour, and any resulting reduction in water depth. With respect to layouts the RYA stated that they did not have any concerns regarding the indicative Hornsea Three layouts presented. RYA also considered the corridor between the projects to be more than adequate with respect to use by recreational craft.	Measures adopted as part of Hornsea Three are outlined in section 7.10 and section 23 of the NRA Internal navigation impacts are considered in section 7.11 and section 22 of the NRA.
February 2017	CA – consultation meeting	CA stated that it is difficult to consult on sites this far offshore due to the variation in routes taken by recreational craft as well as the international component; however it was stated that CA have no major issues with the development. CA stated that the navigational corridor was at a good angle and the width more than adequate for any recreational vessels sailing in the area. With respect to layouts the CA preferred larger straight lines where possible. The CA would also like to see advice added to the Nautical Almanac for recreational vessels sailing through the area, advice on courses etc. for navigating through the navigational corridor or Hornsea Three array area. They stated that lots of yachtsmen will not go through a wind farm.	Internal navigation impacts are considered in section 7.11 and section 22 of the NRA.
February 2017	CoS – consultation meeting	Introductory meeting to the Hornsea Three development. Overview of the winter and summer marine traffic was shown; no specific comments were raised by the CoS. It was noted that there are DFDS Seaways Roll On Roll Off (Ro Ro) routes passing through the Hornsea Three array area, CoS noted that it would be for the operator of those routes to comment in the first instance. Anatec explained the process for identification of regular operators within the marine traffic survey data sets and showed examples of the consultation letters issued. A number of regular operator letters (40+) had been issued either by email or surface mail, requesting feedback on the Hornsea Three array area and Hornsea Three offshore cable corridor. Approach to the NRA, in line with MCA guidance was discussed. No comments were made. CoS queried if any additional routeing measures had been considered for the navigational corridor; it was noted that this would be a decision for the MCA.	Future case routeing is considered in section 7.7.5 and section 17 of the NRA. Cumulative scenarios for Hornsea Three are considered in section 7.13 and section 21 of the NRA respectively. Identified impacts are assessed in section 7.12.
February 2017	Hazard Workshop	See Hazard Log in appendix B of the NRA.	N/A

7.6 Methodology to inform the baseline

7.6.1 Desktop study

7.6.1.1 Information on shipping and navigation within the Hornsea Three array area shipping and navigation study area, Hornsea Three offshore cable corridor shipping and navigation study area and offshore HVAC booster station search area shipping and navigation study area and the cumulative study area was collected through a detailed desktop review of existing studies and datasets. These are summarised at Table 7.4 below.

Table 7.4: Summary of key desktop reports.

Title	Sources	Year	Author
Admiralty Sailing Direction	North Sea (West) Pilot NP 54	2016	UKHO
AIS fishing and recreational survey data for London Array offshore wind farm (OWF) site	Shore based AIS stations	2016 to 2017	Anatec
AIS survey data for Hornsea Three offshore cable corridor	Shore based AIS stations (combined with site specific survey data)	2016	Anatec
Fishing surveillance satellite data	MMO	2009	MMO
Fishing sightings data	MMO	2005 to 2009	MMO
Marine aggregates dredging data and transit routes	The Crown Estate (TCE) and British Marine Aggregates and Producers Association (BMAPA)	2016	TCE and BMAPA
Maritime incident data	Marine Accident Investigation Branch (MAIB)	2005 to 2014	MAIB
Maritime incident data	Royal National Lifeboat Institute (RNLI)	2005 to 2014	RNLI
Ministry of Defence (MOD) Search and Rescue Helicopter Operations	MOD	2011 to 2015	MOD
Southern North Sea shipping routes	Anatec ShipRoutes	2017	Anatec
UK Admiralty charts 1187, 1503, 2182a and 4140	United Kingdom Hydrographic Office (UKHO)	2016	UKHO

7.6.1.2 Following agreement with the MCA and TH, the Hornsea Three offshore cable corridor was primarily assessed using AIS data only and it is therefore noted that there will be limitations with the data associated with non-AIS targets as stated in section 7.7.3. A total of 40 days of data (coinciding with the marine traffic survey data for the Hornsea Three array area shipping and navigation study area – see section 7.7.2) was assessed and has been combined with the marine traffic survey data for the Hornsea Three array area shipping and navigation study area, where possible, as noted in section 7.7.3.

7.6.1.3 Fishing vessel navigational activities were assessed against the marine traffic survey data; however satellite and sightings data collected by the MMO was also used as secondary sources noting the limitations of the data given its age.

7.6.1.4 Offshore oil and gas installations were identified using charted data including positional information on fixed platforms and wellheads. Using these data, possible cumulative effects with other offshore installations, their support vessels and the increased risk associated with the platform locations were identified.

7.6.1.5 Marine aggregate dredging data (licensed areas and active areas) were obtained from TCE. This information was used to identify commercial aggregate dredging activity and transit routes in proximity to the Hornsea Three array area and Hornsea Three offshore cable corridor.

7.6.1.6 Other navigational features such as IMO Routeing measures and Ministry of Defence (MOD) Practice and Exercise Areas (PEXAs) have been considered using charted data.

7.6.1.7 Southern North Sea vessel routeing is assessed using Anatec's ShipRoutes database which has been developed using AIS data from multiple AIS datasets over a number of years. It is regularly updated to ensure it reflects any changes to historical routeing or vessel numbers.

7.6.2 Site specific surveys

7.6.2.1 In order to inform the EIA, site specific surveys were undertaken as agreed with the MCA and as per the requirements set out in Marine Guidance Notice (MGN) 543 (MCA, 2016). A summary of the surveys undertaken to date is outlined in Table 7.5 below, with further information in section 7 of the NRA.

7.6.2.2 In order to meet the requirements of MGN 543 a combined dataset of 40 days of AIS, visual and Radar marine traffic survey data was collected for the Hornsea Three array area shipping and navigation study area and 28 days for the Hornsea Three offshore HVAC booster station search area shipping and navigation study area. Both sets of data were collected within summer and winter periods to demonstrate any seasonal variation.

Table 7.5: Summary of site specific survey data.

Title	Extent of survey	Overview of survey	Survey contractor	Year	Reference to further information
Hornsea Three array area marine traffic survey (summer)	Hornsea Three array area shipping and navigation study area	AIS, visual and Radar vessel survey (26 days between 6 June – 18 June and 22 June - 4 July 2016) determining existing shipping activity within and in the vicinity of the Hornsea Three array area in accordance with MGN 543.	Anatec	2016	Volume 5, annex 7.1: Hornsea Three Array Area, Offshore Cable Corridor and Offshore HVAC Booster Station Search Area Navigational Risk Assessment
Hornsea Three offshore HVAC booster station search area marine traffic survey (summer)	Hornsea Three offshore HVAC booster station search area shipping and navigation study area	AIS, visual and Radar vessel survey (14 days between 16 and 29 September 2016) determining existing shipping activity within and in the vicinity of the Hornsea Three offshore HVAC booster station search area in accordance with MGN 543.	Anatec	2016	
Hornsea Three array area marine traffic survey (winter)	Hornsea Three array area shipping and navigation study area	AIS, visual and Radar vessel survey (14 days between 10 - 16 November and 26 November - 3 December 2016) determining existing shipping activity within and in the vicinity of the Hornsea Three array area in accordance with MGN 543.	Anatec	2016	
Hornsea Three offshore HVAC booster station search area marine traffic survey (winter)	Hornsea Three offshore HVAC booster station search area shipping and navigation study area	AIS, visual and Radar vessel survey (14 days between 17 – 19 November and 4 - 15 December 2016) determining existing shipping activity within and in the vicinity of the Hornsea Three offshore HVAC booster station search area in accordance with MGN 543.	Anatec	2016	

7.6.2.3 The majority of vessels were recorded on AIS. AIS is now fitted on all commercial vessels operating in UK waters over 300 Gross Registered Tonnage (GRT) engaged on international voyages, over 500 GRT on domestic voyages, passenger vessels carrying 12 or more persons and fishing vessels over 15 m. Small vessels not carrying AIS were captured by Radar and visual observations where possible, meaning where they were close enough for the Radar or observer to see them, including vessels of less than 300 GRT.

7.7 Baseline environment

7.7.1 Navigational features

7.7.1.1 Hornsea Three is situated within the southern North Sea where numerous shipping routes are located. These routes currently co-exist safely alongside a number of notable activities including:

- Oil and gas activities: including operational gas platforms with pipelines running to and from offshore fields;
- Other offshore renewable energy installations (OREIs);
- Submarine cables;
- Military practice areas; and
- Marine aggregate extraction areas.

7.7.1.2 A plot of the key navigational features within the southern North Sea and in proximity to Hornsea Three is presented in Figure 7.2.

7.7.1.3 The following navigational features have been identified in proximity to the offshore aspects of Hornsea Three:

- IMO routeing measures: the southbound side of the Off Botney Ground Traffic Separation Scheme (TSS) passes approximately 6.54 nm (12.1 kilometres (km)) to the southeast of the Hornsea Three array area;
- Oil or gas surface platforms: there are no oil or gas surface platforms or producing subsea well heads located within the Hornsea Three array area or offshore HVAC booster station search area. The nearest oil or gas surface platforms to the Hornsea Three array area are the Windermere platform and Chiswick platform, located approximately 0.98 nm (1.8 km) and 1.45 nm (2.7 km) to the east of the Hornsea Three array area respectively. There are a number of oil or gas surface platforms located within the Hornsea Three offshore cable corridor shipping and navigation study area, with the nearest to the offshore HVAC booster station search area being the Clipper South platform and Audrey A platform, located 0.49 nm (910 m) to the west and 0.74 nm (1.4 m) to the northwest of the Hornsea Three offshore HVAC booster station search area respectively. No oil or gas surface platforms intersect the Hornsea Three offshore cable corridor or temporary working area;
- Aggregate dredging areas: there are no aggregate dredging areas intersecting the Hornsea Three array area or the offshore cable corridor. The eastern boundary of an option area (Area 491) runs alongside the boundary of the Hornsea Three offshore cable corridor, intersecting the Hornsea Three offshore cable corridor or the temporary working area. Two marine aggregate extraction application areas (Areas 483 and 506) are also located in proximity to the Hornsea Three offshore cable corridor.
- Other wind farm developments: there are a number of current and proposed offshore wind farms to the southwest of the Hornsea Three array area with the nearest being Dudgeon Offshore Windfarm (under construction) and Triton Knoll Offshore Windfarm (consented), located 46.9 nm (86.9 km) and 54.4 nm (101 km) to the southwest of the Hornsea Three array area respectively. The Dogger Bank Zone is located to the north of the Hornsea Three array area, with each of the developments within this zone consented. The former East Anglia zone is located to the south of the Hornsea Three array area, with each of the developments in this zone either at the pre-planning application stage or consented;
- MOD PEXAs: the northeastern corner of the Hornsea Three array area intersects a submarine exercise area by a distance of approximately 123 m;
- Marine Environmental High Risk Area (MEHRA): there are no MEHRA in or near to the Hornsea Three array area. The closest MEHRA is the Spurn Bight MEHRA but is located approximately 48.6 nm (90.0 km) to the northwest of the Hornsea Three offshore cable corridor; and
- Naval depth charge area: a naval depth charge area is located approximately 6.67 nm (12.35 km) to the east of the Hornsea Three array area.

7.7.2 Marine traffic in proximity to Hornsea Three array area

Commercial vessel analysis

7.7.2.1 This section provides an overview of the vessel tracks recorded on AIS and Radar during the site specific surveys for the baseline shipping and navigation review of the Hornsea Three array area shipping and navigation study area. This includes 40 full days of AIS data, Radar data and visual sightings recorded within the Hornsea Three array area shipping and navigation study area from survey vessels working at the Hornsea Three array area during the following periods:

- 6 to 18 June 2016;
- 22 June to 4 July 2016;
- 10 to 16 November 2016; and
- 23 November to 3 December 2016.

7.7.2.2 These variations in survey periods allow for the assessment to account for seasonal variations. Further information on the marine traffic survey methodology is provided in section 7 of the NRA.

7.7.2.3 A number of tracks recorded during the survey were classified as temporary (non-routine), such as the tracks of the survey vessels and traffic associated with temporary drilling rigs, and has therefore been excluded from the analysis. Oil and gas affiliated vessels supporting permanent installations were retained in the analysis.

7.7.2.4 A plot of the vessel tracks recorded during a 26 day survey period in June and July 2016 (summer), colour-coded by vessel type, and excluding temporary traffic (as defined above) is presented in Figure 7.3. A plot of the tracks recorded during a further 14 day survey period in November and December 2016 (winter), colour-coded by vessel type, and excluding temporary traffic, is presented in Figure 7.4. The summer survey was longer in duration on account of the fact that it was a piggy-back survey and so the additional survey days were acquired at minimal additional cost.

7.7.2.5 In order to provide a comparison of marine traffic between the two survey periods (which are of differing duration), plots of the vessel tracks for each survey period converted to a tracks per day density grid are presented in Figure 7.5 and Figure 7.6. Furthermore, the analysis presented in the remainder of this section is given in terms of the unique vessels per day.

7.7.2.6 A unique vessel is defined as an individual vessel identified on that calendar day even if there are multiple AIS tracks associated with that vessel. Individually vessels are identified, in the majority, by their Maritime Mobile Service Identity (MMSI) number.

7.7.2.7 For the 26 days analysed in summer 2016, there was an average of 42 unique vessels per day passing within the Hornsea Three array area shipping and navigation study area, recorded on AIS and Radar (excluding temporary traffic). There was an average of 15 unique vessels per day intersecting the Hornsea Three array area.

7.7.2.8 For the 14 days analysed in winter 2016, there was an average of 28 unique vessels per day passing within the Hornsea Three array area shipping and navigation study area, recorded on AIS and Radar (excluding temporary traffic). There was an average of 13 unique vessels per day intersecting the Hornsea Three array area.

7.7.2.9 Throughout the summer period the majority of tracks were cargo vessels (33% within the Hornsea Three array area) and fishing vessels (30%). Throughout the winter period the majority of tracks were cargo vessels (47% within the Hornsea Three array area) and tankers (19%).

7.7.2.10 Vessel lengths overall (LOA) recorded throughout the survey periods ranged from 9 m (the pleasure craft *Bjxrkski-2*) to a maximum of 333 m (four crude oil tankers including the *Selene Trader*). The average length of vessels within the Hornsea Three array area shipping and navigation study area throughout the summer and winter periods were 104 m and 120 m respectively.

7.7.2.11 Vessel draughts recorded throughout the survey periods ranged from 1.8 m (wind farm support vessel *MCS Blue Norther*) to a maximum of 20.6 m (oil products tanker *Victory 1*). The average draught of vessels within the Hornsea Three array area shipping and navigation study area throughout the summer and winter periods were 5.1 m and 5.9 m respectively.

7.7.2.12 It should be noted that 10% of the total number of unique vessels recorded within the Hornsea Three array area shipping and navigation study area did not broadcast a draught on AIS and hence have been excluded from the vessel draught analysis.

7.7.2.13 Sixteen main commercial routes have been identified as transiting through the Hornsea Three array area shipping and navigation study area. Plots of the main routes and corresponding 90th percentiles (areas within which 90% of vessel traffic transiting a route are situated as per MGN 543) within the Hornsea Three array area shipping and navigation study area are presented in Figure 7.7. These routes and percentiles have been defined using the principles set out in MGN 543. A main route is defined as a route commonly used by multiple vessels or a route frequently used by a unique vessel. The vessel frequencies along these routes vary from 1 vessel every 10 days, to 3 to 4 vessels per day.

7.7.2.14 Details of the main routes (1 to 16), including the average number of vessels that transit through the Hornsea Three array area shipping and navigation study area per day and the main vessel types, are provided in Table 7.6.

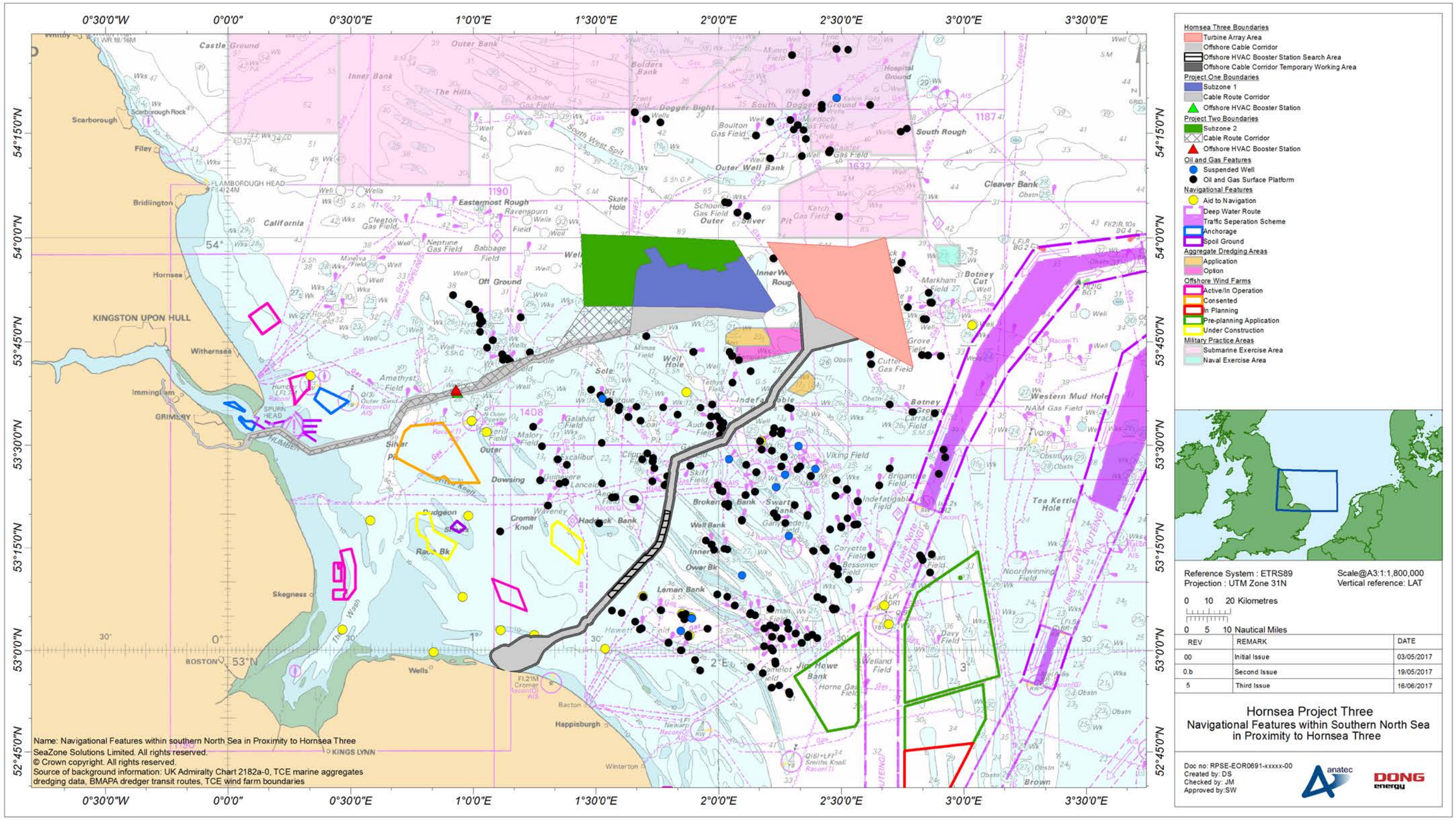

Figure 7.2: Navigational features within southern North Sea in proximity to Hornsea Three.

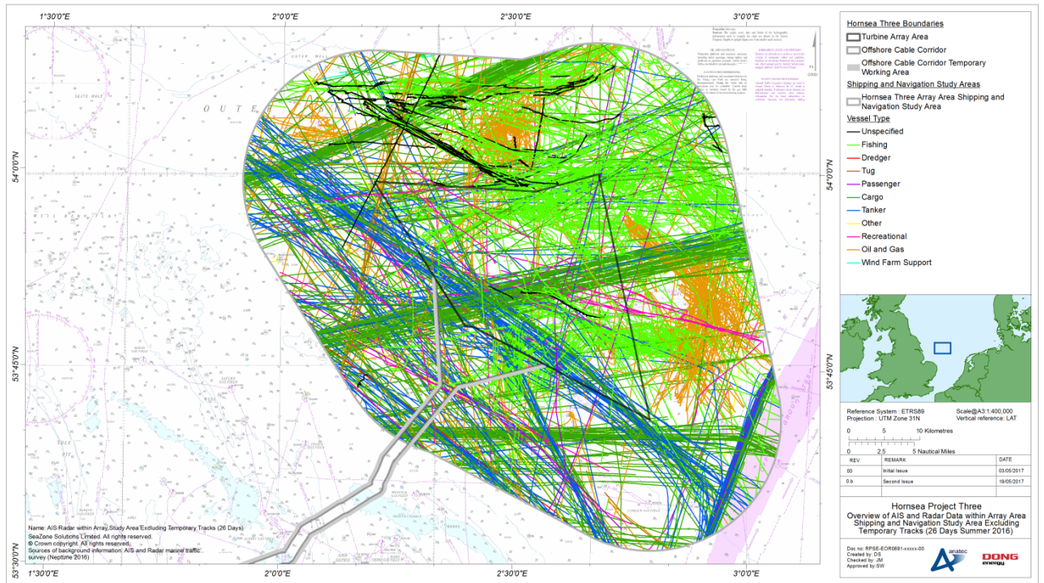

Figure 7.3: Overview of AIS and Radar data within Hornsea Three array area shipping and navigation study area excluding temporary tracks (26 days summer 2016).

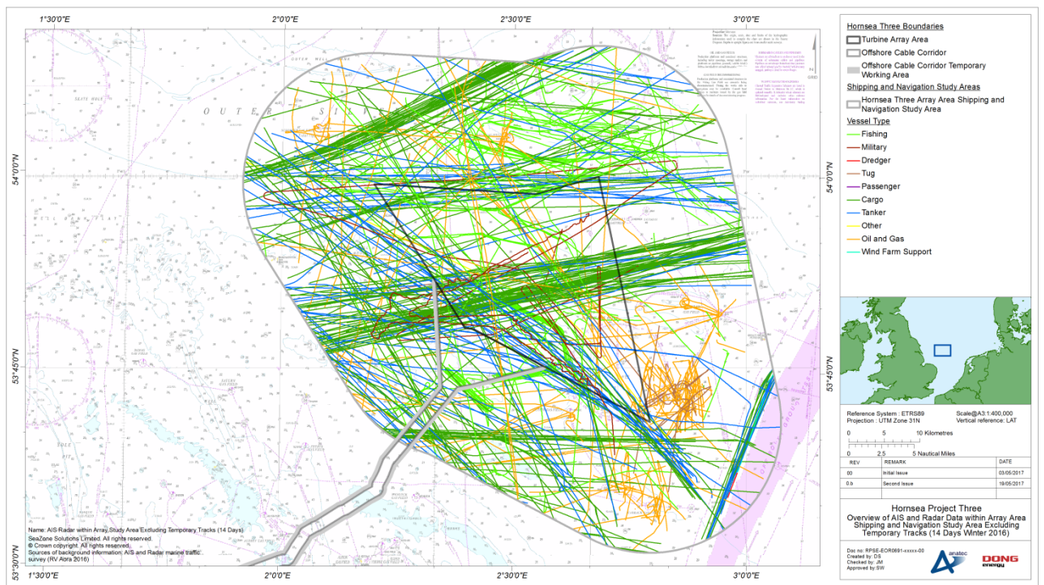

Figure 7.4: Overview of AIS and Radar data within Hornsea Three array area shipping and navigation study area excluding temporary tracks (14 days winter 2016).

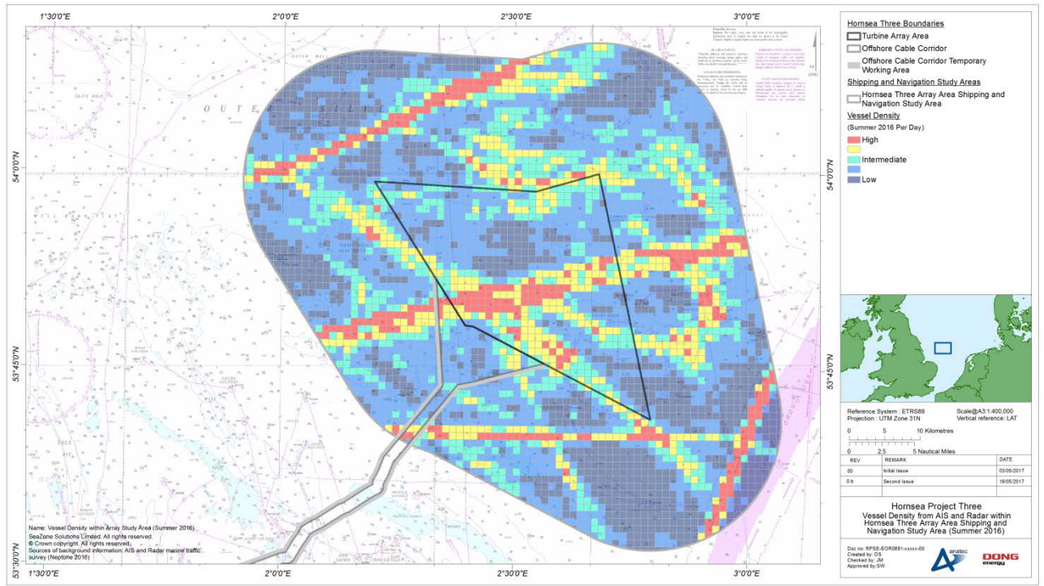

Figure 7.5: Vessel density from AIS and Radar within Hornsea Three array area shipping and navigation study area (summer 2016).

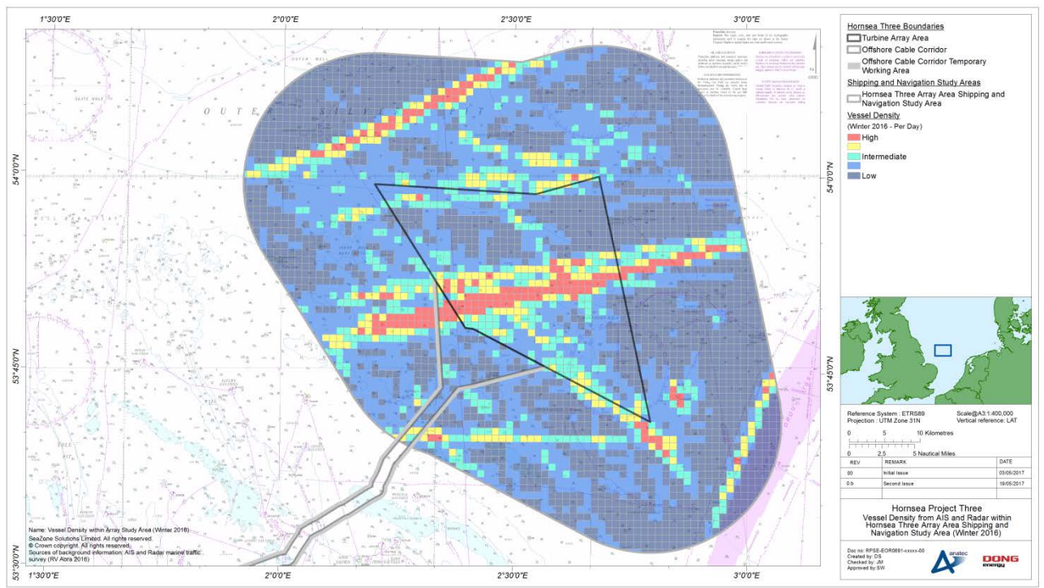

Figure 7.6: Vessel density from AIS and Radar within Hornsea Three array area shipping and navigation study area (winter 2016).

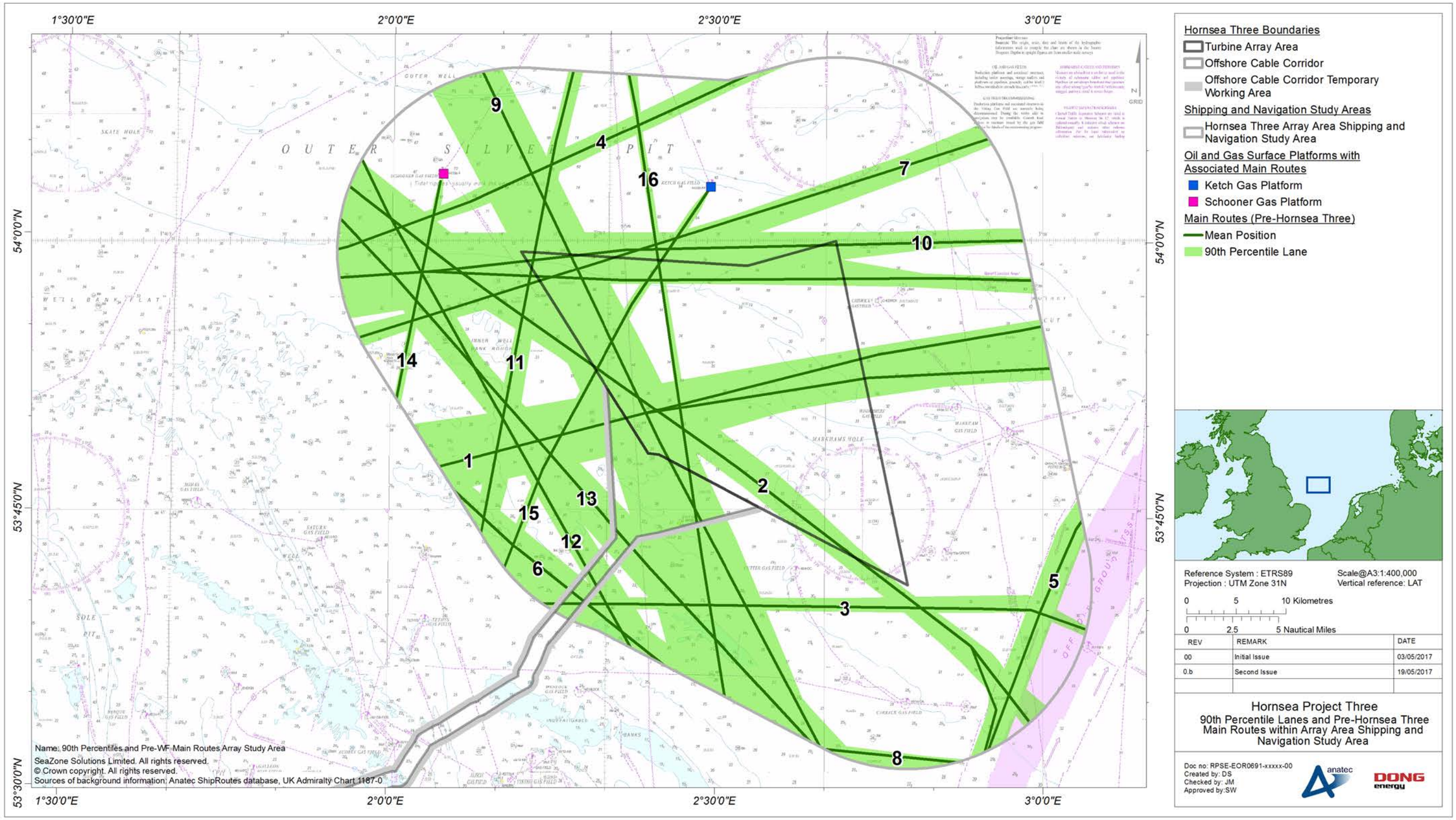

Figure 7.7: 90th percentile lanes and pre-Hornsea Three main routes within Hornsea Three array area shipping and navigation study area.

Table 7.6: Main routes, average numbers and destination within Hornsea Three array area shipping and navigation study area.

Route number (as shown in Figure 7.8)	Number of vessels per day (average)	Destinations and main vessel types identified
Route 1	3 to 4 vessels per day	Immingham (UK) to Cuxhaven (Germany). Route 1 is used by cargo vessels (90%) and tankers (10%). Route 1 is a DFDS Seaways ferry route from Immingham to Cuxhaven and splits on approach to the Off Botney Ground TSS. The main vessel operating on this route is the *Hafnia Seaways*.
Route 2	1 to 2 vessels per day	Forth Ports (UK) to Rotterdam (Netherlands). Route 2 is generally used by tankers (64%) and cargo vessels (34%).
Route 3	1 to 2 vessels per day	Immingham (UK) to Cuxhaven (Germany). Route 3 is generally used by cargo vessels (97%). Route 3 is a DFDS Seaways ferry route (as with Route 1) and also includes a KESS Ro Ro) freight service from Grimsby (UK) to Emden (Germany). The main vessels operating on this route are the *Jutlandia Seaways* (DFDS Seaways) and the *Neckar Highway* (KESS).
Route 4	2 to 3 vessels per day	Immingham (UK) to Esbjerg (Denmark). Route 4 is generally used by cargo vessels (96%). Route 4 is a DFDS Seaways Ro Ro freight service operated by three vessels; the *Ark Dania*, *Ark Germania* and *Primula Seaways*.
Route 5	2 vessels per day	Off Botney Ground TSS southbound. Route 5 is generally used by cargo vessels (42%), tankers (42%) and passenger vessels (14%). Route 5 includes vessels transiting too many locations, particularly ports within the English Channel.
Route 6	1 to 2 vessels per day	Forth Ports (UK) to Amsterdam (Netherlands). Route 6 is generally used by tankers (53%) and cargo vessels (39%).
Route 7	1 vessel per 2 days	Immingham (UK) to Esbjerg (Denmark). Route 7 is used by cargo vessels (67%) and tankers (33%).Route 7 is a DFDS Seaways Ro Ro freight service (as with Route 4) generally operated by the *Ark Dania* (eastbound transits only).
Route 8	1 vessel per 2 days	Immingham (UK) to Emden (Germany). Route 8 is used by cargo vessels (100%). Route 8 is a KESS route from Grimsby to Emden (as with Route 3) generally operated by the *Weser Highway* (westbound only).
Route 9	1 vessel per 2 days	Icelandic Ports to Rotterdam (Netherlands). Route 9 is generally used by cargo vessels (63%) and tankers (26%).
Route 10	1 vessel per day	Immingham (UK) to German Ports. Route 10 is generally used by cargo vessels (56%) and tankers (42%) with German port destinations including Bremen, Hamburg and Cuxhaven.
Route 11	1 vessel per 2 days	Great Yarmouth (UK) to Murdoch Gas Field. Route 11 is used by oil and gas affiliated vessels.
Route 12	1 vessel per 2 days	Icelandic Ports to Rotterdam (Netherlands). Route 12 is generally used by cargo vessels (87%).
Route 13	2 vessels per 3 days	Icelandic Ports to Amsterdam (Netherlands). Route 13 is generally used by cargo vessels (48%) and tankers (34%).
Route 14	1 vessel per 10 days	Great Yarmouth (UK) to Schooner Gas Field. Route 14 is used by oil and gas affiliated vessels (100%). The main vessel using this route is the *Putford Trader*.
Route 15	1 vessel per 5 days	Great Yarmouth (UK) to Ketch Gas Field. Route 14 is used by oil and gas affiliated vessels (100%). The main vessel using this route is the *Putford Trader*.
Route 16	1 vessel per 5 days	Great Yarmouth (UK) to Murdoch Gas Field. Route 16 is an alternative route to Route 11 and is used by oil and gas affiliated vessels (100%). The main vessels using this route are the *VOS Glory* and *VOS Gorgeous*.

Recreational vessel activity and cruising routes

7.7.2.15 For the purposes of the shipping and navigation assessment, recreational activity includes sailing and motor craft (including those undertaking dive/fish excursions) of between 2.4 and 24 m, as per European Union (EU) Directive 94/25/EC and the Recreational Craft Regulations 2004.

7.7.2.16 A plot of the recreational vessel tracks recorded throughout the marine traffic survey is presented in Figure 7.8. From the marine traffic survey data, there was an average of one unique recreational craft per day passing within the Hornsea Three array area shipping and navigation study area. However, 45% of all recreational activity was recorded on two days, 28 and 29 June 2016, when the annual 500 Mile North Sea Race for sailing vessels passed through the Hornsea Three array area.

7.7.2.17 It is noted that 87% of recreational craft recorded throughout the combined summer and winter survey periods were recorded on AIS, with only 13% recorded on Radar.

Fishing vessel activity

7.7.2.18 Fishing vessel activity has been identified from the marine traffic surveys, sightings patrols and satellite data.

7.7.2.19 A plot of the fishing vessel tracks recorded throughout the marine traffic survey is presented in Figure 7.9. From the marine traffic survey data, it can be seen that a high level of fishing vessel activity was recorded within the Hornsea Three array area shipping and navigation study area, with vessels tracked transiting through the Hornsea Three array area as well as actively engaged in fishing.

7.7.2.20 Flag state (nationality) information was available for approximately 85% of fishing vessels recorded on AIS and Radar within the Hornsea Three array area shipping and navigation study area. Of the nationalities identified, the most common were the Netherlands (37%), UK (24%), France (15%) and Belgium (12%).

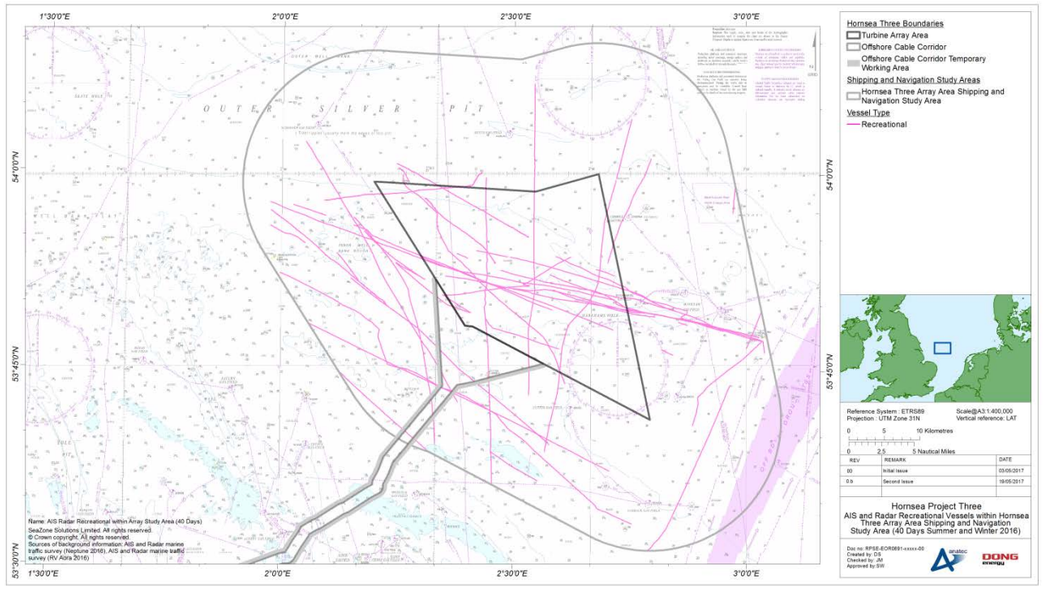

Figure 7.8: AIS and Radar recreational vessels within Hornsea Three array area shipping and navigation study area (40 days summer and winter 2016).

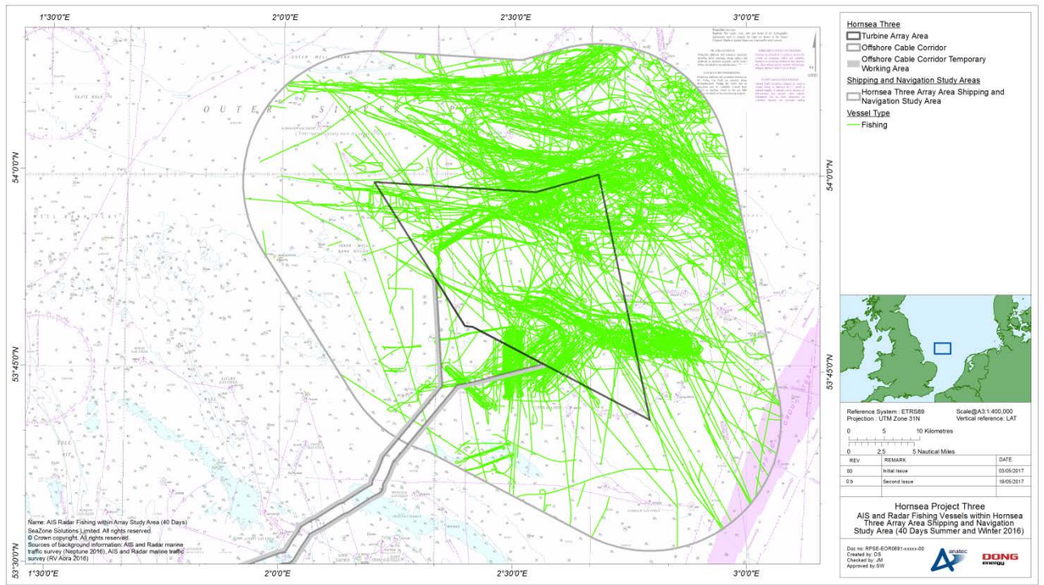

Figure 7.9: AIS and Radar commercial fishing vessels within Hornsea Three array area shipping and navigation study area (40 days summer and winter 2016).

7.7.2.21 Fishing method information was available and automatically provided for approximately 78% of fishing vessels recorded on AIS and Radar within the Hornsea Three array area shipping and navigation study area. Of the fishing methods identified, the most common were demersal stern trawlers (34%), beam trawlers (33%) and seine netters (20%). No recreational fishing vessels were identified within the marine traffic survey data.

7.7.2.22 Fishing vessel sightings (overflight and/or vessel-based), recorded between 2005 and 2009, and satellite data (collected for fishing vessels of 15 m length and over), recorded in 2009, was also analysed. In both cases the fishing vessel nationality distribution shows good agreement with the data from the marine traffic survey, with the Netherlands and UK the most common nationalities.

7.7.2.23 Fishing method information was available for approximately 22.4% of fishing vessel satellite positions within the Hornsea Three array area shipping and navigation study area. Of the fishing methods identified, the most common were demersal stern trawlers, beam trawlers and bottom seiners. Again, this shows good agreement with the data from the marine traffic survey.

Search and rescue

7.7.2.24 In March 2013, the Bristow Group were awarded the contract by the MCA (through their Department for Transport (DfT) remit) to provide helicopter SAR operations in the UK over a ten year period, and took over the service from the previous provider in April 2015. There are ten base locations for the SAR helicopter service. The last base location to go live is expected to be at Stornoway in July 2017. The nearest SAR helicopter base is a new purpose-built base located at Humberside, approximately 105 nm to the west of the centre of the Hornsea Three array area (see Figure 7.11), and has been in operation since April 2015. This base operates two Sikorsky S-92 aircraft.

7.7.2.25 Companies operating offshore typically have resources of vessels, helicopters and other equipment available for normal operations that can assist with emergencies offshore. Moreover, all vessels, under IMO obligations set out in the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974) as amended, are required to render assistance to any person or vessel in distress if safely able to do so.

7.7.2.26 Further details on emergency response resources, including the Royal National Lifeboat Institute (RNLI) and HM Coastguard (HMCG), can be found in section 12 of the NRA.

Maritime accidents and incidents

7.7.2.27 The location of accidents, injuries and hazardous incidents reported to the MAIB within the Hornsea Three array area shipping and navigation study area for the ten year period between January 2005 and December 2014, colour-coded by type, are presented in Figure 7.10. It should be noted that the MAIB aim for 97% accuracy in reporting locations of accidents.

7.7.2.28 A total of five unique incidents with one incident involving two vessels, were reported within the Hornsea Three array area shipping and navigation study area, corresponding to an average of approximately one incident every two years. None of these incidents occurred within the Hornsea Three array area.

7.7.2.29 The most frequently recorded incident type was “Accident to Person”, representing 60% of the total incidents.

7.7.2.30 Data on RNLI lifeboat responses within the Hornsea Three array area shipping and navigation study area for the ten year period between 2005 and 2014 were analysed, with cases of hoax or false alarm excluded. It is noted that the RNLI have a strategic performance standard of reaching casualties up to a maximum of 100 nm from shore and therefore, due to the distance offshore and the journey time to respond, the RNLI may respond to a drifting vessel but are unlikely to respond to a life-saving incident in proximity to the Hornsea Three array area.

7.7.2.31 It was found that no launches to incidents were recorded by the RNLI within the Hornsea Three array area shipping and navigation study area throughout the ten year period analysed. The closest incident recorded by the RNLI occurred approximately 215 m outside of the Hornsea Three array area shipping and navigation study area and featured a fishing vessel involved in a collision.

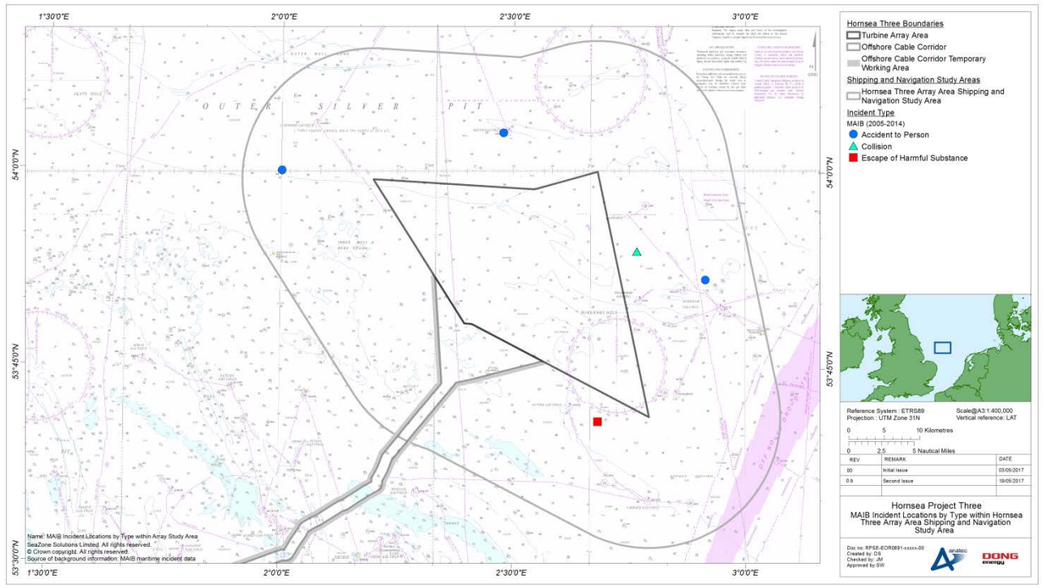

Figure 7.10: MAIB incident locations by type within Hornsea Three array area shipping and navigation study area (2005 to 2014).

7.7.3 Marine traffic in proximity to Hornsea Three offshore cable corridor

Commercial vessel analysis

7.7.3.1 This section provides an overview of the vessel tracks recorded on AIS during the desktop study for the baseline shipping and navigation review of the Hornsea Three offshore cable corridor. This includes 40 full days of AIS data recorded within the Hornsea Three offshore cable corridor shipping and navigation study area during the same periods as the data analysed for the Hornsea Three array area shipping and navigation study area.

7.7.3.2 It is noted that unlike the datasets used for the analysis of marine traffic in proximity to the Hornsea Three array area and Hornsea Three offshore HVAC booster station search area, this dataset does not include comprehensive Radar data and therefore there will be limitations with the data associated with non-AIS targets especially in the nearshore area.

7.7.3.3 The Hornsea Three offshore cable corridor is crossed by a number of dense traffic routes, with the majority of these between the UK east coast and mainland Europe, including the Netherlands, Belgium, Germany and France. There are also a notable number of dense traffic routes between UK east coast ports close to shore and routes associated with oil and gas affiliated vessels, with Great Yarmouth the primary base port.

7.7.3.4 As previously, a number of tracks recorded during the AIS survey were classified as temporary (non-routine), and have therefore been excluded from the analysis. Oil and gas affiliated vessels supporting permanent installations were retained in the analysis.

7.7.3.5 A plot of the vessel tracks recorded during a 40 day survey period in June and July 2016 (summer) and November and December 2016 (winter), colour-coded by vessel type, and excluding temporary traffic, is presented in Figure 7.12.

7.7.3.6 For the 26 days analysed in summer 2016, there was an average of 97 unique vessels per day passing within the Hornsea Three offshore cable corridor study area, recorded on AIS (excluding temporary traffic). There was average of 87 unique vessels per day intersecting the Hornsea Three offshore cable corridor.

7.7.3.7 For the 14 days analysed in winter 2016, there was also an average of 97 unique vessels per day passing within the Hornsea Three offshore cable corridor, recorded on AIS (excluding temporary traffic). There was an average of 86 unique vessels per day intersecting the Hornsea Three offshore cable corridor.

7.7.3.8 Throughout the summer period the majority of tracks were cargo vessels (50% within the Hornsea Three offshore cable corridor) and tankers (20%). Throughout the winter period the majority of tracks were also cargo vessels (56% within the Hornsea Three offshore cable corridor study area) and tankers (21%).

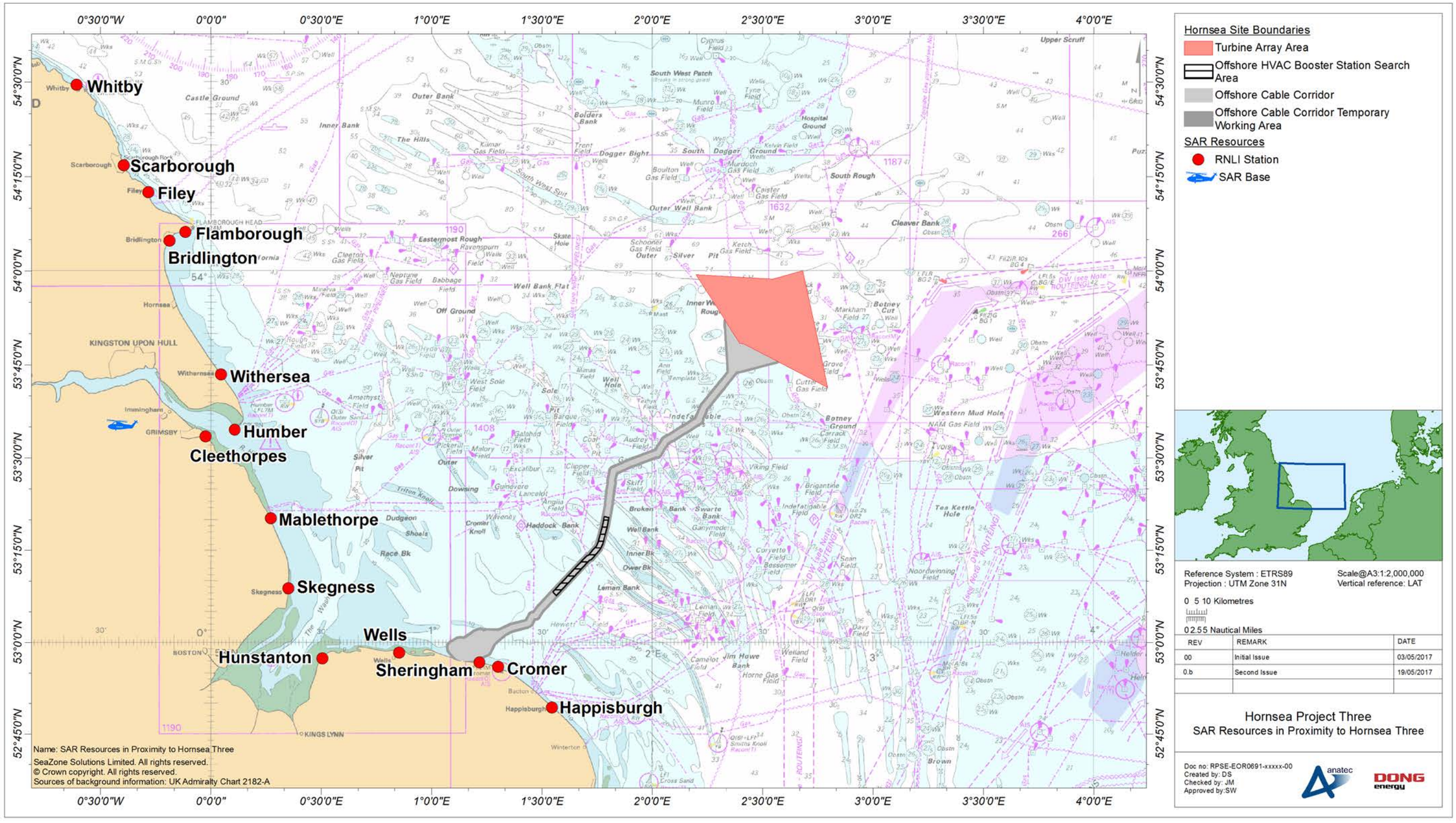

Figure 7.11: SAR resources in proximity to Hornsea Three.

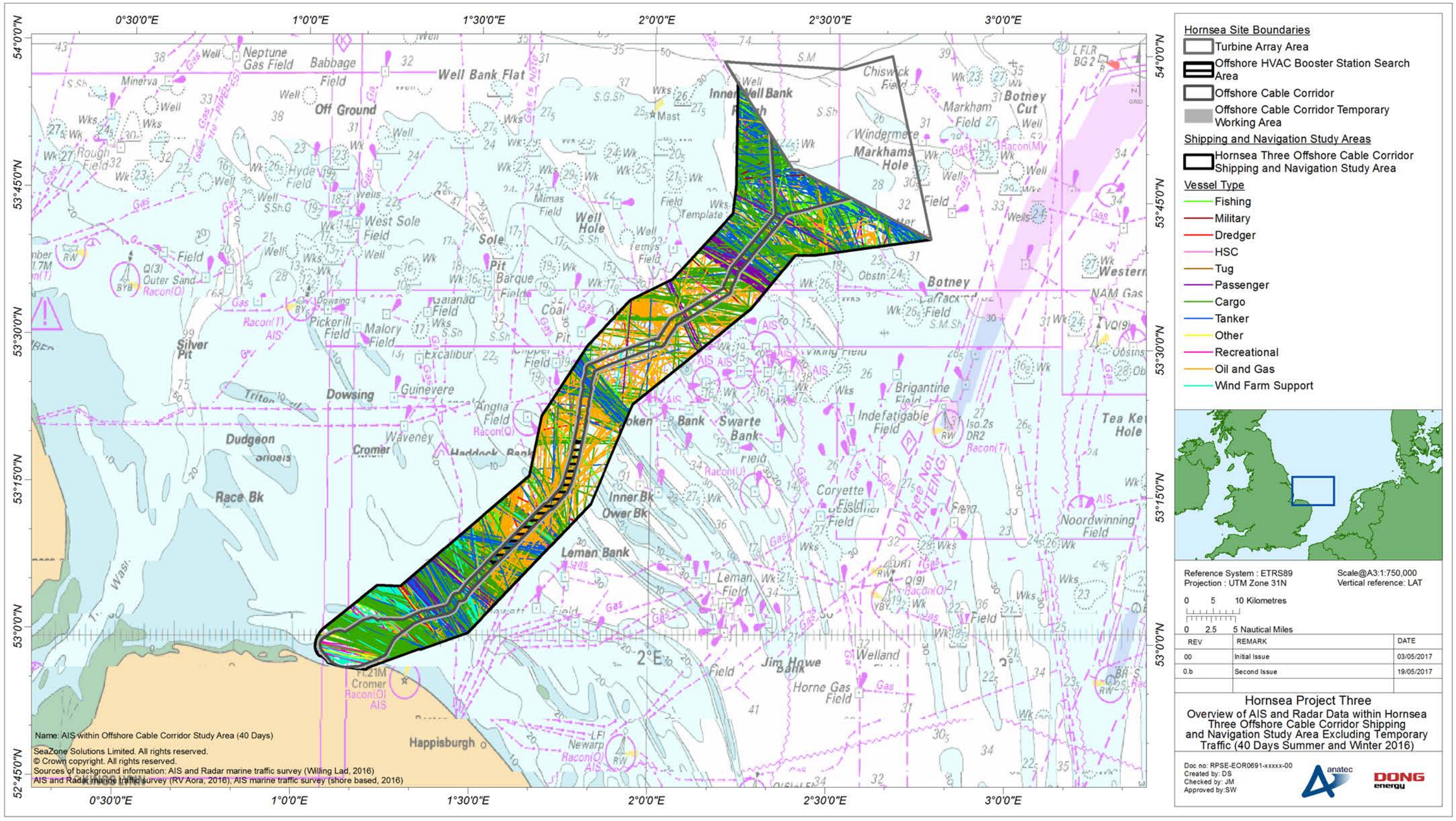

Figure 7.12: Overview of AIS data within Hornsea Three offshore cable corridor study area excluding temporary tracks (40 days summer and winter 2016).

7.7.3.9 Vessel LOA recorded throughout the survey periods ranged from 5 m (recreational sailing vessel *Wolfies Toy* and *RNLI Lifeboat D-734*) to a maximum of 333 m (crude oil tanker *Selene Trader*). The average lengths of vessels within the Hornsea Three offshore cable corridor shipping and navigation study area throughout the summer and winter periods were 108 m and 115 m respectively.

7.7.3.10 Vessel draughts recorded throughout the survey period ranged from 0.9 m (wind farm support vessel *Eastern Aura*) to 20.6 m (oil products tanker *Victory 1*). The average draught of vessels within the Hornsea Three offshore cable corridor shipping and navigation study area throughout the summer and winter survey periods was 5.3 m.

7.7.3.11 It should be noted that 10% of the total number of unique vessels within the Hornsea Three offshore cable corridor shipping and navigation study area did not broadcast a draught on AIS and hence have been excluded from the analysis.

Recreational vessel activity and cruising routes

7.7.3.12 Throughout the combined summer and winter AIS survey period, an average of one to two recreational vessels per day passed within the Hornsea Three offshore cable corridor shipping and navigation study area and one to two within the Hornsea Three offshore cable corridor. The majority of these vessels were undertaking a passage alongside the shore.

7.7.3.13 From the marine traffic survey, recreational vessel activity within the Hornsea Three offshore HVAC booster station search area shipping and navigation study area was relatively low, with just four tracks recorded throughout the survey period, an average of one recreational vessel every seven days.

Fishing vessel activity

7.7.3.14 Throughout the combined summer and winter survey period, an average of three to four fishing vessels per day passed within the Hornsea Three offshore cable corridor shipping and navigation study area and two to three within the Hornsea Three offshore cable corridor. The majority of these vessels were either on passage in a north-south direction or activity engaged in fishing activities in the vicinity of the Hornsea Three array area or the shore.

7.7.4 Marine traffic in proximity to Hornsea Three offshore HVAC booster station search area

Commercial vessel analysis

7.7.4.1 This section provides an overview of the vessel tracks recorded on AIS and Radar during the site-specific surveys for the baseline shipping and navigation review of the Hornsea Three offshore HVAC booster station search area. This includes 28 full days of AIS data, Radar data and visual sightings recorded within the Hornsea Three offshore HVAC booster station search area shipping and navigation study area from survey vessels working at the Hornsea Three offshore HVAC booster station search area during the following periods:

- 16 to 29 September 2016;
- 17 to 19 November 2016; and
- 4 to 15 December 2016.

7.7.4.2 As previously, these variations in survey periods allow for the assessment to account for seasonal variations.

7.7.4.3 As previously, a number of tracks recorded during the survey period were classified as temporary (non-routine), and have therefore been excluded from the analysis. Oil and gas affiliated vessels supporting permanent installations were retained in the analysis.

7.7.4.4 A plot of the vessel tracks recorded during a 28 day survey period in September 2016 (14 days summer) and November and December 2016 (14 days winter), colour-coded by vessel type, and excluding temporary traffic, is presented in Figure 7.13.

7.7.4.5 For the 14 days analysed in summer 2016, there was an average of 28 unique vessels per day passing within the Hornsea Three offshore HVAC booster station shipping and navigation study area, recorded on AIS and Radar (excluding temporary traffic). There was an average of five unique vessels per day intersecting the Hornsea Three offshore HVAC booster station search area.

7.7.4.6 For the 14 days analysed in winter 2016, there was an average of 29 unique vessels per day passing within the Hornsea Three offshore HVAC booster station shipping and navigation study area, recorded on AIS and Radar (excluding temporary traffic). There was an average of four unique vessels per day intersecting the Hornsea Three offshore HVAC booster station search area.

7.7.4.7 Throughout the survey periods the majority of tracks were cargo vessels (38% within the Hornsea offshore HVAC booster station search area) and tankers (18%). However, 36% of tracks intersecting the Hornsea Three offshore HVAC booster station search area were wind farm support vessels transiting to and from Dudgeon Offshore Windfarm.

7.7.4.8 Vessel LOA recorded throughout the survey periods ranged from 13 m (sailing vessel *Mae West*) to a maximum of 292 m (bulk carrier *KSL San Francisco*). The average length of vessels within the Hornsea Three offshore HVAC booster station shipping and navigation study area throughout the summer and winter periods were 116 m and 125 m respectively.

7.7.4.9 Vessel draughts recorded throughout the survey periods ranged from 1.1 m (wind farm support vessel *Dalby Don*) to a maximum of 13 m (bulk carrier *KSL San Francisco*). The average draught of vessels within the Hornsea Three offshore HVAC booster station shipping and navigation study area throughout the summer and winter periods were both 5.3 m.

7.7.4.10 It should be noted that 4% of the total number of unique vessels within the Hornsea Three offshore HVAC booster station shipping and navigation study area did not broadcast a draught on AIS and hence have been excluded from the analysis.

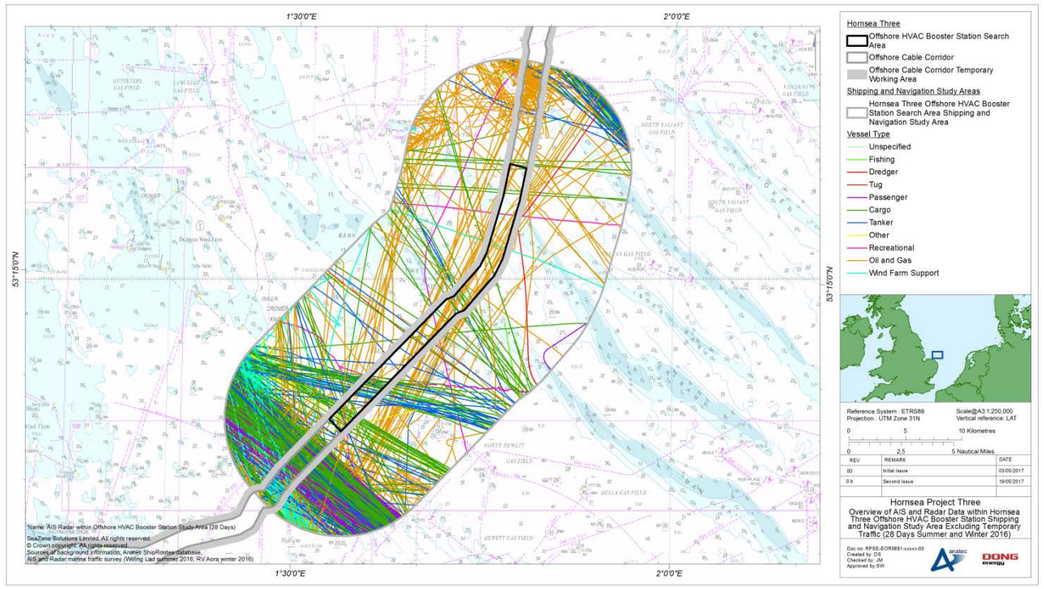

Figure 7.13: Overview of AIS and Radar data within offshore HVAC booster station search area shipping and navigation search area excluding temporary traffic (28 days summer and winter 2016).

7.7.4.11 Nine main commercial routes have been identified as transiting through the Hornsea Three offshore HVAC booster station shipping and navigation study area. Plots of the main routes and corresponding 90th percentiles within the offshore HVAC booster station study area are presented in Figure 7.14. As previously, these routes and percentiles have been defined using the principles set out in MGN 543.

7.7.4.12 Details of the main routes (1 to 9), including the average number of vessels that transit through the Hornsea Three offshore HVAC booster station study area per day and the main vessel types, are provided in Table 7.7.

Table 7.7: Main routes, average numbers and destination within offshore HVAC booster station study area.

Route number (as shown in Figure 7.14)	Number of vessels per day (average)	Destinations and main vessel types identified
Route 1	13 to 14 vessels per day	Immingham (UK) to Rotterdam (Netherlands). Route 1 is generally used by cargo vessels (57%), passenger vessels (22%) and tankers (20%). Route 1 is a commercial ferry route (used by DFDS Seaways, Stena Line and Cobelfret) from Immingham and Killingholme to Rotterdam and Vlardingen. Vessels operating on this route include the *Fionia Seaways*, *Stena Transporter* and *Amandine*.
Route 2	1 vessel per day	Forth Ports (UK) to Zeebrugge (Belgium). Route 2 is used by cargo vessels (100%). Route 2 is a DFDS Seaways Ro Ro freight service from Rosyth to Zeebrugge operated by the *Finlandia Seaways*.
Route 3	2 to 3 vessels per day	Great Yarmouth (UK) to Dudgeon Offshore Windfarm. Route 3 is used by wind farm support vessels (100%) visiting the nearby Dudgeon site.
Route 4	1 vessel per 2 days	Immingham (UK) to Rotterdam (Netherlands). Route 4 is generally used by cargo vessels (78%) and tankers (17%). Route 4 includes a small number of adverse weather transits by DFDS Seaways vessels between Immingham and Cuxhaven.
Route 5	1 vessel per day	Immingham (UK) to Rotterdam (Netherlands). Route 5 is generally used by tankers (52%) and cargo vessels (39%).
Route 6	1 vessel per 2 days	Great Yarmouth (UK) to Audrey Gas Field. Route 6 is used by oil and gas affiliated vessels visiting a number of fields to the north of the Hornsea Three offshore HVAC booster station search area.
Route 7	1 vessel per 2 days	Great Yarmouth (UK) to Clipper Gas Field. Route 7 is used by oil and gas affiliated vessels visiting a number of fields to the north of the Hornsea Three offshore HVAC booster station search area.
Route 8	1 vessel per 2 days	Great Yarmouth (UK) to Babbage Gas Field. Route 8 is used by oil and gas affiliated vessels visiting a number of fields to the north of the Hornsea Three offshore HVAC booster station search area.
Route 9	1 to 2 vessels per day	Tees (UK) to Rotterdam (Netherlands). Route 9 is generally used by tankers (49%) and cargo vessels (37%).

Recreational vessel activity and cruising routes

7.7.4.13 From the marine traffic survey, recreational vessel activity within the Hornsea Three offshore HVAC booster station search area shipping and navigation study area was relatively low, with just four tracks recorded throughout the survey period, an average of one recreational vessel every seven days.

Fishing vessel activity

7.7.4.14 From the marine traffic survey, fishing vessel activity within the Hornsea Three offshore HVAC booster station search area was relatively low, with just five tracks recorded throughout the survey period, an average of one fishing vessel every five to six days.

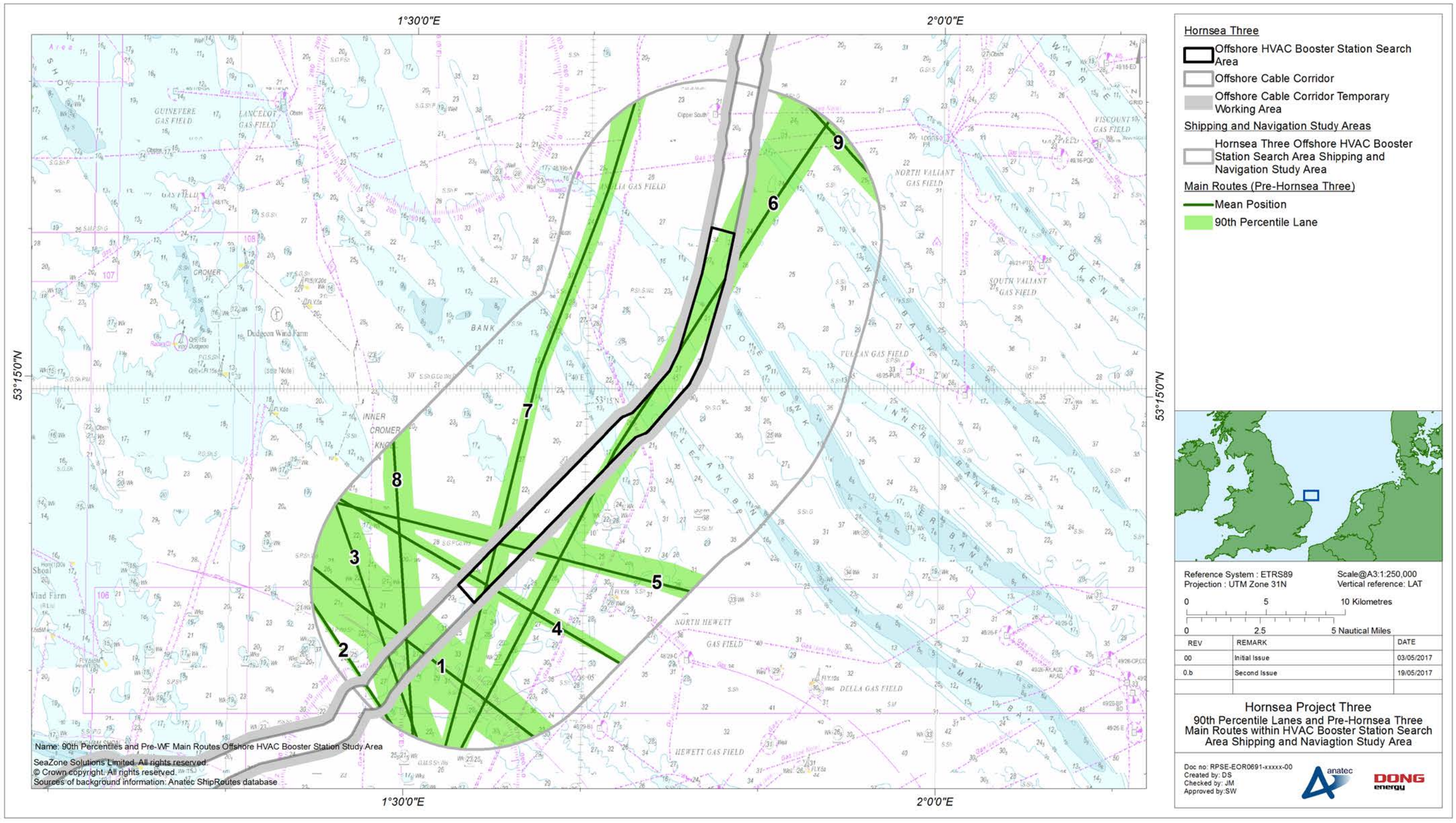

Figure 7.14: 90th percentile lanes and pre-Hornsea Three main routes within offshore HVAC booster station study area.

Maritime accidents and incidents

7.7.4.15 Between January 2005 and December 2014 there were two incidents reported to the MAIB within the Hornsea Three offshore HVAC booster station search area shipping and navigation study area, corresponding to an average of approximately one incident every five years. Neither of these incidents occurred within the Hornsea Three offshore HVAC booster station search area.

7.7.4.16 Both of the incidents were of the "Accident to Person" type and involved vessels associated with the offshore industry, one of which was a standby safety vessel.

7.7.4.17 A total of four RNLI lifeboat launches, excluding hoaxes and alarms, to four unique incidents were recorded within the Hornsea Three offshore HVAC booster station shipping and navigation study area between 2005 and 2014.

7.7.4.18 The incident types recorded were "Machinery Failure" and "Person in Danger"; both representing 50% of the total incidents, and recreational vessels were the most frequently recorded casualty type (50% of all incidents).

7.7.5 Future baseline scenario

7.7.5.1 Due to the distance offshore of the Hornsea Three array area, it is not considered likely that any increase in port traffic, i.e. vessels entering and exiting ports, would impact the general traffic levels around the Hornsea Three array area and offshore cable corridor; therefore a general increase of 10% is applied in the future baseline scenario.

7.7.5.2 For commercial fishing vessel transits, a 10% increase is applied in the future case scenario to demonstrate potential impacts; this value is considered to be reasonable and is used as a standard value throughout future case modelling to demonstrate what changes would occur to the area if vessel activity increased. This value is used due to there being limited reliable information on future activity levels on which any firm assumption could be made.

7.7.5.3 For recreational vessel transits, there are no known major developments that will increase the activity of these vessels in the vicinity of Hornsea Three. As with fishing activity, given the lack of reliable information into future trends a general increase of 10% is applied in the future baseline scenario compared to the current low levels.

7.7.6 Future case scenario with Hornsea Three

7.7.6.1 During the construction period there may be as many as 11,026 return trips made by vessels involved in the installation of Hornsea Three. During the operation and maintenance period there are up to 2,433 crew transfer vessel (CTV) visits per year scheduled, along with many visits from supply vessels and other support vessels.

7.7.6.2 The potential increase in vessel activity levels would increase the probability of vessel to structure allisions (both powered and drifting). Whilst in reality the risk would vary by vessel type, size and route, it is estimated that this would lead to a linear 10% increase on the base case with wind farm allision risk. This is used in order to demonstrate how allision risk may change if the number of vessels increase within the area.

7.7.6.3 The increased activity would also increase the probability of vessel to vessel encounters and hence collisions. Whilst this is not a direct result of Hornsea Three, the increased congestion caused by the potential displacement of traffic due to the Hornsea Three array area and Hornsea Three offshore HVAC booster stations may have an influence. Again, a 10% overall increase was assumed on base case with wind farm risk given the lack of reliable information of likely shipping trends, especially given the distance from a port, of the Hornsea Three array area. Developments in ports and subsequent changes to vessel sizes are the most likely factors to influence traffic levels, and these are most notable and quantifiable near ports and harbours.

7.7.6.4 It is not possible to consider all potential alternative routeing options and so the shortest and therefore mostly likely alternatives have been considered. Assumptions for re-routes include:

- All alternative routes maintain a minimum distance of 1 nm from offshore installations and potential turbine boundaries in line with the MGN 543 shipping template (MCA, 2016). This distance is considered the maximum design scenario for shipping and navigation from a safety perspective, as explained in section 17.7 of the NRA; and
- All mean routes take into account sandbanks and known routeing preferences.

7.7.6.5 MGN 543 (MCA, 2016) provides guidance to offshore renewable energy developers on both the assessment process and design elements associated with the development of an offshore wind farm. Annex 3 of MGN 543 defines a methodology for assessing passing distances between wind farm boundaries but states that it is "*not a prescriptive tool but needs intelligent application*".

7.7.7 Data limitations

7.7.7.1 The desk based data and site specific survey data used in this chapter are detailed in section 7.6.1 and section 7.6.2 respectively. The desk based data sources used are the most up to date publicly available information, as well as those provided through consultation as detailed in section 7.5. The data are therefore limited by what is available and by what has been made available, at the time of writing the PEIR. Further details on the site specific data can be obtained in the NRA.

7.7.7.2 The site-specific data are considered to be in compliance with the requirements of MGN 543 and therefore provides a high level of confidence in the base case that it demonstrates. It is noted that specific agreement was given by the MCA and TH for the use of AIS only data within the Hornsea Three offshore cable corridor shipping and navigation study area (excluding the Hornsea Three offshore HVAC booster station search area shipping and navigation study area) – see section 7.6.1.

7.8 Key parameters for assessment

7.8.1 Maximum design scenario

7.8.1.1 The maximum design scenarios identified in Table 7.8 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. These scenarios have been selected from the details provided in the project description (volume 1, chapter 3: Project Description). Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the project Design Envelope (e.g. different turbine layout), to that assessed here be taken forward in the final design scheme.

7.8.2 Impacts scoped out of the assessment

7.8.2.1 On the basis of the baseline environment and the project description outlined in volume 1, chapter 3: Project Description, a number of impacts are proposed to be scoped out of the assessment for shipping and navigation. These impacts are outlined, together with a justification for scoping them out, in Table 7.9.

Table 7.8: Maximum design scenario considered for the assessment of potential impacts on shipping and navigation.

Potential impact	Maximum design scenario	Justification
Construction phase		
Construction activities within the Hornsea Three array area and offshore cable corridor may displace vessels (excluding commercial ferries) leading to increased journey times or distances during periods of adverse weather.	<u>Hornsea Three array area:</u> • Construction of the Hornsea Three array area could take up to 11 years and be split over two phases; and • Buoyed construction area around the Hornsea Three array area for the duration of all construction phases. <u>Hornsea Three offshore cable corridor:</u> • Maximum installation duration for the surface or subsea offshore HVAC booster stations is up to seven years split over two phases; • Buoyed construction area around the Hornsea Three offshore HVAC booster stations; and • Installation activities within the Hornsea Three offshore cable corridor including 1,000 m advisory safety distance.	Maximum duration and extent of construction period marked by construction buoyage throughout (all phases of constructing and not constructing) may cause maximum displacement to vessels operating in adverse weather.
Construction activities within the Hornsea Three array area may displace commercial ferries leading to increased journey times or distances for commercial ferries during periods of adverse weather.	<u>Hornsea Three array area:</u> • Construction of the Hornsea Three array area could take up to 11 years and be split over two phases; and • Buoyed construction area around the Hornsea Three array area for the duration of all construction phases.	Maximum duration and extent of construction period marked by construction buoyage throughout (all phases of constructing and not constructing) may cause maximum displacement to vessels operating in adverse weather.

Potential impact	Maximum design scenario	Justification
Presence of pre commissioned infrastructure within the Hornsea Three array area and offshore cable corridor may cause increased vessel to structure allision risk external to the array for all vessels.	Hornsea Three array area: • Up to 342 turbines with floating foundations, up to 4,104 mooring lines; excursion area 25% of water depth and 1,000 m mooring cable radius; • Total development area of up to 696 km²; • Up to 12 offshore HVAC collector substations; • Up to three offshore accommodation platforms; • Up to four offshore HVDC substations; • Bridge links up to 100 m length linking co-sited structures, including offshore HVDC substations and accommodation platforms; and • Construction of the Hornsea Three array area could take up to 11 years and be split over two phases. Hornsea Three offshore cable corridor: • Up to four above surface or up to six subsea offshore HVAC booster stations; and • Maximum installation duration for the surface or subsea offshore HVAC booster stations is two phases over seven years.	Pre commissioned structures may create new vessel to structure allision risk throughout the construction phase(s). Maximum extent of largest pre commissioned floating structures may create maximum increase to vessel to structure allision return period given the size of the structures at the waterline.
Presence of pre commissioned infrastructure within the Hornsea Three array area and offshore cable corridor may increase vessel to structure allision risk external to the array for NUC vessels in an emergency situation (including machinery related problems or navigational system errors).	Hornsea Three array area: • Up to 342 turbines with floating foundations, up to 4,104 mooring line; excursion area 25% of water depth and 1,000 m mooring cable radius; • Total development area of up to 696 km²; • Up to 12 offshore HVAC collector substations; • Up to three offshore accommodation platforms; • Up to four offshore HVDC substations; • Bridge links up to 100 m length linking co-sited structures, including offshore HVDC substations and accommodation platforms; and • Construction of the Hornsea Three array area could take up to 11 years and be split over two phases. Hornsea Three offshore cable corridor: • Up to four above surface or up to six subsea offshore HVAC booster stations; and • Maximum installation duration for the surface or subsea offshore HVAC booster stations is two phases over seven years.	Pre commissioned structures may create new vessel to structure allision risk to NUC vessels throughout the construction phase(s). Maximum extent of largest pre commissioned floating structures may create maximum increase to vessel to structure allision return period given the size of the structures at the waterline.
Presence of infrastructure within the Hornsea Three array area may cause increased vessel to structure allision risk internally within the Hornsea Three array area for recreational and fishing vessels.	Hornsea Three array area: • Up to 342 turbines with floating foundations, up to 4,104 mooring lines; excursion area 25% of water depth and 1,000 m mooring cable radius; • Total development area of up to 696 km²; • Up to 12 offshore HVAC collector substations; • Up to three offshore accommodation platforms; • Up to four offshore HVDC substations; • Bridge links up to 100 m length linking co-sited structures, including offshore HVDC substations and accommodation platforms; and • Construction of the Hornsea Three array area could take up to 11 years and be split over two phases.	Pre commissioned structures may create new vessel to structure allision risk throughout the construction phase(s) for vessels navigating internally within the array. Maximum extent of largest pre commissioned floating structures may create maximum increase to vessel to structure allision return period given the size of the structures at the waterline.

Potential impact	Maximum design scenario	Justification
Physical presence of pre commissioned structures (including sub surface elements) and cables (which may be exposed or partially buried) may present an increased risk of gear snagging for commercial fishing vessels with mobile gear.	<u>Hornsea Three array area:</u> • Up to 342 turbines with jacket foundation. • Total development area of up to 696 km²; • Up to 12 offshore HVAC collector substations; • Up to three offshore accommodation platforms; • Up to four offshore HVDC substations; • Up to 850 km array and 225 km interconnector cables; and • Construction of the Hornsea Three array area could take up to 11 years and be split over two phases. <u>Hornsea Three offshore cable corridor:</u> • Up to four above surface or up to six subsea offshore HVAC booster stations; • Maximum installation duration for the surface or subsea offshore HVAC booster stations is two phases over seven years; • Up to six export cables of up to 145 km in length (from Hornsea Three array area boundary to landfall) buried or protected within 1,000 m Hornsea Three offshore cable corridor width (550 to 850 m final corridor width); • Up to 37 cable/pipeline crossings; • Maximum installation duration of export cables is nine years over two phases; and • Advisory safety distances of up to 1,000 m for cable laying vessels.	Pre commissioned structures may create additional gear snagging risk throughout the construction phase(s) for commercial fishing vessels. Maximum extent of largest pre commissioned structures that vessels will navigate within, array cables and export cables may create maximum snagging risk for commercial vessels with mobile gear.
Operational and maintenance phase		
Presence of infrastructure within the Hornsea Three array area and Hornsea Three offshore cable corridor may displace vessels (excluding commercial ferries) leading to increased journey times or distances during periods of adverse weather.	<u>Hornsea Three array area:</u> • Anticipated design life of 25 years; • Up to 342 turbines with floating foundations, up to 4,104 mooring lines; excursion area 25% of water depth and 1,000 m mooring cable radius; • Total development area of up to 696 km²; • Up to 12 offshore HVAC collector substations; • Up to three offshore accommodation platforms; • Up to four offshore HVDC substations; • Bridge links up to 100 m length linking co-sited structures, including offshore HVDC substations and accommodation platforms; and • 500 m maintenance safety zones. <u>Hornsea Three offshore cable corridor:</u> • Up to four above surface or up to six subsea offshore HVAC booster stations; and • 500 m maintenance safety zones.	Maximum development area with no option for internal navigation may cause a maximum deviation to vessels operating in adverse weather. Could temporarily increase with periods of maintenance which require safety zones.

Potential impact	Maximum design scenario	Justification
Presence of infrastructure within the Hornsea Three array area may displace commercial ferries leading to increased journey times or distances for commercial ferries during periods of adverse weather.	<u>Hornsea Three array area:</u> • Anticipated design life of 25 years; • Up to 342 turbines with floating foundations, up to 4,104 mooring; excursion area 25% of water depth and 1,000 m mooring cable radius; • Total development area of up to 696 km^2; • Up to 12 offshore HVAC collector substations; • Up to three offshore accommodation platforms; • Up to four offshore HVDC substations; • Bridge links up to 100 m length linking co-sited structures, including offshore HVDC substations and accommodation platforms; and • 500 m maintenance safety zones.	Maximum development area with no option for internal navigation may cause a maximum deviation to commercial ferries operating in adverse weather. Could temporarily increase with periods of maintenance which require safety zones.
Presence of infrastructure within the Hornsea Three array area may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk.	<u>Hornsea Three array area:</u> • Anticipated design life of 25 years; • Up to 342 turbines with floating foundations, up to 4,104 m mooring lines; excursion area 25% of water depth and 1,000 m mooring cable radius; • Total development area of up to 696 km^2; • Up to 12 offshore HVAC collector substations; • Up to three offshore accommodation platforms; • Up to four offshore HVDC substations; • Bridge links up to 100 m length linking co-sited structures, including offshore HVDC substations and accommodation platforms; and • 500 m maintenance safety zones. <u>Number of vessels and personnel:</u> • Up to 20 crew transfer vessels (CTVs) (2,433 return trips per year); • Up to four offshore supply vessels (OSVs); • Supply vessels (312 return trips per year); • Up to 87 jack-up return trips per year; and • Operational hours 24/7.	Maximum development area and maximum number of commercial vessels with no option for internal navigation may cause maximum displacement of vessels and increased encounters and vessel to structure collision risk external to the array. Maximum number of vessel movements to and from the array would create maximum encounters and vessel to structure collision risk.
Presence of the Hornsea Three offshore HVAC booster stations may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk.	<u>Hornsea Three offshore cable corridor:</u> • Anticipated design life of 25 years; • Up to four above surface or up to six subsea offshore HVAC booster stations; • Operational aids to navigation (buoys); and • 500 m maintenance safety zones. <u>Number of vessels and personnel:</u> • Up to 20 CTVs (2,433 return trips per year); • Up to four OSVs; • Supply vessels (312 return trips per year); • Up to 87 jack-up return trips per year; and • Operational hours 24/7.	Maximum number and extent of the Hornsea Three offshore HVAC booster stations and maximum number of operational vessels may cause maximum displacement of vessels and increased encounters and vessel to structure collision risk. Maximum number of vessel movements to and from the array, export cable or Hornsea Three offshore HVAC booster stations development would create maximum encounters and vessel to structure collision risk.

Potential impact	Maximum design scenario	Justification
Presence of infrastructure within the Hornsea Three array area may increase vessel to structure allision risk external to the array for all vessels.	Hornsea Three array area: • Anticipated design life of 25 years; • Up to 342 turbines with floating foundations, up to 4,104 mooring lines; excursion area 25% of water depth and 1,000 m mooring cable radius; • Total development area of up to 696 km^2; • Up to 12 offshore HVAC collector substations; • Up to three offshore accommodation platforms; • Up to four offshore HVDC substations; and • Bridge links up to 100 m length linking co-sited structures, including offshore HVDC substations and accommodation platforms.	Maximum amount of new infrastructure within the Hornsea Three array area and with increased structure density on the perimeter may cause maximum vessel to structure allision risk for all vessels. Maximum extent of largest floating structures may create maximum increase to vessel to structure allision return period.
Presence of infrastructure within the Hornsea Three array area may increase vessel to structure allision risk external to the array for NUC vessels in an emergency situation (including machinery related problems or navigational system errors).	Hornsea Three array area: • Anticipated design life of 25 years; • Up to 342 turbines with floating foundations, up to 4,104 mooring lines; excursion area 25% of water depth and 1,000 m mooring cable radius; • Total development area of up to 696 km^2; • Up to 12 offshore HVAC collector substations; • Up to three offshore accommodation platforms; • Up to four offshore HVDC substations; and • Bridge links up to 100 m length linking co-sited structures, including offshore HVDC substations and accommodation platforms.	Maximum amount of new infrastructure within the Hornsea Three array area and with increased structure density on the perimeter may cause maximum vessel to structure allision risk for all NUC vessels. Maximum extent of largest floating structures may create maximum increase to vessel to structure allision return period.
Presence of infrastructure within the Hornsea Three array area may cause increased vessel to structure allision risk internally within the Hornsea Three array area for recreational and fishing vessels.	Hornsea Three array area: • Anticipated design life of 25 years; • Up to 342 turbines with floating foundations, up to 4,104 mooring lines; excursion area 25% of water depth and 1,000 m mooring cable radius; • Total development area of up to 696 km^2; • Up to 12 offshore HVAC collector substations; • Up to three offshore accommodation platforms; • Up to four offshore HVDC substations; • Bridge links up to 100 m length linking co-sited structures, including offshore HVDC substations and accommodation platforms; and • 1,000 m minimum spacing.	Maximum number of structures with minimum spacing may cause maximum vessel to structure allision risk for vessels navigating internally within the array. Maximum extent of largest floating structures (including sub surface hazards) may create maximum increase to vessel to structure allision return period.
Presence of surface offshore HVAC booster stations within the Hornsea Three offshore cable corridor may increase vessel to structure allision risk for all vessels.	Hornsea Three offshore cable corridor: • Anticipated design life of 25 years; • Up to four surface offshore HVAC booster stations; and • Bridge links up to 100 m length linking co-sited structures, including offshore HVDC substations and accommodation platforms.	Maximum number of surface offshore HVAC booster stations within a cluster, orientated against the predominant direction of traffic may cause maximum increase to vessel to structure allision return period.

Potential impact	Maximum design scenario	Justification
Presence of subsea HVAC booster stations and cable protection within the Hornsea Three offshore cable corridor may increase vessel to sub surface structure allision risk for all vessels.	<u>Hornsea Three offshore cable corridor:</u> • Anticipated design life of 25 years; • Up to six subsea HVAC booster stations; • Water depth of less than 30 m; and • Operational aids to navigation (buoys). • Up to six export cables of up to 145 km in length (from Hornsea Three array area boundary to landfall) buried or protected within 1,000 m Hornsea Three offshore cable corridor width (550 to 850 m final corridor width); • Up to 37 cable/pipeline crossings; • Cable protection measures (all); and • Rock protection berm, sloped profile above seabed level: 7 m overall width and 2 m maximum height.	Maximum number of subsea HVAC booster stations within a cluster, orientated against the predominant direction of traffic and maximum use of cable protection in the shallowest water may cause maximum increase to vessel to structure allision return period.
Physical presence of structures (including sub surface elements) and cables may present an increased risk of gear snagging for commercial fishing vessels with mobile gear.	<u>Hornsea Three array area:</u> • Anticipated design life of 25 years; • Up to 342 turbines with jacket foundations. • Total development area of up to 696 km^2; • Up to 12 offshore HVAC collector substations (jackets); • Up to three offshore accommodation platforms (jackets); • Up to four offshore HVDC substations (jackets); • 1,000 m minimum spacing; and • Up to 850 km array and 225 km interconnector cables; and <u>Hornsea Three offshore cable corridor:</u> • Anticipated design life of 25 years; • Up to four above surface (jackets) or up to six subsea HVAC booster stations; • Up to six export cables of up to 145 km in length (from Hornsea Three array area boundary to landfall) buried or protected within 1,000 m Hornsea Three offshore cable corridor width (550 to 850 m final corridor width); • Up to 37 cable/pipeline crossings; • Cable protection measures (all); and • Rock protection berm, sloped profile above seabed level: 7 m overall width and 2 m maximum height.	Maximum number of turbines with jacket foundations, other structures with jackets and maximum length of export and array cables may create maximum snagging risk for commercial fishing vessels with mobile gear.

Potential impact	Maximum design scenario	Justification
Physical presence of structures may alter the approach of search and rescue helicopters.	Hornsea Three array area: • Anticipated design life of 25 years; • Up to 342 turbines with floating foundations, up to 4,104 mooring lines; excursion area 25% of water depth and 1,000 m mooring cable radius; • 1,000 m mooring radius associated with floating foundation; • Total development area of up to 696 km²; • Up to 12 offshore HVAC collector substations; • Up to three offshore accommodation platforms; • Up to four offshore HVDC substations; and • Bridge links up to 100 m length linking co-sited structures, including offshore HVDC substations and accommodation platforms. No. of vessels and personnel: • Up to 20 CTVs (2,433 return trips per year); • Up to four OSVs; • Supply vessels (312 return trips per year); • Up to 87 jack-up return trips per year; • Operational hours 24/7; • 680 personnel; • Accommodation platforms housing up to 600 people; and • 4,902 return flights.	Maximum intensity of people, vessels and aircraft on site causing the greatest potential for a SAR incident. Maximum number of structures over widest extent (layout A) causing the maximum reduction in POD.
Decommissioning phase		
Decommissioning activities within the Hornsea Three array area and Hornsea Three offshore cable corridor may displace vessels leading to increased journey times or distances during periods of adverse weather.	Hornsea Three array area: • Maximum duration of decommissioning phase of up to 11 years; and • Buoyed decommissioning area around the Hornsea Three array area for the duration of decommissioning phases. Hornsea Three offshore cable corridor: • Buoyed decommissioning area around the Hornsea Three offshore HVAC booster stations; and • Cables removed during a maximum decommissioning phase.	Maximum duration and extent of decommissioning period (including all phases) may cause maximum displacement to vessels operating in adverse weather.
Decommissioning activities within the Hornsea Three array area may displace commercial ferries leading to increased journey times or distances for commercial ferries during periods of adverse weather.	Hornsea Three array area: • Maximum duration of decommissioning phase of up to 11 years; and • Buoyed decommissioning area around the Hornsea Three array area for the duration of decommissioning phases.	Maximum duration and extent of decommissioning period (including all phases) may cause maximum displacement to commercial ferries operating in adverse weather.

Potential impact	Maximum design scenario	Justification
Presence of decommissioning infrastructure within the Hornsea Three array area and Hornsea Three offshore cable corridor may cause increased vessel to structure allision risk external to the array for all vessels.	Hornsea Three array area: • Up to 342 wind turbines with floating foundations; up to 4,104 mooring lines; excursion area 25% of water depth; 1,000 m mooring cable radius. • Total development area of up to 696 km²; • Up to 12 offshore HVAC collector substations; • Up to three offshore accommodation platforms; • Up to four offshore HVDC substations; • Bridge links up to 100 m length linking co-sited structures, including offshore HVDC substations and accommodation platforms; and • Maximum duration of decommissioning phase. Hornsea Three offshore cable corridor: • Up to four above surface or up to six subsea offshore HVAC booster stations; and • Maximum duration of decommissioning phase for the Hornsea Three offshore HVAC booster stations; and • Cables left in situ.	Decommissioned structures may continue to create vessel to structure allision risk throughout the decommissioning phase(s) for all vessels.
Presence of decommissioning infrastructure within the Hornsea Three array area and Hornsea Three offshore cable corridor may cause increased vessel to structure allision risk for NUC vessels in an emergency situation (including machinery related problems or navigational system errors).	Hornsea Three array area: • Up to 342 wind turbines with floating foundations; up to 4,104 mooring lines; excursion area 25% of water depth; 1,000 m mooring cable radius. • Total development area of up to 696 km²; • Up to 12 offshore HVAC collector substations; • Up to three offshore accommodation platforms; • Up to four offshore HVDC substations; • Bridge links up to 100 m length linking co-sited structures, including offshore HVDC substations and accommodation platforms; and • Maximum duration of decommissioning phase. Hornsea Three offshore cable corridor: • Up to four above surface or up to six sub subsea HVAC booster stations; • Maximum duration of decommissioning phase for the Hornsea Three offshore HVAC booster stations; and • Cables left in situ.	Decommissioned structures may continue to create vessel to structure allision risk throughout the decommissioning phase(s) for NUC vessels.
Presence of infrastructure within the Hornsea Three array area may cause increased vessel to structure allision risk internally within the array for recreational and fishing vessels.	Hornsea Three array area: • Up to 342 turbines with floating foundations, up to 4,104 mooring lines; excursion area 25% of water depth and 1,000 m mooring cable radius; • Total development area of up to 696 km²; • Up to 12 offshore HVAC collector substations; • Up to three offshore accommodation platforms; • Up to four offshore HVDC substations; • Bridge links up to 100 m length linking co-sited structures, including offshore HVDC substations and accommodation platforms; and • Maximum duration of decommissioning phase.	Decommissioning structures may continue to create vessel to structure allision risk throughout the decommissioning phase for vessels navigating internally within the array.

Potential impact	Maximum design scenario	Justification
Physical presence of decommissioned structures (including sub surface elements) and cables (left in situ) may present an increased risk of gear snagging for commercial fishing vessels with mobile gear.	Hornsea Three array area: • Up to 342 turbines with jacket foundations; • Total development area of up to 696 km²; • Up to 12 offshore HVAC collector substations; • Up to three offshore accommodation platforms; • Up to four offshore HVDCs substations; • Up to 850 km array and 225 km interconnector cables; and • Maximum duration of decommissioning phase. Hornsea Three offshore cable corridor: • Up to four above surface or up to six subsea offshore HVAC booster stations; • Maximum duration of decommissioning phase for the Hornsea Three offshore HVAC booster stations; and • Cables left in situ.	Decommissioning structures may continue to create additional gear snagging risk throughout the decommissioning phase for commercial fishing vessels. Cables left in situ may create a maximum duration of risk.

Table 7.9: Impacts scoped out of the assessment for shipping and navigation.

Potential impact	Justification
Construction phase	
Construction activities within the Hornsea Three array area and offshore cable corridor may displace vessels leading to increased journey times or distances.	When the deviations noted in section 17 of the NRA are considered against the minimal consultation responses received there are predicted to be no significant impacts on commercial vessels. The impact is therefore assessed to be negligible or no perceptible impact with the mitigation measures adopted (with embedding of information promulgation in place to aid passage planning) for Hornsea Three in place (including information promulgation in place to aid passage planning) for the construction phase. This is associated with the vessels not being on timetabled services, not carrying large number of passengers (limited on board safety effects) and the small increases in length compared to the overall journey distances. It is noted that the maximum increase in journey distance is 5.48% for route 15. Route 15 deviates close to the Hornsea Three array area in the conservative assessment and in reality the vessel operators would likely passage plan to deviate sooner and thus decrease the length of the deviation (by reducing the angle of the deviation). Vessels also only operate on this route on average once every five days making the impact negligible. Deviations for vessels (other than commercial ferries) are scoped out of the assessment.
Construction activities within the offshore cable corridor may displace commercial ferries leading to increased journey times or distances.	There are no deviations identified in association with the Hornsea Three offshore cable corridor offshore HVAC booster stations for commercial ferries.
Construction activities within the Hornsea Three offshore cable corridor and offshore HVAC booster station may displace vessels leading to increased journey times or distances during periods of adverse weather.	There are no adverse weather impacts identified in association with the Hornsea Three offshore cable corridor or offshore HVAC booster stations.

Potential impact	Justification
Construction activities within the Hornsea Three array area and offshore cable corridor may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk.	Given the increased sea room, vessels will likely pass more than the 1 nm from the edge of the buoyed construction area considered within the conservative deviation assessment (section 17 of the NRA). Experience at other offshore wind farm developments shows that during the construction phase vessels will deviate at increased distance from current areas of activity and do not use partially completed structures or buoyage as way points meaning that hotspots that can be created at the corners of operational wind farms do not occur. When considering vessels passage planning and the increased level of mitigation measures in place during construction there is not expected to be any perceptible level of vessel to vessel collision risk. The frequency of vessels encountering construction (or decommissioning) vessels near the Hornsea Three array area would also be very low in particular as the Hornsea Three array area is not a dense area (compared to other areas around the UK) for vessel routes. There have been no reported incidents of vessel to vessel collisions in proximity to a wind farm under construction in the UK. When considering the low numbers of third party vessels in the area (compared to other UK areas), existing regulations such as COLREGS (IMO, 1972), guidance such as MGN 372 (MCA, 2008), other measures adopted as part of Hornsea Three (section 7.10) the impact is considered to be broadly acceptable (not significant) given the negligible risk of collision. Experience with the renewables industry shows that during the operational phase vessels do use structures as way points and will aim to route much closer to an array than during the construction phase; resulting in potential hot spots for traffic activity and thus a greater potential for encounters and thus collision risk. This impact is therefore considered within section 7.11.2. However it is again noted that there have been no reported incidents of vessel to vessel collision in proximity to an operational wind farm. Cumulative development will decrease the amount of available sea room in which vessels can passage plan and therefore vessel to vessel collision risk during the operational phase has been assessed within section 7.13.
Presence of infrastructure within the Hornsea Three array area may cause increased vessel to structure allision risk for commercial vessels in transit.	Regular operators were consulted as part of the NRA methodology and were asked to indicate whether they would enter the Hornsea Three array area or would navigate around. All of the commercial operators attending the Hazard Workshop indicated that they would not enter the array in part due to the small deviations required (as part of the entire journey and considering the speed reduction they would likely make to enter the Hornsea Three array area (as with a port entrance channel)). When considering this alongside lessons learnt from other wind farms where negligible levels of commercial vessels have been recorded passing through arrays, it is considered extremely unlikely that a commercial vessel would enter the array. For commercial vessels this impact is considered to be broadly acceptable (not significant).
Physical presence of partially installed cables (which may be exposed or partially buried) and other subsea infrastructure may present an increased risk of anchor snagging for all vessels.	Given measures adopted as part of Hornsea Three and the negligible level of anchoring within the Hornsea Three array area shipping study area and the offshore cable corridor shipping and navigation study area the impact is expected to be broadly acceptable (not significant).
Operational and maintenance phase	
Presence of infrastructure within the Hornsea Three array area and offshore cable route corridor may displace vessels leading to increased journey times or distances.	When the deviations noted in section17 of the NRA they are considered against the consultation responses received there are predicted to be no significant impacts on commercial vessels and the impact is considered to be broadly acceptable (not significant) (with information promulgation in place to aid passage planning) for all phases.
Presence of infrastructure within the Hornsea Three offshore cable route corridor may displace commercial ferries leading to increased journey times or distances.	There are no deviations identified in association with the Hornsea Three offshore cable corridor offshore HVAC booster stations for commercial ferries.
Presence of infrastructure within the Hornsea Three offshore cable corridor or offshore HVAC booster station(s) may displace vessels leading to increased journey times or distances during adverse weather.	There are no adverse weather impacts identified in association with the Hornsea Three offshore cable corridor or offshore HVAC booster stations.
Presence of infrastructure within the Hornsea Three offshore cable corridor and offshore HVAC booster station(s) may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk.	As the export cable will be buried or protected there are not anticipated to be any effects associated with increased encounters or vessel to vessel collision risk for vessels. The offshore HVAC booster stations will be designed so that the results of the modelling and traffic assessment are considered alongside other identified receptors. Final agreement will be required with statutory stakeholders as to the location of the Hornsea Three offshore HVAC booster stations; however concerns regarding the location were limited to avoidance of key navigational routes. Fishing and recreational users had no concerns. If the proposed principles are followed then it is assumed that the risk of collision will be broadly acceptable (not significant) given the small extent of the development area.
Presence of infrastructure within the Hornsea Three array area may cause increased vessel to structure allision risk for commercial vessels in transit.	Regular operators were consulted as part of the NRA methodology and were asked to indicate whether they would enter the Hornsea Three array area or would navigate around. All of the commercial operators attending the Hazard Workshop indicated that they would not enter the array in part due to the small deviations required (as part of the entire journey and considering the speed reduction they would likely make to enter the Hornsea Three array area (as with a port entrance channel)). When considering this alongside lessons learnt from other wind farms where negligible levels of commercial vessels have been recorded passing through arrays, it is considered extremely unlikely that a commercial vessel would enter the array. For commercial vessels this impact is considered to be broadly acceptable (not significant).
Presence of the Hornsea Three offshore cable corridor could increase the risk of vessel encounters and therefore collision risk.	As the export cable will be buried or protected there are not anticipated to be any effects associated with increased encounters or collision risk for vessels.

Potential impact	Justification
Presence of cables and other subsea infrastructure may present an anchor snagging risk for all vessels.	Given measures adopted as part of Hornsea Three and the negligible level of anchoring within the Hornsea Three array area shipping study area and the offshore cable corridor shipping and navigation study area the impact is expected to be broadly acceptable (not significant).
Impacts on the use and operation of position fixing equipment.	Section 19.12 of the NRA summarises the effects on communication and positioning equipment which are considered to be negligible or not perceptible and is therefore screened out of the assessment. It is noted that cumulative effects on marine Radar, associated with the proposed navigational corridor, are considered in section 7.11.
Impacts on marine aggregate dredging areas and MOD PEXAs	No impacts were identified associated with shipping and navigation receptors in marine aggregate dredging areas or MOD PEXAs. Routes to and from marine aggregate dredging routes and MOD PEXA areas (where identified in the marine traffic surveys) are considered with the baseline assessment and under commercial vessel impacts.
Decommissioning phase	
Decommissioning activities within the Hornsea Three array area and Hornsea Three offshore cable corridor may displace vessels leading to increased journey times or distances.	When the deviations noted in section 17 of the NRA are considered against the consultation responses received there are predicted to be no significant impacts on commercial vessels and the impact are considered to be broadly acceptable (not significant) (with embedding of information promulgation in place to aid passage planning) for all phases. Although the purpose of the NRA is to first and foremost assess the impact of Hornsea Three in isolation, given the successful consent of Hornsea Project One and Hornsea Project Two which present the same maximum effect for the deviated vessels, this impact is therefore considered broadly acceptable (not significant) and with no safety effects.
Decommissioning activities within the Hornsea Three offshore cable corridor may displace commercial ferries leading to increased journey times or distances.	There are no deviations identified in association with the Hornsea Three offshore cable corridor or Hornsea Three offshore HVAC booster stations for commercial ferries.
Decommissioning activities within the Hornsea Three offshore cable corridor and offshore HVAC booster station(s) may displace vessels leading to increased journey times or distances during periods of adverse weather.	There are no adverse weather impacts identified in association with the Hornsea Three offshore cable corridor or Hornsea Three offshore HVAC booster stations.
Decommissioning activities within the Hornsea Three array area and Hornsea Three offshore cable corridor may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk.	Given the increased sea room, vessels will likely pass more than the 1 nm from the edge of the buoyed construction area considered within the maximum deviation assessment (section 17 of the NRA). The frequency of vessels encountering construction (or decommissioning) vessels near the Hornsea Three array area would also be very low. As it is likely that vessels will pass more than the 1 nm from the edge of the buoyed construction area it would also mean the number of hot spots where vessels would be likely to meet would be reduced, thus lowering the risk of encounter. When considering the low numbers of third party vessels in the area (compared to other UK areas), existing regulations such as COLREGS (IMO, 1972), guidance such as MGN 372 (MCA, 2008), other measures adopted as part of Hornsea Three (section 7.10) and additional mitigation measures, the impact is considered to be broadly acceptable (not significant) given the negligible risk of collision.
Presence of infrastructure within the array may cause increased vessel to structure allision risk for commercial vessels in transit.	Regular operators were consulted as part of the NRA methodology and were asked to indicate whether they would enter the Hornsea Three array area or would navigate around. All of the commercial operators attending the Hazard Workshop indicated that they would not enter the array in part due to the small deviations required (as part of the entire journey and considering the speed reduction they would likely make to enter the Hornsea Three array area (as with a port entrance channel)). When considering this alongside lessons learnt from other wind farms where negligible levels of commercial vessels have been recorded passing through arrays, it is considered extremely unlikely that a commercial vessel would enter the array. For commercial vessels, this impact is considered to be broadly acceptable (not significant).
Physical presence of decommissioned cables (left in situ) and other subsea infrastructure will present an increased risk of anchor snagging for all vessels.	Given measures adopted as part of Hornsea Three and the negligible level of anchoring within the Hornsea Three array area shipping study area and the offshore cable corridor shipping and navigation study area the impact is expected to be broadly acceptable (not significant).

7.9 Impact assessment criteria

7.9.1.1 Shipping and navigation is assessed primarily in accordance with guidance provided by the key regulator, the MCA. The primary guidance documents used when assessing impacts are listed in section 7.4.

7.9.1.2 The MCA require that their methodology is used as a template for undertaking impact assessments (MCA, 2015). This template is centred on risk management and requires a submission that shows that sufficient controls are, or will be, in place in order for the assessed risk (base case and future case) to be judged as broadly acceptable or tolerable.

7.9.1.3 As such, the Environmental Impact Assessment for shipping and navigation presents risk within the assessment of magnitude (see Table 7.11).

7.9.1.4 The following provides an overview of the process of assessing risk to navigational receptors and how the outputs of the NRAs have been carried forward to assess significance of effect.

7.9.2 Hazard Workshop

7.9.2.1 In order to gather expert opinion and local knowledge, a Hazard Workshop was undertaken during which a project and site-specific hazard log was prepared (see appendix B of the NRA). The hazard log identified hazards relating to Hornsea Three, the level of risk associated with the hazards, the controls to be put in place and the tolerability of the residual risks.

7.9.2.2 The hazard log also identified standard and additional mitigation measures required to show that the hazards associated with the wind farm are broadly acceptable or tolerable on the basis of ALARP declarations, in line with regulatory requirements. This information was then fed into the formal safety assessment (FSA) process (see section 7.9.3 below) to identify impacts associated with the development.

7.9.3 Formal Safety Assessment process

7.9.3.1 The IMO FSA process (see Guidelines for FSA) (IMO, 2002) is the process that has been applied in the NRA. This is a structured and systematic methodology based on risk. As part of the FSA, the impact of Hornsea Project Two was considered against the baseline datasets identified.

7.9.3.2 There are five basic steps within this process:

- Step 1: identification of hazards (a list of all relevant accident scenarios with potential causes and outcomes);
- Step 2: risk analysis (evaluation of risk factors);
- Step 3: risk control options (devising regulatory measures to control and reduce the identified risks);
- Step 4: cost benefit assessment (determining cost effectiveness of risk control measures); and
- Step 5: recommendations for decision-making (information about the hazards, their associated risks and the cost effectiveness of alternative risk control measures).

7.9.4 Environmental Impact Assessment methodology

7.9.4.1 Following completion of the FSA and the NRAs, this information was fed into the Environmental Impact Assessment process.

7.9.4.2 The detailed Environmental Impact Assessment methodology is defined in volume 1, chapter 5: Environmental Impact Assessment Process and Methodology. In summary, information about the project and the project activities for all stages of the project lifecycle (construction, operation and maintenance and decommissioning) has been combined with information about the environmental baseline to identify the potential interactions between the project and the environment. These potential interactions are known as potential impacts. The potential impacts are then assessed to give a level of significance of effect upon the receiving environment/receptors.

7.9.4.3 Significance is assessed by correlating the magnitude of the impact and the sensitivity of the receptor.

7.9.4.4 The sensitivity of the receptor is defined by the:

- Vulnerability;
- Recoverability; and
- Value/importance of that receptor.

7.9.4.5 For the shipping and navigation assessment the following factors were also taken into consideration:

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

7.9.4.6 The criteria for defining sensitivity in this chapter are outlined in Table 7.10 below.

Table 7.10: Definition of terms relating to the sensitivity of the receptor.

Sensitivity	Definition used in this chapter
Very High	Receptor is of critical value to the local, regional or national economy and/or the receptor is highly vulnerable to impacts with regard to navigational safety that may arise from the project and/or recoverability is long term or not possible.
High	Receptor is of high value to the local, regional or national economy and/or the receptor is generally vulnerable to impacts with regard to navigational safety that may arise from the project and/or recoverability is slow or costly.
Medium	Receptor is of medium value to the local, regional or national economy and/or the receptor is somewhat vulnerable to impacts with regard to navigational safety that may arise from the project and/or has good levels of recoverability.
Low (or lower)	Receptor is of low value to the local, regional or national economy and/or the receptor is not generally vulnerable to impacts with regard to navigational safety that may arise from the project and/or has very good recoverability.
Negligible	Receptor is of negligible value to the local, regional or national economy and/or the receptor is not vulnerable to impacts with regard to navigational safety that may arise from the project and/or has very good recoverability.

7.9.4.7 The magnitude of an impact is defined by the:

- Spatial extent;
- Duration (long, medium or short term);
- Frequency or risk of occurrence; and
- Reversibility of the effect.

7.9.4.8 The criteria for defining magnitude in this chapter are outlined in Table 7.11 below.

7.9.4.9 The significance of the effect upon shipping and navigation is determined by correlating the magnitude of the impact and the sensitivity of the receptor. The particular method employed for this assessment is presented in Table 7.12. Where a range of significance of effect is presented in Table 7.12, the final assessment for each effect is based upon expert judgement.

7.9.4.10 For the purposes of this assessment, any effects with a significance level of minor or less have been concluded to be not significant in terms of the Environmental Impact Assessment Regulations.

Table 7.11: Definition of terms relating to the magnitude of an impact.

Magnitude of impact	Definition used in this chapter
Major	The receptor is of international extent. The impact would be of long term duration and continuous throughout all phases. The impact would not be reversible, noting that all shipping and navigational receptors are not reversible during the project lifecycle given the presence of structures within a previously open sea area. The impact will be reversible post decommissioning.
Moderate	The receptor is of national extent. The impact would be of medium duration but continuous throughout a phase. The impact would not be reversible, noting that all shipping and navigational receptors are not reversible during the project lifecycle given the presence of structures within a previously open sea area. The impact will be reversible post decommissioning.
Minor	The receptor is of regional or national extent. The impact would be of short duration and intermittent throughout a phase. The impact would not be reversible, noting that all shipping and navigational receptors are not reversible during the project lifecycle given the presence of structures within a previously open sea area. The impact will be reversible post decommissioning.
Negligible	The receptor is of local extent. The impact would be of short duration but intermittent throughout a phase. The impact would not be reversible, noting that all shipping and navigational receptors are not reversible during the project lifecycle given the presence of structures within a previously open sea area. The impact will be reversible post decommissioning.
No change	No perceptible change.

Table 7.12: Matrix used for the assessment of the significance of the effect.

		Magnitude of impact				
Sensitivity of receptor		*No change*	*Negligible*	*Minor*	*Moderate*	*Major*
	Negligible	Negligible	Negligible	Negligible or minor	Negligible or minor	Minor
	Low	Negligible	Negligible or minor	Negligible or minor	Minor	Minor or moderate
	Medium	Negligible	Negligible or minor	Minor	Moderate	Moderate or major
	High	Negligible	Minor	Minor or moderate	Moderate or major	Major or substantial
	Very high	Negligible	Minor	Moderate or major	Major or substantial	Substantial

7.9.4.11 The category of risk that is identified within the FSA and how this relates to the Environmental Impact Assessment of significance is presented in Table 7.13. This has been used as a guide to advise whether the significance of the EIA correlates with the results of the FSA process.

Table 7.13: FSA risk ranking and Environmental Impact Assessment significance ranking correlation.

FSA risk ranking	Environmental Impact Assessment significance ranking
Broadly Acceptable (low risk)	Negligible/minor
Tolerable (intermediate risk)	Minor moderate
Unacceptable (high risk)	Major/substantial

7.10 Measures adopted as part of Hornsea Three

7.10.1.1 As part of the project design process, a number of designed-in measures have been proposed to reduce the potential for impacts on shipping and navigation (see Table 7.14). This approach has been employed in order to demonstrate commitment to measures by including them in the design of Hornsea Three and have therefore been considered in the assessment presented in section 7.9 below. These measures are considered standard industry practice for this type of development. Assessment of sensitivity, magnitude and therefore significance includes implementation of these measures.

Table 7.14: Designed in measures adopted as part of Hornsea Three.

Mitigation measures adopted as part of for Hornsea Three	Justification
Aid to Navigation Management Plan	An Aid to Navigation Management Plan is required to mitigate risk associated with extinguished lights and sound signals throughout all phases of Hornsea Three.
Application and use of safety zones of up to 500 m during construction/maintenance and decommissioning phases	With regard to the application for and use of safety zones to protect the development site, Section 95 of the Energy Act 2004 states that where there is a proposal to construct or operate a renewable energy installation such as wind turbines and associated infrastructure, a notice may be issued declaring specific areas around the installation to be safety zones in order to secure the safety of, in the case of Hornsea Three array area, the wind turbines, offshore HVDC substations, offshore HVAC collector substations, accommodation platforms and offshore HVAC booster stations. Schedule 16 of the Energy Act 2004 and The Electricity (Offshore Generating Stations) (Safety Zones) (Application Procedures and Control of Access) Regulations 2007 provide details of the application process. 500 m safety zones for the construction, major maintenance and eventual decommissioning phases of a wind turbine, offshore HVDC substation, offshore HVAC collector substation, accommodation platform and offshore HVAC booster stations life will be applied for. These will cover only those parts of the total site in which such activities are actually taking place at a given time in order to reduce the amount of time that mariners and other users of the sea will be required to deviate around the safety zones. Once the activity has been completed in that specific location, the 500m safety zone will then be removed (or reduced to 50m in the case of partially complete works) at that location. During the operational and maintenance phase, it is unlikely that adjacent wind turbines will undergo major maintenance at the same time, and therefore that safety zones may be present around adjacent turbines, however this may be required in exceptional circumstances. As above, safety zones with a radius of up to 50m around wind turbines and platforms where installation has finished but other work is on-going (pre-commissioning) may also be applied for.
Application and use of safety zones of up to 500 m during operation for manned platforms	Operational safety zones of 500 m will be applied for around accommodation platforms. Given that these would be required over the life of the project, these safety zone applications will need to include a safety case.
Blade clearance	Turbines will be constructed to ensure that the minimum rotor blade clearance is at least 34.97 m above LAT.
Bridge links	Consideration will be given to navigational safety when designing the height and location of bridge links within the Hornsea Three array area (e.g., avoiding higher risk locations such as at the periphery of the array) and the bridge links will be designed in line with MCA and TH requirements as per experience within the oil and gas industry.
Buoyed construction area	Buoys will be deployed around construction work in line with TH requirements. These will include a combination of cardinal and/or safe water marks.
Cable Burial Risk Assessment and periodic surveys	Cables will be buried where seabed conditions allow, and cable protection measures will be employed to mitigate risks associated with anchor interaction where necessary. The subsea cables will be subject to periodic inspection in order to confirm they remain buried or protected and do not become a hazard to marine navigation. This will include ad hoc inspections after any reported actual anchor interactions. A cable specification and installation plan, and a scour protection management and cable armouring plan, including details on any cable protection, will be submitted to the MMO at least four months prior to the construction of the wind farm, along with a Cable Burial Risk Assessment.
Charting of Hornsea Three array area and offshore HVAC booster stations	The Hornsea Three array area will be marked on relevant UKHO Admiralty charts. These areas have generally been marked as “submarine power cable area”’ as well as with wind farm symbology. The Hornsea Three offshore HVAC booster stations shall also be charted.

Mitigation measures adopted as part of for Hornsea Three	Justification
Charting of export cables and array cables	Cables will be marked on nautical charts in line with the UK Hydrographic Office (UKHO) standards. Note that depending on the scale of the chart, array cabling may not be shown and it may only be the export cable that is visible.
Compliance with UK and Flag State regulations and IMO conventions including COLREGs and SOLAS	Compliance to ensure that standard levels of navigation and vessel safety continue to be adhered to by all project related vessels during all phases.
Electromagnetic interference minimisation	A Cable Specification and Installation Plan will be prepared as part of the Code of Construction Practice. This will include the technical specification of offshore electrical circuits, and a desk-based assessment of attenuation of electro-magnetic field strengths, shielding and cable burial depth in accordance with industry good practice.
ERCoP	An ERCoP will be developed and implemented for the construction, operation and maintenance and decommissioning phases of the project.
Guard vessels	Guard vessel(s) will be present within the Hornsea Three array area and along the export cable route during key periods of construction and potentially during certain maintenance activities within the operational phase.
International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) guidance and aids to navigation	Structures within the wind farm will be marked and lit in accordance with IALA Recommendation O-139 on the Marking of Man-Made Offshore Structures (IALA, 2013). Other visual and auditory aids to navigation may also be implemented. Under a requirement of the DCO, the placement and standard of aids to navigation will be agreed with TH prior to the construction of the wind farm.
Marine coordination	Appropriate marine coordination will be in place to help ensure that project vessels do not present an unacceptable risk to each other or to transiting vessels.
Marine pollution contingency planning	Creation of an ERCoP in line with guidance, from the construction phase onwards is proposed. This will include interfaces with the UK National Contingency Plan. Measures will be adopted to ensure that the potential for release of pollutants from construction and operation and maintenance activities is minimised, which will include planning for accidental spills and responding to all potential contaminant releases.
MGN 543	The individual wind turbine structures will be designed in accordance with MGN 543 (MCA, 2016) and procedures put in place for generator shut down and other operational requirements in emergency situations.
Monitoring by AIS	Vessel traffic monitoring by AIS for the duration of the construction period. A report will be submitted to the MMO and the MCA at the end of each year of the construction period (28 day period per year). Monitoring during the operational phase will also be required for a minimum of 1 year. This is as per the relevant DCO condition.
Personal Protective Equipment (PPE)	All personnel will wear the correct PPE suitable for the location and role at all times, as defined by the relevant Quality, Health, Safety and Environment (QHSE) documentation. This will include the use of Personal Locator Beacons (PLBs).
Promulgation of information	Information and warnings will be distributed via Notices to Mariners and other appropriate media (e.g. Admiralty Charts and fishermen's awareness charts) to enable vessels to effectively and safely navigate around the Hornsea Three array area and the Hornsea Three offshore cable corridor. This may include additional consultation above and beyond the minimum standard required.
QHSE documentation	Marine QHSE documentation will ensure safe operation on a daily basis, including work vessel operations.
Advisory safety distance	Advisory safety distance of up to 1,000 m will be requested during construction and decommissioning phases, and around cable installation/removal or maintenance vessels. These are advisory and not enforceable; however vessels will also be displaying Restricted in Ability to Manoeuvre lights under COLREGs.
Self-help capabilities	Provision of self-help capabilities to deal with wind farm associated emergencies. Consideration shall be given to towage, pollution response and man overboard.
Temporary aids to navigation	Consultation with TH on the implementation of temporary aids to navigation for construction activities.
Vessel health and safety requirements	As industry standard mitigation, the Applicant will ensure that all vessels meet both IMO conventions for safe operation as well as HSE requirements, where applicable. This shall include the following good practice: • Wind farm associated vessels will comply with International Maritime Regulations; • All vessels, regardless of size, will be required to carry AIS equipment on board; • All vessels engaged in activities will comply with relevant regulations for their size and class of operation and will be assessed on whether they are "fit for purpose" for activities they are required to carry out; and • All marine operations will be governed by operational limits, tidal conditions, weather conditions and vessel traffic information. • Walk to work solutions will be utilised.

7.11 Assessment of significance

7.11.1 Construction phase

7.11.1.1 The impacts of the offshore construction of Hornsea Three have been assessed on shipping and navigation. The environmental impacts arising from the construction of Hornsea Three are listed in Table 7.8 above along with the maximum design scenario against which each construction phase impact has been assessed.

7.11.1.2 A description of the potential effect on shipping and navigation receptors caused by each identified impact is given below.

Construction activities within the Hornsea Three array area and offshore cable corridor may displace vessels (excluding commercial ferries) leading to increased journey times or distances during periods of adverse weather.

7.11.1.3 As discussed in Table 7.9 deviations associated with normal operations have been scoped out given that the maximum deviations present negligible increases (when considered against the length of the route and the number of vessels on the route) and that there are no safety implications associated with the routeing options.

7.11.1.4 Adverse weather includes wind, wave and tidal conditions as well as reduced visibility due to fog that can hinder a vessel's normal route and/or speed of navigation. Adverse weather routeing is considered to be significant course adjustments to mitigate vessel movement in adverse weather conditions. When transiting in adverse weather conditions, a vessel is likely to encounter various kinds of weather and tidal phenomena, which may lead to severe roll motions, potentially causing damage to cargo, equipment and/or danger to persons on board. The sensitivity of a vessel to these phenomena will depend on the actual stability parameters, hull geometry, vessel type, size and speed. The probability of occurrence, in a particular sea state, may differ for each vessel.

7.11.1.5 Adverse weather is considered most significant for passenger vessels, due to the potential health and safety risks (as well as comfort) to people on board (such as sea sickness and difficulty moving around the vessel). This can also have implications for regular timetabled vessels due to increases in journey time and potential cancellations. Mitigations for vessels include adjusting their heading to position themselves 45° to the wind, altering or delaying sailing times, reducing speed and/or potentially cancelling journeys. However due to the open sea area around the Hornsea Three array area, there is not expected to be any significant limitations to routeing options.

7.11.1.6 With regards to reduced visibility, measures adopted as part of Hornsea Three, notably COLREGS are required by both the Applicant and the vessel operator. The Applicant will ensure that Hornsea Three is marked and lit in accordance with requirements defined by TH and this scheme will include fog horns to alert vessels to the position of structures when visibility is poor. Vessels are also required to take appropriate measures with regards to safe speed under the COLREGS (IMO, 1972, plus amendments), which considers determining a safe speed in conjunction with the state of visibility, the state of the wind, sea and current as well as the proximity of navigational hazards.

Magnitude of impact

7.11.1.7 Construction activities, notably the buoyed construction area around the Hornsea Three array area and within the offshore cable corridor may displace vessels leading to increased journey times or distances during periods of adverse weather.

7.11.1.8 The impact is predicted to be of regional spatial extent given that vessels will plan routeing in advance of reaching the Hornsea Three array area, short term duration (maximum design scenario during the longest construction period including all phase), intermittent given that adverse weather will not occur every day of the construction period and not reversible given that following construction the vessels cannot return to their previous adverse weather routeing since the array will be in situ and operational. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

7.11.1.9 When measures adopted as part of Hornsea Three are considered against the probability of adverse weather including restricted visibility, the low numbers of vessels within the Hornsea Three array area and the available sea room, the impact is considered to be broadly acceptable under the FSA.

7.11.1.10 Vessels (excluding commercial ferries) are generally important to the regional economy, but given the very low frequency of adverse weather routeing required (due to the low frequency of adverse weather), the open sea area available in which vessels can deviate and the low effect of adverse weather on commercial vessels, the receptor is deemed to be of low vulnerability, very good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

7.11.1.11 Overall, it is predicted that the sensitivity of the receptor is considered to be **low** and the magnitude is deemed to be **minor**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Construction activities within the Hornsea Three array area may displace commercial ferries leading to increased journey times or distances for commercial ferries during periods of adverse weather.

7.11.1.12 Of the commercial ferries identified only DFDS Seaways raised concerns regarding their adverse weather routeing. This is considered to be due to the fact that the other identified operators do not transit through the Hornsea Three array area, and are only recorded within the wider Hornsea Three array area shipping and navigation study area.

Magnitude of impact

7.11.1.13 Construction activities, notably the buoyed construction area around the Hornsea Three array area may displace commercial ferries from their normal operating routes leading to increased journey times or distances during periods of adverse weather.

7.11.1.14 Paragraph 7.11.2.10 to 7.11.2.16 gives further detail on DFDS routeing.

7.11.1.15 Given the low frequency of adverse weather in the vicinity of the Hornsea Three array area, any increased deviations associated with weather conditions are expected to be minimal and of a limited temporal duration for the pre commissioning phase. No adverse weather impacts have been identified for the installation of the Hornsea Three offshore cable corridor or the construction of the Hornsea Three offshore HVAC booster stations.

7.11.1.16 The impact is therefore predicted to be of regional spatial extent (given the routes of the commercial ferries – UK to mainland Europe), short term duration (maximum design scenario during the construction phase), intermittent (given the frequency of occurrence of adverse weather) and not reversible (given that the structures will remain in situ during the operational phase). It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

7.11.1.17 When considered against the frequency of occurrence, impacts on adverse weather routes are considered broadly acceptable under the FSA.

7.11.1.18 Commercial ferries are important to the regional economy, but given the very low frequency of adverse weather routeing required, the open sea area available in which vessels can deviate, the sensitivity of the passengers on board, the receptor is deemed to be of medium vulnerability, good recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

7.11.1.19 Overall, it is predicted that the sensitivity of the receptor is considered to be **medium** and the magnitude is deemed to be **minor**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Presence of pre commissioned infrastructure within the Hornsea Three array area and offshore cable corridor may cause increased vessel to structure allision risk external to the array for all vessels.

Magnitude of impact

7.11.1.20 The physical presence of pre commissioned infrastructure within the Hornsea Three array area and offshore cable corridor may cause increased vessel to structure allision risk external to the array for vessels in a previously open sea area. However during the construction phase measures adopted as part of Hornsea Three will be in place to ensure that the risk is maintained within ALARP parameters including the presence of a buoyed construction area and construction safety zones (500 m during installation and 50 m pre commissioning), temporary aids to navigation, notice to mariners and charting will also allow mariners to identify the location of pre commissioned structures to passage plan around current areas of activity or installed infrastructure.

7.11.1.21 Experience within the offshore wind farm industry shows that industry standard mitigation measures are tested and effective with third party vessels adhering to buoyed construction areas and generally keeping well clear of ongoing construction activity. As per the maximum design scenario (Table 7.8) for this impact, both the Hornsea Three array area and offshore HVAC booster station(s) will have buoyed areas around them (likely to be a combination of cardinal marks and special marks) which will help to ensure that vessels remain a safe distance from pre commissioned infrastructure.

7.11.1.22 There have been no recorded incidents, within UK waters, associated with third party vessels alliding with a pre commissioned offshore wind farm structure and, although there have been incidents with construction vessels manoeuvring within a construction area, experience in offshore wind farm construction for developers, contractors and the vessel operators has significantly increased with extensive measures developed within the industry to prevent such incidents.

7.11.1.23 During the construction phase, Hornsea Three construction areas shall be monitored by the Marine and Helicopter Coordination Centre (MHCC) located in Grimsby via VHF, and AIS but also through the presence of construction vessels. Currently Hornsea Three is out with the Global Maritime Distress and Safety System (GMDSS) sea area A1 and the presence of the MHCC, offshore VHF aerials, AIS receivers and the presence of onsite construction vessels will mean a positive impact for communication, monitoring and SAR.

7.11.1.24 Should a vessel on site require assistance, then Hornsea Three, including under SOLAS obligations, are beneficially placed to provide assets including navigational information (including weather forecasting) and safety support.

7.11.1.25 The impact is predicted to be of local spatial extent (given that it can only occur in close proximity to the pre-commissioned structures), short term duration (maximum design scenario during the construction phase), continuous for the duration of construction following installation of the first pre commissioned structure and not reversible (given that the structures will remain in situ during the operational phase). It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

7.11.1.26 How much damage a vessel sustains on collision with a structure will depend upon the energy of impact, including the size and structural integrity of the vessel and the sea state at the time.

7.11.1.27 Considering the lessons learnt, the consultation feedback (section 7.5) and the low frequency of occurrence the risk of allision within the Hornsea Three array area during construction is considered broadly acceptable with measures adopted as part of Hornsea Three in place under the FSA.

7.11.1.28 The receptor is deemed to be of low vulnerability given the limited potential for significant damage, good recoverability as the routes will settle into new patterns and medium value given the limited potential to impact shipping operations. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

7.11.1.29 Overall, it is predicted that the sensitivity of the receptor is considered to be **medium** and the magnitude is deemed to be **minor**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Presence of pre-commissioned infrastructure within the Hornsea Three array area and offshore cable corridor may increase vessel to structure allision risk external to the array for NUC vessels in an emergency situation (including machinery related problems or navigational system errors).

Magnitude of impact

7.11.1.30 Presence of pre-commissioned structures on the perimeter of, or within, the Hornsea Three array area and structures within the Hornsea Three offshore cable corridor may increase vessel to structure allision risk external to the array for NUC vessels in an emergency situation (including machinery related problems or navigational system errors) or when adverse weather conditions may cause the NUC vessel to drift to the edge of, or within, the Hornsea Three array area.

7.11.1.31 However, incidents statistics (see section 13 of the NRA), the lessons learnt from other offshore wind farms and historical MAIB/RNLI statistics all confirm that the frequency of machinery related failures in the area is negligible. The probability of a vessel being NUC in the area is therefore anticipated to be extremely low. This impact risk will be present for a limited time (the construction period) and only during periods of adverse weather when the direction of the wind or tide could cause the vessel to drift within the array.

7.11.1.32 Given this low frequency and the increased presence of vessels able to render assistance at Hornsea Three during the construction phase, this impact is considered to be effectively managed.

7.11.1.33 The impact is predicted to be of local spatial extent (given that it can only occur in close proximity to the pre-commissioned structures), short term duration (maximum design scenario during the construction phase), intermittent (requiring both an NUC incident and adverse weather) and not reversible (given that the structures will remain in situ during the operational phase). It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of receptor

7.11.1.34 How much damage a vessel sustains upon allision with a structure will depend upon the energy of impact, including the size and structural integrity of the fixed structure and vessel and the sea state at the time.

7.11.1.35 As vessels NUC are considered to be at drift, they are typically travelling at lower speeds which will reduce the consequence of an encounter with a wind turbine or associated infrastructure. A large vessel NUC is less sensitive to allision with pre-commissioned infrastructure than a smaller vessel due to the relative structural strength of the vessel compared with the structure.

7.11.1.36 Considering the low frequency of occurrence, lessons learnt and consultation feedback (see section 7.3), the risk of allision on the perimeter of, or within, the Hornsea Three array area or within the offshore cable corridor during construction is considered broadly acceptable with measures adopted as part of Hornsea Three in place under the FSA.

7.11.1.37 The receptor is deemed to be of medium vulnerability, very good recoverability (as the vessels can adapt to the presence of turbines) and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

7.11.1.38 Overall, it is predicted that the sensitivity of the receptor is considered to be **medium** and the magnitude is deemed to be **negligible**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Presence of pre-commissioned infrastructure within the Hornsea Three array area may cause increased vessel to structure allision risk internally within the construction area for recreational and fishing vessels.

Magnitude of impact

7.11.1.39 The presence of pre-commissioned infrastructure within the Hornsea Three array area may cause increased vessel to structure allision risk internally within the turbine array for recreational and fishing vessels. However during the construction phase measures adopted as part of Hornsea Three will be in place to ensure that the risk is maintained within ALARP parameters including the presence of a buoyed construction area and construction safety zones (500 m during installation and 50 m pre commissioning), temporary aids to navigation, notice to mariners and charting will also allow recreational and fishing vessels to identify the location of pre commissioned structures and to passage plan around current areas of activity or installed infrastructure.

7.11.1.40 Experience in wind farm construction for developers, contractors and the vessel operators is now extensive, with a number of wind farms located within dense shipping and development areas meaning that mitigations for the construction phases are tested. Currently Hornsea Three is out with the Global Maritime Distress and Safety System (GMDSS) sea area A1, but is within sea area A2 meaning that Medium Frequency (MF) calling or satellite communications are available.

7.11.1.41 However, MF and satellite communications are not generally carried by recreational vessels or other smaller fishing vessels due to the high cost of equipment. Therefore, the presence Hornsea Three marine coordination, offshore VHF aerials, AIS receivers and on site construction vessels will mean a positive impact for communication, monitoring and SAR for vessels navigating within the construction area. Should a vessel on site require assistance or information, then Hornsea Three assets are beneficially placed to provide support including navigational information such as weather forecasting.

7.11.1.42 The impact is predicted to be of local spatial extent (given that it can only occur within the array construction area), short term duration (maximum design scenario during the construction phase), continuous (given that pre-commissioned structures will continue to present a risk until they are commissioned) and not reversible (given that the structures will thereafter remain in situ during the operational phase). It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

7.11.1.43 Under the FSA this allision risk associated with navigating internally within the area is considered to be Tolerable with Mitigation given the low frequency of vessels likely to navigate within the array area.

7.11.1.44 How much damage a vessel actually sustains in the event that a collision with a structure does occur, will depend upon the energy of impact, as well as the size and structural integrity of the vessel and the sea state at the time. As fishing and recreational vessels are smaller and could be of non-steel construction they are likely to be vulnerable to the impact.

7.11.1.45 Vessels are only considered sensitive to this impact when they are within the pre-commissioned Hornsea Three array area. This impact represents a new risk of allision in a previously open sea area. The receptor is deemed to be of low vulnerability (given limited exposure to significant damage due to vessel size and type), good recoverability and low value (due to the impact being on small craft/vessels). The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

7.11.1.46 Overall, it is predicted that the sensitivity of the receptor is considered to be **low** and the magnitude is deemed to be **minor**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Physical presence of pre-commissioned structures (including sub surface elements) and cables (which may be exposed or partially buried) may present an increased risk of gear snagging for commercial fishing vessels with mobile gear.

7.11.1.47 This impact (and equivalent impacts for other phases) considers the navigational safety risk associated with commercial fishing; economic impacts are considered in volume 2, chapter 6: Commercial Fisheries.

Magnitude of impact

7.11.1.48 The physical presence of pre-commissioned structures (including sub surface elements of the structures such as J-tubes) and cables (which may be exposed or partially buried) may present an increased risk of gear snagging for commercial fishing vessels with mobile gear. The wind farm structures considered within the modelling of this impact are jackets rather than floating foundations since for fishing vessels internal navigation is considered unlikely in comparison to the use of jacket foundations. Conservative consequences are associated with vessel foundering due to the potential for the vessel snagging on a sub surface hazard.

7.11.1.49 During consultation, the Dutch Fishing Association VISNED noted that under the following circumstances fishing, including trawling and fly-shooting would be possible in amongst the indicative Layout A: "*if the weather is ok, if the fish are still present, in areas where turbine foundations are not floating and the distance between turbines is ≥1 km. For fishing, the separation between turbines is more important than the regularity of the layout*".

7.11.1.50 It is noted that Dutch fishing vessels (including those flagged in the UK) are predominant in the area. VISNED also noted that in good weather fishing vessels are likely to transit through the wind farm. In order to reduce risk associated with fishing activity within the Hornsea Three array area, further consultation is required with relevant fishing stakeholders. It is assumed from a navigational perspective that fishing vessel navigational safety risk would be ALARP if fishing vessels avoid the floating foundation design; hence why jacket foundations are considered rather than floating foundations within this impact.

7.11.1.51 In order to ensure vessels do not enter the Hornsea Three array area when it is not safe to do so (given underwater hazards) additional mitigation may need to be discussed with the Department of Environment, Farming and Rural Affairs (DEFRA) and the owners of fishing vessels known to be active within the area to fully mitigate this impact. Foundation types other than floating foundations, including jacket foundations, would be assumed ALARP based on the minimum 1 km spacing.

7.11.1.52 The most severe consequence of snagging is foundering. Foundering is considered to be when a vessel suffers structural or stability failure and sinks. It is noted that this type of incident is considered to have a very low frequency based on historical incident data for the UK (between 1994 and 2008 only approximately 4% of all MAIB incident types were listed as “flooding/foundering”); therefore when the frequency of foundering is considered against the frequency of snagging, this impact is considered to be low risk.

7.11.1.53 During the construction phase it is noted that measures adopted as part of Hornsea Three are in place to prevent fishing vessels coming in close proximity to any pre commissioned structures.

- Buoyed construction area clearly identifying the location of construction works and vessels so that fishing vessels may plan around areas of current construction;
- 500 m construction and 50 m pre-commissioning safety zones to legally prevent vessels getting in close proximity to structures during the commissioning phase;
- MHCC – the centre can alert vessels on site to current areas of work and issue warnings using standard marine terminology;
- Extensive promulgation of information to ensure that vessels are fully informed and fish plotters are updated; and
- Advisory safety distance for installation and construction vessels promulgated by notice to mariners, VHF broadcasts and other standard marine methods of communication.

7.11.1.54 Construction techniques will prevent exposed cables as far as possible but it is possible that there could be periods where certain sections of cable may not be buried or protected.

7.11.1.55 There have been no recorded incidents of vessels snagging pre-commissioned structures within a UK wind farm construction area.

7.11.1.56 The impact is predicted to be of local spatial extent (given that the impact can only occur in proximity to construction or installation impacts), short term duration (due to the greater duration of effect than any effect for transiting vessels), intermittent (as pre commissioned structures or cables may not always present a risk) and not reversible (given that post commissioning operational turbines will continue to present a snagging risk). It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

7.11.1.57 The presence of measures adopted as part of Hornsea Three will ensure that the risk is maintained within tolerable limits under the FSA.

7.11.1.58 Fishing vessels will be made aware of the structure and cable installation activities and the location of safety zones or advisory safety distances through the promulgation of information including notice to mariners, and through use of advisory safety zones around cable laying vessels. A fishing vessel will therefore be able to passage plan in order to avoid fishing in an area of ongoing construction or installation activity. The potential interaction will depend upon the type of gear used.

7.11.1.59 Given the likelihood of a fishing vessel experiencing this impact within the Hornsea Three array area and the varying levels of severity, the receptor is deemed to be of medium vulnerability, good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

7.11.1.60 Overall, it is predicted that the sensitivity of the receptor is considered to be **medium** and the magnitude is deemed to be **minor**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Future monitoring

7.11.1.61 The following monitoring requirements have been identified for the construction phase in relation to shipping and navigation:

- Monitoring and inspection of cables during installations to ensure cables are not left exposed and/or unmarked in order to, amongst other things; reduce snagging risk to anchors and fishing gear. This is undertaken by developers as standard practice as a means to ensure assets are not at risk and also as a health and safety requirement.
- Monitoring of floating foundation moorings to ensure that they are stable until they are fully commissioned; and.
- The DCO will require post-construction vessel traffic monitoring by AIS as per Table 7.14

7.11.2 Operational and maintenance phase

7.11.2.1 The impacts of the offshore operation and maintenance of Hornsea Three have been assessed on shipping and navigation. The environmental impacts arising from the operation and maintenance of Hornsea Three are listed in Table 7.8 along with the maximum design scenario against which each operational and maintenance-phase impact has been assessed.

7.11.2.2 A description of the potential effect on shipping and navigation receptors caused by each identified impact is given below.

Presence of infrastructure within the Hornsea Three array area and Hornsea Three offshore cable corridor may displace vessels (excluding commercial ferries) leading to increased journey times or distances during periods of adverse weather.

Magnitude of impact

7.11.2.3 Operation and maintenance activities within the Hornsea Three array area and Hornsea Three offshore cable corridor may displace vessels leading to increased journey times or distances during periods of adverse weather. No adverse weather impacts were identified for commercial routes in general, recreational or fishing vessels with regards to route deviations; however, given the safety implications, this impact has been assessed within this chapter.

7.11.2.4 Adverse weather impacts associated with the operation and maintenance phase are as per those identified for the construction phase in paragraph 7.11.1.4. The extent at which the impact is considered (maximum development area) and the likely effects on the receptors do not change, apart from the duration, throughout the phases. The sensitivity of a vessel to adverse weather will depend on the actual stability parameters, hull geometry, vessel type, vessel size and speed. The probability of occurrence, in a particular sea state, may differ for each vessel.

7.11.2.5 The impact is predicted to be of regional spatial extents (vessel transiting between the UK and mainland Europe), medium term duration (maximum design scenario during the operation and maintenance phase), intermittent (given the frequency of occurrence of adverse weather) and not reversible (given than the permanent presence of the structures during the operational life means that vessels cannot return to any preferred adverse weather routeing). It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

7.11.2.6 When measures adopted as part of Hornsea Three are considered against the probability of adverse weather including restricted visibility, the low numbers of vessels within the Hornsea Three array area and the available sea room, the impact is considered to be broadly acceptable under the FSA.

7.11.2.7 Vessels (excluding commercial ferries) are generally important to the regional economy, but given the very low frequency of adverse weather routeing required, the open sea area available in which vessels can deviate and the low effect of adverse weather on commercial vessels, the receptor is deemed to be of low vulnerability, very good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

7.11.2.8 Overall, it is predicted that the sensitivity of the receptor is considered to be **low** and the magnitude is deemed to be **minor**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Presence of infrastructure within the Hornsea Three array area may displace commercial ferries leading to increased journey times or distances for commercial ferries during periods of adverse weather.

7.11.2.9 Of the commercial ferries identified only DFDS Seaways raised concerns regarding their adverse weather routeing. This is considered to be due to the fact that the other identified operators do not transit through the Hornsea Three array area, and are only recorded within the wider Hornsea Three array shipping and navigation study area.

Magnitude of impact

7.11.2.10 Operation and maintenance activities within the Hornsea Three array area may displace commercial ferries leading to increased journey times or distances for commercial ferries during periods of adverse weather. The effects of adverse weather associated with the operation and maintenance phase are as per those identified for the construction phase within paragraph 7.11.1.12.

7.11.2.11 Following the Hazard Workshop where concerns were raised about commercial ferry adverse weather routes, an additional assessment was undertaken in liaison with DFDS Seaways to ensure that their adverse weather routes were considered. Four commercial routes which altered their course to account for adverse weather conditions are presented in Figure 7.15; all routes are operated by DFDS Seaways who provided the waypoint information used in this assessment.

7.11.2.12 Two adverse weather routes were identified in proximity to the Hornsea Three array area shipping and navigation study area for the Cuxhaven (Germany) to Immingham (UK) route operated by DFDS Seaways, with both intersecting the Hornsea Three array area. The adverse weather routes and standard routes are presented in more detail in Figure 7.15. When compared with a year of shore based AIS data from 2016, additional adverse weather routes for the Ro Ro vessel, *Hafnia Seaways* were recorded to the northwest of the Hornsea Three array area. These routes do not intersect the Hornsea Three array area.

7.11.2.13 The Ro Ro vessel *Hafnia Seaways* operates the various passages between Cuxhaven (Germany) and Immingham (UK). It is noted that the Ro Ro is a commercial ferry and carries mostly containerised cargo and a maximum of 12 passengers plus crew.

7.11.2.14 The Rosyth (UK) to Zeebrugge (Belgium) and the Newcastle (UK) to Ijmuiden (Netherlands) adverse weather routes operate to the west of the Hornsea Three array area shipping and navigation study area and do not pass through the Hornsea Three array area. The Newcastle (UK) to Ijmuiden (Netherlands) route is transited by a cruise ferry and the coastal Rosyth (UK) to Zeebrugge (Belgium) route which is operated by a Ro Ro. Again the Ro Ro is commercial and carries mostly containerised cargo and a maximum of 12 passengers plus crew.

7.11.2.15 From the year of AIS data (2016) that was analysed, eight potential adverse weather transits were identified. When considered against the number of potential normal crossings this equates to less than 2% of transits (during the 2016 sample) using adverse weather routeing to the north of the Hornsea Three array area. The vessels on this route are commercial Ro Ro vessels that carry a limited number of passengers and are therefore more able to withstand adverse weather conditions than passenger ferries (due to health and safety risks to on-board passengers).

7.11.2.16 The impact is predicted to be of regional spatial extent (given the routes of the commercial ferries – UK to mainland Europe), medium term duration (maximum design scenario during the operation and maintenance phase), intermittent (given the frequency of occurrence of adverse weather) and not reversible (given than the permanent presence of the structures during the operational life means that vessels cannot return to any preferred adverse weather routeing). It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

7.11.2.17 When considered against the frequency of occurrence, impacts on adverse weather routes are considered broadly acceptable under the FSA.

7.11.2.18 Commercial ferries are important to the regional economy, but given the very low frequency of adverse weather routeing required, the open sea area available in which vessels can deviate and the sensitivity of the passengers on board, the receptor is deemed to be of medium vulnerability, good recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

7.11.2.19 Overall, it is predicted that the sensitivity of the receptor is considered to be **medium** and the magnitude is deemed to be **minor**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

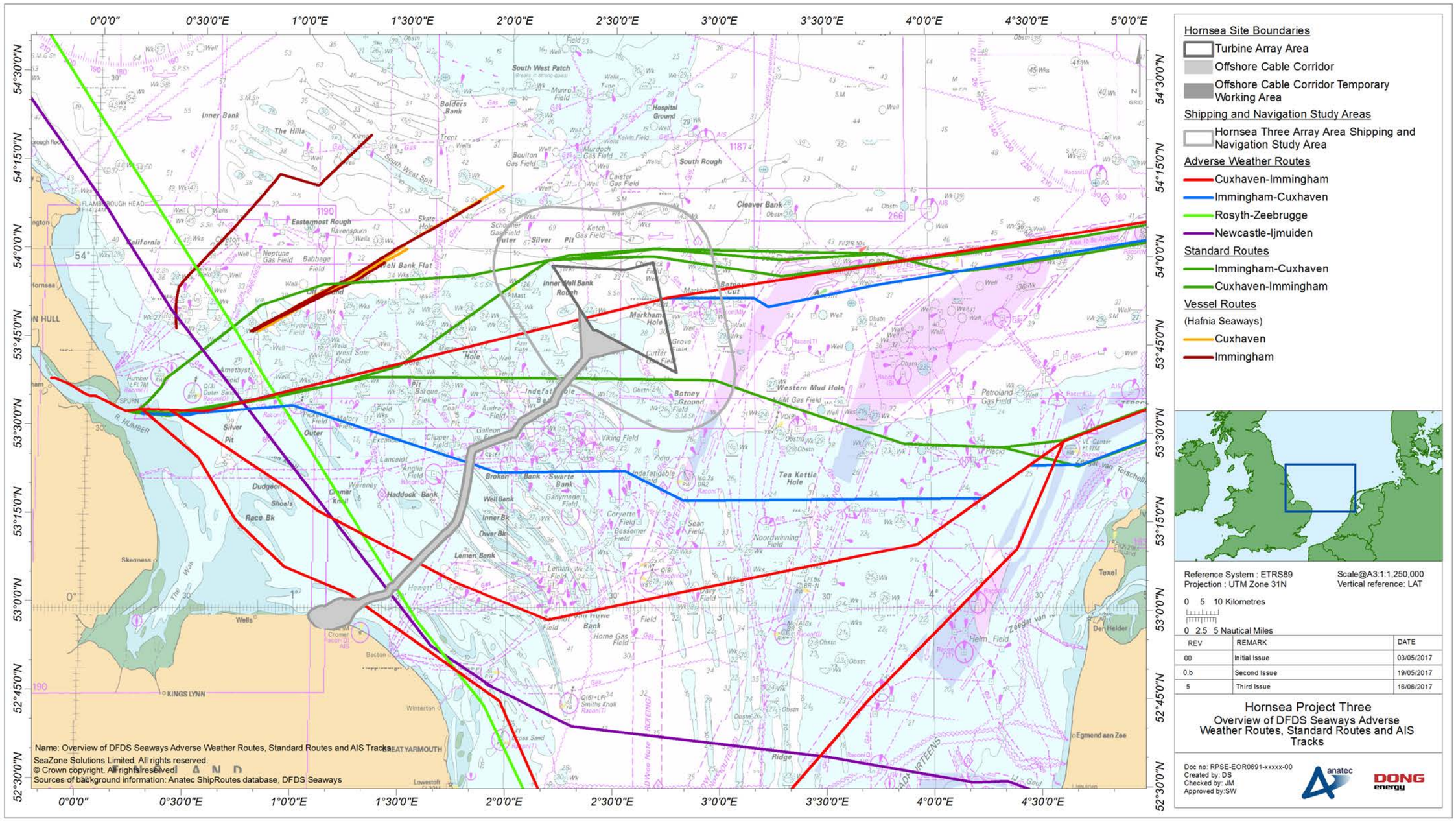

Figure 7.15: Overview of DFDS Seaways adverse weather routes, standard routes and AIS tracks.

Presence of infrastructure within the Hornsea Three array area may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk.

Magnitude of impact

7.11.2.20 Presence of infrastructure within the Hornsea Three array area may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk. Details of vessel to vessel encounters and vessel to vessel collision modelling can be found in section 18.2.1 of the NRA.

7.11.2.21 It is noted that a conservative approach to vessel to vessel collision modelling is adopted as it is assumed that all vessels pass at a minimum distance of 1 nm from the Hornsea Three array area. In reality, vessels will use all available sea room, reducing hot spots and therefore collision risk.

Encounters and collision risk between third party vessels

7.11.2.22 The presence of infrastructure within the Hornsea Three array area may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk. Deviations would be required for eight of the 16 main routes identified, with the level of deviation required varying between 4.6 nm for route 1 (eastbound) and 0.2 nm for route 2 (eastbound).

7.11.2.23 For the displaced routes, the increase in distance, both in terms of distance and percentage change, are presented in Table 7.15. It is noted that increases in route length are based on indicative final destinations, and those routes for which a differing deviation is reported in each direction of transit followed a different passage in each direction of transit in the base case scenario.

Table 7.15: Future case main route deviations within the Hornsea Three array area shipping and navigation study area.

Route number	Number of vessels per day(s) (average)	Increase in distance (nm)	Increase in total route length (%age)
Route 1 (eastbound)	3 to 4	4.62	1.59%
Route 1 (westbound)		4.21	1.44%
Route 2 (eastbound)	1 to 2	0.21	0.05%
Route 2 (westbound)		0.51	0.13%
Route 7	1 every 2 days	0.51	0.16%
Route 9 (eastbound)	1 every 2 days	0.56	0.05%
Route 9 (westbound)		0.55	0.05%
Route 10 (eastbound)	1 every 2 days	0.38	0.13%
Route 10 (westbound)		0.51	0.17%
Route 11	1 every 2 days	0.29	0.27%
Route 15	1 every 5 days	5.59	5.48%
Route 16	1 every 5 days	3.17	2.69%

7.11.2.24 Figure 7.16 shows the deviated routes. It can be seen that the areas of highest encounters produced are at the corners along the southern and western boundaries of the Hornsea Three array area. There is a relatively small number of routeing vessels to the east of the Hornsea Three array area, with no routes required to deviate along the eastern boundary of the Hornsea Three array area.

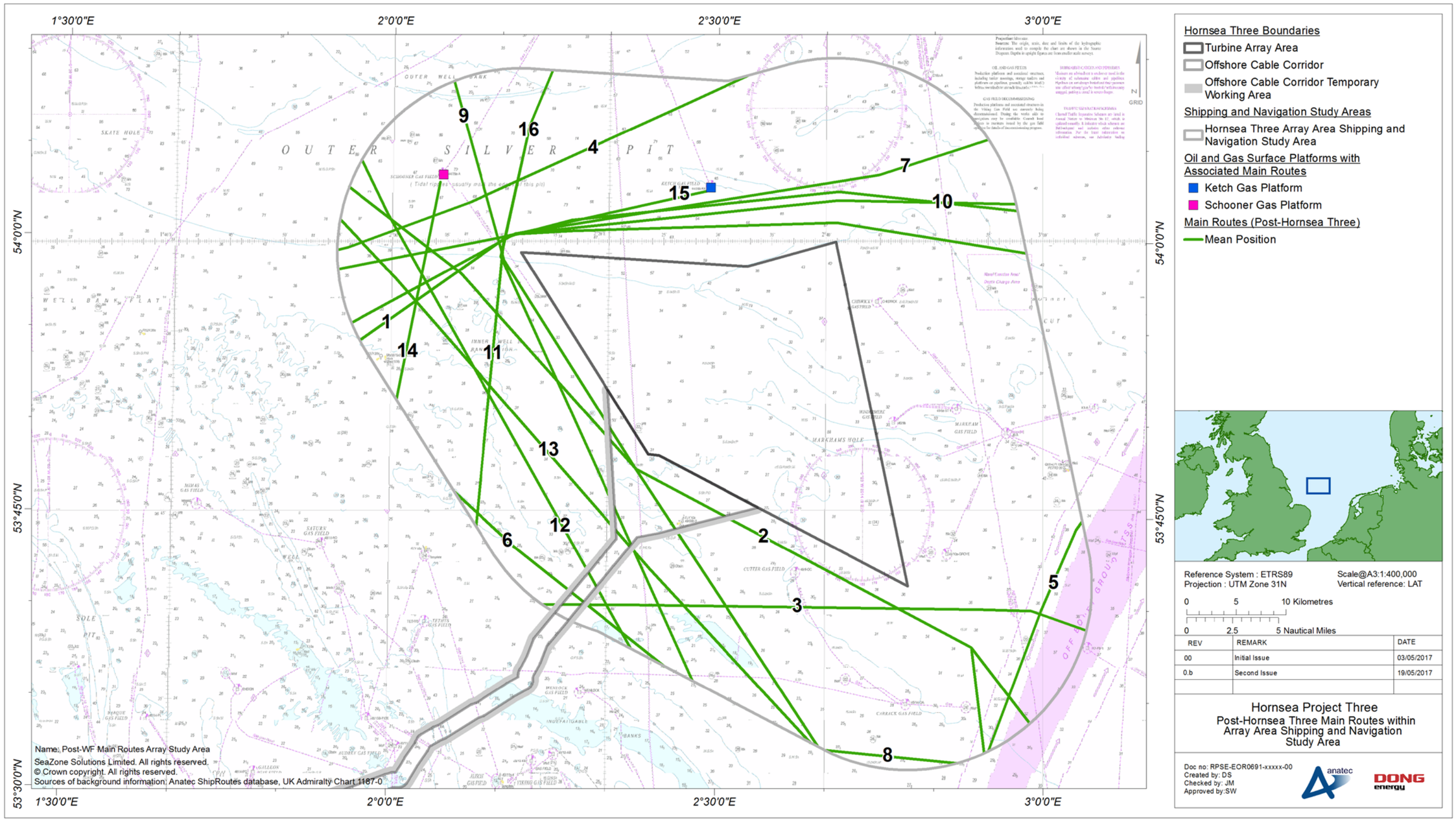

Figure 7.16: Post-Hornsea Three main routes within Hornsea Three array area shipping and navigation study area.

7.11.2.25 An assessment of current vessel to vessel encounters was carried out by replaying at high speed 40 days of the marine traffic survey data (further detail is provided in section 18.2.1 of the NRA).

7.11.2.26 Within the model, an encounter is defined as two vessels passing within 1 nm of one another within one minute. This helps to illustrate where existing vessel congestion is highest and therefore where offshore developments, such as an offshore wind farm, could potentially increase congestion and therefore also increase the risk of encounters and collisions. No account has been given as to whether the encounters are head on or stern to head; just close proximity. It was assessed that the density of vessel encounters in the vicinity of the Hornsea Three array area would be variable, with higher vessel encounter density occurring across the centre of the Hornsea Three array area as well as to the north and east. This is due to the high level of fishing activity in the region, with the longer duration that fishing vessels present within the Hornsea Three array area shipping and navigation study area resulting in an increased number of vessel encounters. There are also high density spots at the locations of the Markham and Grove gas fields. Again, given the slow speed at which fishing vessels operate it is likely that they will encounter each other but not be at risk of collision.

7.11.2.27 There were 365 encounters observed throughout the 40 day traffic survey period, corresponding to an average of nine encounters per day. The day with the most vessel encounters was 7 June with 43 unique encounters observed. In contrast, there were three days during the winter period with just one vessel encounter. The majority of encounters involved fishing vessels (61% during summer and 19% during winter), oil and gas affiliated vessels (15% during summer and 20% during winter) and cargo vessels (10% during summer and 14% during winter).

7.11.2.28 The annual vessel to vessel collision frequency within the Hornsea Three array area following the installation of Hornsea Three is expected to be 6.59×10^{-3}, corresponding to a major collision return period of one in 152 years. This represents a 21.4% increase in collision frequency compared to the pre-wind farm result for the maximum design scenario as per section 7.8.1 and Layout A shown in Figure 7.17. This is considered to be a conservative increase given that the conservative assumption is made that vessels will route in close proximity to the edge of the Hornsea Three array area.

7.11.2.29 Although not modelled beyond 10 nm, the extent of this impact will cover a larger geographical area due to the start and finishing locations of the vessel routes and the early alterations to course which vessels could be required to make; however the large extent is likely to also aid mitigation of the impact by preventing the creation of collision risk hotspots near the Hornsea Three array area by increasing the point at which vessels will alter course to deviate around the Hornsea Three array area.

7.11.2.30 Mitigation measures adopted for Hornsea Three are in place to manage increased traffic levels and encounters between third party vessels; given the low levels (compared to other UK sea areas) and these mitigations, the increase in risk of encounters is expected to be ALARP. These include Compliance with Flag State regulations including International Maritime Organization Conventions including COLREGs (IMO, 1972) and to date there have been no recorded collision incidents between third party vessels attributed to the operation of an offshore wind farm. It is noted that traffic volumes at Hornsea Three are notably lower than at other round three development areas.

Encounters and collision risk associated with third party vessels exiting the Hornsea Three array area

7.11.2.31 MGN 543 (MCA, 2016) identifies the potential for visual navigation to be impaired by the location of offshore wind farm structures, decreasing vessels' ability to sight each other (when hidden behind structures). Based on the hazard log, collision risk frequency could increase further in reduced visibility when wind farm related vessels exiting the Hornsea Three array area may not be easily sighted. However, COLREGS (IMO, 1972) should mitigate this impact by regulating all vessels to operate at a safe speed and use sound signals to notify others of their presence.

7.11.2.32 A total of 40 recreational vessels were recorded within the Hornsea Three array area shipping and navigation study area throughout the 40 day marine traffic survey, ten of which were identified operating on the same day and as part of a long distance yacht race – the 500 Mile North Sea Race. Therefore, recreational vessels per day within the Hornsea Three array area are expected to be one or less; or excluding the yacht race one every 1.5 days. On average, 11 fishing vessels per day were recorded within the Hornsea Three array area shipping and navigation study area throughout the 40 day marine traffic survey, but were concentrated in general to the northwest of the Hornsea Three array area away from commercial routes.

7.11.2.33 Due to the low levels of small craft/vessels likely to be operating within the array or in proximity to the commercial vessel routes, the frequency of encounters and thus collision risk involving third party vessels exiting the Hornsea Three array area is likely to be low.

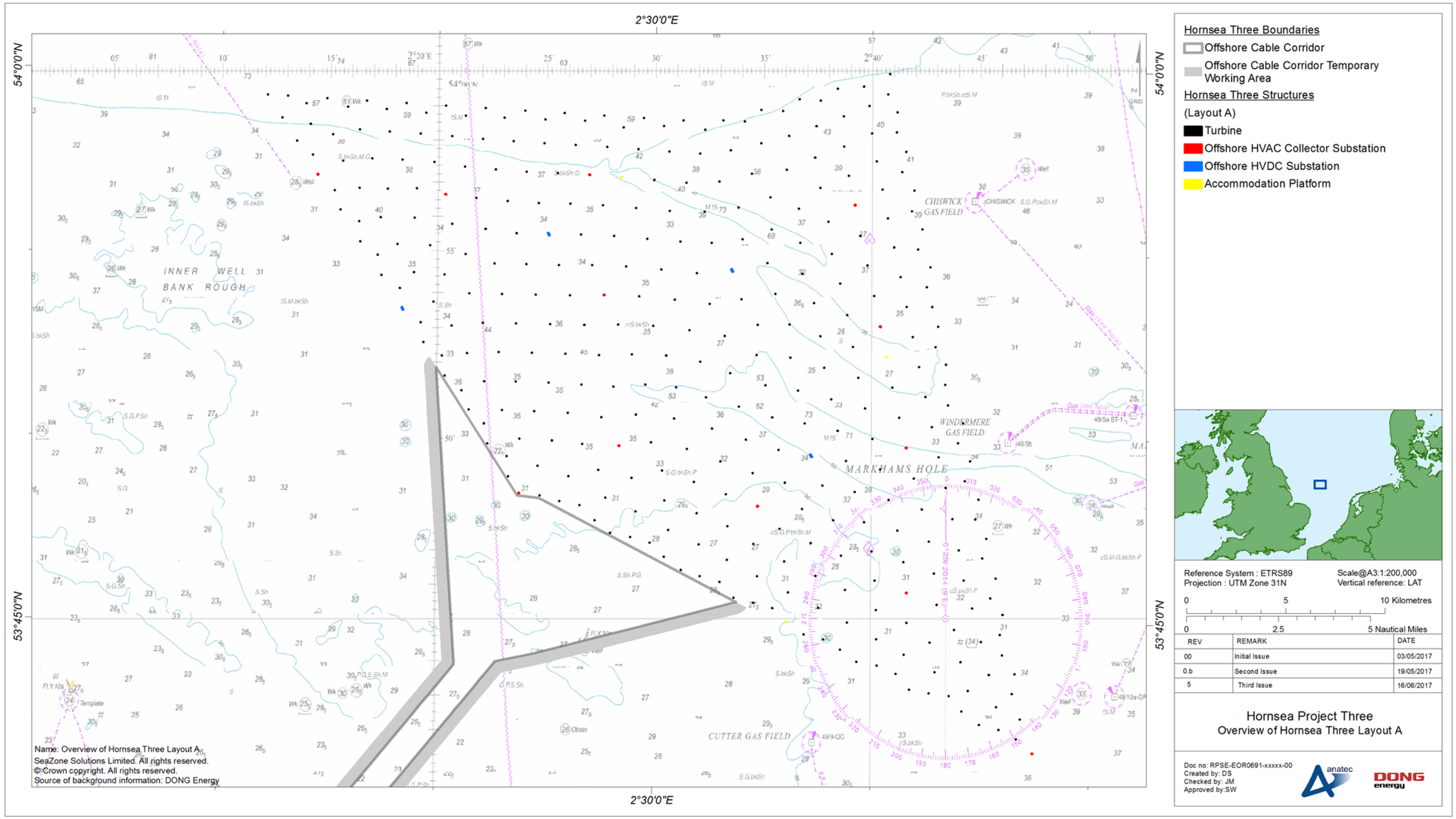

Figure 7.17: Overview of Hornsea Three Layout A.

7.11.2.34 Any offshore wind farm should be designed so as to best aid navigational safety and not interfere with visual acquisition of other targets. The Hornsea Three array area represents an increase in the minimum spacing of the individual turbines when compared to other existing developed and planned wind farms. One kilometre spacing is a significant distance in which targets would only be temporarily masked from other approaching vessels, noting that the maximum design scenario foundation diameter is 75 m (based on 160 turbines) as per the maximum design scenario. Considering the spacing and the size of structures, it is unlikely that a small craft within or about to exit the array would be masked from passing vessels. It is also likely that vessels would pass at a distance greater than the maximum design scenario 1 nm passing distance assessed. Therefore, this impact is considered to be ALARP.

Visual interference (navigational aids and/or landmarks)

7.11.2.35 Due to the distance offshore of Hornsea Three it is predicted there will be no impacts on existing aids to navigation and/or landmarks. Indeed, it is likely to become a key navigational aid in an area previously devoid of lights and marks to assist passing vessels. This could be of particular benefit to recreational and small craft who may lack advanced navigational technology; given cost and bridge space.

Encounters and collision risk associated with operations and maintenance vessels

7.11.2.36 It is anticipated that up to 2,433 round trips (per annum) for CTVs will be made between the Hornsea Three array area and base ports during the operation of Hornsea Three. Aside from personnel transfer there will also be up to four OSVs stationed on site; 312 return supply vessels trips and up to 87 jack up return trips (all per annum). As with the construction and decommissioning phases, vessel to vessel encounters between operations and maintenance vessels and third party vessels are expected to be of a low frequency given the measures adopted as part of Hornsea Three already in place.

7.11.2.37 Impacts relating to operations and maintenance vessel visits to the Hornsea Three offshore cable corridor are expected to be negligible over the life of the project and therefore no significant impacts are expected. However, measures adopted as part of Hornsea Three of COLREGs (IMO, 1972) and minimum advisory safety distances is in place to mitigate encounters, near misses and thus collision.

7.11.2.38 Consultation responses from regular operators did not identify any concern associated with collision with operations and maintenance vessels for vessels operating in or near the Hornsea Three array area. The impact is predicted to be of regional spatial extent (given the routes of the commercial vessels within the southern North Sea), medium term duration (maximum design scenario during the operation and maintenance phase), intermittent (given the conservative likelihood of nine encounters per day) and not reversible (given that than the permanent presence of the structures during the operational-phase means that vessels cannot return to any preferred routeing). It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor.

Sensitivity of receptor

7.11.2.39 When considered with measures adopted as part of Hornsea Three included in section 23 of the NRA, the low density of third party vessels operating in the area (meaning low encounters and thus low collision risk), lessons learnt and experience within the industry, the impact on encounters and collision risk is considered negligible and consequently the effect for the operational and maintenance phase is expected to be broadly acceptable under the FSA.

7.11.2.40 Vessels are generally important to the regional economy, but given the open sea area available in which vessels can navigate there are not expected to be the creation of any hot spots of increased encounters; hot spots meaning a significant increase in encounters in an isolated area, rather than a general increase over the entire Hornsea Three array shipping and navigation study area.

7.11.2.41 The receptor is deemed to be of low vulnerability, good recoverability and high value. The sensitivity of the receptor is therefore, considered to be low.

Significance of effect

7.11.2.42 Overall, it is predicted that the sensitivity of the receptor is considered to be low and the magnitude is deemed to be minor. The effect will, therefore, be of minor adverse significance, which is not significant in EIA terms.

Presence of the Hornsea Three offshore HVAC booster stations may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk.

Magnitude of impact

7.11.2.43 The presence of the offshore HVAC booster stations may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk.

7.11.2.44 As final locations for the proposed offshore HVAC booster stations (surface or sub surface) have not been defined, it is not yet possible to give a final ranking for a defined location. However three indicative maximum design scenario locations for shipping and navigation have been assessed based on a tightly packed layout within the busiest shipping routes within the offshore HVAC booster station search area (see Figure 18.15 to Figure 18.17 of the NRA).

7.11.2.45 Location 1 would require deviations for two of the nine main routes identified, while Location 2 and Location 3 would each require deviations for one of the nine main routes identified. The level of deviation required was generally small, with the highest deviation 0.55 nm for route 5 with location 1. For each of the Hornsea Three offshore HVAC booster station locations, the increase in distance for the displaced routes, both in terms of distance and percentage change, are presented in Table 7.16 to Table 7.18. It is noted that increases in route length are based on indicative final destinations.

Table 7.16: Summary of future case main route deviations within offshore HVAC booster station shipping and navigation study area for Location 1.

Route number	Frequency of deviation (average)	Increase in distance (nm)	Increase in total route length
Route 5	1 every day	0.55	0.32%
Route 7	1 every 3 days	0.04	0.07%

Table 7.17: Summary of future case main route deviations within offshore HVAC booster station shipping and navigation study area for Location 2.

Route number	Frequency of deviation (average)	Increase in distance (nm)	Increase in total route length
Route 6	1 every day	-0.00[a]	-0.01%

[a] This deviation results in the total route length decreasing by a small quantity.

Table 7.18: Summary of future case main route deviations within offshore HVAC booster station shipping and navigation study area for Location 3.

Route number	Frequency of deviation (average)	Increase in distance (nm)	Increase in total route length
Route 6	1 every day	0.27	0.42%

7.11.2.46 Scenarios where the offshore HVAC booster stations have been sited in isolation, pairs or other small groups have not been modelled and may require further consultation with the MCA and TH as part of the final scheme design approval process. It is noted that in 2016 the offshore HVAC booster station search area shipping and navigation study area was reduced in size to exclude a dense navigational route to the southwest.

7.11.2.47 The results of the modelling and traffic assessment will be considered alongside the results of other identified receptor assessments as part of siting and design of the Hornsea Three offshore HVAC booster stations. Final agreement will be required with statutory stakeholders as to the location of the offshore HVAC booster stations; however, level of concern as to the location was limited to avoidance of key navigational routes. No specific concerns have been raised by the commercial fishing and recreational users as part of the consultation undertaken to date.

7.11.2.48 It is assumed that there is no maximum spacing required by the regulators given that each structure, as with oil and gas platforms, can be marked as an isolated structure (noting that the development principles would apply to each of the (up to) six possible locations and that significant cumulative deviations would be avoided).

7.11.2.49 The impact is predicted to be of regional spatial extent (given the routes of the commercial vessels within the southern North Sea), medium term duration (maximum design scenario during the operation and maintenance phase), intermittent (given the low likelihood of encounters) and not reversible (given than the permanent presence of the structures during the operational life means that vessels cannot return to any preferred adverse weather routeing). It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **moderate**.

Sensitivity of receptor

7.11.2.50 If the principles (paragraph 7.11.2.54) are followed then it is assumed that the risk of collision will be broadly acceptable under the FSA; however as these are not measures adopted as part of Hornsea Three they have not been considered within the impact assessment presented in this PEIR.

7.11.2.51 Vessels are generally important to the regional economy but, given the open sea area available in which vessels can navigate, it is not expected that significant hot spots reflecting increased vessel encounters will be created.

7.11.2.52 The receptor is deemed to be of medium vulnerability, good recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

7.11.2.53 Overall, it is predicted that the sensitivity of the receptor is considered to be **medium** and the magnitude is deemed to be **moderate**. The effect will, therefore, be of **moderate adverse** significance, which is significant in EIA terms.

Further mitigation

7.11.2.54 In order to mitigate the risk of encounters by minimising deviations to vessels associated with the offshore HVAC booster stations the following principles should be followed when considering the final location(s):

- Will be placed so as to be sympathetic to shipping and within ALARP parameters;
- Aids to navigation should be installed (in consultation with TH) to identify the offshore HVAC booster stations potentially as isolated structure(s); and
- Additional buoyage (in consultation with TH) may be required depending on the number, location and type of the offshore HVAC booster stations.

7.11.2.55 Taking these principles into consideration, the residual effect will be of **minor adverse** significance, which is not significant in EIA terms.

Presence of infrastructure within the Hornsea Three array area may increase vessel to structure allision risk external to the array for all vessels.

Magnitude of impact

7.11.2.56 Presence of infrastructure within the Hornsea Three array area may cause increased vessel to structure allision risk external to the array for all vessels.

7.11.2.57 Based on modelling of the revised routeing (Figure 7.16), proposed layouts and local Metocean data, the annual powered vessel to structure allision frequency was 9.22×10^{-4}, corresponding to an allision return period of one in 1,084 years.

7.11.2.58 If all of the fixed structures within the array area are considered to be a single installation, this is a higher allision frequency than the historical average of 5.3×10^{-4} per operational year for offshore installations on the United Kingdom Continental Shelf (UKCS) (one in 1,900 years). The risk of allisions associated with the Hornsea Three array area is estimated to be approximately 1.75 times higher. This reflects the high number of wind farm structures included in Layout A (see Figure 7.17) and the conservative deviations assumed (1 nm passing distance from the edge of the array).

7.11.2.59 The individual wind farm structure allision frequencies ranged from 5.39×10^{-4} for the turbine located on the southeastern corner of the Hornsea Three array area to negligible for a number of structures located within the centre and to the east of the Hornsea Three array area. Figure 18.8 within the NRA presents the annual powered vessel to structure allision frequency for each structure, including turbines, offshore HVAC collector substations, offshore HVDC substations and accommodation platforms.

External lighting and marking affecting the risk of allision

7.11.2.60 Lighting and marking as mitigation for vessel to structure allision risk for external navigation is the only impact whereby Layout B presents a maximum design scenario (as per Figure 9.4 of the NRA). Layout B demonstrates large internal and external spacing of structures. It is noted that there is no maximum spacing value included within the Design Envelope. This means that the preferred intervals for lighting indicated within IALA 0-139 guidance (IALA, 2013) may not be achievable noting that IALA guidance states that "*in the case of a large or extended windfarm, the distance between Significant Peripheral Structures (SPS) should not exceed 3 nm*". It is noted that an SPS light should also have a 5 nm range. Therefore, following consent and once a final layout is decided, additional consultation with TH may be required to identify additional lighting requirements. This will be required to ensure that lighting is fully visible around the Hornsea Three array area and may include the need for additional floating aids to navigation, increased light intensity or potential (given the future date of construction) novel technologies such as electronic aids to navigation.

7.11.2.61 Following consideration of guidance from, and the experience gained at, other developments, it is considered that impacts relating to the effectiveness of lighting and marking are manageable through post consent consultation to identify additional mitigations; this would mean that spacing above 1,000 m does not impact on operational (and peripheral) lighting and marking.

7.11.2.62 Layout A presents a maximum design scenario for the failure of navigational aids. If a SPS turbine was unexpectedly extinguished, internal or unlit turbines could be exposed to an increased allision risk. However, given measures adopted as part of Hornsea Three including back up power supplies, Supervisory Control and Data Acquisition (SCADA) systems and Aids to Navigation Management Plans, the increased allision risk that would relate to a temporarily extinguished SPS's is expected to be manageable when considered against the frequency of occurrence which would be low given that SPS lights are required to have an IALA category one availability of 99.8 % (IALA, 2013). This would mean that staggered peripheral boundaries are considered acceptable with those mitigations in place for Hornsea Three in isolation.

Offshore HVAC collector substations, accommodation platforms and offshore HVDC platforms

7.11.2.63 Indicative locations for offshore HVAC collector substations, accommodation platforms and offshore HVDC substations have been identified within Layout A and Layout B. Although these layouts are indicative these structures may not be placed on the extreme periphery of the Hornsea Three array area in proximity to dense traffic routes (west, north and south boundaries of the Hornsea Three array area) given, amongst other factors, the increased allision risk for vessels due to the size of the structure and potential consequences due to the resistant force of the structure compared to the energy of the impact. The impact is predicted to be of local spatial extent (given that the vessels would need to be in proximity to the structures), medium term duration (maximum design scenario during the operation and maintenance phase), continuous for the duration of operation (due to the presence of the structures) and not reversible (given than the permanent presence of the structures during the operational life).

7.11.2.64 It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

7.11.2.65 When considering the conservative routes and layouts modelled with measures adopted as part of Hornsea Three in place, the impact is assumed to broadly acceptable under the FSA.

7.11.2.66 Vessels are only considered sensitive to this impact when they are in proximity to the edge of the Hornsea Three array area; however it is a new risk of allision in a previously open sea area. The receptor is deemed to be of low vulnerability given the limited potential for significant damage, have a good level of recoverability (as vessels will settle into new routes) and be of medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

7.11.2.67 Overall, it is predicted that the sensitivity of the receptor is considered to be **medium** and the magnitude is deemed to be **minor**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms; noting that the presence of larger structures on the periphery of the array could significantly increase risk and may require assessment post consent.

Presence of infrastructure within the Hornsea Three array area may increase vessel to structure allision risk external to the array for NUC vessels in an emergency situation (including machinery related problems or navigational system errors).

Magnitude of impact

7.11.2.68 Presence of infrastructure within the Hornsea Three array area may increase vessel to structure allision risk external to the array for NUC vessels in an emergency situation (including machinery related problems or navigational system errors).

7.11.2.69 Presence of infrastructure within the Hornsea Three array area may increase the vessel to structure allision risk external to the array for NUC vessels in an emergency situation (including machinery related problems or navigational system errors). However, given incident statistics (see section 13 of the NRA) lessons learnt from other offshore wind farms, and modelling results which indicate one incident every 1,369 years for a conservative weather assisted NUC vessel to structure allision, the frequency of occurrence is considered to be low.

7.11.2.70 Given this low frequency and the increased presence of vessels (including OSVs) able to render assistance at the Hornsea Three array area, this impact is considered ALARP.

7.11.2.71 The impact is predicted to be of local spatial extent (given that the vessels would need to be in proximity to the structures), medium term duration (maximum design scenario during the operation and maintenance phase), intermittent (given the low frequency of an NUC event) and not reversible (given than the permanent presence of the structures during the operational life). It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of receptor

7.11.2.72 Considering the frequency of occurrence, lessons learnt and consultation feedback, the risk of vessel to structure allision at the Hornsea Three array area during operation and maintenance is considered broadly acceptable with measures adopted as part of Hornsea Three in place under the FSA.

7.11.2.73 How much damage a vessel sustains on allision with a structure will depend on the energy of impact, including the size and structural integrity of the vessel and the sea state at the time.

7.11.2.74 As vessels NUC are considered to be at drift, they are typically travelling at low speeds which will reduce the consequence of an encounter with a wind turbine or associated infrastructure. A large NUC vessel is less sensitive to a collision with infrastructure than a smaller vessel due to the relative structural strength of the vessel compared with the structure.

7.11.2.75 Vessels are only considered sensitive to this impact when they are in proximity to the edge of the Hornsea Three array area; however it is a new risk of allision in a previously open sea area where they are highly vulnerable when NUC.

7.11.2.76 The receptor is deemed to be of high vulnerability, very good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

7.11.2.77 Overall, it is predicted that the sensitivity of the receptor is considered to be **medium** and the magnitude is deemed to be **negligible**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms; noting that the presence of larger structures on the periphery of the array could significantly increase risk and may require assessment post consent.

Presence of infrastructure within the Hornsea Three array area may cause increased vessel to structure allision risk internally within the array for recreational and fishing vessels.

Magnitude of impact

7.11.2.78 Presence of infrastructure within the Hornsea Three array area may cause increased vessel to structure allision risk internally within the array for recreational and fishing vessels.

7.11.2.79 A key concern raised during consultation is the risk posed by the irregularity of proposed layouts as presented in the indicative Layout A and Layout B.

7.11.2.80 MGN 543 states that in "*in order to minimise risks to surface vessels and/or SAR helicopters transiting through an OREI, structures (turbines, substations etc.) should be aligned and in straight rows or columns. Multiple lines of orientation provide alternative options for passage planning and for vessels and aircraft to counter the environmental effects on handling i.e. sea state, tides, currents, weather, visibility etc. Developers should plan for at least two lines of orientation unless they can clearly demonstrate that fewer are acceptable*" (MCA, 2016).

7.11.2.81 Impacts on SAR helicopters associated with layouts considered separately (paragraphs 7.11.2.129 to 7.11.2.147); and this impact focuses solely on surface navigation.

Increased internal allision risk associated with fishing vessels and recreational craft

7.11.2.82 Presence of infrastructure within the Hornsea Three array area may increase vessel to structure allision risk for commercial fishing vessels navigating internally within the turbine array. Consultation with fishing representatives has however indicated that fishing vessels will not trawl within the Hornsea Three array area if floating foundations are used, given the snagging risk and underwater hazards associated within mooring lines and anchors extending up to 1,000 m from the floating foundation. Assuming that floating foundations are not used, the next maximum design scenario is assumed to be jacket foundations which have smaller foundation dimensions of 25×25 m. The estimated allision frequencies of 1 every 5.3 years could be considered high when compared to other allision assessments carried out on developments within UK waters. However the model and the results reflect the significant maximum surface area assumed for all the structures that could be developed within the Hornsea Three array area against the medium density of fishing activity. The fishing allision model assumes that the fishing vessel density following development will remain the same as current levels, however in reality it is likely both that fishing activity will decrease and/or fishing vessels will adapt to the layouts and continue to fish between the turbines. The model does not assume what type of allision incident will occur and reality the most likely would be a minor impact resulting in little or no damage to the vessels.

7.11.2.83 During consultation, the Dutch Fishing Association VISNED noted that under the following circumstances fishing, including trawling and fly-shooting would be possible within indicative Layout A: "*if the weather is okay and fish are still present, in areas where turbine foundations are not floating and the distance between turbines is at least 1 km. For fishing, the separation between turbines is more important than the regularity of the layout".* It is noted that Dutch fishing vessels (including those flagged in the UK) are predominant in the area. VISNED also noted that in good weather fishing vessels are likely to transit through the Hornsea Three array area. Further information is contained within chapter 6: Commercial Fisheries. In order to reduce risk associated with fishing activity within the Hornsea Three array area, further consultation is required, but it is assumed from a navigational perspective that fishing risk would be ALARP if fishing vessels do not enter the array area on account of the floating foundation design. However, in order to ensure vessels do not enter the turbine array when it is not safe to do so (given underwater hazards) additional mitigation may need to be discussed with the MCA and known fishing vessels active within the area to fully mitigate such potential effects. Other foundation types would be assumed ALARP based on the minimum 1,000 m spacing which would allow fishing vessel to effectively adapt to navigating within Layout A or Layout B.

7.11.2.84 As with fishing vessels it is considered likely that recreational craft will adapt to navigating within Layout A and Layout B given the minimum spacing of 1,000 m; recreational traffic levels are also very low within the Hornsea Three array area and negligible levels of recreational transits are likely to be seen.

Under keel allision risk

7.11.2.85 Floating foundations present an under keel allision risk for vessels. The RYA guidance references a minimum of 4 m clearance for all subsea hazards and assuming floating foundation mooring systems do not meet this they could present an under keel allision risk. It is noted that there are low levels of recreational craft that commercial vessels are not anticipated to enter the array and that fishing vessels are not likely to engage in fishing in the array reduces the likelihood of a vessel entering the Hornsea Three array area and the therefore the occurrence. However given the limited understanding of floating foundations design at this point in the development process, no commitment can be made at this stage to ensure that a minimum under keel clearance is maintained and consequently floating foundations are deemed to present a significant risk to vessels navigating through the array area given that any navigational approach could result in an under keel allision. Further development working on floating foundations will be required to ensure risks are within safe levels. The issue is also considered in more detail in volume 5, chapter 6: Commercial Fisheries.

Key points from assessment and consultation

7.11.2.86 Assuming that floating foundations are not used and looking at the issue of surface craft navigating within the array, the following factors gathered from consultation, the Hazard Workshop and marine traffic survey results make the case that Layout A and Layout B are ALARP:

- Predicted levels of transiting vessels (recreational and commercial fishing) will be low compared to other constructed and/or consented wind farms;
- While levels of fishing activity are high within some areas of the Hornsea Three array area, this will vary seasonally and annually. Some commercial fisheries representatives have indicated that their main concerns are over the foundation type used and the spacing rather than the alignment. Feedback from fishermen indicates that, if floating foundations with 1,000 m radius mooring lines were used, fishing vessels could not fish within the Hornsea Three array area. Overall, the majority of risk associated with internal navigation is related to vessels engaged in fishing, noting that consultation the MCA confirmed that vessels engaged in fishing are out with the MCA's navigational safety remit;
- Demersal trawlers active within the array area are expected to target specific fishing grounds, meaning that it is unlikely that the skippers would choose to fish along fixed lines of orientation;
- Consultation indicates that commercial vessels (in transit), other than commercial fishing vessels, will not navigate through the Hornsea Three array area;
- The RYA stated that, given the very low level of recreational traffic within the Hornsea Three array area, they had no express concerns with either Layout A or Layout B;
- The CA confirmed their general policy that wind farm layouts should have "straight see-through channels between the turbines" while recognising that the Hornsea Three array is in an area of very light yachting and recreational traffic. The CA confirmed that the penalty of not having straight see-through "channels" at Hornsea Three "may prove minimal and therefore acceptable to many".

The CA also noted that the penalty of extra time and distance incurred as a result of avoiding the Hornsea Three array area would mostly be minimal and thus it is likely that yachts and recreational craft may at the time of passage choose to avoid or be in a position where they should avoid the Hornsea Three array area;

- The CA stated a preference for additional aids to navigation to be provided within the array;
- Marine traffic survey data shows very low recreational vessel movements (especially when excluding the *500 Mile North Sea Race*) and those that were in the area would be well equipped and experienced (given the distance offshore);
- Aids to navigation similar to those deployed at the London Array OWF could be used at the Hornsea Three array area to assist third party internal navigation;
- Visibility is generally good or very good at the Hornsea Three array area. Appendix C of volume 5, annex 7.1: Hornsea Three Array Area, Offshore Cable Corridor and Offshore HVAC Booster Station Search Area NRA includes further detail on visibility. The total percentage of time that the visibility is below 2 km is around 1.3%;
- Cumulatively no other development will border the Hornsea Three array area;
- It is unlikely that third party vessels will be required to perform SOLAS obligations within the Hornsea Three array area, given that Hornsea Three vessels are likely to be present on site; and
- The Hornsea Three array area is largely out with the operational area for the RNLI and the MCA do not operate any surface craft assets within the southern North Sea.

Assessment of maximum design scenario which includes floating foundations

7.11.2.87 The overall impact of an increased internal allision risk for fishing vessels and recreational craft is predicted to be of local spatial extent (given it is internal to the array), medium term duration (maximum design scenario during the operation and maintenance phase), continuous (as the structures will be continually present) and not reversible (given the permanent presence of the structures during the operational life). It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

7.11.2.88 Recreational and commercial fishing vessels are only considered sensitive to this impact when they are in the Hornsea Three array area; however, it is a new risk of allision in a previously open sea area. The under keel allision risk also presents a significant risk of allision, including the potential for vessels to founder. The receptor is therefore deemed to be of high vulnerability (given the lack of experience associated with recreational users, the unmarked nature of the hazard and potential for damage/loss of life), have no recoverability (given that the risk will always be present for the operational life) and of medium value given the potential for substantial damage to vessels. The sensitivity of the receptor is therefore, considered to be **very high**.

Significance of effect

7.11.2.89 As noted, MCA guidance states that a UK developer they can seek to demonstrate that fewer lines of orientation area acceptable and therefore looking at surface craft, the NRA makes the case that fewer lines are tolerable with mitigation under the FSA.

7.11.2.90 Given that this PEIR has only considered indicative layouts, Table 22.2 in the NRA identifies layout elements that should be considered post-consent, again excluding consideration for SAR helicopter access. Table 22.2 identifies potential issues identified, risk rankings for indicative Layout A and proposed mitigation for layouts to bring the effects into ALARP parameters for comparison against any post consent layout designs.

7.11.2.91 However given the significant allision risk associated with under keel hazards this impact is not considered to be tolerable under the FSA process if floating foundations are used that present an under keel clearance and thus allision risk.

7.11.2.92 Overall, it is predicted that the sensitivity of the receptor is considered to be **very high** and the magnitude is deemed to be **minor**. The effect will, therefore, be of **major adverse** significance, which is significant in EIA terms.

Further mitigation

7.11.2.93 The sensitivity (vulnerability and recoverability) may be improved by improving internal aids (as requested by recreational sea users) and promulgation of information but also by fully exploring the risks associated with floating foundations mooring lines. If safe under keel clearance is confirmed the vulnerability could be reduced and allow internal navigation too continue within the array. In order to mitigate the risk of internal allision, the following principles should be followed when considering the final location(s):

- If floating foundations are selected and under keel clearance cannot be guaranteed, additional mitigation and consultation will be required;
- Additional aids to navigation to assist internal navigation: Following consultation responses from recreational users, Hornsea Three will consult with TH and MCA to consider internal aids to navigation; and
- Additional means of communication to assist third parties: Marine coordination facilities, offshore VHF aerials, AIS transceivers/receivers and on site vessels shall be used to mitigate risk to third party vessels navigating internally.

7.11.2.94 Floating turbine technology is currently at an early stage of development. This assessment considers a certain type of floating turbine concept to present a maximum design scenario. There are a range of floating foundations, as well as other foundation types (such as monopiles and jacket foundations), that will be considered for Hornsea Three. If such alternative technologies were to be used (those foundations that are more "tried and tested" by the offshore wind farm industry or alternative floating concepts), or if the spatial extent of deployment of the floating foundation design considered in this assessment was reduced, then it is considered likely that this impact would be reduced because these options may present a lesser risk to navigational safety.

Presence of surface offshore HVAC booster stations within the Hornsea Three offshore cable corridor may increase vessel to structure allision risk for all vessels.

Magnitude of impact

7.11.2.95 Presence of surface offshore HVAC booster stations within the Hornsea Three offshore cable corridor may increase vessel to structure allision risk for all vessels.

7.11.2.96 As with vessel to vessel collision risk, vessel to structure allision risk associated with the offshore HVAC booster stations would be acceptable assuming they are located away from key navigational routes. Fishing and recreational users had no concerns. The maximum design scenario could include up to four surface offshore HVAC booster stations.

7.11.2.97 Based on the vessel routeing identified for the region (see Figure 18.15 to Figure 18.17 of the NRA), the anticipated change in routeing due to the Hornsea Three offshore HVAC booster stations, and assumptions that the mitigation measures (as noted in Table 7.8) adopted for Hornsea Three are in place, the frequency of an errant vessel under power deviating from its route to the extent that it comes into proximity with a Hornsea Three offshore HVAC booster station is not considered to be a probable occurrence.

7.11.2.98 Based on modelling of the revised routeing; proposed layouts and local Metocean data, the annual powered vessel to structure allision frequency for each of the three Hornsea Three offshore HVAC booster station locations is presented in Table 7.19.

Table 7.19: Powered vessel to structure allision probabilities for Hornsea Three offshore HVAC booster station locations.

Hornsea Three offshore HVAC booster station location	Annual powered vessel to structure allision frequency	Allision return period
Location 1	2.15×10^{-4}	One in 4,653 years
Location 2	5.96×10^{-5}	One in 16,779 years
Location 3	3.23×10^{-5}	One in 30,950 years

7.11.2.99 These are lower allision frequencies than the historical average of 5.3×10^{-4} per operational year for offshore installations on the UKCS (one in 1,900 years). The risk to the Hornsea Three offshore HVAC booster stations is estimated to be up to approximately 0.4 times lower (for the highest annual powered vessel to structure allision frequency), depending on the location of the Hornsea Three offshore HVAC booster stations.

7.11.2.100 The impact is predicted to be of local spatial extent (given the impact can only occur when vessels are in proximity to the offshore HVAC booster stations, medium term duration (maximum design scenario during the operation and maintenance phase), intermittent (given the low levels of vessels) and not reversible (given than the permanent presence of the structures during the operational life). It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **moderate**.

Sensitivity of receptor

7.11.2.101 How much damage a vessel actually sustains in the event collision with a structure does occur, will depend on the energy of impact, including the size and structural integrity of the vessel and the sea state at the time.

7.11.2.102 Vessels are generally important to the regional economy, but given the open sea area available in which vessels can navigate there is not expected to be a significant increase in vessel to structure allision risk if the Hornsea Three offshore HVAC booster stations are situated with consideration for traffic routeing.

7.11.2.103 The receptor is deemed to be of medium vulnerability, good recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

7.11.2.104 If the principles (paragraph 7.11.2.106) are followed then it is assumed that the risk of allision will be broadly acceptable under the FSA; however as these are not measures adopted as part of Hornsea Three they have not been considered within the below assessment.

7.11.2.105 Overall, it is predicted that the sensitivity of the receptor is considered to be **medium** and the magnitude is deemed to be **moderate**. The effect will, therefore, be of **moderate adverse** significance, which is significant in EIA terms.

Further mitigation

7.11.2.106 In order to mitigate the risk of allision associated with the Hornsea Three offshore HVAC booster stations the following principles should be followed when considering the final location(s):

- The Hornsea Three offshore HVAC booster stations should not be located within 0.5 nm (based on the shipping template within MGN 543 (MCA, 2016)) of an identified historical route within the

Hornsea Three offshore HVAC booster station search area shipping and navigation study area, meaning that any deviation required by third party vessels would be negligible;

- If the maximum number of surface or subsea offshore HVAC booster stations is built they should be aligned or grouped so as to be sympathetic to shipping;
- Aids to navigation should be installed (in consultation with TH) to identify the Hornsea Three offshore HVAC booster stations as isolated structure(s);
- Additional buoyage (in consultation with TH) may be required depending on the number, location and type of the Hornsea Three offshore HVAC booster stations; and
- Further consultation will be required with the MCA and TH to agree the final location(s).

7.11.2.107 Taking these principles into consideration, the residual effect will be of **minor adverse** significance, which is not significant in EIA terms.

Presence of subsea HVAC booster stations and cable protection within the Hornsea Three offshore cable corridor may increase vessel to sub surface structure allision risk for all vessels.

Magnitude of impact

7.11.2.108 Presence of subsea HVAC booster stations and cable protection within the Hornsea Three offshore cable corridor may increase vessel to sub surface structure allision risk for all vessels.

Sub surface offshore HVAC booster stations

7.11.2.109 Presence of subsea HVAC booster stations and cable protection within the Hornsea Three offshore HVAC booster station search area may increase vessel to sub surface structure allision risk for all vessels; the assessment of this risk will depend upon the final location(s) of the subsea HVAC booster stations.

7.11.2.110 Following identification of both a location and layout of the (up to) six subsea HVAC booster stations, under keel clearance allision modelling shall be undertaken. TH have indicated that a surface buoy (likely per structure) will be required where the under keel clearance is less than 30 m; but again, as with consultation on the surface Hornsea Three offshore HVAC booster stations, the siting of the subsea HVAC booster stations should follow the same principles and not be located in areas of dense shipping activity.

Hornsea Three offshore cable corridor

7.11.2.111 A Cable Burial Risk Assessment shall be undertaken to ensure that any protection methods used for the export cables do not impact under keel clearance for small craft in the near shore area or at cable crossings. This was specifically raised as a concern by the RYA and recreational impacts shall be considered during the Cable Burial Risk Assessment.

7.11.2.112 To prevent impacts on navigational equipment post installation, Hornsea Three will ensure that electromagnetic interference is mitigated.

7.11.2.113 The impact is predicted to be of local spatial extent, medium term duration, intermittent and not reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **moderate**.

Sensitivity of receptor

7.11.2.114 How much damage a vessel actually sustains in the event collision with a structure does occur, will depend on the energy of impact, including the size and structural integrity of the vessel and the sea state at the time.

7.11.2.115 The receptor is deemed to be of medium vulnerability, good recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

7.11.2.116 If the principles for the location of the Hornsea Three offshore HVAC booster stations (section 7.11.2.44) are followed then it is assumed that the risk of sub surface allision will be broadly acceptable under FSA; however as these are not measures adopted as part of Hornsea Three they have not been considered within the below assessment.

7.11.2.117 Overall, it is predicted that the sensitivity of the receptor is considered to be **medium** and the magnitude is deemed to be **moderate**. The effect will, therefore, be of **moderate adverse** significance, which is significant in EIA terms.

Further mitigation

7.11.2.118 In order to mitigate the risk of allision associated with the subsea HVAC booster stations the following principles should be considering when developing the final location/s.

- Will be placed so as to be sympathetic to shipping and within ALARP parameters;
- If the maximum number of sub surface offshore HVAC booster stations is built they should be aligned or grouped so as to be sympathetic to shipping;
- Following this assessment of maximum design scenario locations further consultation will be required with the MCA and TH to agree final location; and
- The sub surface offshore HVAC booster stations will require marker buoys (in consultation with TH) in water depths giving less than 30 m under keel clearance. This is noted as likely given the water depths but will be dependent on the final dimensions.

7.11.2.119 Taking these principles into consideration, the residual effect will be of **minor adverse** significance, which is not significant in EIA terms.

Physical presence of structures (including sub surface elements) and cables may present an increased risk of gear snagging for commercial fishing vessels with mobile gear.

Magnitude of impact

7.11.2.120 The physical presence of structures (including sub surface elements of the structures such as J-tubes) and cables may present an increased risk of gear snagging for commercial fishing vessels with mobile gear.

7.11.2.121 The physical presence of structures (including sub surface elements of the structures such as J-tubes) and cables (which may be exposed or partially buried) may present an increased risk of gear snagging for commercial fishing vessels with mobile gear. The wind farm structures considered within the modelling of this impact are jackets rather than floating foundations since for fishing vessels internal navigation is considered unlikely in comparison to the use of jacket foundations. Conservative consequences are associated with vessel foundering due to the potential for the vessel snagging on a sub surface hazard.

7.11.2.122 The most severe consequence of snagging is foundering. Foundering is considered to be when a vessel suffers structural or stability failure and sinks. It is noted that this type of incident is considered to have a very low frequency based on historical incident data for the UK (between 1994 and 2008 only approximately 4% of all MAIB incident types were listed as “flooding/foundering”); therefore when the frequency of foundering is considered against the frequency of snagging, this impact is considered to be low risk.

7.11.2.123 It is noted that Dutch fishing vessels (including those flagged in the UK) are predominant in the area. VISNED also noted that in good weather fishing vessels are likely to transit through the wind farm. In order to reduce risk associated with fishing activity within the Hornsea Three array area, further consultation is required with relevant fishing stakeholders. It is assumed from a navigational perspective that fishing vessel navigational safety risk would be ALARP if fishing vessels avoid the floating foundation design; hence why jacket foundations are considered rather than floating foundations within this impact.

7.11.2.124 In order to ensure vessels do not enter the Hornsea Three array area when it is not safe to do so (given underwater hazards) additional mitigation may need to be discussed with DEFRA and the owners of fishing vessels known to be active within the area to fully mitigate this impact. Foundation types other than floating foundations, including jacket foundations, would be assumed ALARP based on the minimum 1 km spacing.

7.11.2.125 In order to reduce risk associated with fishing activity within the Hornsea Three array area, further discussion with known fishing vessels with regards to layouts to ensure that safety of navigation for vessels is required. It is noted that this may require consultation with DEFRA.

7.11.2.126 The impact is predicted to be of local spatial extent, medium term duration, intermittent and not reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

7.11.2.127 Given the likelihood of a fishing vessel experiencing this impact within the Hornsea Three array area, the receptor is deemed to be of medium vulnerability, good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

7.11.2.128 Gear snagging during operation is considered tolerable with mitigation under the FSA, noting that further consultation is required with respect to floating foundations, which are mitigated through fishermen not fishing within the array area. However, since jackets are considered to be the maximum design scenario foundation type for gear snagging due to the likelihood of fisherman not fishing within the array area with floating foundations in place, the sensitivity of the receptor is considered to be **medium** and the magnitude is deemed to be **minor**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Physical presence of structures may alter the approach of search and rescue helicopters.

7.11.2.129 As described in the SAR Technical Report (appendix C, annex 7.1: Hornsea Three Array Area, Offshore Cable Corridor and Offshore HVAC Booster Station Search Area NRA) SAR operations are multi-phase, and multi-faceted, undertakings. As such, it is important to clearly define what is, and is not, being considered as part of the assessment presented below. Essentially, this assessment seeks to determine the overall impact of Hornsea Three on SAR operations by comparing the effectiveness, and likely success, of a SAR operation undertaken within the Hornsea Three array area against the effectiveness, and likely success, of the SAR operation if it were to be undertaken in the same area prior to the presence of the Hornsea Three infrastructure. It is of note that the facilities and infrastructure associated with Hornsea Three will have both adverse and beneficial impacts on SAR operations.

7.11.2.130 This assessment is focused on the potential impacts upon SAR operations that could arise as a result of the infrastructure present within the array area. Impacts that could potentially be associated with the presence of the offshore HVAC booster stations, and any vessels that may be required to maintain the export cable, are not deemed to be significant and are not considered further within this assessment.

7.11.2.131 The receptor for this impact is identified as the SAR function and, more specifically, the search-phase of a SAR operation.

Magnitude of impact

7.11.2.132 As described in the SAR Technical Report (appendix C, annex 7.1: Hornsea Three Array Area, Offshore Cable Corridor and Offshore HVAC Booster Station Search Area NRA) SAR operations comprise a number of distinct phases. The initial phase of a SAR operation is the planning phase. The planning phase will commence as soon as the potential requirement to mobilise a SAR helicopter has been identified. Given the distance between the Hornsea Three array area and the nearest SAR helicopter base (Humberside Airport), it is likely that the SAR crew will undertake the majority of the planning phase aboard the SAR helicopter as it transits to the scene of the incident. Following the initial notification of an incident, the expected time on-scene for a SAR helicopter is 1 hour and 5 minutes during the day and 1 hour and 35 minutes at night.

7.11.2.133 The presence of the infrastructure located within the Hornsea Three array area may introduce complications to the planning phase. However, helicopter SAR crews are highly competent and experienced when it comes to planning and undertaking SAROPS within areas that contain man-made obstacles and at locations that feature complex and challenging topographic features such as mountain ranges and sea cliffs. Furthermore, the presence of the infrastructure within the Hornsea Three array area may support the planning phase if, for example, the person making the distress call refers to wind farm infrastructure as a means of conveying positional information. It is likely that the Hornsea Three array area will be manned throughout the majority of the operational-phase and a range of equipment and facilities (including an OSV, other support vessels, personnel transfer helicopters, the MHCC, AIS receivers, VHF aerials, fibre optic cables linking the array area with the MHCC, etc.) may also be able to provide information that supports the planning phase.

7.11.2.134 Given the minimum 1 km spacing between structures in the array area, it is not considered that access to, or egress from, the array area will be significantly degraded.

7.11.2.135 The presence of infrastructure within the Hornsea Three array area may impact the recovery-phase of a SAR operation. However, SAR crews are familiar with the hazards that fixed structures may pose to the mechanics of a recovery operation, and turbine blades will be fixed in the preferred position during a SAR operation. Overall, it is not expected that the recovery phase of a SAR operation will be significantly impacted as a result of the presence of infrastructure within the Hornsea Three array area.

7.11.2.136 As in any aviation activity, there is a small risk of equipment failure during SAR helicopter operations. In most cases, technical malfunctions will not affect the safety of the helicopter, though it may be necessary to abort the mission and return to base. In more serious cases, the crew may opt to land at the nearest suitable site, potentially a heli-deck-equipped platform within the Hornsea Three array area or the nearest point of land. It is conceivable that the presence of infrastructure within the Hornsea Three array area could impede the progress of a SAR crew looking to climb safely out of the array area following a serious malfunction, such as an engine failure. However, the likelihood of an engine in-flight shut-down, or engine power loss, occurring while a SAR helicopter is conducting a SAR operation within the Hornsea Three array is extremely remote (see appendix C of the NRA).

7.11.2.137 SAR helicopter crews are exposed to a range of hazards during SAR operations, and the crew will rely on available means to manage the associated risks. The presence of infrastructure within the Hornsea Three array area will introduce additional hazards that are not present at an open-water location. However, for the purposes of this assessment, it is reasonable to assume that SAR pilots will take steps to manage hazards associated with the presence of Hornsea Three infrastructure, such that SAR crews are not exposed to a significant increase in risk. As such, potential impacts to SAR crews are not considered as part of this assessment.

7.11.2.138 The presence of infrastructure within the Hornsea Three array area will have an impact on the search-phase of SAR operations, and this is the primary impact considered in further detail below.

7.11.2.139 Appendix C of the NRA identifies that there have been 9,000 SAR incidents in the UK over a five-year period (2011 to 2015 inclusive). Historically a higher proportion of incidents over land or in coastal areas involve a search than those offshore. Therefore, the data was further analysed to identify how many incidents located more than 10 nm offshore included an element of search. It was found that 46 out of 724 offshore operations involved a search, corresponding to approximately 6.4% of the total. This includes incidents described as “Search”, “Search and Assist”, “Search and Medical Rescue”, “Search and Recovery” and “Search and Rescue”. As such, it can be seen that the majority of SAR operations will be flown to known locations including vessels or life-rafts that are able to transmit their location. However, given that flights to known locations will not require a search, this scenario is not the subject of the main assessment presented below.

7.11.2.140 As detailed in paragraph 7.11.2.86, commercial shipping is expected to avoid transiting through the Hornsea Three array area. Furthermore, given the likely passing distances (at least 1 nm) and expected drift speeds, it is unlikely that a commercial vessel NUC, or a person that has fallen into the water from a commercial vessel, will drift into the Hornsea Three array area. However, fishing vessels and recreational sailing vessels are expected to be present within the Hornsea Three array area. As such, this assessment is based on the plausible worst-case incident scenario of a SAR helicopter crew searching for an individual in the water who is wearing a life jacket but who is not equipped with a PLB. For this individual to be at an unknown location somewhere within the Hornsea Three array area, it is likely that they would have fallen from either a fishing or recreational vessel and that a period of time would have elapsed between the last confirmed sighting of that individual and the time at which the person was confirmed as missing.

7.11.2.141 The presence of a wind farm could have a range of beneficial effects that either remove the need for, or support, the search-phase a SAR operation. For example, an OSV equipped with a fast rescue craft may be on scene before a SAR helicopter arrives. If the position of a casualty is known, the SOV could recover survivors quickly and it could commence a search if necessary, although it is a less effective platform for this than a helicopter. Other facilities within the wind farm could also be used: SAR helicopters operating at low level could relay communications to shore via wind farm assets, the SAR helicopter might be able to land on a suitable platform within the array (which could have aviation fuel available), and information such as navigational information and weather forecasting could be provided to the SAR crew.

7.11.2.142 The impact is predicted to be of local spatial extent, medium-term duration, continuous and not reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

7.11.2.143 This assessment demonstrates that infrastructure present within the Hornsea Three array area may impact the search phase of a SAR operation. It also demonstrates the low frequency at which this impact is expected to manifest itself (there is less than a 50% probability that a search will be required within the Hornsea Three area during the 25-year operational-phase).

7.11.2.144 The receptor is deemed to be high value, generally vulnerable to the impacts associated with the presence of infrastructure within the Hornsea Three array area, and to have very good recoverability. However, in view of the low frequency of occurrence, the sensitivity of the receptor is considered to be **medium**.

Significance of effect

7.11.2.145 The sensitivity of the receptor is considered to be **medium** and the magnitude is deemed to be **minor**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

7.11.2.146 Discussions remain ongoing between the Applicant and the MCA regarding the mitigating effect of designing layouts that are more regular than Layouts A and B, as shown in the NRA. It is understood that increasing the regularity of the Hornsea Three layout would partially mitigate the impact upon the search phase of SAR operations. However, the initial results of a Cost Benefit Analysis (CBA) indicate that the cost penalty associated with a suboptimal layout is grossly disproportionate to the safety benefit gained. Furthermore, it is of note that the current approach to subsidising renewable energy in the UK is based on a competitive bidding process, meaning that cost increases associated with a less efficient layout design will necessarily be passed on to the UK bill payer.

Future monitoring

7.11.2.147 The following monitoring requirements have been identified for the operation and maintenance phase in relation to shipping and navigation:

- Monitoring and inspection of cables during operation and maintenance may be conducted periodically by the operator to confirm cables remain buried and protected in order to, amongst other factors, ensure the security of the asset, reduce snagging risk to anchors and fishing gear;
- Monitoring of floating foundations to identify if any moorings fail, global positioning system (GPS) tracking shall be considered; and
- The DCO will require post-construction vessel traffic monitoring by AIS as per Table 7.14.

7.11.3 Decommissioning phase

7.11.3.1 The impacts of the offshore decommissioning of Hornsea Three have been assessed on shipping and navigation. The environmental impacts arising from the decommissioning of Hornsea Three are listed in Table 7.8 along with the maximum design scenario against which each decommissioning-phase impact has been assessed.

7.11.3.2 A description of the potential effect on shipping and navigation receptors caused by each identified impact is given below.

Decommissioning activities within the Hornsea Three array area and Hornsea Three offshore cable corridor may displace vessels leading to increased journey times or distances during periods of adverse weather.

Magnitude of impact

7.11.3.3 Decommissioning activities within the Hornsea Three array area and offshore cable corridor may displace vessels leading to increased journey times or distances during periods of adverse weather.

7.11.3.4 Adverse weather impacts associated with the decommissioning phase are as per those identified for the construction phase within paragraph 7.11.1.4. The extent at which the impact is considered (maximum development area) and the likely effects on the receptors do not change, apart from the duration, throughout the phases. The sensitivity of a vessel to adverse weather will depend on the actual stability parameters, hull geometry, vessel type, vessel size and speed. The probability of occurrence, in a particular sea state, may differ for each vessel.

7.11.3.5 The impact is predicted to be of regional spatial extent, short term duration (maximum design scenario during the decommissioning phase), intermittent and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

7.11.3.6 When measures adopted as part of Hornsea Three are considered against the probability of adverse weather including restricted visibility, the low numbers of vessels within the Hornsea Three array area and the available sea room, the impact is considered to be broadly acceptable under the FSA.

7.11.3.7 Vessels (excluding commercial ferries) are generally important to the regional economy, but given the very low frequency of adverse weather routeing required, the open sea area available in which vessels can deviate and the low effect of adverse weather on commercial vessels, the receptor is deemed to be of low vulnerability, very good level of recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

7.11.3.8 Overall, it is predicted that the sensitivity of the receptor is considered to be **low** and the magnitude is deemed to be **minor**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Decommissioning activities within the Hornsea Three array area may displace commercial ferries leading to increased journey times or distances for commercial ferries during periods of adverse weather.

Magnitude of impact

7.11.3.9 Decommissioning activities within the Hornsea Three array area may displace commercial ferries leading to increased journey times or distances for commercial ferries during periods of adverse weather.

7.11.3.10 Adverse weather impacts associated with the decommissioning phase are as per those identified for the construction phase from paragraph 7.11.1.12. The extent at which the impact is considered (maximum development area) and the likely effects on commercial ferries do not change, apart from the duration, throughout the phases.

7.11.3.11 The impact is predicted to be of regional spatial extent, short term duration, intermittent and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

7.11.3.12 Given the low frequency of adverse weather in the Hornsea Three array area, any increased deviations associated with weather conditions are expected to be minimal and of a limited temporal duration for the pre decommissioning phase. No adverse weather impacts have been identified for the decommissioning of the offshore HVAC booster stations or Hornsea Three offshore cable corridor. When considered against the frequency of occurrence, impacts on adverse weather routes are considered broadly acceptable under the FSA.

7.11.3.13 Commercial ferries are important to the regional economy, and given very low frequency of adverse weather routeing required, the open sea area available in which vessels can deviate but the sensitivity of the passengers on board, the receptor is deemed to be of medium vulnerability, have a good level of recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

7.11.3.14 Overall, it is predicted that the sensitivity of the receptor is considered to be **medium** and the magnitude is deemed to be **minor**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Presence of decommissioning infrastructure within the Hornsea Three array area and Hornsea Three offshore cable corridor may cause increased vessel to structure allision risk external to the array for all vessels.

Magnitude of impact

7.11.3.15 Presence of decommissioning infrastructure within the Hornsea Three array area and offshore cable corridor may cause increased vessel to structure allision risk external to the array for all vessels; however, during the decommissioning phase measures adopted as part of Hornsea Three will be in place to ensure that the risk is maintained within ALARP parameters.

7.11.3.16 The impact is predicted to be of local spatial extent, short term duration, continuous for the duration of decommissioning and is reversible post decommissioning. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

7.11.3.17 The risk of allision within the Hornsea Three array area during decommissioning is considered broadly acceptable with measures adopted as part of Hornsea Three in place under the FSA; given the low frequency.

7.11.3.18 Vessels are only considered sensitive to this impact when they are in proximity to the decommissioning Hornsea Three array area or offshore HVAC booster stations. The receptor is deemed to be of low vulnerability, have a good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

7.11.3.19 Overall, it is predicted that the sensitivity of the receptor is considered to be **medium** and the magnitude is deemed to be **minor**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Presence of decommissioning infrastructure within the Hornsea Three array area and Hornsea Three offshore cable corridor may cause increased vessel to structure allision risk for NUC vessels in an emergency situation (including machinery related problems or navigational system errors).

Magnitude of impact

7.11.3.20 Presence of decommissioning infrastructure within the Hornsea Three array area and offshore cable corridor may increase vessel to structure allision risk external to the array for NUC vessels in an emergency situation (including machinery related problems or navigational system errors). However, given incidents statistics (see section 13 of the NRA) and lessons learnt from other offshore wind farms, this impact is considered to be of low frequency.

7.11.3.21 Given this low frequency and the increased presence of vessels associated with decommissioning of Hornsea Three which will be able to render assistance, this impact is considered ALARP.

7.11.3.22 The impact is predicted to be of local spatial extent, short term duration, intermittent and reversible. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of receptor

7.11.3.23 Considering the frequency of occurrence, lessons learnt and consultation feedback, the risk of allision within the Hornsea Three array area during decommissioning is considered broadly acceptable with measures adopted as part of Hornsea Three in place under the FSA.

7.11.3.24 Vessels are only considered sensitive to this impact when they are in proximity to the decommissioned Hornsea Three array area or offshore HVAC booster stations. The receptor is deemed to be of high vulnerability, very good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

7.11.3.25 Overall, it is predicted that the sensitivity of the receptor is considered to be **medium** and the magnitude is deemed to be **negligible**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Presence of infrastructure within the Hornsea Three array area may cause increased vessel to structure allision risk internally within the array for recreational and fishing vessels.

Magnitude of impact

7.11.3.26 Presence of infrastructure within the Hornsea Three array area may cause an increased vessel to structure allision risk internally within the array for recreational and fishing vessels; however during the decommissioning phase measures adopted as part of Hornsea Three in place will ensure that the risk is within tolerable limits (see paragraph 7.11.1.40).

7.11.3.27 The impact is predicted to be of local spatial extent, short term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

7.11.3.28 Vessels are only considered sensitive to this impact when they are in the decommissioned Hornsea Three array area; however it is an existing risk of allision in a previously open sea area. The receptor is deemed to be of low vulnerability, good recoverability and low value (due to the impact being on small craft/vessels). The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

7.11.3.29 Overall, it is predicted that the sensitivity of the receptor is considered to be **low** and the magnitude is deemed to be **minor**. The effect will, therefore be of **minor adverse** significance, which is not significant in EIA terms.

Physical presence of decommissioned structures (including sub surface elements) and cables (left in situ) may present an increased risk of gear snagging for commercial fishing vessels with mobile gear.

Magnitude of impact

7.11.3.30 The physical presence of decommissioned structures (including sub surface elements of the structures such as J-tubes) and cables (left in situ) may present an increased risk of gear snagging for commercial fishing vessels with mobile gear. The wind farm structures considered within the modelling of this impact are jackets rather than floating foundations since for fishing vessels internal navigation is considered unlikely in comparison to the use of jacket foundations. Conservative consequences are associated with vessel foundering due to the potential for the vessel snagging on a sub surface hazard.

7.11.3.31 The impact is predicted to be of local spatial extent, short term duration, intermittent and reversible post decommissioning. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

7.11.3.32 The presence of measures adopted as part of Hornsea Three will ensure that the risk is maintained within tolerable limits under the FSA.

7.11.3.33 Given the likelihood of a fishing vessel experiencing this impact within the Hornsea Three array area and the varying levels of severity, the receptor is deemed to be of medium vulnerability, good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be medium.

Significance of effect

7.11.3.34 Overall, it is predicted that the sensitivity of the receptor is considered to be medium and the magnitude is deemed to be minor. The effect will, therefore, be of minor adverse significance, which is not significant in EIA terms.

Future monitoring

7.11.3.35 No future monitoring for the decommissioning phase is required.

7.12 Cumulative Effect Assessment Methodology

7.12.1 Screening of other projects and plans into the Cumulative Effect Assessment

7.12.1.1 The Cumulative Effect Assessment (CEA) takes into account the impact associated with Hornsea Three together with other projects and plans. The projects and plan selected as relevant to the CEA presented within this chapter are based upon the results of a screening exercise undertaken as part of the "CEA long list" of projects (see annex 4.5: Cumulative Effects Screening Matrix and Location of Schemes). Each project on the CEA long list has been considered on a case by case basis for scoping in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved.

7.12.1.2 In undertaking the CEA for Hornsea Three, it is important to bear in mind that other projects and plans under consideration will have differing potential for proceeding to an operational stage and hence a differing potential to ultimately contribute to a cumulative impact alongside Hornsea Three. For example, relevant projects and plans that are already under construction are likely to contribute to cumulative impact with Hornsea Three (providing effect or spatial pathways exist), whereas projects and plans not yet approved or not yet submitted are less certain to contribute to such an impact, as some may not achieve approval or may not ultimately be built due to other factors. For this reason, all relevant projects and plans considered cumulatively alongside Hornsea Three have been allocated into "Tiers", reflecting their current stage within the planning and development process. This allows the CEA to present several future development scenarios, each with a differing potential for being ultimately built out. Appropriate weight may therefore be given to each Tier in the decision making process when considering the potential cumulative impact associated with Hornsea Three (e.g. it may be considered that greater weight can be placed on the Tier 1 assessment relative to Tier 2). An explanation of each tier is included below:

- Tier 1: Hornsea Three considered alongside other projects/plans currently under construction and/or those consented but not yet implemented, and/or those submitted but not yet determined and/or those currently operational that were not operational when baseline data was collected, and/or those that are operational but have an on-going impact.
- Tier 2: All projects/plans considered in Tier 1, as well as those on relevant plans and programmes likely to come forward but have not yet submitted an application for consent (the PINS programme of projects is the most relevant source of information). Specifically, this Tier include all projects where the developer has submitted a Scoping Report; and
- Tier 3: All projects/plans considered in Tier 2, as well as those on relevant plans and programmes likely to come forward but have not yet submitted an application for consent (the PINS programme of projects is the most relevant source of information). Specifically, this Tier include all projects where the developer has advised PINS in writing that they intend to submit an application in the future but have not submitted a Scoping Report.

7.12.1.3 It is noted that Tier 1 includes projects, plans and activities that are operational, under construction, consented but not yet implemented and submitted but not yet determined. The certainty associated with other projects, plans and activities, in terms of the scale of the development and the likely impacts, increase as they progress from submitted applications to operational projects. In particular, offshore wind farms seek consent for a maximum design scenario and the as built offshore wind farm will be selected from the range of consented scenarios. In addition, the maximum design scenario quoted in the application (and the associated Environmental Statement) are often refined during the determination period of the application. For example, it is noted that the Applicant for Hornsea Project One has gained consent for an overall maximum number of turbines of 240, as opposed to 332 considered in the Environmental Statement. Similarly, Hornsea Project Two has gained consent for an overall maximum number of turbines of 300, as opposed to 360 considered in the Environmental Statement.

7.12.1.4 It should be noted that the CEA presented in this shipping and navigation chapter has been undertaken on the basis of information presented in the Environmental Statements for the other projects, plans and activities. The level of impact on shipping and navigation would likely be reduced from those presented here. In addition, Hornsea Three is currently considering how the different levels of certainty associated with projects in Tier 1 can be reflected in the CEA and an update, in terms to the approach to tiering, will be presented in the Environmental Statement.

7.12.1.5 The specific projects scoped into this CEA and the Tiers into which they have been allocated, are outlined in Table 7.20. The projects included as operational in this assessment have been commissioned since the baseline studies for this project were undertaken and as such were excluded from the baseline assessment.

Table 7.20: List of other projects and plans considered within the CEA.

Tier	Phase	Project/Plan	Distance from Hornsea Three array area (km)	Distance from Hornsea Three offshore cable corridor (km)	Details	Date of construction (if applicable)	Overlap of construction phase with Hornsea Three construction phase	Overlap of operation phase with Hornsea Three operation phase
1	*Offshore wind farms*							
	Awaiting consent	East Anglia Three (UK)	103	87	Up to 1,200 MW (up to 172 turbines of up to 7 to 12 MW capacity).	2020	Yes	Yes
	Consented	Borssele 1 and 2 (Netherlands)	216	181	684 MW to 760 MW (69 to 127, 6 MW to 10 MW turbines).	2017	No	Yes
	Consented	Borssele 3 and 4 (Netherlands)	217	175	664 MW to 740 MW (123 6 MW to 10 MW turbines).	2018	No	Yes
	Consented	Deutsche Bucht Offshore Wind Farm (Germany)	203	217	252 MW (30 8 MW turbines). Off the west coast of Germany.	2017	No	Yes
	Consented	Dogger Bank Creyke Beck A (UK)	76	91	Up to 1.2 GW (up to 200 turbines of up to 10 MW capacity).	2021	Yes	Yes
	Consented	Dogger Bank Creyke Beck B (UK)	99	115	Up to 1.2 GW (up to 200 turbines of up to 10 MW capacity).	2021	Yes	Yes
	Consented	Dogger Bank Teesside A (UK)	107	123	Up to 1.2 GW.	2023	Yes	Yes
	Consented	Dogger Bank Teesside B (UK)	95	108	Up to 1.2 GW.	2023	Yes	Yes
	Consented	East Anglia One (UK)	152	106	714 MW (102 7 MW turbines).	2019	No	Yes
	Consented	He dreiht I (Germany)	228	311	732 MW (Up to 80 turbines). Off the west coast of Germany.	Unavailable	No	Yes
	Consented	Hohe See (Germany)	239	254	497 MW (71 7 MW turbine).	2018	No	Yes
	Consented	Hornsea Project Two (UK)	7	18	Up to 300 6 to 15 MW turbines.	2019	No	Yes
	Consented	Hywind Scotland Pilot (UK)	438	455	30 MW (5 6 MW turbines).	2017	No	Yes
	Consented	Kincardine Offshore Wind Farm (UK)	422	438	48 MW (8 6 MW turbines).	2018	No	Yes
	Consented	Noerdlicher Grund (Germany)	295	314	320 MW to 384 MW (64 5 MW to 6 MW turbines).	Unavailable	Unavailable	Unavailable
	Consented	Norther (Belgium)	236	163	Up to 370 MW (44 8 MW turbine). Belgium. Vlaanderen region.	2017	No	Yes
	Consented	Rental Area A (Belgium)	231	155	309 MW (42 7.35 MW turbines).	2017	No	Yes
	Consented	Seastar (Belgium)	225	149	252 MW (42 6 MW turbines).	2017	No	Yes
	Consented	Trianel Windpark Bokrum (Bokrum West II) Phase 2 (Germany)	242	255	203 MW (32 6.15 MW turbines).	2017	No	Yes

Tier	Phase	Project/Plan	Distance from Hornsea Three array area (km)	Distance from Hornsea Three offshore cable corridor (km)	Details	Date of construction (if applicable)	Overlap of construction phase with Hornsea Three construction phase	Overlap of operation phase with Hornsea Three operation phase
1	Consented	Triton Knoll (UK)	100	44	750 to 900 MW (113 to 288 8 MW turbines). Greater Wash, 20 miles off the coast of Lincolnshire and 28 miles from the coast of North Norfolk.	2017	No	Yes
	Under construction	Buitengaats (Netherlands)	214	228	300 MW (75 4 MW turbines). Part of a 600 MW project called Gemini Offshore Wind Farm with the 300 MW ZeeEnergie OWF.	N/A	No	Yes
	Under construction	Dudgeon (UK)	87	11	Twenty miles off the coast of Cromer, North Norfolk. 560 MW. (67 turbines 402 MW)	N/A	No	Yes
	Under construction	Galloper (UK)	195	79	Up to 336 MW (56 6 MW turbines).	N/A	No	Yes
	Under construction	Global Tech I (Germany)	245	258	400 MW (80 5 MW turbine). Off the west coast of Germany.	N/A	No	Yes
	Under construction	Gode Wind I (Germany)	275	289	332 MW (55 6 MW turbines). Off the west coast of Germany.	N/A	No	Yes
	Under construction	Gode Wind II (Germany)	276	290	252 MW (42 6 MW turbines). Off the west coast of Germany.	N/A	No	Yes
	Under construction	Hornsea Project One (UK)	7	7	Up to 240 5 to 8 MW turbines.	2017	No	Yes
	Under construction	INNOGY Nordsee I (Germany)	262	276	Off the west coast of Germany. 54 turbines, capacity 332 MW.	N/A	No	Yes
	Under construction	MEG Offshore I (now Merkur Offshore Wind Farm) (Germany)	247	260	Off the west coast of Germany. 400 MW.	2017	No	Yes
	Under construction	Nordergruende (Germany)	353	368	110.7 MW (18 6.15 MW turbines).	N/A	No	Yes
	Under construction	Race Bank (UK)	114	28	Up to 580 MW.	N/A	No	Yes
	Under construction	Rampion Wind Farm (UK)	388	266	400 MW (116 3.45 MW turbines).	N/A	No	Yes
	Under construction	Sandbank 24 (Germany)	298	317	288 MW (72 4 MW turbines).	N/A	No	Yes
	Under construction	Veja Mate (Germany)	208	221	200 MW (40 5 MW turbines).	N/A	No	Yes
	Under construction	ZeeEnergie (Netherlands)	203	216	300 MW (75 4 MW turbines). Part of a 600 MW project called Gemini Offshore Wind Farm with the 300 MW Buitengaats OWF.	N/A	No	Yes
	Operational	Alpha Ventus (Formerly Borkum West I) (Germany)	252	266	60 MW. Off the west coast of Germany.	N/A	No	Yes

Tier	Phase	Project/Plan	Distance from Hornsea Three array area (km)	Distance from Hornsea Three offshore cable corridor (km)	Details	Date of construction (if applicable)	Overlap of construction phase with Hornsea Three construction phase	Overlap of operation phase with Hornsea Three operation phase
1	Operational	Amrumbank West (Germany)	328	342	288 MW (80 to 3.6 MW turbines). Off the west coast of Germany.	N/A	No	Yes
	Operational	BARD Offshore 1 (Germany)	215	229	400 MW (80 5 MW turbines). Offshore Wind Farm (OWF) Off the west coast of Germany. Located some 90 km northwest of the island of Borkum.	N/A	No	Yes
	Operational	Belwind 1 (Belgium)	220	141	165 MW (55 33 MW turbines). Belgium. Zone 3 & Bligh Bank. Developer Belwind NV (various owners). Fully Commissioned.	N/A	No	Yes
	Operational	Belwind Alstom Haliade Demonstration (Belgium)	222	178	6 MW (1 6 MW turbine).	N/A	No	Yes
	Operational	Borkum Riffgrund 1 (Germany)	245	259	312 MW (77 4 MW turbines).	N/A	No	Yes
	Operational	Butendiek (Germany)	346	364	288 MW (80 3.6 MW turbines).	N/A	No	Yes
	Operational	DanTysk (Germany)	314	333	288 MW (80 3.6 MW turbines).	N/A	No	Yes
	Operational	Emden (Germany)	295	311	4.5 MW (1 4.5 MW turbine).	N/A	No	No
	Operational	Eneco Luchterduinen (Netherlands)	170	185	129 MW (43 3 MW turbines).	N/A	No	Yes
	Operational	Greater Gabbard (UK)	198	119	504 MW (140 3.6 MW turbines).	N/A	No	Yes
	Operational	Gunfleet Sands Demo (UK)	245	137	12 MW (2 6 MW turbines).	N/A	No	Yes
	Operational	Gunfleet Sands I (UK)	240	133	108 MW (30 3.6 MW turbines).	N/A	No	Yes
	Operational	Gunfleet Sands II (UK)	239	134	64.8 MW (18 3.6 MW turbines).	N/A	No	Yes
	Operational	Horns Rev (Denmark)	368	388	160 MW (80 2 MW turbines).	N/A	No	No
	Operational	Horns Rev 2 (Denmark)	358	379	209.3 MW (91 2.3 MW turbines).	N/A	No	Yes
	Operational	Humber Gateway (UK)	128	86	Up to 219 MW (73 3 MW turbines).	N/A	No	Yes
	Operational	Irene Vorrink I (Netherlands)	223	240	11.4 MW (19 0.6 MW turbines). Part of a larger 16.8 MW (28 0.6 MW turbines) project.	N/A	No	No
	Operational	Irene Vorrink II (Netherlands)	223	240	5.4 MW (9 0.6 MW turbines). Part of a larger 16.8 MW (28 0.6 MW turbines) project.	N/A	No	No
	Operational	Kentish Flats (UK)	272	164	90 MW (30 3 MW turbines). Fully commissioned December 2005.	N/A	No	Yes
	Operational	Kentish Flats Extension (UK)	273	165	49.5 MW (15 3.3 MW turbines).	N/A	No	Yes

Tier	Phase	Project/Plan	Distance from Hornsea Three array area (km)	Distance from Hornsea Three offshore cable corridor (km)	Details	Date of construction (if applicable)	Overlap of construction phase with Hornsea Three construction phase	Overlap of operation phase with Hornsea Three operation phase
1	Operational	Lely (Netherlands)	184	201	2 MW. Operational.	N/A	N/A	Unavailable
	Operational	Lincs / LID6 1 /(UK)	139	41	270 MW (75×3.6 MW).	N/A	No	Yes
	Operational	London Array (UK)	230	92	630 MW (175 3.6 MW turbines).	N/A	No	Yes
	Operational	Lynn and Inner Dowsing Wind Farms (UK)	147	43	194 MW (54 3.6 MW monopile turbines). Located 5 km off the coast of Skegness.	N/A	No	Yes
	Operational	Meerwind Süd/Ost (Germany)	326	339	288 MW (80 3.6 MW turbines). Off the west coast of Germany.	N/A	No	Yes
	Operational	Mermaid	217	135	288 MW (48 6 MW turbines).	N/A	No	Yes
	Operational	Noerdlicher Grund Teil Sandbank (Germany)	297	316	288 MW (72 4 MW turbines).	N/A	No	Yes
	Operational	Nordsee Ost (Germany)	326	340	295.2 MW (48 6.15 MW turbines). Off the west coast of Germany 35 miles to the northeast of the island of Heligoland.	N/A	No	Yes
	Operational	Northwind (Belgium)	229	153	216 MW (72 3 MW turbines). Belgium.	N/A	No	Yes
	Operational	Offshore Windpark Egmond aan Zee (Netherlands)	157	173	108MW (36 3 MW turbines).	N/A	No	Yes
	Operational	Prinses Amaliapark (Netherlands)	153	168	120 MW (60 2 MW turbines).	N/A	No	Yes
	Operational	Riffgat (Germany)	241	356	108 MW (30 to 3.6 MW turbines).	N/A	No	Yes
	Operational	Robin Rigg East (UK)	391	369	90 MW (30 3 MW turbines).	N/A	No	Yes
	Operational	Robin Rigg West (UK)	392	369	90 MW (30 3 MW turbines).	N/A	No	Yes
	Operational	Scroby Sands (UK)	132	48	60 MW (30 2 MW turbines).	N/A	No	Yes
	Operational	Sheringham Shoal (UK)	109	7	316.8 MW (88 3.6 MW turbines). Sheringham, Greater Wash. 17 to 23 km off North Norfolk.	N/A	No	Yes
	Operational	Teesside (UK)	224	229	1.5 km north east Teesmouth. 62.1 MW (27 2.3 MW turbines).	N/A	No	Yes
	Operational	Thanet (UK)	260	168	300 MW (100 3 MW monopile turbines). UK, offshore wind, Round 2. 12 km off Foreness Point, Kent.	N/A	No	Yes
	Operational	Thornton Bank Phase I (Zone 1 C-Power) (Belgium)	237	158	30 MW (6 5 MW turbines). Belgium, Vlaanderen region.	N/A	No	No

Tier	Phase	Project/Plan	Distance from Hornsea Three array area (km)	Distance from Hornsea Three offshore cable corridor (km)	Details	Date of construction (if applicable)	Overlap of construction phase with Hornsea Three construction phase	Overlap of operation phase with Hornsea Three operation phase
1	Operational	Thornton Bank Phase II (Belgium)	237	158	184.5 MW (30 6.15 MW turbines). Belgium, Vlaanderen region.	N/A	No	Yes
	Operational	Thornton Bank Phase III (Zone 1 C-Power 2) (Belgium)	235	160	110 MW (18 6.15 MW turbines). Belgium, Vlaanderen region.	N/A	No	Yes
	Operational	Trianel Windpark Bokrum (Borkum West II) Phase 1(Germany)	241	255	200 MW (40 5 MW turbines).	N/A	No	Yes
	Operational	Trianel Windpark Borkum Phase 1 (Germany)	242	255	200 MW (40 5 MW turbines).	N/A	No	Yes
	Operational	Westermeerdijk buitendijks (Netherlands)	215	232	144 MW (48 3 MW turbines).	N/A	No	Yes
	Operational	Westermost Rough (UK)	132	106	210 MW (35 6 MW turbines).	N/A	No	Yes
	Decommissioning	Blyth (UK)	270	284	4 MW (2 2 MW turbines). One mile off the Northumberland coast, UK.	2017 decommissioning	No	No
	Oil and gas infrastructure							
	Producing	Schooner Gas Field	2	19	Gas Field – Producing	N/A	N/A	Yes
2	*Offshore wind farms*							
	Pre-planning application	Norfolk Vanguard	73	51	Up to 1800 MW.	2020	No	Yes
3	*Offshore wind farms*							
	Pre-planning application	East Anglia Two	158	94	Up to 800 MW.	2022	Yes	Yes
	Pre-planning application	Methil Demonstration Project - 2B Energy	411	426	Operated by Forthwind Limited, round/type - Demonstration/Agreement for Lease.	Unavailable	No	Yes
	Pre-planning application	Norfolk Boreas	53	64	Up to 1800 MW.	Unavailable	Unavailable	Unavailable
	Pre-planning application	Bokrum-Riffgrund West II (Germany)	224	238	258 MW (43 6 MW turbines).	2019	No	Yes
	Pre-planning application	East Anglia One North (UK)	141	90	600 MW – 800 MW	Unavailable	Unavailable	Unavailable
	Pre-planning application	Northwester 2 (Belgium)	222	175	210 to 296 MW (22 to 70 3 to 10 MW turbines).	2018	No	Yes

7.12.2 Maximum design scenario

7.12.2.1 The maximum design scenarios identified in Table 7.21 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. The cumulative impacts presented and assessed in this section have been selected from the details provided in the Hornsea Three project description (volume 1, chapter 3: Project Description), as well as the information available on other projects and plans, in order to inform a "maximum design scenario". Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the project Design Envelope (e.g. different turbine layout), to that assessed here be taken forward in the final design scheme.

Table 7.21: Maximum design scenario considered for the assessment of potential cumulative impacts on shipping and navigation.

Potential impact	Maximum design scenario	Justification
Construction phase		
Construction activities within the Hornsea Three array area and other Tier 1 , 2 and 3 wind farms developments may displace vessels leading to increased journey times or distances for all commercial vessels.	Tier 1 • All offshore wind farms in tier 1 in Table 7.20 above. Tier 2 • All offshore wind farms in tier 2 in Table 7.20 above. Tier 3 • All offshore wind farms in tier 3 in Table 7.20 above.	Maximum buoyed construction area and simultaneous activity with Hornsea Three and other Tier 1, 2 and 3 projects resulting in greatest extent of activity and therefore greatest potential for displacement of vessels.
Construction activities within the Hornsea Three array area and other Tier 1and Tier 2 wind farm developments may displace vessels leading to increased journey times or distances for all vessels (including commercial ferries) during periods of adverse weather.	Tier 1 • All offshore wind farms in tier 1 in Table 7.20 above. Tier 2 • All offshore wind farms in tier 2 in Table 7.20 above. Tier 3 • No projects identified.	Maximum buoyed construction area and simultaneous activity with Hornsea Three and other Tier 1 and 2 projects resulting in greatest extent of activity and therefore greatest potential for displacement of vessels during adverse weather. Tier 3 projects do not significantly impact vessel routeing given their size or phase of development.
Presence of pre commissioned infrastructure within the Hornsea Three array area and other Tier 1 projects may increase vessel to structure allision risk external to the array for all vessels, including NUC vessels.	Tier 1 • Hornsea Project One and Hornsea Project Two; and • Schooner gas platform. Tier 2 • No projects identified. Tier 3 • No projects identified.	Maximum construction area at Hornsea Three cumulatively with Hornsea Project One, Hornsea Project Two and Schooner Gas Platform increasing the vessel to structure allision risk locally within the area. Tier 2 and 3 projects do not increase the risk of allision given the phase of the installations or the direction of routeing through the Tier 3 projects (which does not intersect with Hornsea Three).
Construction activities within the Hornsea Three array area and other Tier 1 wind farm developments may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk.	Tier 1 • Hornsea Project One and Hornsea Project Two. Tier 2 • No projects identified. Tier 3 • No projects identified.	Maximum development of infrastructure and simultaneous activity with Hornsea Three and other Tier 1 resulting in greatest extent of activity and greatest potential for displacement of vessels, and therefore resulting in the maximum increase in encounters and vessel to vessel collision risk. Tier 2 and 3 projects do not significantly impact vessel routeing given the phase and the potential for creation of hot spots
Operational and maintenance phase		
Presence of infrastructure within the Hornsea Three array area and other Tier 1, Tier 2 and Tier 3 wind farm developments may displace vessels leading to increased journey times or distances for all commercial vessels.	Tier 1 • All offshore wind farms in tier 1 in Table 7.20 above. Tier 2 • All offshore wind farms in tier 2 in Table 7.20 above. Tier 3 • All offshore wind farms in tier 3 in Table 7.20 above.	Maximum development of infrastructure and simultaneous activity with Hornsea Three and other Tier 1 , 2, and 3 projects resulting in greatest extent of activity and therefore greatest potential for displacement of vessels.
Presence of infrastructure within the Hornsea Three array area may displace vessels leading to increased journey times or distances for commercial vessels during periods of adverse weather.	Tier 1 • All offshore wind farms in tier 1 in Table 7.20 above. Tier 2 • All offshore wind farms in tier 2 in Table 7.20 above. Tier 3 • All offshore wind farms in tier 3 in Table 7.20 above.	Maximum development of infrastructure and simultaneous activity with Hornsea Three and other Tier 1, 2 and 3 projects resulting in greatest extent of activity and therefore greatest potential for displacement of vessels during adverse weather.

Potential impact	Maximum design scenario	Justification
Presence of infrastructure within the Hornsea Three array area and other Tier 1 and Tier 2 projects may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk.	Tier 1 • Hornsea Project One and Hornsea Project Two; and • Schooner gas platform. Tier 2 • No projects identified. Tier 3 • No projects identified.	Maximum development of infrastructure and simultaneous activity with Hornsea Three and other Tier 1 projects resulting in greatest extent of activity and greatest potential for displacement of vessels, and therefore resulting in the maximum increase in encounters and vessel to vessel collision risk. Tier 2 and 3 projects do not significantly impact vessel routeing.
Presence of infrastructure within the Hornsea Three array area and other Tier 1 projects may increase vessel to structure allision risk external to the array for all vessels, including NUC vessels.	Tier 1 • Hornsea Project One and Hornsea Project Two; and • Schooner gas platform. Tier 2 • No projects identified. Tier 3 • No projects identified.	Maximum development of infrastructure at Hornsea Three cumulatively with Hornsea Project One, Hornsea Project Two and Schooner Gas Platform increasing the vessel to structure allision risk locally within the area. Tier 2 and 3 projects do not increase the risk of allision given the phase of the installations or the direction of routeing through the Tier 3 projects (which does not intersect with Hornsea Three).
Decommissioning phase		
Decommissioning activities within the Hornsea Three array area and other Tier 1, 2 and 3 wind farm developments may displace vessels leading to increased journey times or distances for all commercial vessels.	Tier 1 • All offshore wind farms in tier 1 in Table 7.20 above. Tier 2 • All offshore wind farms in tier 2 in Table 7.20 above. Tier 3 • All offshore wind farms in tier 3 in Table 7.20 above.	Maximum buoyed decommissioning area and simultaneous activity with Hornsea Three and other Tier 1, 2 and 3 projects resulting in greatest extent of activity and therefore greatest potential for displacement of vessels.
Decommissioning activities within the Hornsea Three array area may displace vessels leading to increased journey times or distances during periods of adverse weather.	Tier 1 • All offshore wind farms in tier 1 in Table 7.20 above. Tier 2 • All offshore wind farms in tier 2 in Table 7.20 above. Tier 3 • All offshore wind farms in tier 3 in Table 7.20 above.	Maximum buoyed decommissioning area and simultaneous activity with Hornsea Three and other Tier 1, 2 and 3 projects resulting in greatest extent of activity and therefore greatest potential for displacement of vessels during adverse weather.
Decommissioning activities within the Hornsea Three array area and other Tier 1 wind farm developments may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk.	Tier 1 • Hornsea Project One and Hornsea Project Two. Tier 2 • No projects identified. Tier 3 • No projects identified.	Maximum decommissioning of infrastructure and simultaneous activity with Hornsea Three and other Tier 1 projects resulting in greatest extent of activity and greatest potential for displacement of vessels, and therefore resulting in the maximum increase in encounters and vessel to vessel collision risk. Tier 2 and Tier 3 projects do not significantly impact vessel routeing given their size or phase of development.
Presence of decommissioned infrastructure within the Hornsea Three array area and other Tier 1 projects may increase vessel to structure allision risk external to the array for all vessels, including NUC vessels.	Tier 1 • Hornsea Project One and Hornsea Project Two; and • Schooner gas platform. Tier 2 • No projects identified. Tier 3 • No projects identified.	Maximum decommissioning area at Hornsea Three cumulatively with Hornsea Project One, Hornsea Project Two and Schooner Gas Platform increasing the vessel to structure allision risk locally within the area. Tier 2 and 3 projects do not increase the risk of allision given the phase of the installations or the direction of routeing through the Tier 3 projects (which does not intersect with Hornsea Three).

7.13 Cumulative Effect Assessment

7.13.1.1 A description of the significance of cumulative effects upon shipping and navigation receptors arising from each identified impact is given below.

7.13.2 Construction phase

Construction activities within the Hornsea Three array area and other Tier 1and Tier 2 wind farm developments may displace vessels leading to increased journey times or distances for all vessels.

Magnitude of impact

7.13.2.1 Construction activities within the Hornsea Three array area and other Tier 1 wind farm developments may displace vessels leading to increased journey times or distances for all vessels.

7.13.2.2 The construction of Tier 1 offshore wind farms in the southern North Sea area including within international waters may result in further displacement of vessel routes passing through Hornsea Three. Over the southern North Sea area additional displacement will be small (see Table 7.15) and the actual number of vessels using these routes is not likely to change.

7.13.2.3 The largest increases in route length will be seen within proximity to Hornsea Project One and Hornsea Project Two however within the Hornsea Project Two Environmental Statement the cumulative impact of Hornsea Project One and Hornsea Project Two was considered to be a long term and continuous impact but of a small increase in distance/time combined with a low frequency.

7.13.2.4 Although further deviations are now required due to the presence of the Hornsea Three array area; assessment and consultation response do not indicate that this will be significantly greater than assessed in the consented Hornsea Project One or Hornsea Project Two. Therefore Hornsea Three, Hornsea Project One and Hornsea Project Two in combination are considered to be not significant. The cumulative impact is therefore considered broadly acceptable under the FSA given the following reasons:

- The majority of routes impacted by the cumulative developments run east to west and therefore are already deviated to the maximum extent by Hornsea Project One and Hornsea Project Two;
- Impacts were considered minor adverse within the Hornsea Project Two Environmental Statement;
- There are fewer dense and significant routes passing through Hornsea Three (than Hornsea Project One and Hornsea Project Two); and
- The proposed navigational corridor provides a useable alternative to deviating around the area.

7.13.2.5 See Figure 7.18 for post development cumulative impact routeing as assessed in section 21 of the NRA.

Tier 1

7.13.2.6 The impact is predicted to be of regional spatial extent, short term duration, continuous and not reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **moderate**.

Sensitivity of receptor

7.13.2.7 Vessels are generally important to the regional economy, but given the available sea room, the early point at which the vessel can passage plan to avoid the construction area, and the creation of a navigational corridor (even during the construction phase) between Hornsea Three, Hornsea Project One and Hornsea Project Two, the receptor is deemed to be of low vulnerability, very good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

7.13.2.8 Overall, it is predicted that the sensitivity of the receptor is considered to be **low** and the magnitude is deemed to be **moderate**. The effect will, therefore be of **minor adverse** significance, which is not significant in EIA terms with measures adopted as part of Hornsea Three in place.

Tier 2

7.13.2.9 Tier 2 wind farm developments will continue to increase areas where vessels will have to passage plan around; however as developments do not impact the same routes or are smaller and/or not in close proximity to Hornsea Three (based on the list of identified Tier 2 projects) there are not expected to be any impacts on routeing above that identified for Tier 1 projects given the available sea room to passage plan with minimal deviations.

Magnitude of impact

7.13.2.10 Construction activities within the Hornsea Three array area and other Tier 1 and Tier 2 wind farm developments may displace all vessels leading to increased journey times or distances.

7.13.2.11 The impact is predicted to be of regional spatial extent, short term duration, continuous and not reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **moderate**.

Sensitivity of receptor

7.13.2.12 Vessels are generally important to the regional economy, but given the available sea room, the early point at which the vessel can passage plan to avoid the construction area but also the creation of a navigational corridor (even during the construction phase) between Hornsea Three, Hornsea Project One and Hornsea Project Two, the receptor is deemed to be of low vulnerability, very good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

7.13.2.13 Overall, it is predicted that the sensitivity of the receptor is considered to be **low** and the magnitude is deemed to be **moderate**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms with measures adopted as part of Hornsea Three in place.

Tier 3

7.13.2.14 Tier 3 wind farm developments have the potential to increase areas where vessels will have to passage plan around; however given the limited information on these projects it has not been possible to make an effective assessment. It is noted that the SNSOWF study did consider the projects noted as Tier 3 within the assessment and they were found to be broadly acceptable to regulators with the understanding that an NRA would be required when they are progressed.

Hornsea Three offshore cable corridor and offshore HVAC booster stations

7.13.2.15 There were no perceptible cumulative deviations identified in association with the Hornsea Three offshore cable corridor or offshore HVAC booster stations.

Construction activities within the Hornsea Three array area and other Tier 1 and Tier 2 wind farm developments may displace vessels leading to increased journey times or distances for all vessels during periods of adverse weather.

Hornsea Three array area

7.13.2.16 As with impacts related to the development of Hornsea Three in isolation, adverse weather includes wind, wave and tidal conditions as well as reduced visibility due to fog that can hinder a vessel's normal route and/or speed of navigation.

7.13.2.17 The construction of Tier 1 offshore wind farms in the southern North Sea area including within international waters may result in further displacement of vessels from adverse weather routeing options that pass through Hornsea Three. Over the southern North Sea area additional displacement will be small (see Figure 7.18) and given the low frequency of adverse weather in the area requiring deviations the impact is expected to be low.

7.13.2.18 The largest impact on adverse weather routeing will be seen within proximity to Hornsea Project One and Hornsea Project Two. It is noted that Hornsea Project One and Hornsea Project Two are consented and therefore cumulative adverse weather impacts would be the same given the routes that intersect Hornsea Three, Hornsea Project One or Hornsea Project Two. Other offshore wind farm developments have no impact given the distance from the former Hornsea Zone, the stage of development and the likely direction of the adverse routes. Given the available sea room, distance from shore (giving numerous routeing options) and the preference identified for coastal passenger ferry routeing, the cumulative impact is considered to be broadly acceptable under the FSA. Mitigation measures adopted for Hornsea Three include marking, charting and promulgation of information to ensure that vessels are able to effectively passage plan.

Hornsea Three offshore cable corridor and offshore HVAC booster stations

7.13.2.19 There were no perceptible cumulative adverse weather impacts identified in association with the Hornsea Three offshore cable corridor or offshore HVAC booster stations.

Tier 1

Magnitude of impact

7.13.2.20 Construction activities within the Hornsea Three array area and other Tier 1 wind farm developments may displace vessels leading to increased journey times or distances for all vessels during periods of adverse weather.

7.13.2.21 The impact is predicted to be of regional spatial extent, short term duration, intermittent and not reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **moderate**.

Sensitivity of receptor

7.13.2.22 Vessels are generally important to the regional economy, but given the very low frequency of adverse weather routeing required, the open sea area available in which vessels can deviate and the low effect of adverse weather on commercial vessels, the receptor is deemed to be of low vulnerability, very good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

7.13.2.23 Overall, it is predicted that the sensitivity of the receptor is considered to be **moderate** and the magnitude is deemed to be **low**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

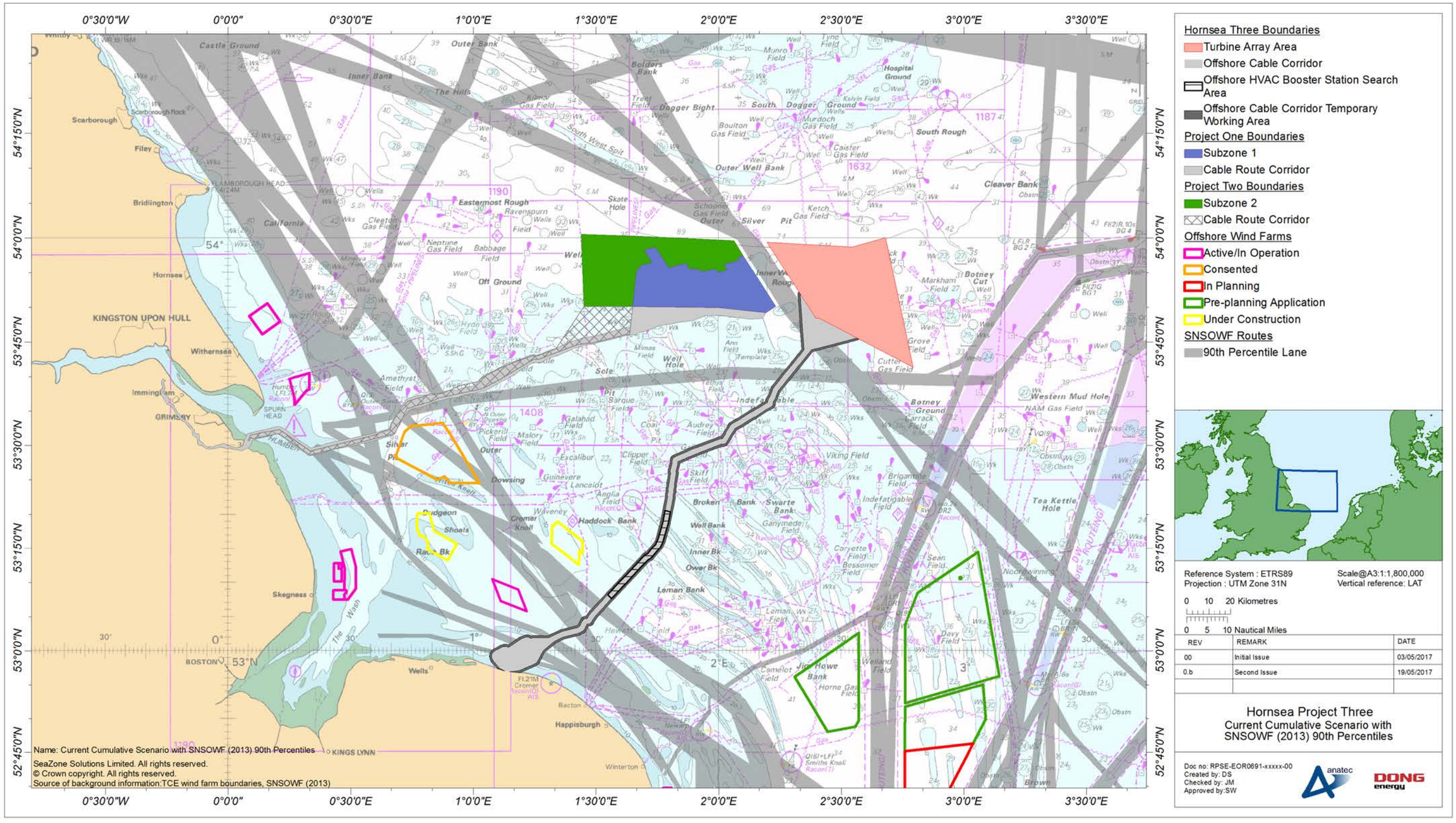

Figure 7.18: Current cumulative scenario with SNSOWF (2013) 90th percentiles.

Tier 2

7.13.2.24 Tier 2 wind farm developments will continue to increase areas where vessels will have to navigate around in adverse weather; however, as developments do not impact the same routes or are smaller and/or not in close proximity to Hornsea Three (based on the list of identified Tier 2 projects) there are not expected to be any impacts on routeing above that identified for Tier 1 projects given the available sea room to passage plan with minimal deviations.

Magnitude of impact

7.13.2.25 Construction activities within the Hornsea Three array area and other Tier 1 and Tier 2 wind farm developments may displace all vessels leading to increased journey times or distances during periods of adverse weather.

7.13.2.26 The impact is predicted to be of regional spatial extent, short term duration, intermittent and not reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **moderate**.

Sensitivity of receptor

7.13.2.27 Vessels are generally important to the regional economy, but given the very low frequency of adverse weather routeing required, the open sea area available in which vessels can deviate and the low effect of adverse weather on commercial vessels, the receptor is deemed to be of low vulnerability, very good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

7.13.2.28 Overall, it is predicted that the sensitivity of the receptor is considered to be **moderate** and the magnitude is deemed to be **low**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Tier 3

7.13.2.29 Tier 3 wind farm developments have the potential to increase areas where vessels will have to passage plan around; however given the limited information on these projects and adverse weather routeing information in the vicinity of these projects it has not been possible to make an effective assessment.

Construction activities within the Hornsea Three array area and other Tier 1 wind farm developments may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk.

Magnitude of impact

7.13.2.30 Construction activities within the Hornsea Three array area and other Tier 1 wind farm developments may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk.

7.13.2.31 The presence of buoyed construction areas, safety zones and the increased level of vessel activity required for Hornsea Three construction may lead to an increase in vessel to vessel collision risk due to displacement of vessels into previously lower density areas and increased encounters with construction vessels. The frequency of collision is likely to increase further in reduced visibility when identification of wind farm related construction vessels exiting/entering the wind farm construction area may become more difficult.

7.13.2.32 Cumulatively during the construction of Hornsea Three (and assuming Hornsea Project One and Hornsea Project Two are constructed), the proposed navigational corridor should be assessed to ensure risk or inconvenience to third parties caused by buoyed construction areas is mitigated (as per further mitigation). If there is significant overlap between the Hornsea Three construction area and the proposed navigational corridor there may need to be temporary measures put in place in consultation with the MCA and TH, to ensure that any works on the western edge of the Hornsea Three array area do not adversely impact the safety of third party vessels within the proposed navigational corridor by increasing the risk of encounters. Stakeholders, during the hazard workshop, noted that consideration should be given to the placement of cardinal or special marks around construction areas to ensure that they do not adversely impact vessels using the proposed navigational corridor.

7.13.2.33 However, in the majority, it is anticipated that the proposed navigational corridor will be available for use by transiting vessels during construction and consideration (in consultation with the MCA and TH) will be given to the size and location of the buoyed construction (or decommissioning) area around the array to minimise impacts. It is also likely that marine coordination will be facilitated from a central location for all the applicants' projects thus ensuring effective lines of communication and information transfer during the construction phase.

7.13.2.34 The Schooner gas platform is located at the northern end of the proposed navigational corridor, and may create increased encounters by requiring vessels to navigate with consideration for it when entering or exiting the corridor; however given that there is still sufficient sea room to undertake navigational manoeuvres during Hornsea Three, Hornsea Project One and Hornsea Project Two construction activities, measures adopted as part of Hornsea Three in place, and vessel numbers using the navigational corridor are likely to be low (Anatec, 2016), the impact is intermittent.

Tier 1

7.13.2.35 The impact is predicted to be of regional spatial extent, short term duration, intermittent and not reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor.

Sensitivity of receptor

7.13.2.36 The commercial vessels, commercial fishing vessels (in transit), recreational vessels and wind farm operator vessels are most likely to experience the impact (and therefore be potentially sensitive to a collision) when in proximity to Hornsea Three. It is noted however that early course alterations could lead to additional vessel interactions at any point along the vessels' route.

7.13.2.37 Measures adopted as part of Hornsea Three will ensure that vessels are able to passage plan to mitigate the effects of deviations as well as international guidance COLREGs ensuring that the vessel take correct action to avoid encounters and collisions.

7.13.2.38 The consequence of a collision will vary depending on the vessels involved and the potential energy of a collision.

7.13.2.39 Vessels are generally important to the regional economy, but given the small number of vessels, on average less than five per day (Anatec, 2016), likely to use the navigational corridor there are not expected to be the creation of any hot spots or increased encounters. The receptor is deemed to be of low vulnerability, good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be low.

Significance of effect

7.13.2.40 Overall, it is predicted that the sensitivity of the receptor is considered to be low and the magnitude is deemed to be minor. The effect will, therefore, be of minor adverse significance, which is not significant in EIA terms.

Further mitigation

7.13.2.41 The placement of cardinal buoys during the construction of the western extent of the Hornsea Three array area will give consideration to the long term usability of the proposed navigational corridor (i.e. buoy placements will not adversely impact the usability of the proposed navigational corridor for significant periods).

Presence of pre-commissioned infrastructure within the Hornsea Three array area and other Tier 1 projects may increase vessel to structure allision risk external to the array for all vessels, including NUC vessels.

Magnitude of impact

7.13.2.42 Presence of pre commissioned infrastructure within the Hornsea Three array area cumulatively with Hornsea Project One, Hornsea Project Two and the Schooner Platform may cause increased allision risk for passing vessels; however during the construction phase measures adopted as part of Hornsea Three will be in place to ensure that the risk is maintained within ALARP parameters including Marine Coordination. The MHCC will fully manage vessels movements associated with Hornsea Three (although command of each vessel remains with each individual Master) and will liaise directly with the developers and operators of other Tier 1 projects.

Cumulative construction lighting and marking

7.13.2.43 All Tier 1 projects must be considered in order to minimise any potential effects and avoid confusion from a proliferation of aids to navigation in a high density development of turbines and construction activities.

7.13.2.44 Full consideration should be given to the use of lighting sequences such as different light characters and varied light ranges. Lighting and marking will be discussed with TH in conjunction with the relevant guidance (IALA, 2013). The Applicant may be required to liaise directly with the developers of Hornsea Project One and Hornsea Project Two.

Tier 1

7.13.2.45 The magnitude of the impact will be dependent on both the number of vessels which transit in proximity to Hornsea Three and the number of structures into which the vessels may allide. The presence of Hornsea Project One, Hornsea Project Two and the Schooner platform will increase the geographic extent of the impact and the number of structures; as well as the numbers of routes impacted as per section 21 of the NRA.

7.13.2.46 Buoyed construction areas, safety zones and other measures adopted as part of Hornsea Three will assist vessels in avoiding potential allision with the partially constructed infrastructure, with construction phase overlap limited in duration.

7.13.2.47 The impact is predicted to be of local spatial extent, short term duration, continuous and not reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor.

Sensitivity of receptor

7.13.2.48 The commercial vessels, commercial fishing vessels and recreational vessels will experience the impact and therefore be sensitive to the impact when in proximity to Hornsea Three.

7.13.2.49 The developer will ensure that information is promulgated, as per the measures adopted as part of Hornsea Three, which will help to ensure that vessels do not inadvertently enter any construction area, and temporary aids to navigation on all pre-commissioned structures will alert mariners to their location. Standard international regulations on navigation and on-board bridge equipment provide vessels with the necessary requirements to reduce the allision risk.

7.13.2.50 How much damage a vessel actually sustains in the event collision with a structure does occur, will depend on the energy of impact, the size and structural integrity of the vessel, and the sea state at the time.

7.13.2.51 Vessels are only considered sensitive to this impact when they are in proximity to any infrastructure; however, it is a new risk of allision in a previously open sea area.

7.13.2.52 The receptor is deemed to be of low vulnerability, good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

7.13.2.53 Overall, it is predicted that the sensitivity of the receptor is considered to be **minor** and the magnitude is deemed to be **medium**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Future monitoring

7.13.2.54 No future monitoring has been identified for cumulative impacts.

7.13.3 Operational and maintenance phase

Presence of infrastructure within the Hornsea Three array area and other Tier 1, Tier 2 and Tier 3 wind farm developments may displace vessels leading to increased journey times or distances for commercial vessels.

Magnitude of impact

7.13.3.1 Presence of infrastructure within the Hornsea Three array area and other Tier 1 wind farm developments may displace vessels leading to increased journey times or distances for commercial vessels.

7.13.3.2 Following work undertaken for the Zone Appraisal and Planning (ZAP) including the routeing reports undertaken as part of SNSOWF (Anatec, 2013); a navigation corridor was designed to mitigate impacts on cumulative deviations for the former Hornsea Zone. As with the construction phase, further cumulative deviations will be required, however, these are not considered to be greater than those considered within the SNSOWF report.

Tier 1

7.13.3.3 The impact is predicted to be of regional spatial extent, medium term duration, continuous and not reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **moderate**.

Sensitivity of receptor

7.13.3.4 Vessels are generally important to the regional economy, but given the available sea room, the early point at which the vessel can passage plan to avoid the area of infrastructure and the creation of a navigational corridor between Hornsea Three, Hornsea Project One and Hornsea Project Two the receptor is deemed to be of low vulnerability, very good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

7.13.3.5 Overall, it is predicted that the sensitivity of the receptor is considered to be **moderate** and the magnitude is deemed to be **low**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Tier 2

7.13.3.6 Tier 2 wind farm developments will continue to increase the spatial extent of areas that vessels will have to passage plan around; however, as developments do not impact the same routes or are smaller and/or not in close proximity to Hornsea Three (based on the list of identified Tier 2 projects) there are not expected to be any impacts on routeing above that identified for Tier 1 wind farm developments given the available sea room to passage plan with minimal deviations.

Magnitude of impact

7.13.3.7 Presence of infrastructure within the Hornsea Three array area and other Tier 1 and Tier 2 wind farm developments may displace vessels leading to increased journey times or distances.

7.13.3.8 The impact is predicted to be of regional spatial extent, medium term duration, continuous and not reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **moderate**.

Sensitivity of receptor

7.13.3.9 Vessels are generally important to the regional economy, but given the available sea room, the early point at which the vessel can passage plan to avoid the development area but also the creation of a navigational corridor between Hornsea Three, Hornsea Project One and Hornsea Project Two, the receptor is deemed to be of low vulnerability, very good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

7.13.3.10 Overall, it is predicted that the sensitivity of the receptor is considered to be **low** and the magnitude is deemed to be **moderate**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms with measures adopted as part of Hornsea Three.

Tier 3

7.13.3.11 Tier 3 wind farm developments have the potential to increase the spatial extent of areas that vessels will have to passage plan around; however, given the limited information on these projects it has not been possible to make an effective assessment. It is noted that the SNSOWF study did consider the projects noted as Tier 3 within the assessment and they were found to be broadly acceptable to regulators with the understanding that an NRA would be required when they are progressed.

Hornsea Three offshore cable corridor and Hornsea Three offshore HVAC booster stations

7.13.3.12 There were no perceptible cumulative deviations identified in association with the Hornsea Three offshore cable corridor or Hornsea Three offshore HVAC booster stations.

Presence of infrastructure within the Hornsea Three array area may displace vessels leading to increased journey times or distances for commercial vessels during periods of adverse weather.

Magnitude of impact

7.13.3.13 Presence of infrastructure within the Hornsea Three array area and other Tier 1 wind farm developments may displace vessels leading to increased journey times or distances for commercial vessels during periods of adverse weather.

7.13.3.14 As with impacts related to the development of Hornsea Three in isolation, adverse weather includes wind, wave and tidal conditions as well as reduced visibility due to fog that can hinder a vessel's normal route and/or speed of navigation.

7.13.3.15 Given the available sea room, distance from shore (giving numerous routeing options) and the preference identified for coastal passenger ferry routeing, the cumulative impact is considered to be broadly acceptable under the FSA. Mitigation measures adopted for Hornsea Three include marking, charting and promulgation of information to ensure that vessels are able to effectively passage plan.

Tier 1

7.13.3.16 The impact is predicted to be of regional spatial extent, medium term duration, intermittent and not reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **moderate**.

Sensitivity of receptor

7.13.3.17 Vessels are generally important to the regional economy, but given the very low frequency of adverse weather routeing required, the open sea area available in which vessels can deviate and the low effect of adverse weather on commercial vessels, the receptor is deemed to be of low vulnerability, very good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

7.13.3.18 Overall, it is predicted that the sensitivity of the receptor is considered to be **moderate** and the magnitude is deemed to be **low**. The effect will, therefore be of **minor adverse** significance, which is not significant in EIA terms.

Tier 2

7.13.3.19 Tier 2 wind farm developments will continue to increase areas where vessels will have to navigate around in adverse weather; however as developments do not impact the same routes or are smaller and/or not in close proximity to Hornsea Three (based on the list of identified Tier 2 projects) there are not expected to be any impacts on routeing above that identified for Tier 1 projects given the available sea room to passage plan with minimal deviations.

Magnitude of impact

7.13.3.20 Presence of infrastructure within the Hornsea Three array area and other Tier 1 and Tier 2 wind farm developments may displace vessels leading to increased journey times or distances for commercial vessels during periods of adverse weather.

7.13.3.21 The impact is predicted to be of regional spatial extent, medium term duration, intermittent and not reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **moderate**.

Sensitivity of receptor

7.13.3.22 Vessels are generally important to the regional economy, but given the very low frequency of adverse weather routeing required, the open sea area available in which vessels can deviate and the low effect of adverse weather on commercial vessels, the receptor is deemed to be of low vulnerability, very good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

7.13.3.23 Overall, it is predicted that the sensitivity of the receptor is considered to be **moderate** and the magnitude is deemed to be **low**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Tier 3

7.13.3.24 Tier 3 wind farm developments have the potential to increase areas where vessels will have to passage plan around; however given the limited information on these projects and adverse weather routeing information in the vicinity of these projects it has not been possible to make an effective assessment.

Hornsea Three offshore cable corridor and Hornsea Three offshore HVAC booster stations

7.13.3.25 There were no perceptible cumulative adverse weather impacts identified in association with the Hornsea Three offshore cable corridor or offshore HVAC booster stations.

Presence of infrastructure within the Hornsea Three array area and other Tier 1 and Tier 2 projects may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk

Magnitude of impact

7.13.3.26 Presence of infrastructure within the Hornsea Three array area and other Tier 1 projects may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk.

7.13.3.27 For the operational phase a separate technical study (Anatec, 2016) was undertaken in consultation with the MCA and TH. The aim of the report was to assess whether the proposed navigational corridor width was within ALARP parameters for the purposes of navigation.

Radar interference with the corridor

7.13.3.28 MGN 543 states that, dependent on the proximity to turbines and the location of Radar scanners on a vessels superstructure, some vessels may experience degradation of the Radar display by false echoes. It may be possible that this will reduce the ability of the bridge team to identify other vessels, including crossing vessels entering the proposed navigational corridor from either side of the corridor, which may require avoiding action to be taken. It is common to find that Radar instrumentation is adjusted to reduce unwanted interference which can have the effect of reducing actual target acquisition. This effect has been assessed by the MCA and formed the basis of the MGN 543 (MCA, 2016) shipping template. It is noted that, despite the presence of a significant number of operational wind farms within UK waters (some of which were constructed 15 years ago), there has been no notable issues raised by mariners that have required the MCA to undertaken any further assessment.

7.13.3.29 Further details are contained within the technical note Assessment of Marine Traffic Corridor Design (Anatec, 2016); however, following consideration of the report, the MCA and TH have confirmed that, given the location and indicative traffic numbers, they do not have any significant concerns with, and are content with, the proposed navigational corridor respectively.

7.13.3.30 Concerns were raised at the Hazard Workshop regarding smaller vessels exiting the wind farm into the proposed navigational corridor; with no regard to Rule 9 of COLREGs (IMO, 1972). COLREGS notes that within narrow channels the risk of further vessel to vessel conflict will be consequently increased and therefore requires COLREGs Rule 9 b-d (IMO, 1972) to be adhered to:

- A vessel of less than 20 m in length or a sailing vessel shall not impede the passage of a vessel which can safely navigate only within a narrow channel or fairway; and
- A vessel engaged in fishing shall not impede the passage of any other vessel navigating within a narrow channel or fairway.

7.13.3.31 Given the concern raised, the MCA are currently considering the inclusion of a routeing measure (likely a Deep Water Route (DWR) given the low number of anticipated vessels) or Fairway Buoys to clearly identify navigational priorities within the proposed navigational corridor. However, given the consultation undertaken and the additional technical assessment, it is considered that based on the current size and orientation of the proposed navigational corridor the associated risk is ALARP and that additional mitigation would only be required to confirm routeing priorities within its boundaries for small crossing vessels/craft.

7.13.3.32 Based on modelling of the revised cumulative routeing, proposed layouts and local Metocean data, the annual vessel to vessel collision frequency following the installation of Hornsea Three, Hornsea Project One and Hornsea Project Two was 9.55×10^{-3}, corresponding to a collision return period of one in 105 years. This represents a 9.72% increase in collision frequency compared to the pre-wind farm result.

7.13.3.33 In addition, as part of the zone appraisal and planning process undertaken in 2010/2011, key stakeholders required that an independent assessment into cumulative routeing was undertaken by the three key developers at the time (SMartWind, East Anglia and Forewind). A report into shipping and navigation was therefore undertaken by the Southern North Sea Offshore Wind Forum (SNSOWF) in 2011 (Anatec, 2011) and subsequently updated in 2013 with validated traffic plans and updated zonal plans (Anatec, 2013).

7.13.3.34 During consultation on the SNSOWF report in 2013 no significant concerns were raised in relation to southern North Sea collision risk; these assessments include five wind farm developments within the former Hornsea Zone (Anatec, 2013) including a navigational corridor. Given the measures adopted as part of Hornsea Three, the current three Hornsea projects considered within the cumulative assessment (Hornsea Project One, Hornsea Project Two and Hornsea Three) and the results of the cumulative assessment undertaken within the Hornsea Project Two Environmental Statement (SMartWind, 2014) which ranked the impacts as minor adverse (for a maximum design scenario), the impact is considered tolerable with mitigation under the FSA.

7.13.3.35 Figure 22.2 in the NRA shows the scenarios that were considered compared against the current scoped areas being considered in this chapter.

Tier 1

7.13.3.36 The impact is predicted to be of regional spatial extent, medium term duration, intermittent and not reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

7.13.3.37 The receptor is deemed to be of low vulnerability, good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

7.13.3.38 Overall, it is predicted that the sensitivity of the receptor is considered to be **low** and the magnitude is deemed to be **minor**. The effect will, therefore be of **minor adverse** significance, which is not significant in EIA terms.

Tier 2

Magnitude of impact

7.13.3.39 Presence of infrastructure within the Hornsea Three array area and cumulatively with Tier 1 and Tier 2 projects may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk.

7.13.3.40 The impact is predicted to be of regional spatial extent, medium term duration, intermittent and not reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

7.13.3.41 The receptor is deemed to be of low vulnerability, good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

7.13.3.42 Overall, it is predicted that the sensitivity of the receptor is considered to be **low** and the magnitude is deemed to be **minor**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Hornsea Three offshore cable corridor and Hornsea Three offshore HVAC booster stations

7.13.3.43 There were no perceptible cumulative impacts identified in association with the Hornsea Three offshore cable corridor or Hornsea Three offshore HVAC booster stations and increased encounters and vessel to vessel collision risk.

Presence of infrastructure within the Hornsea Three array area and other Tier 1 projects may increase vessel to structure allision risk external to the array for all vessels, including NUC vessels.

Magnitude of impact

7.13.3.44 Presence of infrastructure within the Hornsea Three array area and other Tier 1 projects may increase vessel to structure allision risk external to the array for all for vessels, including NUC vessels.

7.13.3.45 Following assessment of the cumulative routeing it has been identified that the development of Hornsea Three, Hornsea Project One, Hornsea Project Two and the Schooner gas platform has the potential to cumulatively impact on navigational transits and thus cumulatively increase vessel to structure allision risk. The following effects and mitigations (where required) have been identified and measures have been adopted as part of Hornsea Three.

Alignment either side of the proposed navigation corridor

7.13.3.46 In order to facilitate vessel transits within the proposed navigational corridor, turbines adjacent to the proposed navigational corridor must be approximately aligned as per the indicative layouts A and B. Where feasible, options for sequences lighting and marking (of the proposed navigational corridor) with the Hornsea Three array area and Hornsea Project One and Hornsea Project Two array areas may be considered. It is noted that significant concave or convex sections can cause negative effects on marine Radar and visual navigation by obscuring or preventing position fixing. When defining layouts the Applicant will give full consideration to cumulative issues caused by alignment along the edge of the navigational corridor.

Cumulative lighting and marking

7.13.3.47 As well as lighting and marking within the proposed navigational corridor, all cumulative lighting must be considered in order to minimise any potential effects and avoid confusion from the proliferation of aids to navigation in a high density development of turbines. The mariner will use SPS lights (similar to entering a port) to navigate with, including fixing their position. Following agreement on the final layout post consent a user group should be established, in consultation with TH, to identify those aids to navigation which best aid navigation within the proposed navigational corridor.

7.13.3.48 Full consideration should be given to the use of different light characters and varied light ranges. Lighting and marking will be discussed with TH in conjunction with the relevant guidance (IALA, 2013). Therefore, when defining layouts, the Applicant will give full consideration to cumulative issues caused by lighting and marking.

NUC vessels within the proposed navigational corridor

7.13.3.49 Within the proposed navigational corridor emergency anchoring (dependent on the vessel's speed) could be used to prevent allision with a structure. Apart from the now disused pipeline (linked to the Topaz Well) within the northeast sector of the corridor, the corridor is hazard free which will generally allow safe anchoring. A vessel will have emergency anchoring procedures for areas where there may be subsea hazards (such as port approaches), and these procedures would likely be used within the proposed navigational corridor. It is noted that Rule 9 of COLREGS (IMO, 1972) prevents anchoring within a narrow channel under normal conditions. It is noted that the Topaz well-head will be decommissioned prior to the construction of Hornsea Three.

7.13.3.50 For other types of emergency incidents, it is noted that Hornsea Three, Hornsea Project One and Hornsea Project Two will all be significant marine operations, with each utilising a variety of support vessels during the operation and maintenance phase that will be able to provide emergency support (noting potential downtime during periods of adverse weather).

Differing design envelopes

7.13.3.51 Hornsea Project One and Hornsea Project Two, given the time at which they were assessed, included different design envelopes to that proposed for Hornsea Three. Turbines on opposing sides of the proposed navigational corridor, are therefore to be designed so as to be sympathetic to shipping using the proposed navigational corridor (not impacting on navigation including Radar, visual navigation and position fixing of navigating vessels).

Floating foundations

7.13.3.52 Mooring lines and/or anchors used on floating foundations shall not protrude into the agreed area for the proposed navigational corridor.

7.13.3.53 Considering the proposed mitigations, the "in isolation" modelling results and the consultation responses over the various developments within the former Hornsea Zone, cumulative vessel to structure allision risk external to the array is considered to be tolerable with mitigations under FSA.

Tier 1

7.13.3.54 The impact is predicted to be of local spatial extent, medium term duration, continuous and not reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

7.13.3.55 Vessels are only considered sensitive to this impact when they are in proximity to any infrastructure; however, it is a new risk of allision in a previously open sea area.

7.13.3.56 The receptor is deemed to be of low vulnerability, good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

7.13.3.57 Overall, it is predicted that the sensitivity of the receptor is considered to be **minor** and the magnitude is deemed to be **medium**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Hornsea Three offshore HVAC booster stations

7.13.3.58 There were no perceptible cumulative impacts identified in association with the Hornsea Three offshore HVAC booster stations and vessel to structure allision risk.

7.13.4 Decommissioning phase

Decommissioning activities within the Hornsea Three array area and other Tier 1 wind farm developments may displace vessels leading to increased journey times or distances for all vessels.

Magnitude of impact

7.13.4.1 Decommissioning activities within the Hornsea Three array area and other Tier 1 wind farm developments may displace vessels leading to increased journey times or distances for all vessels.

7.13.4.2 Within the Hornsea Project Two Environmental Statement the cumulative impact of Hornsea Project One and Hornsea Project Two was considered to be a long term and continuous impact but of a low frequency. Although further deviations are now required due to the presence of the Hornsea Three array area; assessment and consultation responses do not consider this to be greater than Hornsea Project One or Hornsea Project Two and therefore Hornsea Three, Hornsea Project One and Hornsea Project Two in combination too. The cumulative impact is therefore considered broadly acceptable under the FSA given the following reasons:

- The majority of routes impacted by the cumulative developments run east to west and therefore are already deviated to the maximum extent by Hornsea Project One and Hornsea Project Two;
- Impacts were considered minor adverse within the Hornsea Project Two Environmental Statement;
- There are fewer dense and significant routes passing through Hornsea Three (than Hornsea Project One and Hornsea Project Two); and
- The proposed navigational corridor provides a useable alternative to deviating around the area.

Tier 1

7.13.4.3 The impact is predicted to be of regional spatial extent, short term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **moderate**.

Sensitivity of receptor

7.13.4.4 Vessels are generally important to the regional economy, but given the available sea room, the early point at which the vessel can passage plan to avoid the construction area and the creation of a navigational corridor (including during the decommissioning phase) between Hornsea Three, Hornsea Project One and Hornsea Project Two, the receptor is deemed to be of low vulnerability, very good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

7.13.4.5 Overall, it is predicted that the sensitivity of the receptor is considered to be **low** and the magnitude is deemed to be **moderate**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms with measures adopted as part of Hornsea Three in place.

Tier 2

7.13.4.6 Tier 2 wind farm developments will continue to increase areas where vessels will have to passage plan around; however as developments do not impact the same routes or are smaller and/or not in close proximity to Hornsea Three (based on the list of identified Tier 2 projects) there are not expected to be any impacts on routeing above that identified for Tier 1 projects given the available sea room to passage plan with minimal deviations.

Magnitude of impact

7.13.4.7 Decommissioning activities within the Hornsea Three array area and other Tier 1 and Tier 2 wind farm developments may displace all vessels leading to increased journey times or distances.

7.13.4.8 The impact is predicted to be of regional spatial extent, short term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **moderate**.

Sensitivity of receptor

7.13.4.9 Vessels are generally important to the regional economy, but given the available sea room, the early point at which the vessel can passage plan to avoid the construction area but also the creation of a navigational corridor (including during the decommissioning phase) between Hornsea Three, Hornsea Project One and Hornsea Project Two, the receptor is deemed to be of low vulnerability, very good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

7.13.4.10 Overall, it is predicted that the sensitivity of the receptor is considered to be **low** and the magnitude is deemed to be **moderate**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms with measures adopted as part of Hornsea Three in place.

Tier 3

7.13.4.11 Tier 3 wind farm developments have the potential to increase areas where vessels will have to passage plan around; however given the limited information on these projects it has not been possible to make an effective assessment. It is noted that the SNSOWF study did consider the projects noted as Tier 3 within the assessment and they were found to be broadly acceptable to regulators with the understanding that an NRA would be required when they are progressed.

Hornsea Three offshore cable corridor and Hornsea Three offshore HVAC booster stations

7.13.4.12 There were no perceptible cumulative deviations identified in association with the Hornsea Three offshore cable corridor or Hornsea Three offshore HVAC booster stations.

Decommissioning activities within the Hornsea Three array area may displace vessels leading to increased journey times or distances during periods of adverse weather.

Magnitude of impact

7.13.4.13 Decommissioning activities within the Hornsea Three array area and other Tier 1 wind farm developments may displace vessels leading to increased journey times or distances for all during periods of adverse weather.

7.13.4.14 As with impacts related to the development of Hornsea Three in isolation, adverse weather includes wind, wave and tidal conditions as well as reduced visibility due to fog that can hinder a vessel's normal route and/or speed of navigation.

7.13.4.15 Given the available sea room, distance from shore (giving numerous routeing options) and the preference identified for coastal passenger ferry routeing, the cumulative impact is considered to be broadly acceptable under FSA. Mitigation measures proposed to be adopted for Hornsea Three include marking, charting and promulgation of information to ensure that vessels are able to effectively passage plan.

Tier 1

7.13.4.16 The impact is predicted to be of regional spatial extent, short term duration, intermittent and Reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **moderate**.

Sensitivity of receptor

7.13.4.17 Vessels are generally important to the regional economy, but given the very low frequency of adverse weather routeing required, the open sea area available in which vessels can deviate and the low effect of adverse weather on commercial vessels, the receptor is deemed to be of low vulnerability, very good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

7.13.4.18 Overall, it is predicted that the sensitivity of the receptor is considered to be **moderate** and the magnitude is deemed to be **low**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Tier 2

7.13.4.19 Tier 2 wind farm developments will continue to increase areas where vessels will have to navigate around in adverse weather, however as developments do not impact the same routes or are smaller and/or not in close proximity to Hornsea Three (based on the list of identified Tier 2 projects) there are not expected to be any impacts on routeing above that identified for Tier 1 projects given the available sea room to passage plan with minimal deviations.

Magnitude of impact

7.13.4.20 Decommissioning activities within the Hornsea Three array area and other Tier 1 and Tier 2 wind farm developments may displace all vessels leading to increased journey times or distances during periods of adverse weather.

7.13.4.21 The impact is predicted to be of regional spatial extent, short term duration, intermittent and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **moderate**.

Sensitivity of receptor

7.13.4.22 Vessels are generally important to the regional economy, but given the very low frequency of adverse weather routeing required, the open sea area available in which vessels can deviate and the low effect of adverse weather on commercial vessels, the receptor is deemed to be of low vulnerability, very good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

7.13.4.23 Overall, it is predicted that the sensitivity of the receptor is considered to be **moderate** and the magnitude is deemed to be **low**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Tier 3

7.13.4.24 Tier 3 wind farm developments have the potential to increase areas where vessels will have to passage plan around; however given the limited information on these projects and adverse weather routeing information in the vicinity of these projects it has not been possible to make an effective assessment.

Hornsea Three offshore cable corridor and Hornsea Three offshore HVAC booster stations

7.13.4.25 There were no perceptible cumulative adverse weather impacts identified in association with the Hornsea Three offshore cable corridor or Hornsea Three offshore HVAC booster stations.

Decommissioning activities within the Hornsea Three array area and other Tier 1 wind farm developments may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk.

Magnitude of impact

7.13.4.26 Decommissioning activities within the Hornsea Three array area and other Tier 1 wind farm developments may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk.

7.13.4.27 During the decommissioning of Hornsea Three the proposed navigational corridor should be assessed to ensure risk or inconvenience to third parties caused by buoyed construction areas is mitigated (as per further mitigation). If there is significant overlap between the Hornsea Three decommissioning area and the proposed navigational corridor there may need to be temporary measures put in place in consultation with the MCA and TH, to ensure that any works on the western edge of the Hornsea Three array area do not adversely impact the safety of third party vessels within the proposed navigational corridor by increasing the risk of encounters.

7.13.4.28 However, in the majority, it is anticipated that the proposed navigational corridor will be available for use by transiting vessels during decommissioning and consideration (in consultation with the MCA and TH) will be given to the size and location of the buoyed decommissioning area around the array to minimise impacts. It is also likely that marine coordination will be facilitated from a central location for all of the applicants' projects thus ensuring effective lines of communication and information transfer during the decommissioning phases.

7.13.4.29 The Schooner gas platform is located at the northern end of the proposed navigational corridor, and may create increased encounters by requiring vessels to navigate with consideration for it when entering or exiting the corridor; however given that there is still sufficient sea room to undertake navigational manoeuvres during Hornsea Three, Hornsea Project One and Hornsea Project Two decommissioning activities, measures adopted as part of Hornsea Three in place, and vessel numbers using the navigational corridor are likely to be low (Anatec, 2016), the impact is intermittent.

Tier 1

7.13.4.30 The impact is predicted to be of regional spatial extent, short term duration, intermittent and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

7.13.4.31 Vessels are generally important to the regional economy, but given the small number of vessels likely to use the navigational corridor there are not expected to be the creation of any hot spots or increased encounters. The receptor is deemed to be of low vulnerability, good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

7.13.4.32 Overall, it is predicted that the sensitivity of the receptor is considered to be low and the magnitude is deemed to be minor. The effect will, therefore, be of minor adverse significance, which is not significant in EIA terms.

Presence of decommissioned infrastructure within the Hornsea Three array area and other Tier 1 projects may increase vessel to structure allision risk external to the array for all vessels, including NUC vessels.

Magnitude of impact

7.13.4.33 Presence of decommissioning infrastructure within the Hornsea Three array area cumulatively with Hornsea Project One, Hornsea Project Two and the Schooner Platform may cause increased allision risk for passing vessels; however during the decommissioning phase measures adopted as part of Hornsea Three will be in place to ensure that the risk is maintained within ALARP parameters including Marine Coordination. The centre will fully manage vessels movements associated with Hornsea Three (although command of each vessel remains with each individual Master) and will liaise directly with the developers and operators of other Tier 1 projects.

Cumulative construction lighting and marking

7.13.4.34 All cumulative projects within his impact assessment must be considered in order to minimise any potential effects and avoid confusion from a proliferation of aids to navigation in a high density development of turbines and decommissioning activities.

7.13.4.35 Full consideration should be given to the use of lighting sequences such as different light characters and varied light ranges. Lighting and marking will be discussed with TH in conjunction with the relevant guidance (IALA, 2013). The applicant may be required to liaise directly with the developers of Hornsea Project One and Hornsea Project Two.

Tier 1

7.13.4.36 The impact is predicted to be of local spatial extent, short term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor.

Sensitivity of receptor

7.13.4.37 Vessels are only considered sensitive to this impact when they are in proximity to any Infrastructure. The receptor is deemed to be of low vulnerability, good recoverability and medium value. The sensitivity of the receptor is therefore, considered to be medium.

Significance of effect

7.13.4.38 Overall, it is predicted that the sensitivity of the receptor is considered to be minor and the magnitude is deemed to be medium. The effect will, therefore, be of minor adverse significance, which is not significant in EIA terms.

Future monitoring

7.13.4.39 No future monitoring has been identified for cumulative impacts.

7.14 Transboundary effects

7.14.1.1 Transboundary impacts relate to impacts that may occur from an activity within one European Economic Area (EEA) state on the environment or interests of another.

7.14.1.2 A screening of transboundary impacts has been carried out and is presented in annex 5.5: Transboundary Impacts Screening Note. This screening exercise identified that there was the potential for potentially significant transboundary effects with regard to shipping and navigation from Hornsea Three upon the interests of other EEA states.

7.14.1.3 It was identified that transboundary issues could arise from Hornsea Three on commercial shipping routes transiting between the UK and other European Economic Area ports. This could also include impacts upon international ports, shipping routes and/or routes affected by other international offshore renewable energy developments. The potentially affected areas include ports within the southern North Sea (as per section 21 of the NRA). The development of Hornsea Three could affect routes operating between the UK and ports located in the Netherlands, Denmark, Belgium and Germany. The results of the vessel deviation assessments in the NRA identified some deviations for routes; however the deviations identified (see section 7.13) were found to be not significant following consideration of measures adopted as part of Hornsea Three.

7.14.1.4 All EEA states that are likely to be significantly affected by Hornsea Three have been consulted as part of the formal phases of consultation. Dialogue with these authorities will continue to take place throughout the development of Hornsea Three in relation to transboundary impacts.

7.15 Inter-related effects

7.15.1.1 Inter-relationships are considered to be the impacts and associated effects of different aspects of the proposal on the same receptor. These are considered to be:

- Project lifetime effects: Assessment of the scope for effects that occur throughout more than one phase of the project (construction, operational and maintenance, decommissioning), to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in these three key project stages (e.g. impacts on routeing and allision risk);
- Receptor-led effects: Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor. As an example, all effects on shipping and navigation, such as deviated vessels, may interact to produce a different or greater effect on this receptor than when the effects are considered in isolation. Receptor-led effects might be short term, temporary or transient effects, or incorporate longer term effects.

7.15.1.2 A description of the likely inter-related effects arising from Hornsea Three on shipping and navigation is provided in chapter 11: Inter-Related Effects (Offshore).

7.16 Conclusion and summary

7.16.1.1 Following a review of the baseline environment, an NRA has been undertaken for Hornsea Three. The NRA included the required formal safety assessment to meet MCA guidance (MCA, 2015 and 2016) for all phases of the project, as well as an assessment of cumulative effects. The NRAs have informed the preliminary environmental impact review presented in this chapter.

7.16.1.2 A summary of the findings of the preliminary environmental impact review which relate to shipping and navigation are presented in Table 7.22 below; the table includes residual impacts following consideration of additional mitigation measures which may be required for the Hornsea Three array area, Hornsea Three offshore cable corridor and Hornsea Three offshore HVAC booster station search area.

Construction phase

7.16.1.3 For the construction phase the assessment shows that there are no impacts which result from the Hornsea Three development which have an effect of major or moderate adverse significance on shipping and navigation. All impacted are therefore within ALARP parameters.

Operation and maintenance phase

7.16.1.4 For the operation and maintenance phase one impact has been identified as major adverse and three identified as moderate adverse.

7.16.1.5 The major impact relates to the presence of infrastructure within the Hornsea Three array area causing increased vessel to structure allision risk internally within the array for recreational and fishing vessels. The severity of this impact is dictated in the majority by catenary mooring floating foundations that, given the limited understanding of the technology, prevent the risk of under keel clearance being mitigated and thus it presents a significant risk of sub surface allision. The following mitigation has been identified that can reduce the level of impact to moderate adverse with the use of catenary mooring floating foundations. However if these foundations are not used the impact would be minor or not significant.

- If floating foundations are selected and under keel clearance of cannot be guaranteed additional mitigation and consultation will be required;
- Additional aids to navigation to assist internal navigation: Following consultation responses from recreational users, Hornsea Three will consult with TH and MCA to consider internal aids to navigation; and
- Additional means of communication to assist third parties: Marine coordination facilities, offshore VHF aerials, AIS transceivers/receivers and on site vessels shall be used to mitigate risk to third party vessels navigating internally.

7.16.1.6 The moderate impacts relate to the position of the Hornsea Three offshore HVAC booster stations. The final siting of the structures (up to six subsea or up to four surface) will be confirmed post consent. IGiven that final locations have not yet been identified and further work is required to ensure that the structures (up to six subsea or up to four surface) are placed so as to minimise impacts on shipping.

7.16.1.7 The impacts are:

- Presence of the Hornsea Three offshore HVAC booster stations may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk;
- Presence of surface offshore HVAC booster stations within the Hornsea Three offshore cable corridor may increase vessel to structure allision risk for all vessels; and
- Presence of subsea HVAC booster stations and cable protection within the Hornsea Three offshore cable corridor may increase vessel to sub surface structure allision risk for all vessels.

7.16.1.8 These impacts can all be reduced to minor and not significant under EIA terms with the following mitigations:

- Offshore HVAC booster stations will be placed so as to be sympathetic to shipping and within ALARP parameters;
- Aids to navigation should be installed to identify the offshore HVAC booster stations as isolated structure(s);
- Additional buoyage may be required depending upon the number, location and type of offshore HVAC booster stations;
- Further consultation will be required with the MCA and TH to agree the final location(s); and

- The subsea HVAC booster stations will require marker buoys (in consultation with TH) in water depths giving less than 30 m under keel clearance. This is noted as likely given the water depths but will be dependent on the final dimensions.

7.16.1.9 All impacts for the Hornsea Three offshore cable corridor are reduced to minor adverse with a Cable Burial Risk Assessment which is one of the measures adopted as part of Hornsea Three.

Decommissioning phase

7.16.1.10 For the decommissioning phase the assessment shows that there are no impacts which result from the Hornsea Three development which have an effect of major or moderate adverse significance on shipping and navigation. All impacted are therefore within ALARP parameters.

Cumulative impacts

7.16.1.11 All cumulative impacts are minor adverse which are not significant in EIA terms with measures adopted as part of Hornsea Three and include consideration for Tier 1, Tier 2 and Tier 3 projects where identified for each impact. Direct communication with Hornsea Project One and Hornsea Project Two is a key mitigation for cumulative impacts to ensure that aids to navigation for the developments are considered at a cumulative level to avoid proliferation of lights.

7.16.1.12 The transboundary impacts, relating to impacts that may occur from an activity within one EEA state on the environment or interests of another, have been assessed in regard to shipping and navigation.

7.16.1.13 It was identified that transboundary issues could arise from the Hornsea Three array area having an effect upon commercial shipping routes transiting between the UK and other European Economic Area ports. However given the minor deviations expected, the impact is assessed to be not significant.

7.16.1.14 Inter-related effects have been assessed on shipping and navigation and are provided in chapter 11: Inter-Related Effects (Offshore). Impacts on shipping and navigation are primarily associated with placing infrastructure within a previously open sea area resulting in potential route deviations which have been assessed within this chapter.

Table 7.22: Summary of potential environmental effects, mitigation and monitoring.

Description of impact	Measures adopted for Hornsea Three	Magnitude of impact	Sensitivity of impact	Significance of effect	Additional measures	Residual effect	Proposed monitoring
Construction phase							
Construction activities within the Hornsea Three array area and Hornsea Three offshore cable corridor may displace vessels leading to increased journey times or distances during periods of adverse weather.	• Promulgation of information.	Minor	Low	Minor adverse	N/A	Minor adverse	N/A
Construction activities within the Hornsea Three array area may displace commercial ferries leading to increased journey times or distances for commercial ferries during periods of adverse weather.	• Promulgation of information.	Minor	Medium	Minor adverse	N/A	Minor adverse	N/A
Presence of pre commissioned infrastructure within the Hornsea Three array area and Hornsea Three offshore cable corridor may cause increased vessel to structure allision risk external to the array for all vessels.	• Aids to Navigation Management Plan; • Application and use of safety zones of up to 500 m around structures during construction and up to 50 m around structures following installation but pre-commissioning; • Back-up power supplies and SCADA systems for turbines; • Buoyed construction area; • Charting of Hornsea Three array area, Hornsea Three offshore HVAC booster stations, export cables and array cables; • Guard vessels; • Lighting and marking of the wind farm in accordance with IALA guidance; • Minimum turbine blade clearance of 34.97 m LAT; • Promulgation of information; • Safe passing distance (advisory) around construction vessels; and • Temporary aids to navigation.	Minor	Medium	Minor adverse	N/A	Minor adverse	Monitoring of floating foundation moorings to ensure that they are stable until they are fully commissioned.
Presence of pre commissioned infrastructure within the Hornsea Three array area and Hornsea Three offshore cable corridor may increase vessel to structure allision risk external to the array for NUC vessels in an emergency situation (including machinery related problems or navigational system errors).	• Guard vessels; • Marine coordination; and • Minimum turbine blade clearance of 34.97 m LAT.	Negligible	Medium	Minor adverse	N/A	Minor adverse	Monitoring of floating foundation moorings to ensure that they are stable until they are fully commissioned.

Description of impact	Measures adopted for Hornsea Three	Magnitude of impact	Sensitivity of impact	Significance of effect	Additional measures	Residual effect	Proposed monitoring
Presence of infrastructure within the Hornsea Three array area may cause increased vessel to structure allision risk internally within the construction area for recreational and fishing vessels.	• Aids to Navigation Management Plan; • Back-up power supplies and SCADA systems for turbines; • Charting of Hornsea Three array area; • Guard vessels; • Lighting and marking of the wind farm in accordance with IALA guidance; • Marine coordination; • Minimum turbine blade clearance of 34.97 m LAT; • Monitoring by AIS and VHF; • Promulgation of information; • Advisory safety distance around construction vessels; and • Temporary aids to navigation.	Minor	Low	Minor adverse	N/A	Minor adverse	Monitoring of floating foundation moorings to ensure that they are stable until they are fully commissioned.
Physical presence of pre commissioned structures (including sub surface elements) and cables (which may be exposed or partially buried) may present an increased risk of gear snagging for commercial fishing vessels with mobile gear.	• Aids to navigation; • Cable Burial Risk Assessment; • Charting of Hornsea Three array area, Hornsea Three offshore HVAC booster stations, export cables and array cables; • Lighting and marking of the wind farm in accordance with IALA guidance; • Minimum turbine blade clearance of 34.97m LAT; and • Promulgation of information.	Minor	Medium	Minor adverse	N/A	Minor adverse	Monitoring and inspection of cables during installations to ensure establish whether cables are not left exposed and/or unmarked in order to, amongst other things, reduce snagging risk to anchors and fishing gear.
Operational and maintenance phase							
Presence of infrastructure within the Hornsea Three array area and Hornsea Three offshore cable corridor may displace vessels leading to increased journey times or distances during periods of adverse weather.	• Promulgation of information.	Minor	Low	Minor adverse	N/A	Minor adverse	The DCO will require post-construction vessel traffic monitoring by AIS as per Table 7.14.
Presence of infrastructure within the Hornsea Three array area may displace commercial ferries leading to increased journey times or distances for commercial ferries during periods of adverse weather.	• Promulgation of information.	Minor	Medium	Minor adverse	N/A	Minor adverse	The DCO will require post-construction vessel traffic monitoring by AIS as per Table 7.14.

Description of impact	Measures adopted for Hornsea Three	Magnitude of impact	Sensitivity of impact	Significance of effect	Additional measures	Residual effect	Proposed monitoring
Presence of infrastructure within the Hornsea Three array area may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk.	• Compliance with COLREGS and SOLAS; • Marine coordination; • Promulgation of information; • QHSE documentation; and • Advisory safety distance around maintenance vessels.	Minor	Low	Minor adverse	N/A	Minor adverse	N/A
Presence of the Hornsea Three offshore HVAC booster stations may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk.	• Compliance with COLREGS and SOLAS; • Marine coordination; • Promulgation of information; • QHSE documentation; and • Advisory safety distance around maintenance vessels.	Moderate	Medium	Moderate adverse	• Will be placed so as to be sympathetic to shipping and within ALARP parameters; • Aids to navigation should be installed to identify the offshore HVAC booster stations as isolated structure(s); and • Addition buoyage may be required depending on the number, location and type of offshore HVAC booster stations.	Minor adverse	N/A
Presence of infrastructure within the Hornsea Three array area may increase vessel to structure allision risk external to the array for all vessels.	• Aids to Navigation Management Plan; • Application and use of safety zones of up to 500 m around structures during operation for manned platforms and major maintenance of structures; • Back-up power supplies and SCADA systems for turbines; • Charting of Hornsea Three array area and array cables; • Guard vessels during major maintenance; • Lighting and marking of the wind farm in accordance with IALA guidance; • Minimum turbine blade clearance of 34.97 m LAT; • Promulgation of information; and • Advisory safety distance around construction vessels.	Minor	Medium	Minor adverse	N/A	Minor adverse	Monitoring of floating foundations to identify if any moorings fail, global positioning system (GPS) tracking shall be considered. Monitoring and inspection of cables during installations to ensure establish whether cables are not left exposed and/or unmarked in order to, amongst other things, reduce snagging risk to anchors and fishing gear.

Description of impact	Measures adopted for Hornsea Three	Magnitude of impact	Sensitivity of impact	Significance of effect	Additional measures	Residual effect	Proposed monitoring
Presence of infrastructure within the Hornsea Three array area may increase vessel to structure allision risk external to the array for NUC vessels in an emergency situation (including machinery related problems or navigational system errors).	• Guard vessels during major maintenance; • Marine coordination; and • Minimum turbine blade clearance of 34.97 m LAT.	Negligible	Medium	Minor adverse	• Although the layouts considered are indicative, offshore HVAC collector substations, offshore HVDC substations and accommodation platforms may not be placed on the extreme periphery of the Hornsea Three array area in proximity to dense traffic routes. • Although not specified within the Design Envelope it is assumed that there will be vessel support on site during the operational phase to ensure that all emergency response impacts can be effectively managed.	Minor adverse	Monitoring of floating foundations to identify if any moorings fail, global positioning system (GPS) tracking shall be considered. Monitoring and inspection of cables during installations to ensure establish whether cables are not left exposed and/or unmarked in order to, amongst other things, reduce snagging risk to anchors and fishing gear.
Presence of infrastructure within the Hornsea Three array area may cause increased vessel to structure allision risk internally within the array for recreational and fishing vessels.	• Aids to Navigation Management Plan; • Back-up power supplies and SCADA systems for turbines; • Charting of Hornsea Three array area; • Guard vessels during major maintenance; • Lighting and marking of the wind farm in accordance with IALA guidance; • Marine coordination; • Minimum turbine blade clearance of 34.97 m LAT; • Monitoring by AIS and VHF; and • Promulgation of information; • Advisory safety distance around construction vessels.	Minor	Medium	Major Adverse	• If floating foundations are selected and under keel clearance of cannot be guaranteed additional mitigation and consultation will be required. • Additional aids to navigation to assist internal navigation: Following consultation responses from recreational users, Hornsea Three will consult with TH and MCA to consider internal aids to navigation; and • Additional means of communication to assist third parties: Marine coordination facilities, offshore VHF aerials, AIS transceivers/receivers and on site vessels shall be used to mitigate risk to third party vessels navigating internally.	Moderate adverse	Monitoring of floating foundations to identify if any moorings fail, global positioning system (GPS) tracking shall be considered. Monitoring and inspection of cables during installations to ensure establish whether cables are not left exposed and/or unmarked in order to, amongst other things, reduce snagging risk to anchors and fishing gear.

Description of impact	Measures adopted for Hornsea Three	Magnitude of impact	Sensitivity of impact	Significance of effect	Additional measures	Residual effect	Proposed monitoring
Presence of surface offshore HVAC booster stations within the Hornsea Three offshore cable corridor may increase vessel to structure allision risk for all vessels.	• Aids to Navigation Management Plan; • Charting of Hornsea Three offshore HVAC booster stations and export cables; • Lighting and marking of the offshore HVAC booster stations in accordance with IALA guidance; • Promulgation of information; and • Advisory safety distance around maintenance vessels.	Moderate	Medium	Moderate adverse	• Will be placed so as to be sympathetic to shipping and within ALARP parameters; • Aids to navigation should be installed to identify the offshore HVAC booster stations as isolated structure(s). • Addition buoyage may be required depending on the number, location and type of offshore HVAC booster stations. • Further consultation will be required with the MCA and TH to agree the final location(s).	Minor adverse	N/A
Presence of subsea HVAC booster stations and cable protection within the Hornsea Three offshore cable corridor may increase vessel to sub surface structure allision risk for all vessels.	• Aids to navigation; • Cable Burial Risk Assessment; • Charting of Hornsea Three offshore HVAC booster stations and export cables; • Electronic interference minimisation; • Guard vessels during major maintenance; • Lighting and marking of the wind farm in accordance with IALA guidance; • Promulgation of information; • Surface buoy likely per structure) required where the under keel clearance is less than 30 m (indicated by TH).	Moderate	Medium	Moderate adverse	• Will be placed so as to be sympathetic to shipping and within ALARP parameters; • Following this assessment of maximum design scenario locations further consultation will be required with the MCA and TH to agree final location; and • The subsea HVAC booster stations will require marker buoys (in consultation with TH) in water depths giving less than 30 m under keel clearance. This is noted as likely given the water depths but will be dependent on the final dimensions.	Minor adverse	Monitoring and inspection of cables during installations to ensure establish whether cables are not left exposed and/or unmarked in order to, amongst other things, reduce snagging risk to anchors and fishing gear.

Description of impact	Measures adopted for Hornsea Three	Magnitude of impact	Sensitivity of impact	Significance of effect	Additional measures	Residual effect	Proposed monitoring
Physical presence of structures (including sub surface elements) and cables may present an increased risk of gear snagging for commercial fishing vessels with mobile gear.	• Aids to navigation; • Cable Burial Risk Assessment; • Charting of Hornsea Three array area, Hornsea Three offshore HVAC booster stations, export cables and array cables; • Lighting and marking of the wind farm in accordance with IALA guidance; • Minimum turbine blade clearance of 34.97 m LAT; and • Promulgation of information.	Minor	Medium	Minor adverse	N/A	Minor adverse	Monitoring and inspection of cables during installations to ensure establish whether cables are not left exposed and/or unmarked in order to, amongst other things, reduce snagging risk to anchors and fishing gear.
Design of the Hornsea Three array area may impact on the ability of coastguard helicopters to access the area to undertake SAR operations.	N/A	Moderate	High	Minor adverse	N/A	Minor adverse	N/A
Decommissioning phase							
Decommissioning activities within the Hornsea Three array area and Hornsea Three offshore cable corridor may displace vessels leading to increased journey times or distances during periods of adverse weather.	• Promulgation of information.	Minor	Low	Minor adverse	N/A	Minor adverse	N/A
Decommissioning activities within the Hornsea Three array area may displace commercial ferries leading to increased journey times or distances for commercial ferries during periods of adverse weather.	• Promulgation of information.	Minor	Medium	Minor adverse	N/A	Minor adverse	N/A
Presence of decommissioning infrastructure within the Hornsea Three array area and Hornsea Three offshore cable corridor may cause increased vessel to structure allision risk external to the array for all vessels.	• Aids to Navigation Management Plan; • Application and use of safety zones of up to 500 m around structures during decommissioning; • Back-up power supplies and SCADA systems for turbines; • Buoyed decommissioning area; • Guard vessels; • Lighting and marking of the wind farm in accordance with IALA guidance; • Minimum turbine blade clearance of 34.97 m LAT; • Promulgation of information; • Advisory safety distance around construction vessels; and • Temporary aids to navigation.	Minor	Medium	Minor adverse	N/A	Minor adverse	N/A

Description of impact	Measures adopted for Hornsea Three	Magnitude of impact	Sensitivity of impact	Significance of effect	Additional measures	Residual effect	Proposed monitoring
Presence of decommissioning infrastructure within the Hornsea Three array area and Hornsea Three offshore cable corridor may cause increased vessel to structure allision risk for NUC vessels in an emergency situation (including machinery related problems or navigational system errors).	• Guard vessels; • Marine coordination; and • Minimum turbine blade clearance of 34.97 m LAT.	Negligible	Medium	Minor adverse	N/A	Minor adverse	N/A
Presence of infrastructure within the Hornsea Three array area may cause increased vessel to structure allision risk internally within the array for recreational and fishing vessels.	• Aids to Navigation Management Plan; • Back-up power supplies and SCADA systems for turbines; • Guard vessels; • Lighting and marking of the wind farm in accordance with IALA guidance; • Marine coordination; • Minimum turbine blade clearance of 34.97 m LAT; • Monitoring by AIS and VHF; • Promulgation of information; • Advisory safety distance around construction vessels; and • Temporary aids to navigation.	Minor	Low	Minor adverse	N/A	Minor adverse	N/A
Physical presence of decommissioned structures (including sub surface elements) and cables (left in situ) may present an increased risk of gear snagging for commercial fishing vessels with mobile gear.	• Aids to navigation; • Lighting and marking of the wind farm in accordance with IALA guidance; • Minimum turbine blade clearance of 34.97 m LAT; and • Promulgation of information.	Minor	Medium	Minor adverse	N/A	Minor adverse	N/A

7.17 Next Steps

7.17.1.1 A number of marine traffic surveys (both vessel based and desk based) have been undertaken within the Hornsea Three array area and along the offshore cable corridor and this information has been directly used to support the assessment of potential effects on shipping and navigation receptors in this PEIR chapter; therefore no further surveys are required.

7.17.1.2 The shipping and navigation chapter for the Environmental Statement will include details of any further consultation with UK and international stakeholders and further analysis of any additional information that may become available during those consultations.

7.17.1.3 At the time of writing, specific assessments on the location of surface or subsea offshore HVAC booster stations have not been undertaken and further refinement of the search area will be considered following consultation responses received ahead of the drafting of the Environmental Statement chapter. However, given the generic assessment undertaken, lessons learnt from platform placement at other locations and expert opinion an assessment has been undertaken.

7.18 References

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