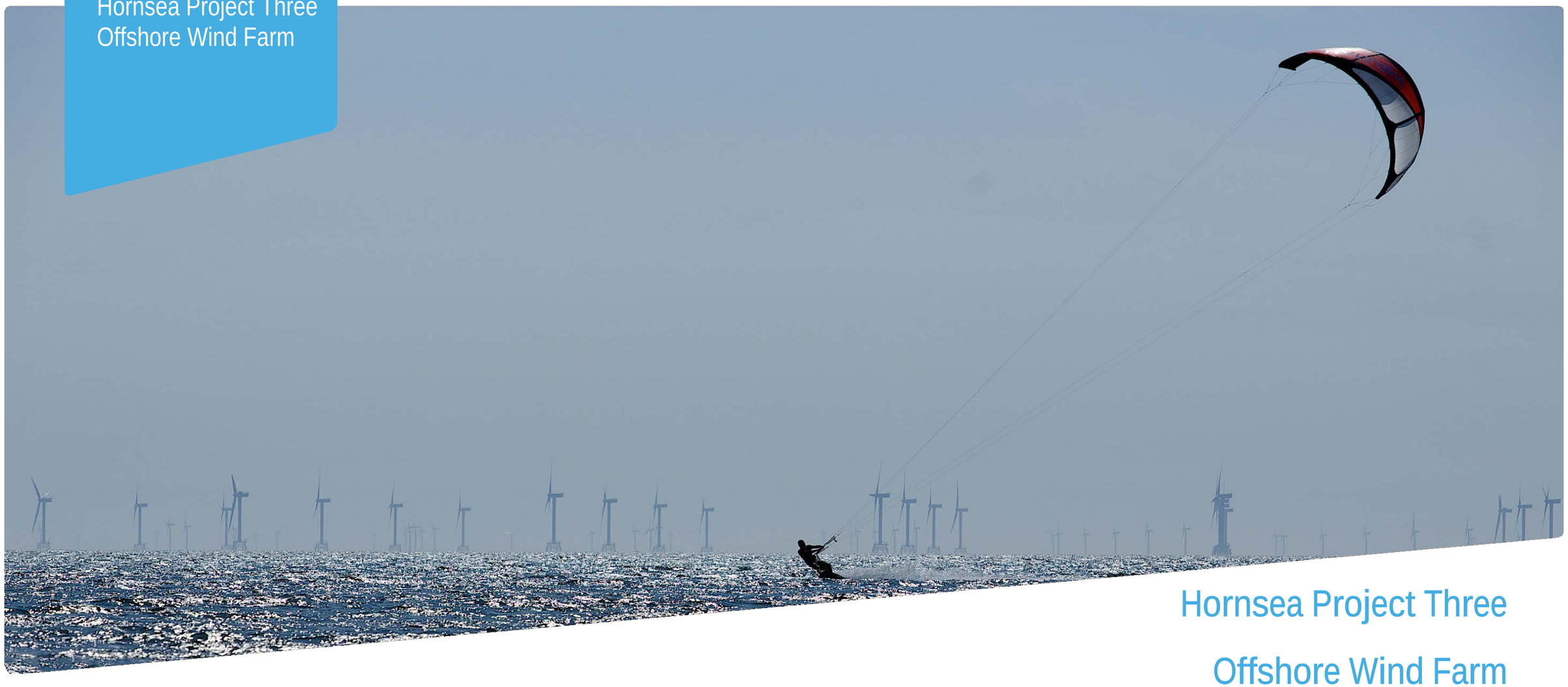
Hornsea Project Three
Offshore Wind Farm



# Hornsea Project Three

# Offshore Wind Farm

## Environmental Statement:
## Volume 2, Chapter 7 – Shipping and Navigation

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APFP Regulation 5(2)(a)

Date: May 2018

Hornsea 3
Offshore Wind Farm

Ørsted

Environmental Impact Assessment

Environmental Statement

Volume 2 – Offshore

Chapter 7 – Shipping and Navigation



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This report is also downloadable from the Hornsea Project Three offshore wind farm website at:

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Front cover picture: Kite surfer near a UK offshore wind farm © Orsted Hornsea Project Three (UK) Ltd., 2018.

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## Glossary

| Term | Definition |
|---|---|
| Allision | Contact between a moving and stationary object. |
| Automatic Identification System (AIS) | Automatic Identification System. A system by which vessels automatically broadcast their identity, key statistics e.g. length, brief navigation details e.g. location, destination, speed and current status e.g. survey. Most commercial vessels and European Union (EU) fishing vessels over 15 m are required to have AIS. |
| 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. |
| Emergency Position Indicating Radio Beacon (EPIRB) | An EPIRB is used to alert search and rescue services in the event of an emergency. It does this by transmitting a coded message on the 406 Megahertz (MHz) distress frequency via satellite and earth stations to the nearest rescue co-ordination centre. EPIRBs are registered to a vessel or aircraft and some also transmit on 121.5MHz which allows a Search and Rescue (SAR) aircraft to home in on them. |
| Environmental Statement | A document reporting the findings of the Environmental Impact Assessment (EIA) and produced in accordance with the EIA Directive as transposed into United Kingdom (UK) law by the EIA 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 vessels 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 (MF) coast station in which continuous Digital Selective Calling (DSC) (2187.5 kilohertz (kHz)) alerting and radiotelephony services are available. For planning purposes, this area typically extends to up to 180 nautical miles (nm) (330 kilometres (km)) offshore during daylight hours, but would exclude any A1 designated areas. In practice, satisfactory coverage may often be achieved out to around 150 nm (280 km) offshore during night time. |
| International Maritime Organization (IMO) Routeing | Predetermined shipping routes established by the IMO. |
| Marine Environmental High Risk Area (MEHRA) | Areas in UK coastal waters where ships' masters are advised of the need to exercise more caution than usual i.e. crossing areas of high environmental sensitivity where there is a risk of pollution from commercial shipping. |
| Marine Guidance Note (MGN) | A system of guidance notes issued by the Maritime and Coastguard Agency (MCA) which provide significant advice relating to the improvement of the safety of shipping and of life at sea, and to prevent or minimise pollution from shipping. |
| Navigational Risk Assessment (NRA) | A document which assesses the overall impact to shipping and navigation of a proposed Offshore Renewable Energy Installation (OREI) based upon formal risk assessment. |
| Not Under Command (NUC) | Under Part A of the International Regulations for Preventing Collisions at Sea (COLREGs), the term "vessel not under command" means a vessel which through some exceptional circumstance is unable to manoeuvre as required by these Rules and is therefore unable to keep out of the way of another vessel. |
| Offshore Renewable Energy Installation (OREI) | 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 EIA, OREI can mean offshore turbines and the associated electrical infrastructures such as offshore High Voltage Alternating Current (HVAC) transformer substations, offshore High Voltage Direct Current (HVDC) converter substations, accommodation platforms and offshore HVAC booster stations. |
| Personal Locator Beacon (PLB) | A PLB works in exactly the same way as an EPIRB by sending a coded message on the 406 MHz distress frequency which is relayed via the Cospas-Sarsat global satellite system. PLBs are typically carried on the person and are registered to the owner and may also transmit on 121.5 MHz. |
| Radar | Radio Detection And Ranging – an object-detection system which uses radio waves to determine the range, altitude, direction, or speed of objects. |
| Regular Operator | A commercial vessel operator whose vessel(s) are observed to transit through a particular region on a regular basis. |
| 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 IMO. 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 |
|---|---|
| AIS | Automatic Identification System |
| ALARP | As Low As Reasonably Practicable |
| BMAPA | British Marine Aggregate Producers Association |
| CA | Cruising Association |
| CEA | Cumulative Effect Assessment |
| CfD | Contract for Difference |
| COLREGs | Convention on the International Regulations for Preventing Collisions at Sea 1972 as amended |
| CoS | Chamber of Shipping |
| CTV | Crew Transfer Vessel |
| DCO | Development Consent Order |
| DEFRA | Department of Environment, Food and Rural Affairs |
| DF | Direction Finding |
| DfT | Department for Transport |
| DSC | Digital Selective Calling |
| DWR | Deep Water Route |
| EEA | European Economic Area |
| EIA | Environmental Impact Assessment |
| ERCoP | Emergency Response Cooperation Plan |
| EU | European Union |
| FSA | Formal Safety Assessment |
| GLA | General Lighthouse Authority |
| GMDSS | Global Maritime Distress and Safety System |
| HMCG | Her Majesty's Coastguard |
| HSE | Health, Safety and Environment |
| HVAC | High Voltage Alternating Current |
| HVDC | High Voltage Direct Current |
| IALA | International Association of Marine Aids to Navigation and Lighthouse Authorities |
| IHO | International Hydrographic Organisation |
| IMO | International Maritime Organization |
| LAT | Lowest Astronomical Tide |
| LOA | Length Overall |
| MAIB | Maritime Accident Investigation Branch |
| MCA | Maritime and Coastguard Agency |
| Metocean | Meteorological Ocean |
| MF | Medium Frequency |
| MGN | Marine Guidance Note |
| MHCC | Marine and Helicopter Coordination Centre |
| MHWS | Mean High Water Springs |
| MMO | Marine Management Organisation |
| MOD | Ministry of Defence |
| MSC | Maritime Safety Council |
| MMSI | Maritime Mobile Service Identity |
| NPS | National Policy Statement |
| NRA | Navigational Risk Assessment |
| NSIP | Nationally Significant Infrastructure Project |
| NUC | Not Under Command |
| OGA | Oil and Gas Authority |
| OREI | Offshore Renewable Energy Installation |
| OSV | Offshore Support Vessel |
| PEIR | Preliminary Environmental Information Report |
| PEXA | Practice and Exercise Area |
| PINS | Planning Inspectorate |
| PLB | Personal Locator Beacon |
| POD | Probability of Detection |
| PPE | Personal Protective Equipment |
| QHSE | Quality, Health, Safety and Environment |
| Radar | Radio Detecting and Ranging |
| RNLI | Royal National Lifeboat Institution |

| 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 Wind Forum |
| SOLAS | Safety of Life at Sea |
| SPS | Significant Peripheral Structure |
| TCE | The Crown Estate |
| TH | Trinity House |
| TSS | Traffic Separation Scheme |
| UK | United Kingdom |
| UKCS | United Kingdom Continental Shelf |
| UKHO | United Kingdom Hydrographic Office |
| VHF | Very High Frequency |
| ZAP | Zone Appraisal and Planning |

## Units

| Unit | Description |
|---|---|
| GRT | Gross Registered Tonnes (volume) |
| GW | Gigawatt (power) |
| km | Kilometre (distance) |
| m | Metre (distance) |
| MHz | Megahertz (frequency) |
| nm | Nautical mile (distance) |

# 7. Shipping and Navigation

## 7.1 Introduction

7.1.1.1 This chapter of the Environmental Statement presents 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 a technical report, which is included at volume 5, annex 7.1: 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) and accompanies the application to the Secretary of State for Development Consent.

7.2.1.2 It is intended that the Environmental Statement will provide statutory and non-statutory consultees with sufficient information to complete the examination of Hornsea Three and will form the basis of agreement on the content of the DCO and/or Marine Licence conditions (as required).

7.2.1.3 In particular, this Environmental Statement 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;
- 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 EIA 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, as shown in Figure 7.1. 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 United Kingdom (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 A 2 nm buffer has been applied around the Hornsea Three offshore cable corridor, as shown in Figure 7.1. As with the Hornsea Three array area shipping and navigation study area, this study area has been defined in order to capture relevant receptors and their movements within and near the Hornsea Three offshore cable corridor. The study area runs between MHWS 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 Hornsea Three offshore High Voltage Alternating Current (HVAC) booster station search area within the Hornsea Three offshore cable corridor, as shown in Figure 7.1. This extent is based on routeing of vessels and the likely size of deviations required. This search area overlaps with the Hornsea Three offshore cable corridor because of a regulator requirement for a marine traffic survey (Automatic Identification System (AIS), visual and Radio Detecting and Ranging (Radar) data) to be undertaken where surface structures are proposed and to identify relevant receptors that may be affected.

### 7.3.4 Hornsea Three shipping and navigation 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 vessel routeing as per the NRA; however changes to routeing have only been shown in detail within a combined 10 nm buffer around the Hornsea Three, Hornsea Project One and Hornsea Project Two array areas, as shown in Figure 7.1.

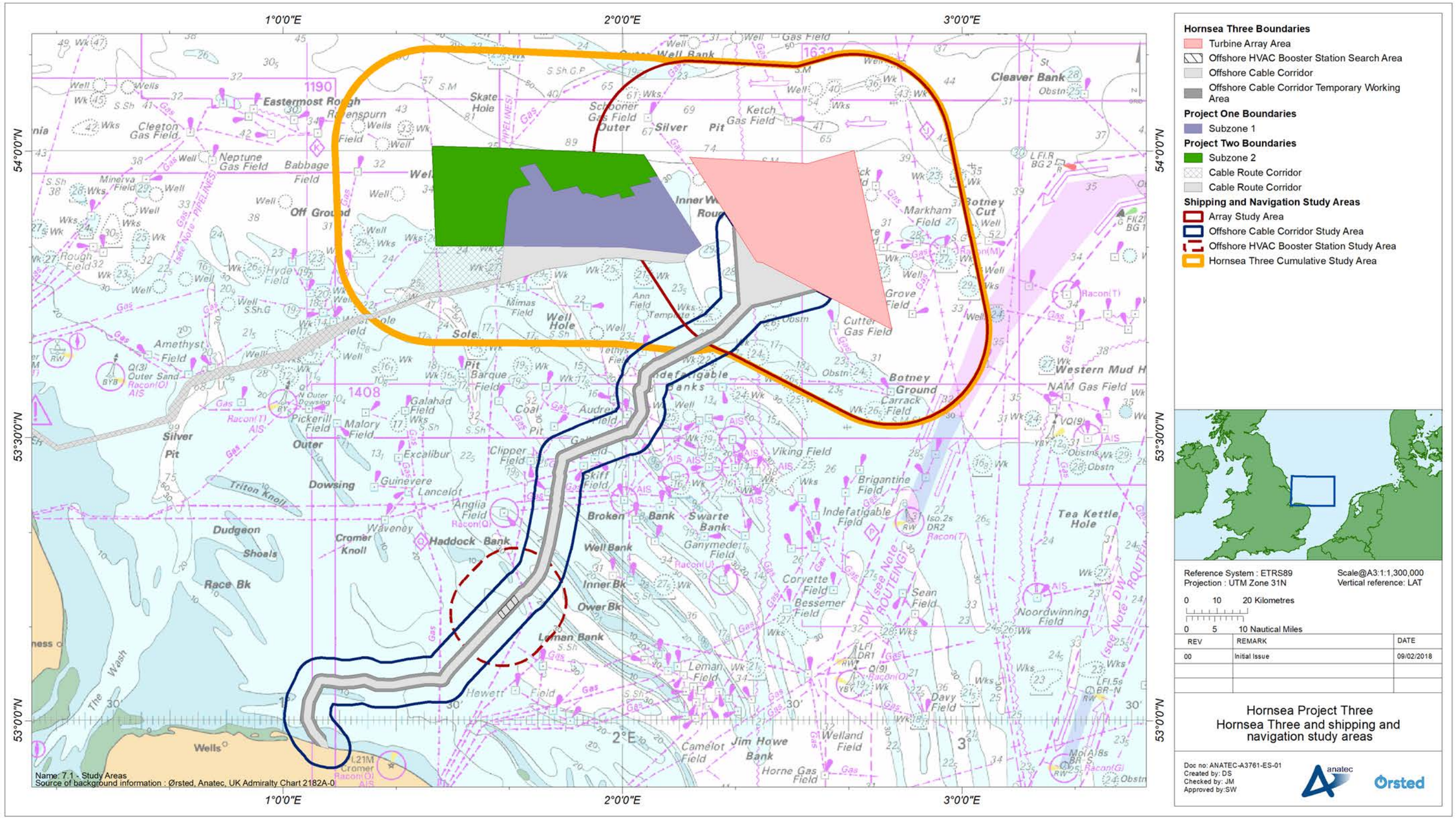


Figure 7.1: Hornsea Three and shipping and navigation study areas.

## 7.4 Planning policy context

### 7.4.1 National Policy Statements (NPS)

7.4.1.1 Planning policy on offshore renewable energy Nationally Significant Infrastructure Projects (NSIPs), specifically in relation to shipping and navigation, is contained in the Overarching National Policy Statement (NPS) for Energy (EN-1; DECC, 2011a) and the NPS for Renewable Energy Infrastructure (EN-3, DECC, 2011b).

7.4.1.2 Overarching NPS 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. These are summarised in Table 7.1 below.

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 Environmental Statement |
|---|---|
| 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 7.5 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 7.5 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 volume 5, annex 7.1: Navigational Risk Assessment. |
| Impacts on recreational craft, such as yachts, should be considered (paragraph 2.6.160 of NPS EN-3). | Section 7.11 and section 7.13 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 11: 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.

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 Environmental Statement |
|---|---|
| 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 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 7.13 respectively 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 section 7.7.3 undertake 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 volume 5, annex 7.1: Navigational Risk Assessment. |
| 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 7.13 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 11: 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 7.13 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 7.13 considers the cumulative impact of Hornsea Three, alongside other projects, plans and activities within the Hornsea Three shipping and navigation cumulative study area. |

### 7.4.2 Other relevant policies

7.4.2.1 No other policies are relevant to shipping and navigation.

## 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 Environmental Statement chapter. Further information on the consultation activities undertaken for Hornsea Three can be found in the Consultation Report (document reference number A5.1) that accompanies the application for Development Consent.

### 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 regarding shipping and navigation, 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 Environmental Statement or how the Applicant has had regard to them. Further information on the consultation activities undertaken for Hornsea Three can be found in the Consultation Report that accompanies the Environmental Statement.

7.5.3.2 It is noted that issues relating to the design of the array layout raised prior to the submission of the Preliminary Environmental Information Report (PEIR) refer to the irregular indicative layout which was under consideration at the time rather than the indicative layout presented in this Environmental Statement.

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, September 2016, November 2016 | MCA and Trinity House (TH) – consultation meeting | Three consultation meetings relating to the proposed approach for Hornsea Three.<br>Marine traffic survey method was discussed and agreed.<br>MCA confirmed they were content with the proposed NRA method and that this should follow the usual process. MCA noted the project's own vessels should also be considered within the NRA.<br>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.<br>It was agreed that the design of a corridor should not prevent compliance, or give reason for a vessel not complying with the Convention on the International Regulations for Preventing Collisions at Sea (COLREGs) (narrow channels and overtaking). | The NRA methodology is contained within section 3 of the NRA. The marine traffic survey methodology is within section 7.6 of this chapter and section 7 of the NRA.<br>The outcomes of the proposed navigational corridor assessment are in section 22.9 of the NRA.<br>An assessment of the proposed navigational corridor has been undertaken with the cumulative collision risk associated with the proposed navigational corridor assessed in section 7.13. |
| November 2016 | MCA – Scoping Opinion | The NRA and Environmental Statement should comply with MGN 543.<br>The NRA should consider routeing particularly in heavy weather so that vessels can make safe passage without significant larger scale deviations.<br>The MCA 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.<br>Any application for safety zones would need to be carefully assessed and supported by experience at the development and construction stages.<br>Assessment of impacts on SAR capability within the region must be undertaken.<br>An Emergency Response Cooperation Plan (ERCoP) will be required within the draft DCO.<br>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.<br>Adverse weather routeing is considered within section 16 of the NRA and assessed within section 7.11 of this chapter and section 22.5 of the NRA.<br>Measures adopted as part of Hornsea Three are outlined in section 7.10 of this chapter and section 23 of the NRA. They include Aids to Navigation and commitment to a Cable Burial Risk Assessment (or similar) and ERCoP.<br>Hornsea Three SAR impacts are considered in Appendix C of the NRA and assessed within section 7.11 of this chapter and section 22.16 of the NRA.<br>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 EIA 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 the Planning Inspectorate (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. |
| November 2016 | TH – Scoping Opinion | Require comprehensive vessel traffic analysis as per Marine Guidance Note (MGN) 543.<br>Any proposed layout should conform to MGN 543 and any structure out with the actual wind farm should have additional risk assessments undertaken.<br>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.<br>TH will require the Hornsea Three array area and obstructions within the Hornsea Three offshore cable corridor to be marked as per IALA-O-139.<br>Any possible national transboundary issues should be assessed and consultation should be undertaken with the Dutch authorities.<br>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 of this chapter and section 23 of the NRA and include Aids to Navigation.<br>The marine traffic survey methodology is within section 7.6 of this chapter and section 7 of the NRA.<br>Rijkwaterstraat were issued the PEIR and NRA (DONG Energy (now Ørsted), 2017) as part of the section 42 consultation and their responses are detailed in in Table 7.3 under an entry dated September 2017.<br>The outcomes of consultation on the proposed navigational corridor and assessment are in section 22.9 of the NRA.<br>A decommissioning plan is considered in section 25.8 of the NRA. |

| 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.<br>The layout of the Hornsea Three array area will not be fixed at the point of the application and therefore the maximum design scenario should be considered within the NRA.<br>The proposed navigational corridor should be considered in consultation with the MCA and TH.<br>The MCA require that a Cable Burial Protection Index study should be undertaken in respect to export cabling.<br>The marine traffic survey must "include non-AIS traffic".<br>The NRA must be in line with MGN 543.<br>Consultation will be undertaken with the MCA on SAR capability within the region.<br>An ERCoP will be required within the draft DCO.<br>The Environmental Statement must consider phasing of the development. | Port assessment is considered in section 10.2 of the NRA; however no impacts were identified.<br>The NRA methodology is contained within section 3 of the NRA.<br>The marine traffic survey methodology is within section 7.6 of this chapter and section 7 of the NRA.<br>SAR impacts are considered in Appendix C of the NRA and assessed within section 7.11.<br>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 station(s) would be between the Lehman and Haddock Bank, but to avoid vessel routeing should stay north of 53°11.0'N.<br>Marine Aggregate Industries: Requested attendance at the Hazard Workshop.<br>KESS: Noted that there were small but manageable deviations for their vessels that operated east – west.<br>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.<br>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 station(s) 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.<br>Marine Aggregate Industries attended the Hazard Workshop – see section 7.9.2 of this chapter and section 20 of the NRA.<br>Vessel deviations are reported in section 18.2.2 and section 18 of the NRA.<br>Commercial ferry impacts are assessed in section 7.11 of this chapter and section 22 of the NRA. |
| February 2017 | Chamber of Shipping (CoS) – consultation meeting | Introductory meeting to the Hornsea Three development.<br>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.<br>Anatec explained the process for identification of Regular Operators within the marine traffic survey datasets 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 offshore cable corridor.<br>Approach to the NRA, in line with MCA guidance was discussed. No comments were made.<br>CoS queried if any additional routeing measures had been considered for the proposed navigational corridor; it was noted that this would be a decision for the MCA. | Future case routeing is considered in section 7.7.5 of this chapter and section 17 of the NRA.<br>Cumulative scenarios for Hornsea Three are considered in section 7.13 of this chapter and section 21 of the NRA. Identified impacts are assessed in section 7.12 of this chapter 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 | Cruising Association (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.<br>CA stated that the proposed navigational corridor was at a good angle and the width more than adequate for any recreational vessels sailing in the area.<br>With respect to layouts the CA preferred larger straight lines where possible.<br>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 proposed 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 of this chapter and section 22 of the NRA. |
| February 2017 | Hazard Workshop | See the hazard log in Appendix B of the NRA. | N/A |
| 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.<br>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.<br>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.<br>TH indicated that, using the experience of the oil and gas industry, and the approach taken for wrecks, any subsea 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.<br>Subsea impacts are considered in section 7.11 of this chapter and section 22 of the NRA.<br>Internal navigation impacts are considered in section 7.11 of this chapter and section 22 of the NRA. |
| February 2017 | Royal Yachting Association (RYA) – consultation meeting | RYA mentioned that, from a recreational perspective, the Hornsea Three 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.<br>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.<br>With respect to layouts the RYA stated that they did not have any concerns regarding the indicative layouts presented. The 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 of this chapter and section 23 of the NRA and include a Cable Burial Risk Assessment (or similar).<br>Internal navigation impacts are considered in section 7.11 of this chapter and section 22 of the NRA. |
| September 2017 | BP Shipping Ltd – section 42 consultation response | The analysis identifies various impacted vessel types and routes via AIS survey, explicitly naming a few individual vessels. Please can you share a list of the vessel names from your AIS surveys, and advise whether you have done any direct consultation with vessel operators of those vessels and what that looked like? | Minor amendments have been made to this chapter of the Environmental Statement to highlight Regular Operator consultation. A letter has been sent to BP Shipping confirming consultation undertaken to date and a consultation meeting has been offered if required. |

| Date | Consultee and type of responses | Issues raised | Response to issue raised and/or where considered in this chapter |
|---|---|---|---|
| September 2017 | CA – section 42 consultation response | The layout of turbines should be in straight lines following a rectangular or similar pattern aligned with the prevailing wind thus enabling a "see-through" passage by small craft. Point is eased by adoption of a minimum turbine spacing of 1,000 m or greater and disorientation of helmsmen can be mitigated to an extent by additional internal marking and lighting.<br>Support fewer, larger, turbines than greater numbers of smaller turbines but would defer to the view of the MCA/TH on the matter.<br>Summer survey data (Hornsea Three offshore HVAC booster stations) rather misses the peak summer season when perhaps double the number of recreational craft surveyed may be typically expected.<br>We reserve on marking and lighting of the structure(s) until more details are available but suspect that additional standard navigation marks may be needed.<br>We have no concerns about cable burial, protection, etc. in depths greater than 10 m. In lesser depths we ask that cables are buried 1 m with a minimum of 1.5 m where yachts may commonly anchor. A smooth bottom with no berms or "humps" over the cable should be maintained at all times. When more details are available we may also ask for provision of a marker beacon or daymark to indicate the landing point from seaward.<br>We fully support safety zones of 50 m around completed turbines and 500 m around maintenance procedures (as indicated by presence of workboats) and accommodation platforms plus 500 m moving zones around cable layers and similar specialised vessels.<br>Hornsea Three should if possible be co-ordinated in layout with the other Hornsea wind farms. The proposed navigational corridor will prove valuable in resolving this concern but may be treated as a narrow channel under Rule 9 of COLREGs and require additional buoyage and lighting.<br>We agree that recreational craft are likely to use the Hornsea Three array area as a passage waypoint and that they can do so safely. CA policy is therefore always to seek consistency in overall design and regulation of all wind farms in northwest Europe.<br>We doubt the very low figures recorded for yachts crossing the Hornsea Three offshore cable corridor. Yacht traffic is not heavy but all on passages between the Channel/east coast rivers and the Humber northwards including Scotland plus those originating from the continent must cross the corridor somewhere.<br>We reserve comment on your landside operating port since the location of this is not yet known.<br>Publishing fixed routeing of construction traffic and the construction site may be advisable. | Internal navigation impacts are considered in section 7.11 of this chapter and section 22 of the NRA.<br>The survey period for the summer season was agreed with the MCA and satisfies the requirements of MGN 543.<br>Regarding burial depths, a Cable Burial Risk Assessment (or similar) is included as a measure adopted as part of Hornsea Three with detail provided in section 7.10 of this chapter and section 23 of the NRA. These sections also provide detail on the application and use of safety zones.<br>Marine traffic surveys for the Hornsea Three offshore cable corridor also considers desktop resources such as the RYA UK Coastal Atlas of Recreational Boating (2016).<br>The CEA in section 7.12 of this chapter and section 21 of the NRA takes into account the impact associated with Hornsea Three together with other projects and plans. This includes the proposed navigational corridor.<br>Construction traffic will be monitored and managed by a marine coordinator so that vessels do not impact on other users.<br>Decisions on the classification of the proposed navigational corridor and requirement for additional marking remain with the MCA and TH. |
| September 2017 | CoS – section 42 consultation response | The CoS has no particular comments to make. | N/A |

| Date | Consultee and type of responses | Issues raised | Response to issue raised and/or where considered in this chapter |
|---|---|---|---|
| September and December 2017 | MCA – section 42 consultation response | MGN 543 Annex 2 Paragraph 6 requires that hydrographic surveys should fulfil the requirements of the International Hydrographic Organisation (IHO) Order 1a standard, with the final data supplied as a digital full density data set, and survey report to the MCA Hydrography Manager. This information will need to be submitted, ideally at the Environmental Statement stage.<br>Export cable routes, Cable Burial Protection Index and cable protections are issues that are yet to be fully developed. However due cognisance needs to address cable burial and protection, particularly close to shore where impacts on navigable water depth may become significant. Any consented cable protection works must ensure existing and future safe navigation is not compromised. The MCA would accept a maximum of 5% reduction in surrounding depth referenced to Chart Datum. Existing charted anchorage areas should be avoided.<br>The array layout will require MCA approval prior to construction to minimise the risks to surface vessels, including rescue boats, and SAR aircraft operating within the site. As such, MCA will seek to ensure all structures are aligned in straight rows and columns. Any additional navigation safety and/or SAR requirements, as per MGN 543 Annex 5, will be agreed at the approval stage.<br>Safety zones during the construction, operation and maintenance and decommissioning phases are supported; however it should be noted that operational safety zones may have a maximum 50 m radius from the individual turbines. A detailed justification would be required for a 50 m operational safety zone, with significant evidence from the construction phase in addition to the baseline NRA required supporting the case.<br>An ERCoP is required to meet the requirements of MCA guidance. The template is available on the MCA website at www.gov.uk. An approved ERCoP will need to be in place prior to construction.<br>A study should be undertaken/updated which establishes the electromagnetic deviation affecting vessels' compasses and other navigating system due to the cable route to the satisfaction of the MCA. | Hydrographic data will be supplied to the MCA. This will consist of the Hornsea Three array area and the surrounding 500 m provided pre-consent, the Hornsea Three export cable route provided post-construction, and both the Hornsea Three array area and the surrounding 500 m and the Hornsea Three export cable route provided post-decommissioning.<br>Measures adopted as part of Hornsea Three are outlined in section 7.10 of this chapter and section 23 of the NRA and include a Cable Burial Risk Assessment (or similar), details on the application and use of safety zones and commitment to an ERCoP.<br>The Development Principles (see volume 4, annex 3.7: Layout Development Principles) will be used to define the layout post consent and will require the MMO to confirm in writing that they have been met.<br>Lessons learnt from previous offshore wind farm developments are provided in section 6 of the NRA and include electromagnetic interference trials undertaken at the North Hoyle offshore wind farm (MCA, 2005). These trials found that offshore wind farm infrastructure did not have any effect on compasses and therefore no further studies are considered necessary. |
| September 2017 | Ministry of Infrastructure and the Environment, Dutch Government (Rijkwaterstaat) – section 42 consultation response | We would like to get the information about the handling of ferries (passenger and Ro Ro) through the wind farm. More specifically:<br>• Are ferries allowed to pass through the wind-farm, and are there limitations based upon vessel length?<br>• Are the adverse weather routes for ferries analysed before or after the construction phase?<br>• Are alternative routes provided through the wind farm, such as by a channel?<br>• Does the routeing of ferries through the Hornsea Three array area differ from in the vicinity of the Hornsea Three offshore HVAC booster station(s)?<br>We would be grateful if you would take some time to get us familiar with the way the Applicant is handling the ferry traffic for this development. | Main routes including ferry routes have been considered at both a base and future case level in section 7.7 and section 7.11.2 of this chapter respectively, and in section 15 and section 18.2.2 of the NRA respectively.<br>Adverse weather routeing is considered within section 16 of the NRA and assessed within section 7.11 of this chapter and section 22.5 of the NRA.<br>Outcomes of the proposed navigational corridor assessment are in section 22.9 of the NRA.<br>Given the small development area of the Hornsea Three offshore HVAC booster station(s) there are not expected to be any impacts on ferry or other vessel routeing – this is considered in section 18.4 of the NRA. |
| September 2017 | Peel Ports Great Yarmouth – section 42 consultation response | Vessel access to the Port should in no way be fettered as a result of the construction or operation of the wind farm or the presence of the export cables. | Measures adopted as part of Hornsea Three are outlined in section 7.10 of this chapter and section 23 of the NRA and include compliance with UK and Flag State regulations and IMO conventions and marine coordination. These mitigations will assist in ensuring that vessel traffic associated with Hornsea Three is safely and effectively managed and does not impact upon third party users. |

| Date | Consultee and type of responses | Issues raised | Response to issue raised and/or where considered in this chapter |
|---|---|---|---|
| September 2017 | TH – section 42 consultation response | TH is satisfied with the PEIR, the contents of which have been noted.<br>However, our concerns remain over the structural design of the substations, as well as their locations and also the proposed layout of the array of turbines. We would of course welcome the earliest of consultation on these matters once further details become available. | TH confirmed (at the consultation meeting in December 2017) that their concerns were in relation to subsea substations (sited on the seabed) and the under keel clearance risk such structures may pose to deep draught vessels, particularly during the construction phase when the structures may not be fully lit and marked.<br>Subsea substations are only under consideration for the offshore HVAC booster stations and not the array substations.<br>An assessment of under keel clearance has been undertaken as part of the Environmental Statement (see section 18.4 of the NRA) and provides an overview of the key areas of risk identified throughout the export cable route, including the offshore HVAC booster station search area. |
| December 2017 | MCA – consultation meeting | In general MCA thought the new Layout A was a positive step forward; and the Development Principles would work well as part of the DCO process once agreed between parties. Comments from MCA included:<br>• Micro-siting of ±150 m should be reduced to allow for greater Probability of Detection (POD).<br>• Would like to see how curved perimeter developments lanes would look in reality; curved layouts can cause issues for SAR. It was noted that internal development lanes would be straight and the curve was to allow for the shape of the lease area. The western boundary would also be straight (subject to micro-siting).<br>• MCA noted that 20 nm (approx.) was too long for a SAR access corridor and that a buffer zone may be required. MCA to look to feed back further info on what is an acceptable distance.<br>• Trials on Helicopter Refuge Areas are being undertaken and MCA will feed back guidance.<br>• Minimum spacing of 1,000 m centre to centre was noted as was the 500 m minimum corridor width which would always be maintained. It was noted that in reality there may be more than one SAR corridor between development lanes.<br>• The Development Principle relating to the inclusion of dense boundaries should also refer to the 1,000 m minimum spacing requirement.<br>• All agreed that the Development Principles would work well as part of the DCO process once the principles had been agreed between parties.<br>No other comments were made on changes to the envelope and MCA saw the removal of floating foundations and the reduction in size of the Hornsea Three offshore HVAC booster station search area as positive steps. | Noted that changes to the proposed project envelope are positive. Development Principles have been considered in volume 4, annex 3.7: Layout Development Principles and the Statement of Common Ground. Any changes discussed and agreed will be implemented in the final version of the Development Principles. |
| December 2017 | TH – consultation meeting | TH noted the single line of orientation and commented that the indicative layout represented a positive step forward compared to the irregular layout with no lines of orientation considered in the PEIR.<br>It was agreed that commercial vessels will not navigate within the array and that in the event of a SAR incident a Hornsea Three vessel would likely be the first responder.<br>TH noted that in general they were content with the Development Principles but had concerns over 300 m micro siting and would like to see this reduced.<br>TH were content with the marine traffic survey data.<br>TH supported the reduction in the size of the Hornsea Three offshore HVAC booster station search area and noted that any deviations required for the offshore HVAC booster stations (up to six) would be minimal.<br>*Post minute note: TH also raised a query on how external curved boundaries could be used/designed.* | Noted that changes to the proposed project envelope are positive. Development Principles have been considered in volume 4 annex 3.7: Layout Development Principles and will be addressed in the Statement of Common Ground. Any changes discussed and agreed will be implemented in the final version of the Development Principles. |

## 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, offshore cable corridor (including offshore HVAC booster station search area) and cumulative shipping and navigation study areas 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 | United Kingdom Hydrographic Office (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) | 2017 | TCE and BMAPA |
| Maritime incident data | Marine Accident Investigation Branch (MAIB) | 2005 to 2014 | MAIB |
| Maritime incident data | Royal National Lifeboat Institution (RNLI) | 2005 to 2014 | RNLI |
| Ministry of Defence (MOD) SAR Helicopter Operations | MOD | 2011 to 2015 | MOD |
| UK Coastal Atlas of Recreational Boating 2.0 | RYA | 2016 | RYA |
| Southern North Sea shipping routes | Anatec ShipRoutes | 2017 | Anatec |
| UK Admiralty charts 105-0, 1187-0 and 2182A-0 | UKHO | 2017 | UKHO |

7.6.1.2 For the Hornsea Three offshore cable corridor 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.

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, any 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 offshore cable corridor.

7.6.1.6 Other navigational features such as IMO Routeing measures and 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 MGN 543 (MCA, 2016). A summary of the surveys undertaken to inform the shipping and navigation EIA are 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.

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.

Table 7.5: Summary of site specific survey data.

| Title | Extent of survey | Overview of survey | Survey contractor | Date | 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: 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 | |

## 7.7 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. It is noted that the Windermere platform is planned to be decommissioned by 2023. 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 Hornsea Three 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 km) 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 offshore cable corridor. The nearest aggregate dredging area is a production area (Area 484) which is located approximately 330 m from the Hornsea Three offshore cable corridor. Another production area (Area 506) and an application area (Area 483) 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 Wind Farm and Triton Knoll Offshore Wind Farm, located approximately 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, and consists of four developments. The former East Anglia zone is located to the south of the Hornsea Three array area, and consists of seven developments;
- 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 46.4 nm (85.9 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 (12.5 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.

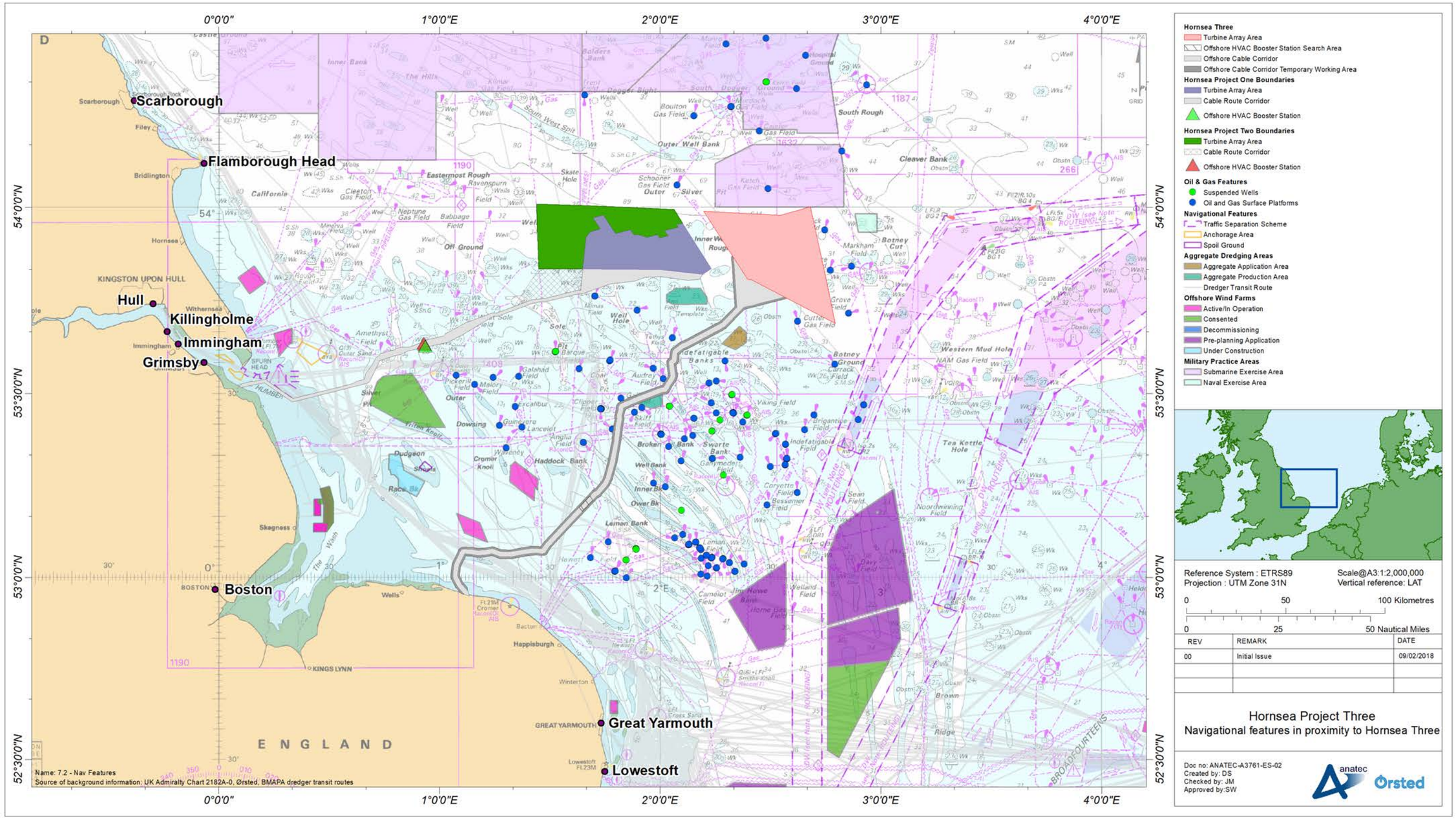


Figure 7.2: Navigational features in proximity to Hornsea Three.

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, Panel A. 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 7.3, Panel B. 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 7.3 (Panel C and Panel D respectively). 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. Individual 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 (45% within the Hornsea Three array area) and tankers (21%).

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 approximately 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 90$^{th}$ 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 7.4. 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. It is noted that the main routes reflect key directions of traffic routeing within the Hornsea Three array area shipping and navigation study area, and there are other vessels operate outside of these routes. Typically, a main route would consist of at least one vessel every two days or be associated with an offshore installation.

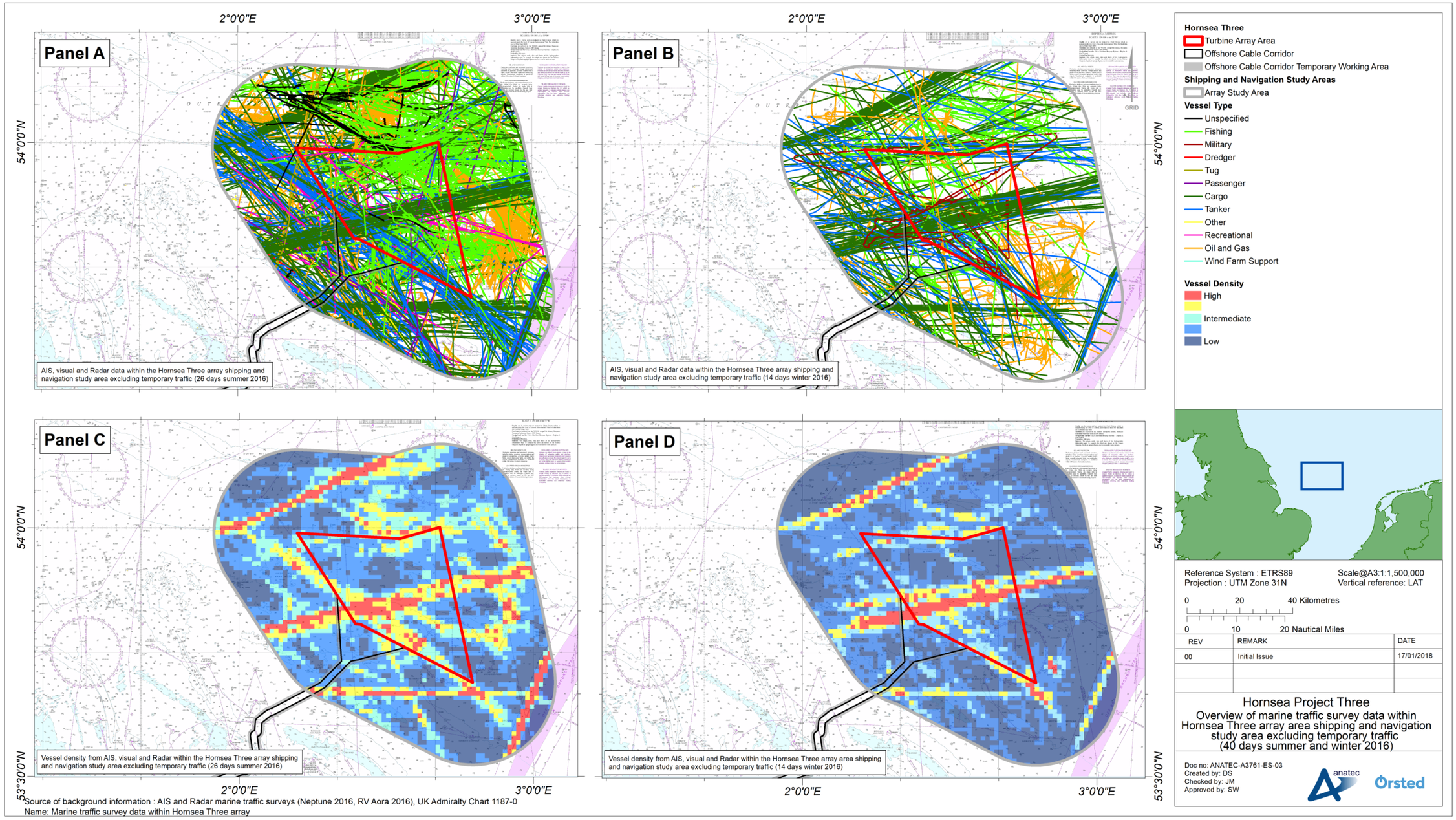


Figure 7.3: Overview of marine traffic survey data within the Hornsea Three array area shipping and navigation study area excluding temporary traffic (40 days summer and winter 2016).

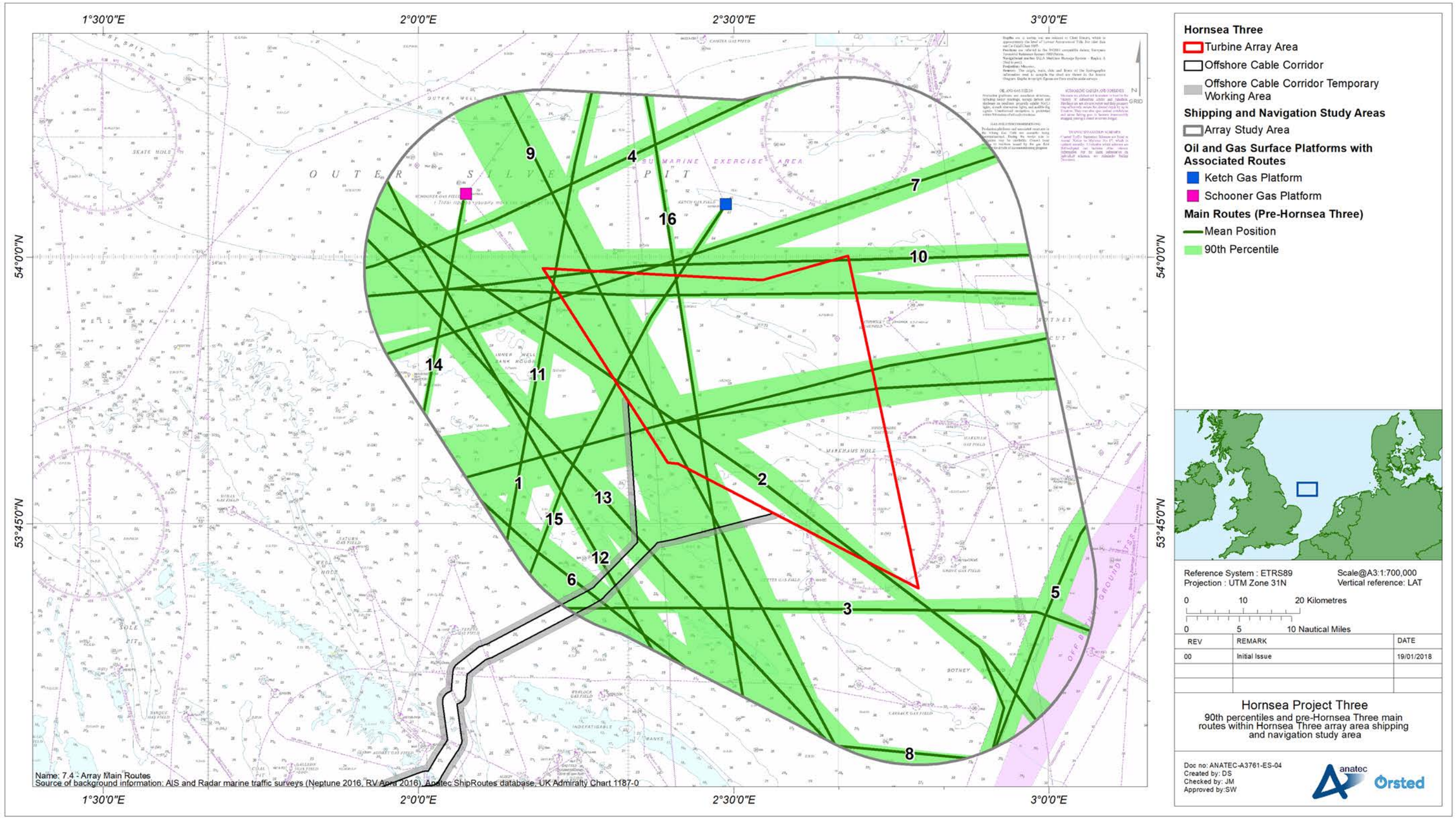


Figure 7.4: 90th percentiles and pre-Hornsea Three main routes within the Hornsea Three array area shipping and navigation study area.

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 7.4) | 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 to 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 transits 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 platform. 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 A platform. 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 platform. 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 platform. 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 the Recreational Craft Regulations 2017 No. 737.

7.7.2.16 A plot of the recreational vessel tracks recorded throughout the marine traffic survey is presented in Figure 7.5. 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 7.6. 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%).

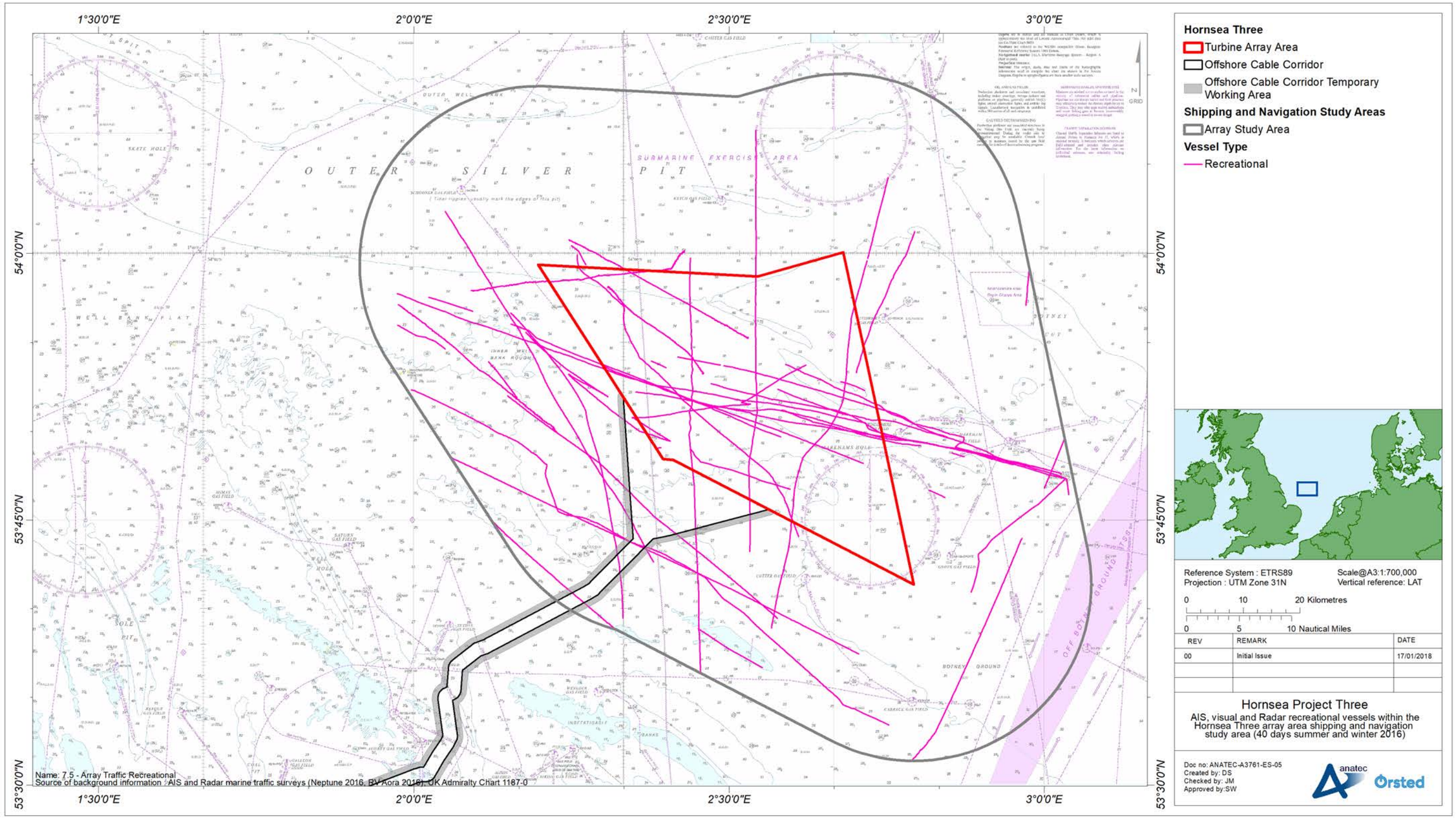


Figure 7.5: AIS, visual and Radar recreational vessels within the Hornsea Three array area shipping and navigation study area (40 days summer and winter 2016).

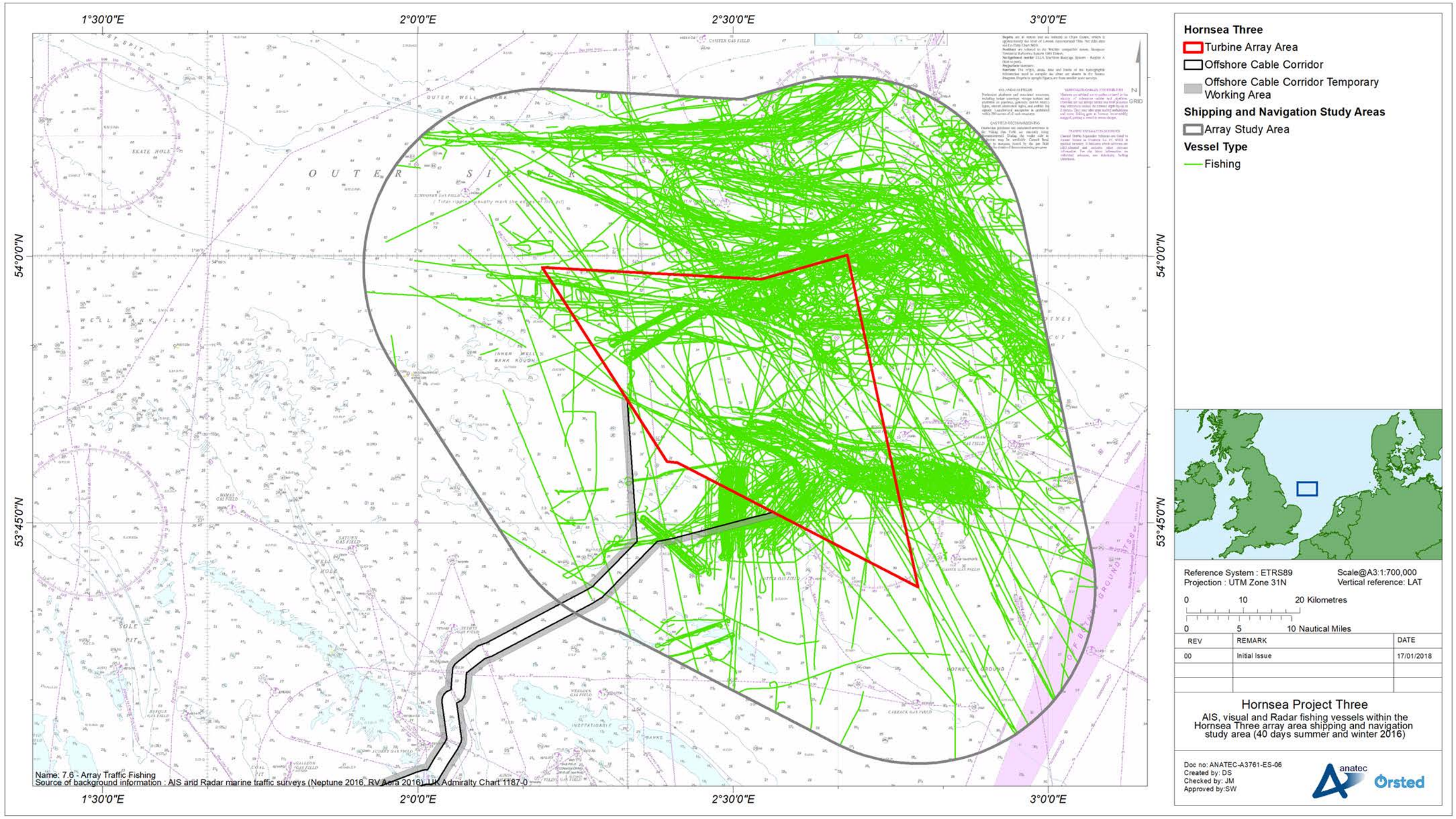


Figure 7.6: AIS, visual and Radar fishing vessels within the Hornsea Three array area shipping and navigation study area (40 days summer and winter 2016).

7.7.2.21 Fishing method information was available 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.

*SAR*

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 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), and has been in operation since April 2015. This base operates two Sikorsky S92A 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 RNLI and Her Majesty's 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 incident type, are presented in Figure 7.7. 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 within the Hornsea Three array area shipping and navigation study area (throughout the ten year dataset) 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 reported by the RNLI within the Hornsea Three array area shipping and navigation study area throughout the ten year period analysed. The closest incident reported 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.

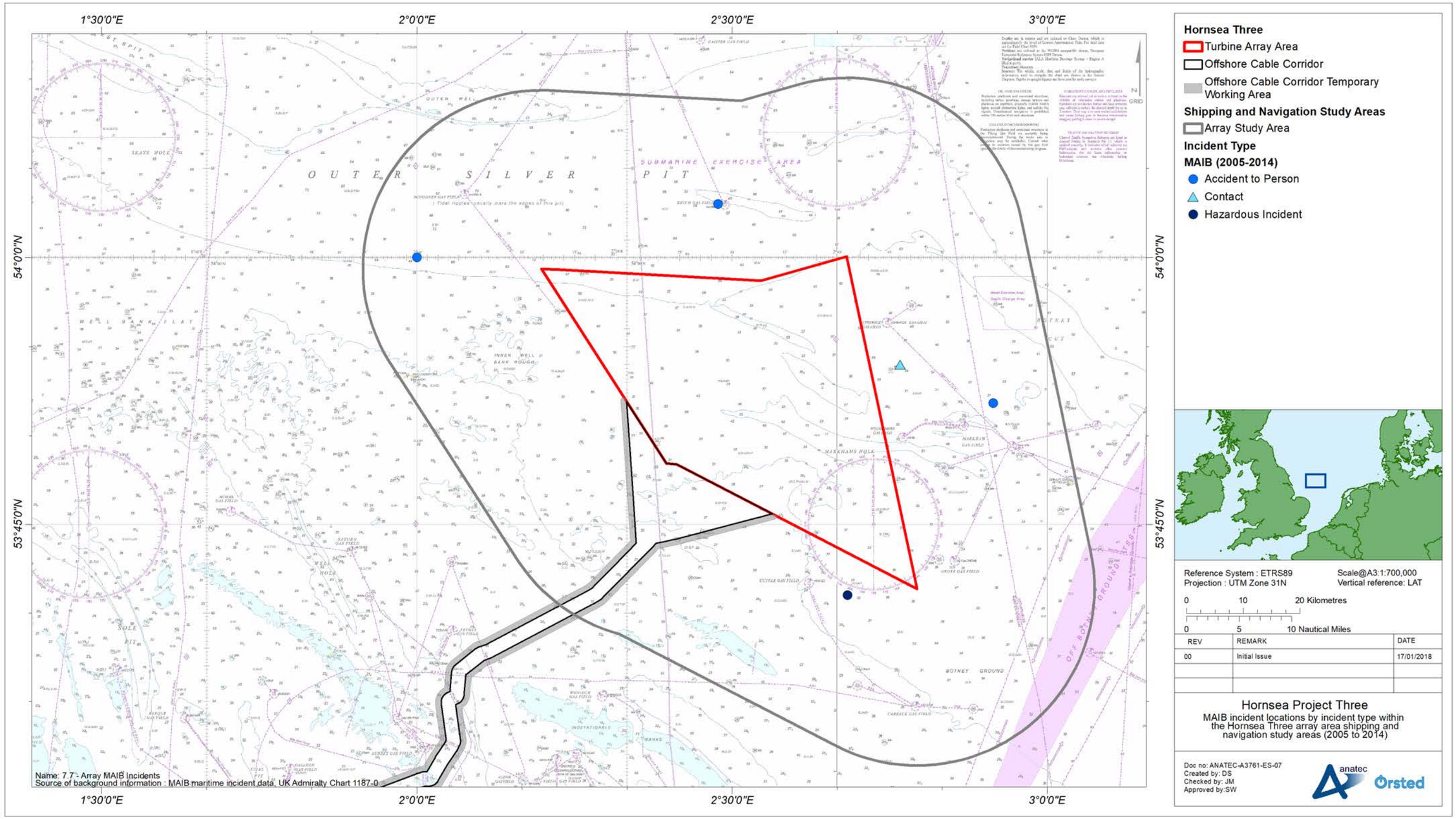


Figure 7.7: MAIB incident locations by incident type within the Hornsea Three array area shipping and navigation study area (2005 to 2014).

## 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 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 7.8.

7.7.3.6 For the 26 days analysed in summer 2016, there was an average of 94 unique vessels per day passing within the Hornsea Three offshore cable corridor shipping and navigation study area, recorded on AIS (excluding temporary traffic). There was average of 86 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 an average of 92 unique vessels per day passing within the Hornsea Three offshore cable corridor shipping and navigation study area, 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 (52% within the Hornsea Three offshore cable corridor) and tankers (20%). Throughout the winter period the majority of tracks were also cargo vessels (57% within the Hornsea Three offshore cable corridor shipping and navigation study area) and tankers (21%).

7.7.3.9 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 105 m and 114 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 15.0 m (crude oil tanker *Serena*). The average draught of vessels within the Hornsea Three offshore cable corridor shipping and navigation study area throughout the summer and winter survey periods were 5.2 m and 5.3 m respectively.

7.7.3.11 It should be noted that approximately 7% 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*

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 itself. The majority of these vessels were undertaking a passage alongside the shore.

7.7.3.13 The RYA's recreational AIS density grid, based upon data recorded over three summer periods between 2011 and 2013, indicates a reasonably high level of recreational activity from AIS equipped craft in the nearshore area of the Hornsea Three offshore cable corridor, including a number of distinctive regular routes. It is noted that the RYA request the use of this data source to identify recreational traffic levels.

*Fishing vessel activity*

7.7.3.14 Throughout the combined summer and winter survey period, an average of two to three fishing vessels per day passed within the Hornsea Three offshore cable corridor shipping and navigation study area and two 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.

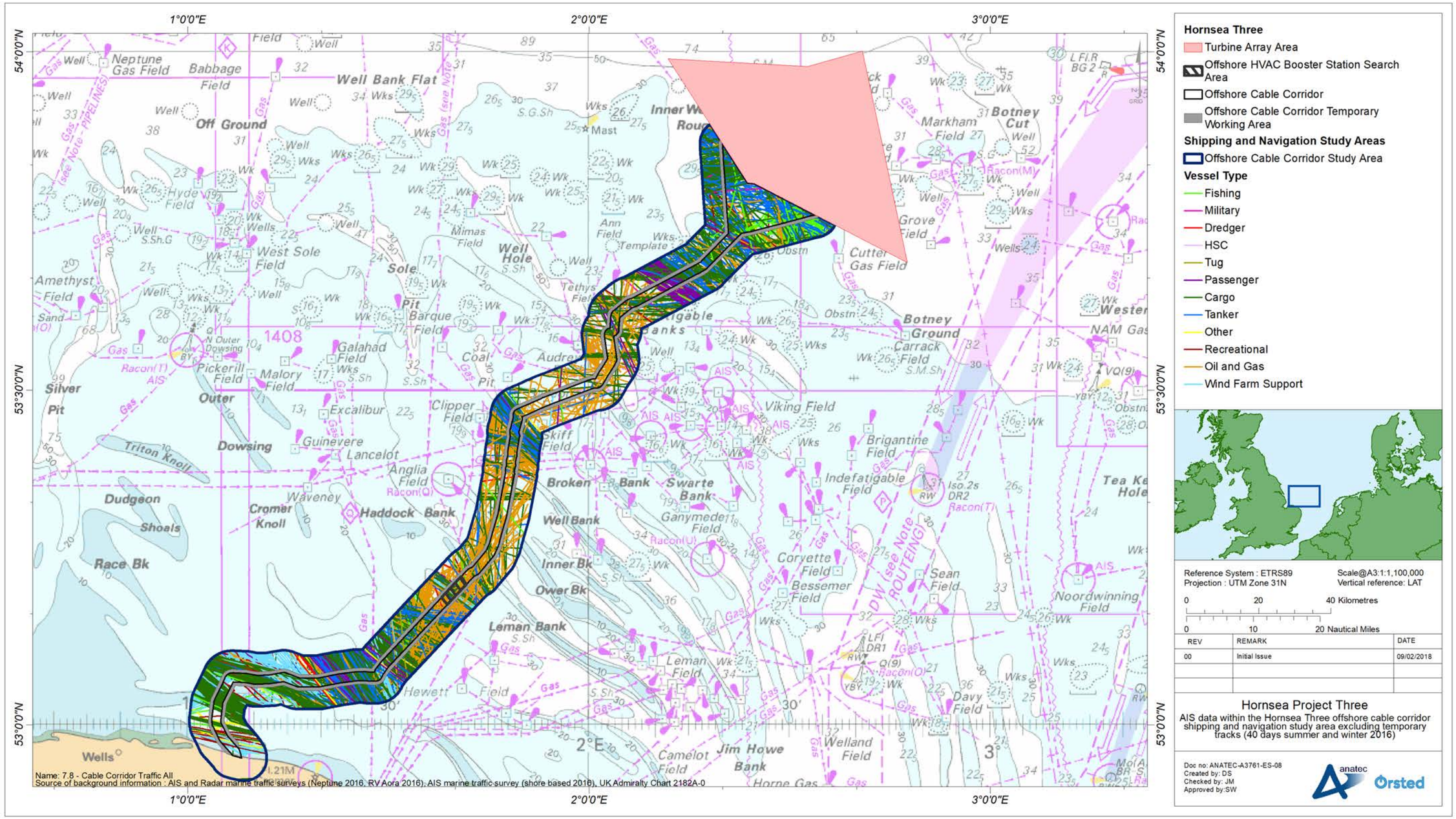


Figure 7.8: Overview of AIS data within the Hornsea Three offshore cable corridor shipping and navigation study area excluding temporary tracks (40 days summer and winter 2016).

### 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 7.9.

7.7.4.5 For the 14 days analysed in summer 2016, there was an average of six unique vessels per day passing within the Hornsea Three offshore HVAC booster station search area shipping and navigation study area, recorded on AIS and Radar (excluding temporary traffic). There was on average less than one unique vessel 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 five unique vessels per day passing within the Hornsea Three offshore HVAC booster station search area shipping and navigation study area, recorded on AIS and Radar (excluding temporary traffic). There was on average less than one unique vessel 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 oil and gas affiliated vessels (67% within the Hornsea offshore HVAC booster station search area) followed by cargo vessels and tankers (both 13%). It is noted that a small proportion of tracks intersecting the Hornsea Three offshore HVAC booster station search area were wind farm support vessels transiting to and from Dudgeon Offshore Wind Farm. This traffic is temporary and associated with the construction of the Dudgeon site however it remains within the assessment as a worst case, given the potential for operational routeing.

7.7.4.8 Vessel LOAs recorded throughout the survey periods ranged from 18 m (the wind farm support vessel *Windcat 9*) to a maximum of 200 m (bulk carrier *Federal Bristol*). The average length of vessels within the Hornsea Three offshore HVAC booster station search area shipping and navigation study area throughout the summer and winter periods were 80 m and 75 m respectively.

7.7.4.9 Vessel draughts recorded throughout the survey periods ranged from 1.2 m (the wind farm support vessel *Dalby Swale*) to a maximum of 8.9 m (chemical tanker *Sten Frigg*). The average draught of vessels within the Hornsea Three offshore HVAC booster station search area shipping and navigation study area throughout the summer and winter periods were 4.6 m and 4.8 m respectively.

7.7.4.10 It should be noted that 5% of the total number of unique vessels within the Hornsea Three offshore HVAC booster station search area shipping and navigation study area did not broadcast a draught on AIS and hence have been excluded from the analysis.

7.7.4.11 Four main commercial routes have been identified as transiting through the Hornsea Three offshore HVAC booster station search area shipping and navigation study area. Plots of the main routes and corresponding 90$^{th}$ percentiles within the offshore HVAC booster station search area shipping and navigation study area are presented in Figure 7.10.

7.7.4.12 As previously, these routes and 90$^{th}$ percentiles have been defined using the principles set out in MGN 543.

7.7.4.13 Details of the main routes (1 to 4), including the average number of vessels that transit through the Hornsea Three offshore HVAC booster station search area shipping and navigation study area per day and the main vessel types, are provided in Figure 7.10. It is noted that the main routes reflect key directions of traffic routeing within the Hornsea Three offshore HVAC booster station search area shipping and navigation study area, and other vessels do operate outside of these routes. Typically a main route would consist of at least one vessel every two days or be associated with an offshore installation.

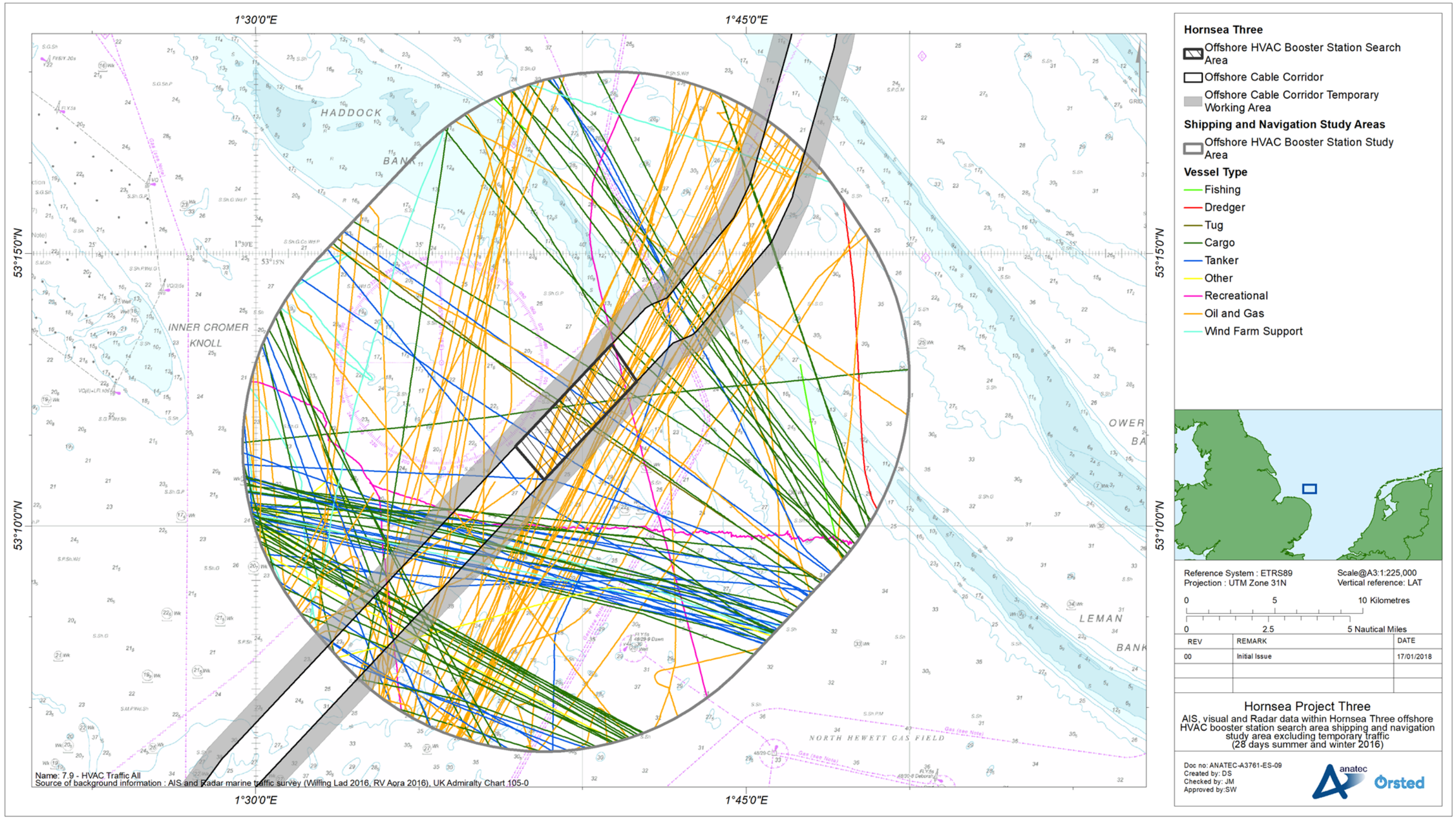


Figure 7.9: AIS, visual and Radar data within the Hornsea Three offshore HVAC booster station search area shipping and navigation search area excluding temporary traffic (28 days summer and winter 2016).

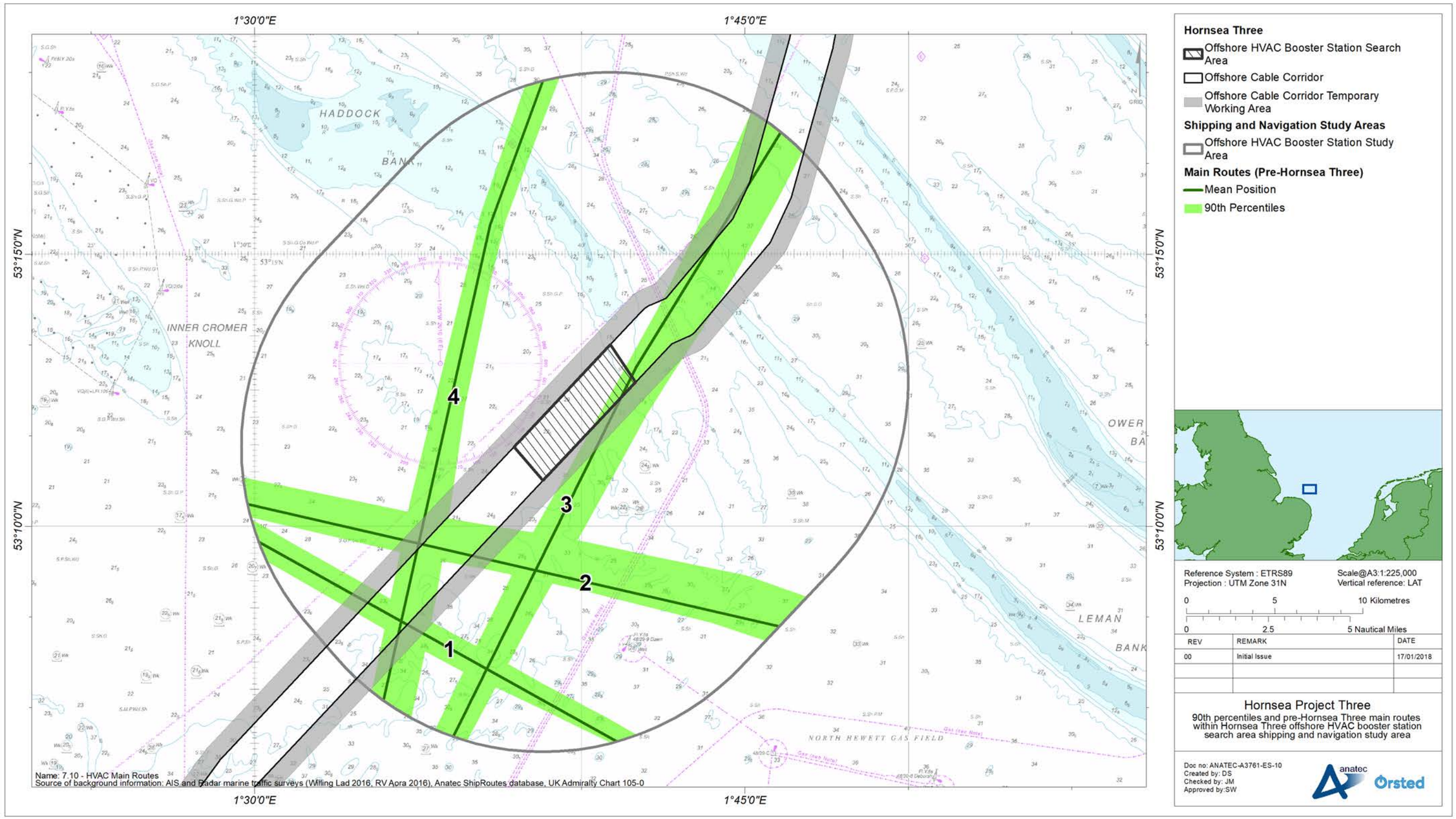


Figure 7.10: 90th percentiles and pre-Hornsea Three main routes within the Hornsea Three offshore HVAC booster station search area shipping and navigation study area.

Table 7.7: Main routes, average numbers and destination within Hornsea Three offshore HVAC booster station search area shipping and navigation study area.

| Route number (as shown in Figure 7.10) | Number of vessels per day (average) | Destinations and main vessel types identified |
|---|---|---|
| Route 1 | 1 vessel per 2 days | Immingham (UK) to Rotterdam (Netherlands). Route 1 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 2 | 1 vessel per day | Immingham (UK) to Rotterdam (Netherlands). Route 2 is generally used by tankers (52%) and cargo vessels (39%). |
| Route 3 | 1 vessel per 2 days | Great Yarmouth (UK) to Audrey Gas Field. Route 3 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 4 | 1 vessel per 2 days | Great Yarmouth (UK) to Clipper Gas Field. Route 4 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. |

*Recreational vessel activity*

7.7.4.14 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 three tracks recorded throughout the survey period, an average of one recreational vessel every seven days.

*Fishing vessel activity*

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

*Maritime accidents and incidents*

7.7.4.16 Between January 2005 and December 2014 there was one incident reported to the MAIB within the Hornsea Three offshore HVAC booster station search area shipping and navigation study area. This was an "Accident to Person" involving a standby safety vessel located approximately 0.78 nm east of the Hornsea Three offshore HVAC booster station search area.

7.7.4.17 A total of three RNLI lifeboat launches, excluding hoaxes and alarms, to three unique incidents were reported within the Hornsea Three offshore HVAC booster station search area shipping and navigation study area, corresponding to an average of one to two incidents per year.

7.7.4.18 Two of the incident types reported involved "Machinery Failure" with the other a "Person in Danger". Both of the "Machinery Failure" incidents involved a recreational vessel, whilst the "Person in Danger" was in relation to an oil and gas affiliated vessel.

7.7.4.19 It is noted that based upon the available data, one of the RNLI incidents reported within the Hornsea Three offshore HVAC booster station search area shipping and navigation study area coincided with the single MAIB incident recorded within the Hornsea Three offshore HVAC booster station search area shipping and navigation study area.

## 7.7.5 Future baseline scenario

7.7.5.1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 recommends that "*an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge*" is included within the Environmental Statement.

7.7.5.2 In the event that Hornsea Three does not come forward, an assessment of the future baseline conditions has been carried out and is described within this section.

7.7.5.3 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.

7.7.5.4 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.

7.7.5.5 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 8,824 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 offshore HVAC booster station(s) 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 this Environmental Statement chapter. Additionally, it is noted that the satellite and sightings data collected by the MMO and used as secondary sources is limited by its age.

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. Consequently there will be limitations with the data associated with non-AIS targets, as stated in section 7.7.3

## 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.

7.8.1.2 It is noted that the anticipated design life of Hornsea Three is 35 years (as stated for the relevant impacts in Table 7.8). However it may be desirable to ‘repower’ Hornsea Three at or near the end of the design life of Hornsea Three to the end of the 50 year Crown Lease period. If the specifications and designs of the new turbines and/or foundations fell outside of the maximum design scenario or the impacts of constructing, operation and maintenance, and decommissioning them were to fall outside those considered by this EIA, repowering would require further consent (and EIA) and is therefore outside of the scope of this document.

### 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. | *Hornsea Three array area:*<br>• Construction of the Hornsea Three array area could take up to eight years and be split over two phases; and<br>• Buoyed construction area around the Hornsea Three array area for the duration of all construction phases.<br>*Hornsea Three offshore cable corridor:*<br>• Maximum installation duration for the surface or subsea offshore HVAC booster stations is up to eight years split over two phases;<br>• Buoyed construction area around the Hornsea Three offshore HVAC booster stations; and<br>• 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. | *Hornsea Three array area:*<br>• Construction of the Hornsea Three array area could take up to eight years and be split over two phases; and<br>• 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. |
| 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:*<br>• Up to 300 turbines with jacket foundations;<br>• Total development area of up to 696 km$^2$;<br>• Up to 12 offshore HVAC transformer substations;<br>• Up to three accommodation platforms;<br>• Up to four offshore High Voltage Direct Current (HVDC) converter substations;<br>• Bridge links up to 100 m length linking co-sited structures, including offshore HVDC converter substations and accommodation platforms; and<br>• Construction of the Hornsea Three array area could take up to eight years and be split over two phases.<br>*Hornsea Three offshore cable corridor:*<br>• Up to four above surface or up to six subsea offshore HVAC booster stations; and<br>• Maximum installation duration for the surface or subsea offshore HVAC booster stations is two phases over eight years. | Pre commissioned structures may create new vessel to structure allision risk throughout the construction phase(s). Maximum extent of largest pre commissioned 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 Not Under Command (NUC) vessels in an emergency situation (including machinery related problems or navigational system errors). | *Hornsea Three array area:*<br>• Up to 300 turbines with jacket foundations;<br>• Total development area of up to 696 km$^2$;<br>• Up to 12 offshore HVAC transformer substations;<br>• Up to three accommodation platforms;<br>• Up to four offshore HVDC converter substations;<br>• Bridge links up to 100 m length linking co-sited structures, including offshore HVDC converter substations and accommodation platforms; and<br>• Construction of the Hornsea Three array area could take up to eight years and be split over two phases.<br>*Hornsea Three offshore cable corridor:*<br>• Up to four above surface or up to six subsea offshore HVAC booster stations; and<br>• Maximum installation duration for the surface or subsea offshore HVAC booster stations is two phases over eight 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 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 |
|---|---|---|
| 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:*<br>• Up to 300 turbines with jacket foundations;<br>• Total development area of up to 696 km²;<br>• Up to 12 offshore HVAC transformer substations;<br>• Up to three accommodation platforms;<br>• Up to four offshore HVDC converter substations;<br>• Bridge links up to 100 m length linking co-sited structures, including offshore HVDC converter substations and accommodation platforms; and<br>• Construction of the Hornsea Three array area could take up to eight 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 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 structures (including subsea 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. | *Hornsea Three array area:*<br>• Up to 300 turbines with jacket foundations;<br>• Total development area of up to 696 km²;<br>• Up to 12 offshore HVAC transformer substations;<br>• Up to three accommodation platforms;<br>• Up to four offshore HVDC converter substations;<br>• Up to 850 km array and 225 km interconnector cables; and<br>• Construction of the Hornsea Three array area could take up to eight years and be split over two phases.<br>*Hornsea Three offshore cable corridor:*<br>• Up to four above surface or up to six subsea offshore HVAC booster stations;<br>• Up to six export cables of up to 163 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);<br>• Up to 44 cable/pipeline crossings;<br>• Maximum installation duration for the surface or subsea offshore HVAC booster stations and export cables is eight years over two phases; and<br>• 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 offshore cable corridor may displace vessels (excluding commercial ferries) leading to increased journey times or distances during periods of adverse weather. | *Hornsea Three array area:*<br>• Anticipated design life of 35 years;<br>• Up to 300 turbines with jacket foundations;<br>• Total development area of up to 696 km²;<br>• Up to 12 offshore HVAC transformer substations;<br>• Up to three accommodation platforms;<br>• Up to four offshore HVDC converter substations;<br>• Bridge links up to 100 m length linking co-sited structures, including offshore HVDC converter substations and accommodation platforms; and<br>• 500 m maintenance safety zones.<br>*Hornsea Three offshore cable corridor:*<br>• Up to four above surface or up to six subsea offshore HVAC booster stations; and<br>• 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. | *Hornsea Three array area:*<br>• Anticipated design life of 35 years;<br>• Up to 300 turbines with jacket foundations;<br>• Total development area of up to 696 km²;<br>• Up to 12 offshore HVAC transformer substations;<br>• Up to three accommodation platforms;<br>• Up to four offshore HVDC converter substations;<br>• Bridge links up to 100 m length linking co-sited structures, including offshore HVDC converter substations and accommodation platforms; and<br>• 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. | *Hornsea Three array area:*<br>• Anticipated design life of 35 years;<br>• Up to 300 turbines with jacket foundations;<br>• Total development area of up to 696 km²;<br>• Up to 12 offshore HVAC transformer substations;<br>• Up to three accommodation platforms;<br>• Up to four offshore HVDC converter substations; and<br>• Bridge links up to 100 m length linking co-sited structures, including offshore HVDC converter substations and accommodation platforms.<br>*Maintenance vessel and helicopter movements and personnel:*<br>Maintenance activities within the Hornsea Three array area, consisting of:<br>• Offshore substation component exchange, painting and removal of organic build-up;<br>• Turbine component exchange, painting, organic waste removal, ladder replacement and anode replacement; and<br>• Array, interconnector and export cable with the Hornsea Three array area remedial burial and repairs.<br>Operation and maintenance vessels and helicopters in the vicinity of the Hornsea Three array area making up to 2,885 return trips per year (including those vessels undertaking maintenance activities listed above), comprised of:<br>• Up to 140 return trips for jack up vessels;<br>• Up to 2,433 return trips for CTVs;<br>• Up to 312 return trips for supply vessel; and<br>• Up to 3,785 total helicopter trips.<br>Operation and maintenance safety zones, consisting of:<br>• 500 m safety zones will be applied for around manned offshore platforms;<br>• 500 m safety zones will be applied for around turbines and offshore platforms undergoing major maintenance; and<br>• Advisory safety distances of 1,000 m will be recommended around vessels undertaking major maintenance activities. | 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.<br>Maximum number of vessel movements to and from the array would create maximum encounters and vessel to vessel collision risk. |

| Potential impact | Maximum design scenario | Justification |
|---|---|---|
| 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. | *Hornsea Three offshore cable corridor:*<br>• Anticipated design life of 35 years;<br>• Up to four above surface or up to six subsea offshore HVAC booster stations; and<br>• Operational Aids to Navigation (buoys).<br>*Maintenance vessel and helicopter movements and personnel:*<br>Maintenance activities within the Hornsea Three array area, consisting of:<br>• Offshore substation component exchange, painting and removal of organic build-up;<br>• Turbine component exchange, painting, organic waste removal, ladder replacement and anode replacement; and<br>• Array, interconnector and export cable with the Hornsea Three array area remedial burial and repairs.<br>Operation and maintenance vessels in the vicinity of the Hornsea Three array area making up to 2,885 return trips per year (including those vessels undertaking maintenance activities listed above), comprised of:<br>• Up to 140 return trips for jack up vessels;<br>• Up to 2,433 return trips for CTVs;<br>• Up to 312 return trips for supply vessels; and<br>• Up to 3,785 total helicopter trips.<br>Operation and maintenance safety zones, consisting of:<br>• 500 m safety zones will be applied for around manned offshore platforms;<br>• 500 m safety zones will be applied for around turbines and offshore platforms undergoing major maintenance; and<br>• Advisory safety distances of 1,000 m will be recommended around vessels undertaking major maintenance activities. | 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.<br>Maximum number of vessel movements to and from the array, export cables or Hornsea Three offshore HVAC booster stations development would create maximum encounters and vessel to vessel collision risk. |
| 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:*<br>• Anticipated design life of 35 years;<br>• Up to 300 turbines with jacket foundations;<br>• Total development area of up to 696 km$^2$;<br>• Up to 12 offshore HVAC transformer substations;<br>• Up to three accommodation platforms;<br>• Up to four offshore HVDC converter substations; and<br>• Bridge links up to 100 m length linking co-sited structures, including offshore HVDC converter 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 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:*<br>• Anticipated design life of 35 years;<br>• Up to 300 turbines with jacket foundations;<br>• Total development area of up to 696 km$^2$;<br>• Up to 12 offshore HVAC transformer substations;<br>• Up to three accommodation platforms;<br>• Up to four offshore HVDC converter substations; and<br>• Bridge links up to 100 m length linking co-sited structures, including offshore HVDC converter 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 structures may create maximum increase to vessel to structure allision return period. |

| Potential impact | Maximum design scenario | Justification |
|---|---|---|
| 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:*<br>• Anticipated design life of 35 years;<br>• Up to 300 turbines with jacket foundations;<br>• Total development area of up to 696 km$^2$;<br>• Up to 12 offshore HVAC transformer substations;<br>• Up to three accommodation platforms;<br>• Up to four offshore HVDC converter substations;<br>• Bridge links up to 100 m length linking co-sited structures, including offshore HVDC converter substations and accommodation platforms; and<br>• 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 structures 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:*<br>• Anticipated design life of 35 years;<br>• Up to four surface offshore HVAC booster stations; and<br>• Bridge links up to 100 m length linking co-sited structures, including offshore HVDC converter 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. |
| Presence of subsea HVAC booster stations and cable protection within the Hornsea Three offshore cable corridor may increase vessel to subsea structure allision risk for all vessels. | *Hornsea Three offshore cable corridor:*<br>• Anticipated design life of 35 years;<br>• Up to six subsea HVAC booster stations;<br>• Water depth of less than 30 m; and<br>• Operational Aids to Navigation (buoys);<br>• Up to six export cables of up to 163 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);<br>• Up to 44 cable/pipeline crossings;<br>• Cable protection measures; and<br>• 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. |
| Presence of structures (including subsea elements) and cables may present an increased risk of gear snagging for commercial fishing vessels with mobile gear. | *Hornsea Three array area:*<br>• Anticipated design life of 35 years;<br>• Up to 300 turbines with jacket foundations;<br>• Total development area of up to 696 km$^2$;<br>• Up to 12 offshore HVAC transformer substations;<br>• Up to three accommodation platforms;<br>• Up to four offshore HVDC converter substations;<br>• 1,000 m minimum spacing; and<br>• Up to 830 km array and 225 km interconnector cables.<br>*Hornsea Three offshore cable corridor:*<br>• Anticipated design life of 35 years;<br>• Up to four above surface (jackets) or up to six subsea HVAC booster stations;<br>• Up to six export cables of up to 163 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);<br>• Up to 44 cable/pipeline crossings;<br>• Cable protection measures; and<br>• 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 |
|---|---|---|
| Operation and maintenance activities may diminish emergency response capability (including SAR) within the Hornsea Three array area. | *Hornsea Three array area:*<br>• Anticipated design life of 35 years;<br>• Up to 300 turbines with jacket foundations;<br>• Total development area of up to 696 km²;<br>• Up to 12 offshore HVAC transformer substations;<br>• Up to three accommodation platforms;<br>• Up to four offshore HVDC converter substations; and<br>• Bridge links up to 100 m length linking co-sited structures, including offshore HVDC converter substations and accommodation platforms.<br>*Maintenance vessel movements and personnel:*<br>Maintenance activities within the Hornsea Three array area, consisting of:<br>• Offshore substation component exchange, painting and removal of organic build-up;<br>• Turbine component exchange, painting, organic waste removal, ladder replacement and anode replacement; and<br>• Array and interconnector cables within the Hornsea Three array area remedial burial and repairs.<br>Operation and maintenance vessels in the vicinity of the Hornsea Three array area making up to 2,885 return trips per year (including those vessels undertaking maintenance activities listed above), comprised of:<br>• Up to 140 return trips for jack up vessels;<br>• Up to 2,433 return trips for CTVs; and<br>• Up to 312 return trips for supply vessels. | Maximum intensity of people, vessels, aircraft and structures within the Hornsea Three array area causing the greatest potential for a SAR incident in a previously undeveloped sea area. |
| *Decommissioning phase* | | |
| 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. | *Hornsea Three array area:*<br>• Maximum duration of decommissioning phase of up to eight years; and<br>• Buoyed decommissioning area around the Hornsea Three array area for the duration of decommissioning phases.<br>*Hornsea Three offshore cable corridor:*<br>• Buoyed decommissioning area around the Hornsea Three offshore HVAC booster stations; and<br>• 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:*<br>• Maximum duration of decommissioning phase of up to eight years; and<br>• 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 offshore cable corridor may cause increased vessel to structure allision risk external to the array for all vessels. | *Hornsea Three array area:*<br>• Up to 300 turbines with jacket foundations;<br>• Total development area of up to 696 km²;<br>• Up to 12 offshore HVAC transformer substations;<br>• Up to three accommodation platforms;<br>• Up to four offshore HVDC converter substations;<br>• Bridge links up to 100 m length linking co-sited structures, including offshore HVDC converter substations and accommodation platforms; and<br>• Maximum duration of decommissioning phase of up to eight years.<br>*Hornsea Three offshore cable corridor:*<br>• Up to four above surface or up to six subsea offshore HVAC booster stations; and<br>• Maximum duration of decommissioning phase for the Hornsea Three offshore HVAC booster stations; and<br>• 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 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:*<br>• Up to 300 turbines with jacket foundations;<br>• Total development area of up to 696 km²;<br>• Up to 12 offshore HVAC transformer substations;<br>• Up to three accommodation platforms;<br>• Up to four offshore HVDC converter substations;<br>• Bridge links up to 100 m length linking co-sited structures, including offshore HVDC converter substations and accommodation platforms; and<br>• Maximum duration of decommissioning phase of up to eight years.<br>*Hornsea Three offshore cable corridor:*<br>• Up to four above surface or up to six sub subsea HVAC booster stations;<br>• Maximum duration of decommissioning phase for the Hornsea Three offshore HVAC booster stations; and<br>• 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:*<br>• Up to 300 turbines with jacket foundations;<br>• Total development area of up to 696 km²;<br>• Up to 12 offshore HVAC transformer substations;<br>• Up to three accommodation platforms;<br>• Up to four offshore HVDC converter substations;<br>• Bridge links up to 100 m length linking co-sited structures, including offshore HVDC converter substations and accommodation platforms; ; and<br>• Maximum duration of decommissioning phase of up to eight years. | 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 |
|---|---|---|
| Presence of decommissioned structures (including subsea 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:*<br>• Up to 300 turbines with jacket foundations;<br>• Total development area of up to 696 km$^2$;<br>• Up to 12 offshore HVAC transformer substations;<br>• Up to three accommodation platforms;<br>• Up to four offshore HVDCs substations;<br>• Up to 850 km array and 225 km interconnector cables; and<br>• Maximum duration of decommissioning phase of up to eight years.<br>*Hornsea Three offshore cable corridor:*<br>• Up to four above surface or up to six subsea offshore HVAC booster stations;<br>• Maximum duration of decommissioning phase for the Hornsea Three offshore HVAC booster stations; and<br>• 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 have no perceptible impact with the mitigation measures adopted for Hornsea Three in place (including information promulgation 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 or offshore HVAC booster station(s) 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 station(s). |
| 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 an 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 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.<br>When considering the low numbers of third party vessels in the area (compared to other UK areas), existing regulations such as COLREGs (IMO, 1972 as amended), 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.<br>Experience with the renewables industry shows that during the operation and maintenance 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 for the operation and maintenance phase within section 7.11.2. However, it is noted that there have been no reported incidents of vessel to vessel collision in proximity to an operational wind farm.<br>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. |

| Potential impact | Justification |
|---|---|
| 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 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 and offshore cable corridor shipping and navigation study areas the impact is expected to be broadly acceptable (not significant). |
| Construction activities may diminish emergency response capability (including SAR) within the Hornsea Three array area. | Given that there will be limited issues relating to access (since the array will not be fully constructed) and additional project vessels involved in the construction of Hornsea Three on site, this impact is expected to be broadly acceptable (not significant).with measures adopted as part of Hornsea Three in place, notably the ERCoP. |
| *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 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 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 station(s) 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 station(s). |
| 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 cables 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.<br>The offshore HVAC booster station(s) 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 station(s); 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 cables will be buried or protected there are not anticipated to be any effects associated with increased encounters or collision risk for vessels. |
| 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.<br>It is noted that cumulative effects on marine Radar, associated with the proposed navigational corridor, are considered in section 7.13.3. |
| 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. |

| Potential impact | Justification |
|---|---|
| *Decommissioning phase* | |
| Decommissioning 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 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.<br>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 offshore HVAC booster station(s) 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 offshore HVAC booster station(s). |
| Decommissioning 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 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 an encounter.<br>When considering the low numbers of third party vessels in the area (compared to other UK areas), existing regulations such as COLREGs (IMO, 1972 as amended), 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). |
| 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). |
| Decommissioning activities may diminish emergency response capability (including SAR) within the Hornsea Three array area. | Given that there will be limited issues relating to access (since the array will not be fully decommissioned) and additional project vessels involved in the decommissioning of Hornsea Three on site, this impact is expected to be broadly acceptable (not significant).with measures adopted as part of Hornsea Three in place, notably the ERCoP. |

## 7.9 Impact assessment methodology

### 7.9.1 Overview

7.9.1.1 The shipping and navigation EIA has followed the methodology set out in volume 1, chapter 5: Environmental Impact Assessment Methodology. Specific to the shipping and navigation EIA, the following guidance documents have also been considered:

- MCA MGN 543 (Merchant and Fishing) Safety of Navigation OREIs – Guidance on UK Navigational Practice, Safety and Emergency Response (MCA, 2016);
- MCA Methodology for Assessing Marine Navigational Safety Risks of Offshore Wind Farms (2015); and
- Guidelines for FSA – Maritime Safety Council (MSC)/Circular 1023/MEPC/Circular 392 (IMO, 2002).

7.9.1.2 The following provides an overview of the process of assessing risk to navigational receptors and how the outputs of the NRA has 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 FSA process (see section 7.9.3 below) to identify impacts associated with the development.

### 7.9.3 FSA 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 Three 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 Impact assessment criteria

7.9.4.1 Following completion of the FSA and the NRA, this information was fed into the EIA process.

7.9.4.2 The detailed EIA methodology is defined in volume 1, chapter 5: Environmental Impact Assessment 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 The criteria for determining the significance of effects is a two stage process that involves defining the sensitivity of the receptors and the magnitude of the impacts. This section describes the criteria applied in this chapter to assign values to the sensitivity of receptors and the magnitude of potential impacts.

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 has a degree of vulnerability 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.

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. |

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 EIA Regulations.

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 EIA significance ranking correlation.

| FSA risk ranking | EIA 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). As there is a commitment to implementing these measures, they are considered inherently part of the design of Hornsea Three and have therefore been considered in the assessment presented in section 7.11 below (i.e. the determination of magnitude and therefore significance assumes implementation of these measures). These measures are considered standard industry practice for this type of development.

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

| Mitigation measures adopted as part of for Hornsea Three | Justification |
|---|---|
| Advisory safe distances | A 1,000 m advisory safe passing distance around work areas will be requested during construction and decommissioning phases, and up to 1,000 m advisory safe distances around cable installation/removal or maintenance vessels. These are advisory and are not enforceable; however vessels will also be displaying Restricted in Ability to Manoeuvre lights under COLREGs (IMO, 1972 as amended). |
| 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 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 the Hornsea Three array area, the turbines, offshore HVDC converter substations, offshore HVAC transformer substations, accommodation platforms and offshore HVAC booster station(s).<br>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.<br>Five hundred metre safety zones for the construction, major maintenance and eventual decommissioning phases of a turbine, offshore HVDC converter substation, offshore HVAC transformer substation, accommodation platform and offshore HVAC booster station's 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 500 m safety zone will then be removed (or reduced to 50 m in the case of partially complete works) at that location.<br>During the operation and maintenance phase, it is unlikely that adjacent 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.<br>As above, safety zones with a radius of up to 50 m around turbines, substations 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 installed platforms where a clear safety case can be demonstrated and where the application is in line with the regulatory guidance. |
| Blade clearance | Turbines will be constructed to ensure that the minimum rotor blade clearance is 34.97 m above Lowest Astronomical Tide (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. |

| Mitigation measures adopted as part of for Hornsea Three | Justification |
|---|---|
| Cable Burial Risk Assessment (or similar) 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.<br>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.<br>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 (or similar). |
| Charting of Hornsea Three array area and offshore HVAC booster station(s) | 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 station(s) shall also be charted. |
| Charting of export cables and array cables | Cables will be marked on nautical charts in line with UKHO standards. Note that depending upon the scale of the chart, array cabling may not be shown and it may only be the export cables that are 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 operation and maintenance 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.<br>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.<br>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 (as of April 2018) | The individual turbine structures will have functions and procedures in place for generator shut down 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 operation and maintenance phase will also be required for a minimum of one year. |
| 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 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 offshore cable corridor.<br>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. |
| 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. |
| Surface buoy | A surface buoy (likely per structure) will be required at the location of subsea HVAC booster station(s) where the under keel clearance is less than 30 m, as indicated by TH. |
| 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 project related vessels meet both IMO conventions for safe operation as well as Health, Safety and Environment (HSE) requirements, where applicable. This shall include the following good practice:<br>• Wind farm associated vessels will comply with International Maritime Regulations;<br>• All vessels, regardless of size, will be required to carry AIS equipment on board;<br>• 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<br>• All marine operations will be governed by operational limits, tidal conditions, weather conditions and vessel traffic information.<br>• Walk to work solutions will be utilised. |

### 7.10.2 Development Principles

7.10.2.1 Development Principles are contained within volume 4, annex 3.7: Layout Development Principles. The Development Principles have been written in consultation with key regulators to ensure that post consent the turbine layout within the Hornsea Three array area satisfactorily meets both navigational and SAR safety requirements whilst also being technically and commercially viable. The concept and use of the Development Principles is agreed with the MCA and TH.

7.10.2.2 Given the potential variables within the design scenario and lessons learnt from the process of layout approval, Hornsea Three will use the Development Principles approach to allow for efficient agreement with the MMO post consent by agreeing the parameters within which the layout must be developed with the key maritime regulators (MCA and TH) during the application and examination process. The Development Principles have been designed with consideration to the following points:

- No surface navigation impacts have been identified relating to the layout with a minimum 1,000 m spacing and therefore the Hornsea Three array area design will be largely driven (with regards to shipping and navigation impacts) by issues relating to SAR assets;
- Allows cumulative consideration to be built in to the process aiding shipping and navigation receptors;
- Include consideration for the recommendations set out in MGN 543 (MCA, 2016) and Annex 5;
- Give confidence to the maritime stakeholders and regulatory authorities that the final layout will be acceptable without the need for an extended final sign off process. The regulators can be assured that, although currently indicative, the final layout will be designed using the Development Principles which have been written to deal with concerns from stakeholders (where considered appropriate and justified);
- The process of writing the Development Principles has allowed for early discussion on issues which have historically been a concern at a very late stage for other projects where it becomes very challenging for the Applicant to take these on board as they have contractual deadlines for installation relating to the Contract for Difference (CfD); and
- Provides more certainly than the standard Deemed Marine Licence condition which simply requires sign off with no parameters to assess against or process by which discussions can be undertaken.

7.10.2.3 The Development Principles will give a clear framework by which the Applicant must work with the MMO on the final layout and by which the MMO can clearly see that the requirements of the key maritime stakeholders, notably the MCA, have been addressed.

7.10.2.4 It is noted that the Development Principles have been designed using an approach agreed and consented within the Dogger Bank Creyke Beck A&B and Dogger Bank Teesside A&B projects.

## 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 potential impacts arising from the construction of Hornsea Three are listed in Table 7.8, 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 preferred route and the number of vessels on the route) and that there are no safety implications associated with the proposed 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 these 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 carrying 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 as amended), 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 of the longest construction period including all phases – nine years), 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. No consultation responses (during the PEIR section 42 consultation phase) were received from Regular Operators (excluding commercial ferries) relating to adverse weather routeing concerns. The sensitivity of the receptor is therefore, considered to be low.

Significance of effect

7.11.1.11 Overall, 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 known commercial ferry operators only DFDS Seaways raised concerns pre PEIR regarding their adverse weather routeing; however they had no further comments to make during the section 42 consultation phase. DFDS Seaways are the only identified commercial ferry operator to transit through the Hornsea Three array 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 Seaways 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 station(s) given the limited size of the development area.

7.11.1.16 The impact is 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 operation and maintenance 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 (safety), 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, 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 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 Very High Frequency (VHF) and AIS but also through the presence of on site 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 on site 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 operation and maintenance 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 upon allision 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 from the assessment of previous wind farm projects and successful implementation of mitigation, 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, 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, incident 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 presence of the MHCC and increased resources/vessels (able to render assistance) on site 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 operation and maintenance 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, the 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 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, 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 nautical 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 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 of 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 operation and maintenance 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 an allision 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; however the energy at which the allision occurs is likely to be much lower. Section 42 consultation responses did not highlight any significant level of concern with regards to allision with structures noting the measures adopted as part of Hornsea Three such as temporary lighting and marking and application for safety zones which were supported by the recreational stakeholders.

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, 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 pre-commissioned structures (including subsea 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 presence of pre-commissioned structures (including subsea 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. Conservative consequences are associated with vessel foundering due to the potential for the vessel snagging on a subsea hazard.

7.11.1.49 During consultation, the Dutch Fishing Association VISNED noted that fishing, including trawling and fly-shooting, would be possible in amongst the indicative layouts shown in the PEIR if the weather was suitable and the fish are present. Additionally, VISNED noted that *"for fishing, the separation between turbines is more important than the regularity of the layout."* The maximum design scenario includes a minimum separation distance of 1,000 m.

7.11.1.50 It is noted that Dutch fishing vessels (including those flagged in the UK) are the predominant fishing vessels in the area. VISNED also noted that in good weather fishing vessels are likely to transit through the wind farm. All foundation types, including the jacket foundations considered in the maximum design scenario, are assumed to be ALARP based on the minimum 1,000 m spacing and measures adopted as part of Hornsea Three to ensure that fishing vessels are able to safely passage plan transits and activity within the Hornsea Three array area.

7.11.1.51 The most severe consequence of snagging is foundering. Foundering is considered to be when a vessel suffers structural or stability failure causing it to take on water. 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. Furthermore, there have been no recorded incidents of vessels snagging pre-commissioned structures within a UK wind farm construction area.

7.11.1.52 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. Consultation responses have shown that shipping and navigational stakeholders are content with the level of mitigation proposed.

- 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.

7.11.1.53 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.

7.11.1.54 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

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

7.11.1.56 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.

7.11.1.57 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

7.11.1.58 Overall, 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*

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

Table 7.15: Construction phase monitoring commitments.

| Environmental effect | Monitoring commitment |
|---|---|
| Presence of pre-commissioned structures (including subsea 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. | 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. |
| 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. | 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 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 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 extent (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. No consultation responses (during the PEIR section 42 consultation phase) were received from Regular Operators (excluding commercial ferries) relating to concerns adverse weather routeing during the operational phase. The sensitivity of the receptor is therefore, considered to be low.

Significance of effect

7.11.2.8 Overall, 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 known commercial ferry operators only DFDS Seaways raised concerns pre PEIR regarding their adverse weather routeing; however they had no further comments to make during the section 42 consultation phase. DFDS Seaways are the only identified commercial ferry operator to transit through the Hornsea Three array 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 7.11; all routes are operated by DFDS Seaways who provided the waypoint information used in this assessment. As noted in paragraph 7.11.2.7, no section 42 consultation responses were received from DFDS Seaways. Commercial ferry routeing was raised by the Ministry of Infrastructure and the Environment, of the Dutch government (Rijkwaterstaat) but as noted in Table 7.3, main routes including ferry routes have been considered at both a base and future case level in section 7.7 and section 7.11.2 of this chapter respectively, and in section 15 and section 18.2.2 of the NRA respectively noting no significant impacts.

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 7.11. 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.

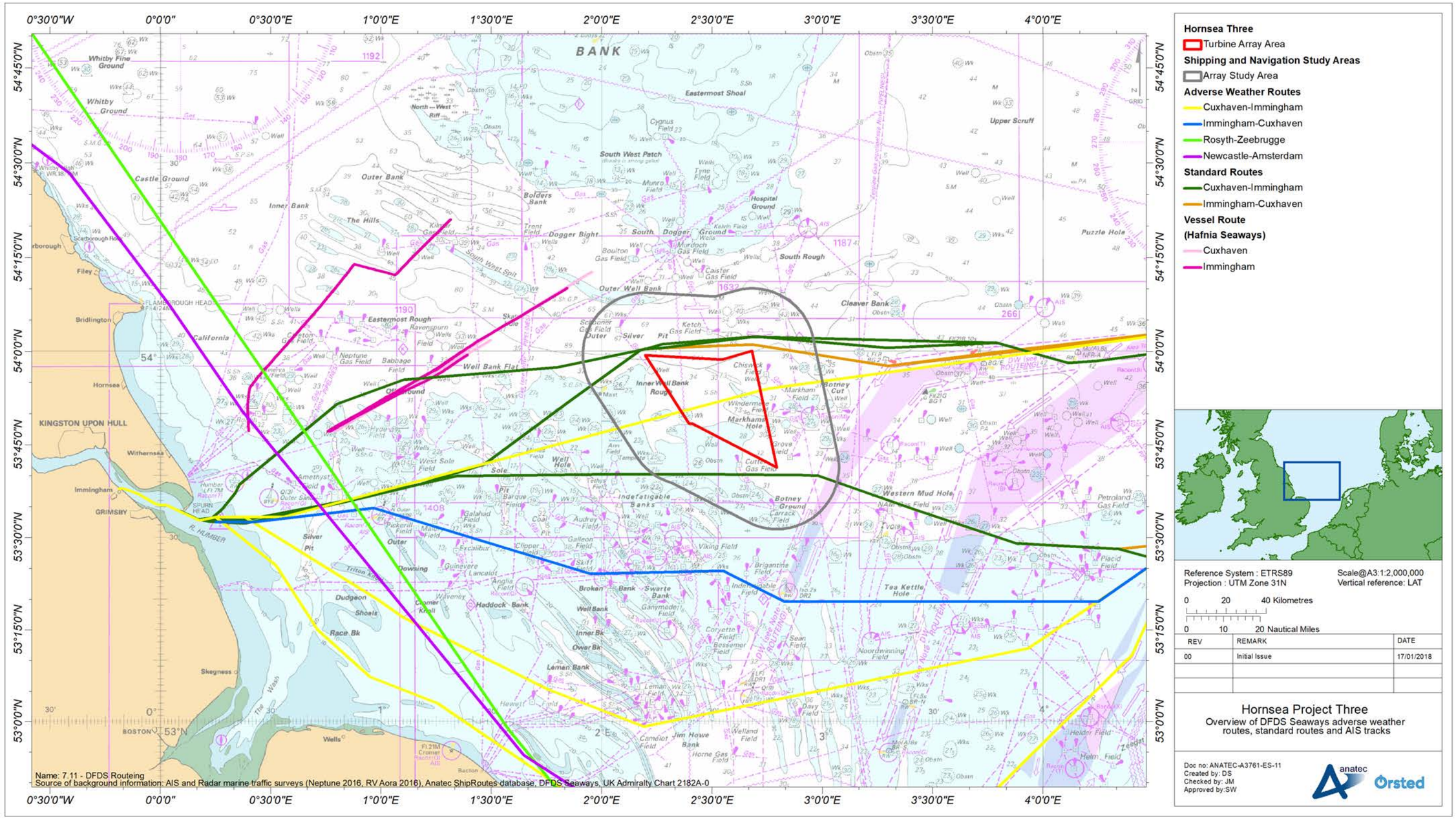


Figure 7.11: Overview of DFDS Seaways adverse weather routes, standard routes and AIS tracks.

Significance of effect

7.11.2.19 Overall, 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 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 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 7.16. 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.

7.11.2.24 Figure 7.12 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.

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).

Table 7.16: 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 (%) |
|---|---|---|---|
| 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 |

7.11.2.26 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 are 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 2016 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).

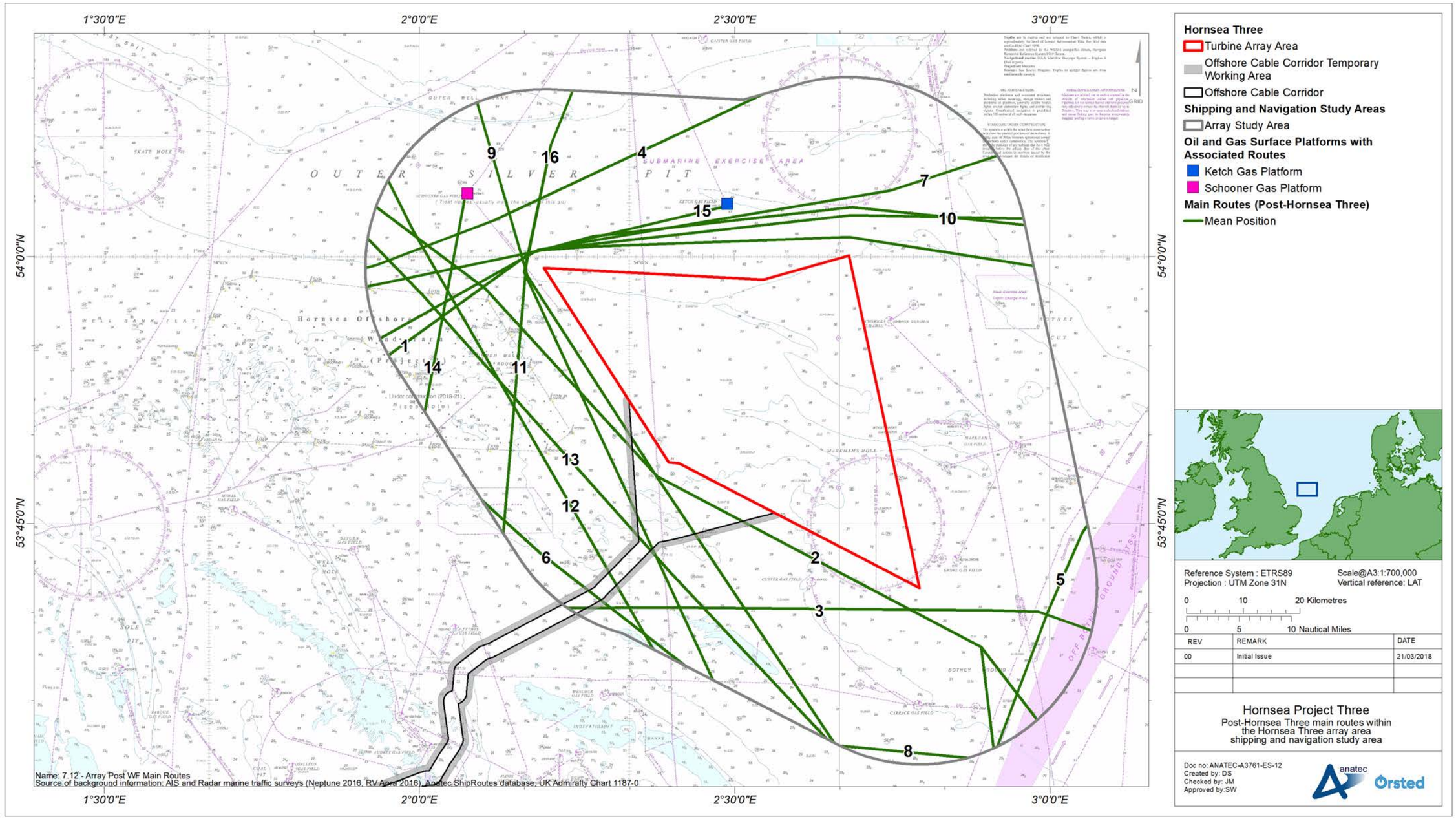


Figure 7.12: Post-Hornsea Three main routes within the Hornsea Three array area shipping and navigation study area.

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 $6.59\times10^{-3}$, 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 7.13. 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 IMO conventions including COLREGs (IMO, 1972 as amended) 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 as amended) 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 north 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.

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 is based upon the maximum number of structures with the maximum foundation size (25×25 m). 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 supply vessel return trips and up to 140 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 the measures adopted as part of Hornsea Three such as COLREGs (IMO, 1972 as amended) and minimum advisory safety distances mitigate encounters, near misses and therefore minimise collision risk.

7.11.2.38 Consultation responses (including section 42 consultation) 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.

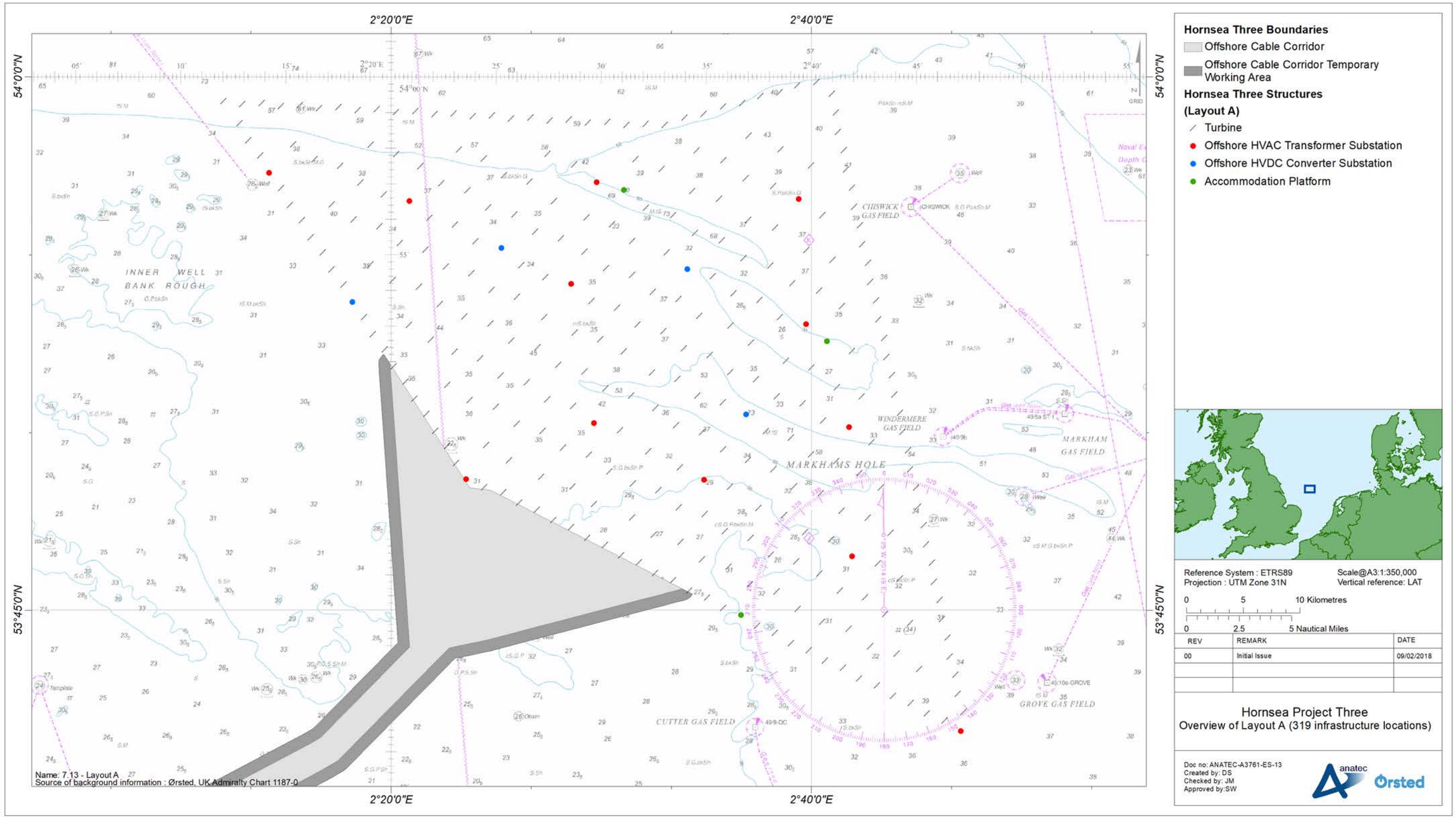


Figure 7.13: Overview of Layout A (319 infrastructure locations).

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 area 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, 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 station(s) 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 station(s) 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 station(s) (surface or subsea) have not been defined, it is not yet possible to risk assess the final locations. However, given the relatively small size of the Hornsea Three offshore HVAC search area, an indicative location central to the search area has been assessed based on a tightly packed layout.

7.11.2.45 Scenarios where the offshore HVAC booster station(s) have been sited in isolation, pairs or other small groups have not been modelled. It is noted that in 2016 the offshore HVAC booster station search area was reduced by approximately 20% in length to exclude a dense navigational route to the southwest. This area was then further refined by approximately 84% in length in 2017 following section 42 consultation. The indicative location does not require any notable deviations for the four main routes identified and would have similar effects to any isolated structure, with regards to vessel routeing, located within the central and southern North Sea. The proposed changes to the Hornsea Three offshore HVAC booster search area were discussed with the MCA and TH at consultation meetings in December 2017. Both parties agreed that the reduction in the extent of the search area was positive and that there were no significant effects with regards to vessel routeing.

7.11.2.46 No specific concerns have been raised by the commercial fishing stakeholders and concerns raised by the CA have been mitigated by the reduced size of the Hornsea Three offshore HVAC booster station search area.

7.11.2.47 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.

7.11.2.48 The impact is predicted to be of local spatial extent (given the low number of routes that would be likely impacted), medium term duration (maximum design scenario during the operation and maintenance phase), intermittent (given the low likelihood of encounters) and not reversible (given that 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

7.11.2.49 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 and that deviations would be negligible.

7.11.2.50 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

7.11.2.51 Overall, 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 infrastructure within the Hornsea Three array area may increase vessel to structure allision risk external to the array for all vessels.

Magnitude of impact

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

7.11.2.53 Based on modelling of the revised routeing (Figure 7.12), indicative layouts and local Meteorological Ocean (Metocean) data, the annual powered vessel to structure allision frequency was $7.51\times10^{-4}$, corresponding to an allision return period of one in 1,331 years.

7.11.2.54 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 $5.3\times10^{-4}$ 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 1.4 times higher. This reflects the high number of wind farm structures included in Layout A (see Figure 7.13) and the conservative deviations assumed (1 nm passing distance from the edge of the array).

7.11.2.55 The individual wind farm structure allision frequencies ranged from $3.88\times10^{-4}$ for the structure 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.

*External lighting and marking affecting the risk of allision*

7.11.2.56 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 O-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.

7.11.2.57 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.

7.11.2.58 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 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 transformer substations, accommodation platforms and offshore HVDC converter substations*

7.11.2.59 Indicative locations for offshore HVAC transformer substations, accommodation platforms and offshore HVDC converter substations have been identified within Layout A. 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).

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

Sensitivity of receptor

7.11.2.61 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.

7.11.2.62 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

7.11.2.63 Overall, 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

7.11.2.64 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).

7.11.2.65 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 1,564 years for a conservative wind assisted NUC vessel to structure allision, the frequency of occurrence is considered to be low.

7.11.2.66 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.

7.11.2.67 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

7.11.2.68 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.

7.11.2.69 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.

7.11.2.70 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 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.

7.11.2.71 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.

7.11.2.72 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

7.11.2.73 Overall, 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

7.11.2.74 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. Following consultation feedback as part of Section 42, the final layout will meet the Development Principles, including maintaining a single line of orientation, as referenced in section 7.10.2

7.11.2.75 Impacts on SAR helicopters associated with layouts considered separately (see paragraph 7.11.2.114); this impact focuses solely on surface navigation.

*Increased internal allision risk associated with fishing vessels and recreational craft*

7.11.2.76 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. The estimated allision frequencies of one every 5.74 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 layout and continue to fish between the turbines. The model does not assume what type of allision incident will occur and in reality, the most likely would be a minor or low energy impact resulting in little or no damage to the vessels.

7.11.2.77 During consultation, the Dutch Fishing Association VISNED also noted that in good weather fishing vessels are likely to transit through the wind farm. All foundation types including the jacket foundations considered in the maximum design scenario are assumed to be ALARP based on the minimum 1,000 m spacing and designed in measures in place to ensure that fishing vessels are able to safely passage plan transits and activity within the Hornsea Three array area. Further information is contained within volume 2, chapter 6: Commercial Fisheries.

7.11.2.78 As with fishing vessels it is considered likely that recreational craft will adapt to navigating within Layout A 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.

*Key points from assessment and consultation*

7.11.2.79 As per the requirements of MGN 543 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 is 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 minimum spacing rather than the alignment. Overall, the majority of risk associated with internal navigation is related to vessels engaged in fishing rather than transiting, noting that during 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 the PEIR layouts and did not raise any further concerns during section 42 consultation;
- With regards to the PEIR layouts, the CA confirmed their general policy that wind farms 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 MCA viewed the new Layout A (with one line of orientation) as a positive step forward compared to the PEIR layouts (with an irregular pattern). Therefore, it is considered that the single line of orientation is a further improvement on irregular layouts.
- 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; however, this would be decided by TH post consent;
- Visibility is generally good or very good at the Hornsea Three array area. Appendix C of the 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*

7.11.2.80 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

7.11.2.81 Recreational and commercial fishing vessels are only considered sensitive to this impact when they are in the Hornsea Three array area. The receptor is therefore deemed to have a degree of vulnerability (given the relative lack of experience associated with recreational users and the new risk of allision in a previously open sea area), have no recoverability (given that the risk will always be present throughout 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 medium.

Significance of effect

7.11.2.82 As noted, MCA guidance states that a UK developer can seek to demonstrate that fewer than two lines of orientation are acceptable and therefore looking at surface craft only, the NRA makes the case that fewer lines are tolerable with mitigation under the FSA methodology. The presence of the Development Principles (as a designed in measure) also gives confidence to the stakeholders that post consent the layout will mitigate key concerns through compliance.

7.11.2.83 Overall, 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 surface offshore HVAC booster station(s) within the Hornsea Three offshore cable corridor may increase vessel to structure allision risk for all vessels.

Magnitude of impact

7.11.2.84 Presence of surface offshore HVAC booster station(s) within the Hornsea Three offshore cable corridor may increase vessel to structure allision risk for all vessels.

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

7.11.2.86 Based on the vessel routeing identified for the region (see Figure 18.38 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.

7.11.2.87 Based on modelling of the revised routeing and local Metocean data, the annual powered vessel to structure allision frequency for the indicative Hornsea Three offshore HVAC booster station location is $1.06\times10^{-4}$, which corresponds to an allision return period of one in 9,435 years.

7.11.2.88 This is a lower allision frequency than the historical average of $5.3\times10^{-4}$ 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 five times lower.

7.11.2.89 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 station(s), 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 minor.

Sensitivity of receptor

7.11.2.90 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.

7.11.2.91 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 station(s) are situated with consideration for traffic routeing.

7.11.2.92 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

7.11.2.93 Overall, 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 subsea HVAC booster station(s) and cable protection within the Hornsea Three offshore cable corridor may increase vessel to subsea structure allision risk for all vessels.

Magnitude of impact

7.11.2.94 Presence of subsea HVAC booster station(s) and cable protection within the Hornsea Three offshore cable corridor may increase vessel to subsea structure allision risk for all vessels.

*Subsea offshore HVAC booster stations*

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

7.11.2.96 Following identification of both a final location and layout of the (up to) six subsea HVAC booster stations, under keel clearance allision modelling shall be undertaken; section 18.4 of the NRA summarises an initial assessment that was undertaken to consider risk based on indicative information on both the location of and the existing marine traffic (AIS only) passing through the Hornsea Three offshore HVAC booster station search area. This initial assessment shows that further consideration may be required regarding under keel clearance in some areas depending on the final design of the subsea HVAC booster stations. Hornsea Three will assess the size of the offshore HVAC booster stations, dependant on the water depths in which they are to be constructed in line with guidance which requires under keel clearance to be considered. It is noted that assessment does not consider traffic displacing itself from the development area or the additional mitigations that could be used to protect both vessels and the installations. For example TH have indicated that a surface buoy (likely per structure) will be required where the under keel clearance is less than 30 m and further work to finalise the location should be undertaken post consent.

*Hornsea Three offshore cable corridor*

7.11.2.97 Section 18.4 of the NRA also considers under keel clearance associated with cable burial and protection and was undertaken post section 42 consultation to address concerns raised by the MCA with regard to reductions in water depth greater than 5%. Although the assessment summarised in section 18.4 shows that areas where the 5% restriction is exceeded will be minimal, designed in measures for Hornsea Three should still include a Cable Burial Risk Assessment (or similar) to ensure that any protection methods used for the export cables do not impact under keel clearance for small craft in the nearshore area or at cable crossings. This was specifically raised as a concern by the RYA and CA (section 42 consultation) and recreational impacts shall be considered during the Cable Burial Risk Assessment (or similar).

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

7.11.2.99 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

7.11.2.100 How much damage a vessel actually sustains in the event a 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. Additionally, given the cable burial or protection that will be in place, the damage sustained to the vessel would likely be relatively low.

7.11.2.101 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

7.11.2.102 Overall, 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 and residual risk

7.11.2.103 In order to mitigate the risk of allision associated with the subsea HVAC booster station(s) the following principles should be considering when developing the final location(s).

- If the maximum number of subsea 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 regarding the final locations. This should include under keel allision risk modelling; and
- The subsea offshore HVAC booster station(s) will require further Aids to Navigation (in consultation with TH) in water depths giving less than 30 m under keel clearance.

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

Presence of structures (including subsea elements) and cables may present an increased risk of gear snagging for commercial fishing vessels with mobile gear.

Magnitude of impact

7.11.2.105 The presence of structures (including subsea 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.

7.11.2.106 The most severe consequences are associated with vessel foundering due to the potential for the vessel snagging on a subsea hazard.

7.11.2.107 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 2014 only approximately 5% 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.

7.11.2.108 It is noted that Dutch fishing vessels (including those flagged in the UK) are predominant in the area. VISNED 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.

7.11.2.109 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, Food and Rural Affairs (DEFRA) and the owners of fishing vessels known to be active within the area to fully mitigate this impact.

7.11.2.110 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 the safety of navigation for vessels is required. It is noted that this may require consultation with DEFRA.

7.11.2.111 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

7.11.2.112 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

7.11.2.113 Overall, 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.

Operation and maintenance activities may diminish emergency response capability (including SAR) within the Hornsea Three array area.

7.11.2.114 Due to the increased presence of vessels, personnel and aircraft associated with the development it is likely that there will be a rise in the probability of an emergency response incident occurring. However, it is likely, given lessons learnt, that emergency response incidents will in the majority be of low consequence such as minor pollution, minor injury or minor vessel damage and will be manageable with the extensive on site resources that will be in place.

7.11.2.115 Aside from the likelihood of an emergency response incident occurring there is also the matter of whether the capability of the emergency providers may be impacted, notably, and as raised in consultation, whether the presence of structures may alter the approach of SAR assets within the Hornsea Three array area.

Magnitude of impact

7.11.2.116 It is likely that the Hornsea Three array area will be manned throughout the majority of the operation and maintenance phase and a range of equipment and facilities (including an OSV, other support vessels, personnel transfer helicopters, the MHCC, AIS receivers, VHF aerials,.) may also be able to provide information that supports the planning phase.

7.11.2.117 The presence of this equipment and facilities will likely mean a positive impact for communication, monitoring and SAR for all sea users (including third party vessels). Hornsea Three offshore personnel (expected to be the predominant user of the Hornsea Three array area) will also be equipped with appropriate PPE for their area and type of task; as well as risk assessments and method statements put in place. Where there is a risk of falling into the water this will include survival suits and PLBs. Also, as standard with offshore developments and as a recommendation contained within MGN 543, an ERCoP will be a measure adopted as part of Hornsea Three and will enable the MCA and the Applicant to monitor and manage all incidents and resources, including SAR assets, effectively.

7.11.2.118 As detailed in paragraph 7.11.2.79, 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 low levels of recreational sailing vessels are expected to be present within the Hornsea Three array area alongside Hornsea Three operation and maintenance vessels.

7.11.2.119 It is therefore likely that the Hornsea Three operation and maintenance vessels will be the primary responder to both its own and lower probability third party incidents within and in proximity to the Hornsea Three array area, given the time taken for an asset to be mobilised and reach the incident location. As a result SAR response times will be improved as the MCA will use resources under the ERCoP (on site) and SOLAS (IMO, 1972) obligations to respond quickly and effectively in a previously open sea area with low levels of third party activity (base case).

7.11.2.120 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 asset has been identified. Given the distance between the Hornsea Three array area and the nearest SAR asset base (Humberside Airport), it is likely that the SAR crew will undertake the majority of the planning phase aboard the SAR assets as it transits to the scene of the incident. For more information regarding SAR assets and their operation see section 7.7.2 and Appendix C of the NRA.

7.11.2.121 The presence of the infrastructure located within the Hornsea Three array area may introduce some complication to the planning phase; however the layout will be in line with the Development Principles agreed in volume 4, annex 3.7: Layout Development Principles. This means that the layout will maintain one line of orientation (SAR Access Lanes) and include a Helicopter Refuge Area if the SAR Access Lanes are over 10 nm in length to further facilitate SAR helicopter planning. The SAR asset crews are highly competent and experienced with regard to planning and undertaking SAR operations with information provided via nautical charts, aeronautical charts and the project specific ERCoP held by the CGOCs.

7.11.2.122 Considering emergency response capability in general the impact is predicted to be of regional spatial extent (given the impact on North Sea response as a whole), medium term duration, intermittent and could be reversible if Hornsea Three resources were found to have a positive impact on SAR responses within the previously open sea area (emergency response will be improved rather than diminished). It is predicted that the impact will affect the receptor both directly and indirectly. The magnitude is therefore, considered to be **minor** with adoption of the Development Principles.

Sensitivity of receptor

7.11.2.123 Consultation noted that the presence of operation and maintenance vessels and helicopters on site may also provide additional emergency response capabilities that had not previously existed. For example, operation and maintenance vessels will be in the best position to aid vessels in an emergency situation, respond quickly to pollution incidents and substation or accommodation structures may be able to provide a place of refuge.

7.11.2.124 However, given the increased numbers of persons on site (in a previously remote area) and thus likelihood of increased emergency response incidents the receptor (those requiring assistance) this 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

7.11.2.125 Overall, 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*

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

Table 7.17: Operational and maintenance phase monitoring commitments.

| Environmental effect | Monitoring commitment |
|---|---|
| Presence of infrastructure 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.<br>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. | The DCO requires post-construction vessel traffic monitoring by AIS as per Table 7.14 |
| Presence of infrastructure within the Hornsea Three array area may increase vessel to structure allision risk external to the array for all vessels.<br>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).<br>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.<br>Presence of subsea HVAC booster stations and cable protection within the Hornsea Three offshore cable corridor may increase vessel to subsea structure allision risk for all vessels.<br>Presence of structures (including subsea elements) and cables may present an increased risk of gear snagging for commercial fishing vessels with mobile gear. | 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. |

## 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 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, 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 station(s) 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 the 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, 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 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 station(s). 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, 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 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 incident 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 station(s). 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, 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, 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 structures (including subsea 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 presence of decommissioned structures (including subsea 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. Conservative consequences are associated with vessel foundering due to the potential for the vessel snagging on a subsea 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 shipping and navigation monitoring to test the predictions made within the decommissioning phase impact assessment is considered necessary.

## 7.12 Cumulative effect assessment methodology

### 7.12.1 Screening of other projects and plans into the CEA

7.12.1.1 The CEA takes into account the impact associated with Hornsea Three together with other projects and plans. The projects and plans 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 volume 4, annex 5.3: Cumulative Effects Screening Matrix). 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 project/plans currently under construction; and/or
    - Those with consent, and, where applicable (i.e. for low carbon electricity generation projects), that have been awarded a CfD but have not yet been implemented; 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 project/plans that have consent but, where relevant (i.e. for low carbon electricity generation projects) have no CfD; and/or
    - Submitted but not yet determined.
- 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 and the adopted development plan including supplementary planning documents are the most relevant sources of information, along with information from the relevant planning authorities regarding planned major works being consulted upon, but not yet the subject of a consent application). Specifically, this Tier includes all projects where the developer has advised PINS in writing that they intend to submit an application in the future, those projects where a Scoping Report is available and/or those projects which have published a PEIR.

7.12.1.3 It is noted that 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 considered a maximum number of turbines of 332 within the Environmental Statement, but has gained consent for 240 turbines. In addition, it is now known that Hornsea Project One 'as built' will consist of 174 turbines. 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. A similar pattern of reduction in the project envelope from that assessed in the Environmental Statement, to the consented project and then to the 'as built' project is also seen across other offshore wind farms of relevance to this CEA. This process of refinement can result in a reduction to associated project parameters, for example the number and length of cable to be installed and the number of offshore substations. The CEA presented in this chapter has been undertaken on the basis of information presented in the Environmental Statements for the other projects, plans and activities. Given that this broadly represents a maximum design scenario, the level of cumulative impact on shipping and navigation would highly likely be reduced from those presented here.

7.12.1.4 The specific projects scoped into this CEA and the tiers into which they have been allocated, are outlined in Table 7.18 and presented in Figure 7.14 (alongside the Hornsea Three shipping and navigation cumulative study area). The projects included as operational in this assessment have been commissioned since the baseline studies for Hornsea Three were undertaken and as such were excluded from the baseline assessment.

Table 7.18: 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* | | | | | | | |
| | Operational | Alpha Ventus (Formerly Borkum West I) (Germany) | 252 | 266 | | N/A | No | Yes |
| | Operational | Amrumbank West (Germany) | 328 | 342 | 80 turbines. | N/A | No | Yes |
| | Operational | BARD Offshore 1 (Germany) | 215 | 229 | 80 turbines. | N/A | No | Yes |
| | Operational | Belwind 1 (Belgium) | 220 | 141 | 55 turbines. | N/A | No | No |
| | Operational | Belwind Alstom Haliade Demonstration (Belgium) | 222 | 178 | One turbine. | N/A | No | Yes |
| | Operational | Blyth (UK) | 270 | 284 | Two turbines. | N/A | No | No |
| | Operational | Borkum Riffgrund 1 (Germany) | 245 | 259 | 77 turbines. | N/A | No | Yes |
| | Operational | Butendiek (Germany) | 346 | 364 | 80 turbines. | N/A | No | Yes |
| | Operational | DanTysk (Germany) | 314 | 333 | 80 turbines. | N/A | No | Yes |
| | Operational | Dudgeon (UK) | 87 | 11 | 67 turbines. | N/A | No | Yes |
| | Operational | Emden (Germany) | 295 | 311 | One turbine. | N/A | No | No |
| | Operational | Eneco Luchterduinen (Netherlands) | 170 | 185 | 43 turbines. | N/A | No | Yes |
| | Operational | Greater Gabbard (UK) | 198 | 119 | 140 turbines. | N/A | No | Yes |
| | Operational | Gunfleet Sands Demo (UK) | 245 | 137 | Two turbines. | N/A | No | Yes |
| | Operational | Gunfleet Sands I (UK) | 240 | 133 | 30 turbines. | N/A | No | Yes |
| | Operational | Gunfleet Sands II (UK) | 239 | 134 | 18 turbines. | N/A | No | Yes |
| | Operational | Horns Rev (Denmark) | 368 | 388 | 80 turbines. | N/A | No | Yes |
| | Operational | Horns Rev 2 (Denmark) | 358 | 379 | 91 turbines. | N/A | No | Yes |
| | Operational | Humber Gateway (UK) | 128 | 86 | Up to 73 turbines. | N/A | No | Yes |
| | Operational | Hywind Scotland Pilot Park (UK) | 438 | 455 | 5 turbines. | 2017 | No | Yes |
| | Operational | Irene Vorrink I (Netherlands) | 223 | 240 | 19 turbines but part of a larger 28 turbine project. | N/A | No | No |
| | Operational | Irene Vorrink II (Netherlands) | 223 | 240 | 9 turbines but part of a larger 28 turbine project. | N/A | No | No |
| | Operational | Kentish Flats (UK) | 272 | 164 | 30 turbines. | N/A | No | Yes |
| | Operational | Kentish Flats Extension (UK) | 273 | 165 | 15 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 | | N/A | Yes | Yes |
| | Operational | Lincs / LID6 1 /(UK) | 139 | 41 | 75 turbines. | N/A | No | Yes |
| | Operational | London Array (UK) | 230 | 92 | 175 turbines. | N/A | No | Yes |
| | Operational | Lynn and Inner Dowsing Wind Farms (UK) | 147 | 43 | 54 turbines. | N/A | No | Yes |
| | Operational | Meerwind Süd/Ost (Germany) | 326 | 339 | 80 turbines. | N/A | No | Yes |
| | Operational | Mermaid (Belgium) | 217 | 135 | 48 turbines. | N/A | No | Yes |
| | Operational | Methil (Samsung) Demo (Levenmouth Turbine) | 411 | 426 | One turbine. | N/A | No | Yes |
| | Operational | Noerdlicher Grund Teil Sandbank (Germany) | 297 | 316 | 72 turbines. | N/A | No | Yes |
| | Operational | Nordsee Ost (Germany) | 326 | 340 | 48 turbines. | N/A | No | Yes |
| | Operational | Northwind (Belgium) | 229 | 153 | 72 turbines. | N/A | No | Yes |
| | Operational | Offshore Windpark Egmond aan Zee (Netherlands) | 157 | 173 | 36 turbines. | N/A | No | Yes |
| | Operational | Prinses Amaliapark (Netherlands) | 153 | 168 | 60 turbines. | N/A | No | Yes |
| | Operational | Riffgat (Germany) | 241 | 356 | 30 turbines. | N/A | No | Yes |
| | Operational | Robin Rigg East (UK) | 391 | 369 | 30 turbines. | N/A | No | Yes |
| | Operational | Robin Rigg West (UK) | 392 | 369 | 30 turbines. | N/A | No | Yes |
| | Operational | Scroby Sands (UK) | 132 | 48 | 30 turbines. | N/A | No | No |
| | Operational | Sheringham Shoal (UK) | 109 | 7 | 88 turbines. | N/A | No | Yes |
| | Operational | Teesside (UK) | 224 | 229 | 27 turbines. | N/A | No | Yes |
| | Operational | Thanet (UK) | 260 | 168 | 100 turbines. | N/A | No | Yes |
| | Operational | Thornton Bank Phase I (Zone 1 C-Power) (Belgium) | 237 | 158 | Six turbines. | N/A | No | Yes |
| | Operational | Thornton Bank Phase II (Belgium) | 237 | 158 | 30 turbines. | N/A | No | Yes |
| | Operational | Thornton Bank Phase III (Zone 1 C-Power 2) (Belgium) | 235 | 160 | 18 turbines. | N/A | No | Yes |
| | Operational | Trianel Windpark Bokrum (Borkum West II) Phase 1 (Germany) | 241 | 255 | 40 turbines. | N/A | No | Yes |
| | Operational | Trianel Windpark Borkum Phase 1 (Germany) | 242 | 255 | 40 turbines. | N/A | No | Yes |
| | Operational | Westermeerdijk buitendijks (Netherlands) | 215 | 232 | 48 turbines. | N/A | No | Yes |
| | Operational | Westermost Rough (UK) | 132 | 106 | 35 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 | Under construction | Buitengaats (Netherlands) | 214 | 228 | 75 turbines. | N/A | No | Yes |
| | Under construction | Galloper (UK) | 195 | 79 | Up to 56 turbines. | N/A | No | Yes |
| | Under construction | Global Tech I (Germany) | 245 | 258 | 80 turbines. | N/A | No | Yes |
| | Under construction | Gode Wind I (Germany) | 275 | 289 | 55 turbines. | N/A | No | Yes |
| | Under construction | Gode Wind II (Germany) | 276 | 290 | 42 turbines. | N/A | No | Yes |
| | Under construction | Hornsea Project One (UK) | 7 | 7 | Up to 240 turbines. | 2017 to 2019 | No | Yes |
| | Under construction | INNOGY Nordsee I (Germany) | 262 | 276 | 54 turbines. | N/A | No | Yes |
| | Under construction | MEG Offshore I (now Merkur Offshore Wind Farm) (Germany) | 247 | 260 | | N/A | No | Yes |
| | Under construction | Nordergruende (Germany) | 353 | 368 | 18 turbines. | N/A | No | Yes |
| | Under construction | Race Bank (UK) | 114 | 28 | 91 turbines | 2017 | No | Yes |
| | Under construction | Rampion Wind Farm (UK) | 388 | 266 | 116 turbines. | N/A | No | Yes |
| | Under construction | Sandbank 24 (Germany) | 298 | 317 | 72 turbines. | N/A | No | Yes |
| | Under construction | Veja Mate (Germany) | 208 | 221 | 40 turbines. | N/A | No | Yes |
| | Under construction | ZeeEnergie (Netherlands) | 203 | 216 | 75 turbines. | N/A | No | Yes |
| | Consented | Borssele 1 and 2 (Netherlands) | 216 | 181 | Between 69 and 127 turbines. | 2017 to 2020 | No | Yes |
| | Consented | Borssele 3 and 4 (Netherlands) | 217 | 175 | 123 turbines. | 2018 to 2021 | No | Yes |
| | Consented | Deutsche Bucht Offshore Wind Farm (Germany) | 203 | 217 | 30 turbines. | 2017 to 2019 | No | Yes |
| | Consented | East Anglia One (UK) | 152 | 106 | 102 turbines. | 2018 to 2019 | No | Yes |
| | Consented | He dreiht I (Germany) | 228 | 311 | Up to 80 turbines. | Unavailable | Unavailable | Unavailable |
| | Consented | Hohe See (Germany) | 239 | 254 | 71 turbines. | 2018 to 2020 | No | Yes |
| | Consented | Hornsea Project Two (UK) | 7 | 18 | Up to 300 turbines. | 2020 to 2022 | No | Yes |
| | Consented | Kincardine Offshore Wind Farm (UK) | 422 | 438 | Eight turbines. | 2018 to 2019 | No | Yes |
| | Consented | Noerdlicher Grund (Germany) | 295 | 314 | 64 turbines. | Unavailable | Unavailable | Unavailable |
| | Consented | Norther (Belgium) | 236 | 163 | 44 turbines. | 2017 to 2018 | No | Yes |
| | Consented | Rental Area A (Belgium) | 231 | 155 | 42 turbines. | 2017 to 2018 | No | Yes |
| | Consented | Seastar (Belgium) | 225 | 149 | 42 turbines. | 2017 to 2018 | No | Yes |
| | Consented | Trianel Windpark Bokrum (Bokrum West II) Phase 2 (Germany) | 242 | 255 | 32 turbines. | 2018 | 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 | Between 113 and 288 turbines. | 2020 to 2021 | No | Yes |
| | *Oil and gas infrastructure* | | | | | | | |
| | Active | Schooner A platform | 11 | 27 | Gas Field – Producing | N/A | N/A | Yes |
| 2 | *Offshore wind farms* | | | | | | | |
| | Consented | East Anglia Three (UK) | 103 | 87 | Up to 172 turbines. | 2019 to 2022 | Yes | Yes |
| | Consented | Dogger Bank Creyke Beck A (UK) | 76 | 91 | Up to 200 turbines. | 2021 to 2024 | Yes | Yes |
| | Consented | Dogger Bank Creyke Beck B (UK) | 99 | 115 | Up to 200 turbines. | 2021 to 2024 | Yes | Yes |
| | Consented | Dogger Bank Teesside A (UK) | 107 | 123 | | 2023 to 2026 | Yes | Yes |
| | Consented | Dogger Bank Teesside B (now Sofia offshore wind farm) (UK) | 95 | 108 | | 2023 to 2026 | Yes | Yes |
| 3 | *Offshore wind farms* | | | | | | | |
| | Pre-planning application | Bokrum-Riffgrund West II (Germany) | 224 | 238 | 43 turbines. | 2019 to 2020 | No | Yes |
| | Pre-planning application | East Anglia One North (UK) | 141 | 90 | | 2021 to 2022 | Yes | Yes |
| | Pre-planning application | East Anglia Two (UK) | 158 | 94 | | 2023 to 2025 | Yes | Yes |
| | Pre-planning application | Methil Demonstration Project - 2B Energy (UK) | 411 | 426 | | Unavailable | Unavailable | Unavailable |
| | Pre-planning application | Norfolk Boreas (UK) | 53 | 64 | | 2024 to 2029 | Yes | Yes |
| | Pre-planning application | Norfolk Vanguard (UK) | 73 | 51 | Between 120 and 257 turbines. | 2020 to 2022 | Yes | Yes |
| | Pre-planning application | Northwester 2 (Belgium) | 222 | 175 | Between 22 and 70 turbines. | 2018 to 2020 | No | Yes |
| | Concept/early planning | Thanet Extension (UK) | 260 | 168 | 34 turbines. | 2020 to 2021 | No | Yes |

## 7.12.2 Maximum design scenario

7.12.2.1 The maximum design scenarios identified in Table 7.19 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. No cumulative impacts have been identified for the Hornsea Three offshore cable corridor given that export cables once buried present no deviation to vessels (and thus will in effect be ignored). For the Hornsea Three offshore HVAC booster station(s),although a minor deviation would be required for some routes, the small area occupied by the offshore HVAC booster stations mean that no cumulative effects have been identified.

Table 7.19: 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 farm developments may displace vessels leading to increased journey times or distances for all commercial vessels. | Tier 1<br>• All offshore wind farms in Tier 1 in Table 7.18 above.<br>Tier 2<br>• All offshore wind farms in Tier 2 in Table 7.18 above.<br>Tier 3<br>• All offshore wind farms in Tier 3 in Table 7.18 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 1 and 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<br>• All offshore wind farms in Tier 1 in Table 7.18 above.<br>Tier 2<br>• All offshore wind farms in Tier 2 in Table 7.18 above.<br>Tier 3<br>• 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<br>• Hornsea Project One and Hornsea Project Two; and<br>• Schooner A platform.<br>Tier 2<br>• No projects identified.<br>Tier 3<br>• No projects identified. | Maximum construction area at Hornsea Three cumulatively with Hornsea Project One, Hornsea Project Two and the Schooner A 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<br>• Hornsea Project One and Hornsea Project Two.<br>Tier 2<br>• No projects identified.<br>Tier 3<br>• 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, 2 and 3 wind farm developments may displace vessels leading to increased journey times or distances for all commercial vessels. | Tier 1<br>• All offshore wind farms in Tier 1 in Table 7.18 above.<br>Tier 2<br>• All offshore wind farms in Tier 2 in Table 7.18 above.<br>Tier 3<br>• All offshore wind farms in Tier 3 in Table 7.18 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<br>• All offshore wind farms in Tier 1 in Table 7.18 above.<br>Tier 2<br>• All offshore wind farms in Tier 2 in Table 7.18 above.<br>Tier 3<br>• All offshore wind farms in Tier 3 in Table 7.18 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 2 projects may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk. | Tier 1<br>• Hornsea Project One and Hornsea Project Two; and<br>• Schooner A platform.<br>Tier 2<br>• No projects identified.<br>Tier 3<br>• 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<br>• Hornsea Project One and Hornsea Project Two; and<br>• Schooner A platform.<br>Tier 2<br>• No projects identified.<br>Tier 3<br>• No projects identified. | Maximum development of infrastructure at Hornsea Three cumulatively with Hornsea Project One, Hornsea Project Two and the Schooner A 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<br>• All offshore wind farms in Tier 1 in Table 7.18 above.<br>Tier 2<br>• All offshore wind farms in Tier 2 in Table 7.18 above.<br>Tier 3<br>• All offshore wind farms in Tier 3 in Table 7.18 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<br>• All offshore wind farms in Tier 1 in Table 7.18 above.<br>Tier 2<br>• All offshore wind farms in Tier 2 in Table 7.18 above.<br>Tier 3<br>• All offshore wind farms in Tier 3 in Table 7.18 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<br>• Hornsea Project One and Hornsea Project Two.<br>Tier 2<br>• No projects identified.<br>Tier 3<br>• 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 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<br>• Hornsea Project One and Hornsea Project Two; and<br>• Schooner A platform.<br>Tier 2<br>• No projects identified.<br>Tier 3<br>• No projects identified. | Maximum decommissioning area at Hornsea Three cumulatively with Hornsea Project One, Hornsea Project Two and the Schooner A 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 1 and 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 the Hornsea Three array area. Over the southern North Sea area additional displacement will be small (see Table 7.16) 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 that 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 7.14 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, 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 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, 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 Southern North Sea Offshore Wind Forum (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 station(s)*

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

Construction activities within the Hornsea Three array area and other Tier 1 and 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 the Hornsea Three array area. Over the southern North Sea area additional displacement will be small (see Figure 7.14) 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 station(s)*

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 station(s).

*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, 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 7.14: Current cumulative scenario with SNSOWF 90th percentiles (2013).

*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 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, 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 additional 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 A 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 proposed 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 vessels 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 likely to use the proposed 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, 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 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

7.13.2.41 Presence of pre commissioned infrastructure within the Hornsea Three array area cumulatively with Hornsea Project One, Hornsea Project Two and the Schooner A 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*

7.13.2.42 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.

7.13.2.43 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*

7.13.2.44 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 A platform will increase the geographic extent of the impact and the number of structures; as well as the number of routes impacted as per section 21 of the NRA.

7.13.2.45 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.

7.13.2.46 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

7.13.2.47 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.

7.13.2.48 The Applicant 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.

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

7.13.2.50 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.

7.13.2.51 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

7.13.2.52 Overall, 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*

7.13.2.53 No shipping and navigation monitoring to test the predictions made within the construction phase cumulative impact assessment is considered necessary.

## 7.13.3 Operational and maintenance phase

Presence of infrastructure 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 commercial vessels.

Magnitude of impact

7.13.3.1 Presence of infrastructure 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 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 navigational 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, 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 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, 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 offshore HVAC booster station(s)*

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 station(s).

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, 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 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, 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 offshore HVAC booster station(s)*

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 station(s).

Presence of infrastructure within the Hornsea Three array area and other Tier 1 and 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.

*Radar interference with the corridor*

7.13.3.27 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.

7.13.3.28 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.

7.13.3.29 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 as amended). 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 as amended) 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.

7.13.3.30 Given the concern raised, the MCA noted consideration 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, 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.

7.13.3.31 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 $9.55\times10^{-3}$, 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.

7.13.3.32 In addition, as part of the ZAP 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 SNSOWF in 2011 (Anatec, 2011) and subsequently updated in 2013 with validated traffic plans and updated zonal plans (Anatec, 2013).

7.13.3.33 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 Three, Hornsea Project One and Hornsea Project Two) 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.

*Tier 1*

7.13.3.34 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

7.13.3.35 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

7.13.3.36 Overall, 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

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

7.13.3.38 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

7.13.3.39 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

7.13.3.40 Overall, 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 offshore HVAC booster station(s)*

7.13.3.41 There were no perceptible cumulative impacts identified in association with the Hornsea Three offshore cable corridor or offshore HVAC booster station(s) 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

7.13.3.42 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.

7.13.3.43 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 A 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 navigational corridor*

7.13.3.44 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 Layout A. 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 proposed navigational corridor.

*Cumulative lighting and marking*

7.13.3.45 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.

7.13.3.46 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*

7.13.3.47 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 as amended) 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.

7.13.3.48 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*

7.13.3.49 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).

7.13.3.50 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*

7.13.3.51 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

7.13.3.52 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.

7.13.3.53 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

7.13.3.54 Overall, 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 station(s)*

7.13.3.55 There were no perceptible cumulative impacts identified in association with the Hornsea Three offshore HVAC booster station(s) and vessel to structure allision risk.

*Future monitoring*

7.13.3.56 No shipping and navigation monitoring to test the predictions made within the operational and maintenance phase cumulative impact assessment is considered necessary.

## 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, 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 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, 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 offshore HVAC booster station(s)*

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

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, 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 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, 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 offshore HVAC booster station(s)*

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

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.

7.13.4.1 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.

7.13.4.2 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.

7.13.4.3 The Schooner A 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 proposed navigational corridor are likely to be low, the impact is intermittent.

*Tier 1*

7.13.4.4 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

7.13.4.5 Vessels are generally important to the regional economy, but given the small number of vessels likely to use the proposed 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

7.13.4.6 Overall, 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

7.13.4.7 Presence of decommissioning infrastructure within the Hornsea Three array area cumulatively with Hornsea Project One, Hornsea Project Two and the Schooner A 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*

7.13.4.8 All cumulative projects within this 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.

7.13.4.9 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*

7.13.4.10 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

7.13.4.11 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

7.13.4.12 Overall, 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*

7.13.4.13 No shipping and navigation monitoring to test the predictions made within the decommissioning phase cumulative impact assessment is considered necessary.

## 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 could have been 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 volume 2, chapter 12: 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 FSA to meet MCA guidance (MCA, 2015 and 2016) for all phases of the project, as well as an assessment of cumulative effects. The NRA has informed the environmental impact review presented in this chapter.

7.16.1.2 Table 7.20 provides a summary of the potential impact, mitigation measures and residual effects in respect to shipping and navigation.

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 impacts are therefore within ALARP parameters.

7.16.1.4 For the operation and maintenance phase one impact has been identified as moderate adverse. This relates to the position of the subsea Hornsea Three offshore HVAC booster station(s). The final siting of the structures (up to six subsea) will be confirmed post consent. Given that final locations have not yet been identified and further work is required to ensure that the structures are placed so as to minimise impacts, the subsea HVAC booster stations and cable protection within the Hornsea Three offshore cable corridor may increase vessel to subsea structure allision risk for all vessels.

7.16.1.5 This impact can 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 station(s) 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 station(s) 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.

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

7.16.1.7 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.

7.16.1.8 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, 2 and 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.

7.16.1.9 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.

7.16.1.10 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 EEA ports. However, given the minor deviations expected, the impact is assessed to be not significant.

7.16.1.11 Inter-related effects have been assessed on shipping and navigation and are provided in volume 2, chapter 12: 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 7.20: 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 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 offshore cable corridor may cause increased vessel to structure allision risk external to the array for all vessels. | • Aids to Navigation Management Plan;<br>• 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;<br>• Back-up power supplies and SCADA systems for turbines;<br>• Buoyed construction area;<br>• Charting of Hornsea Three array area, offshore HVAC booster station(s), export cables and array cables;<br>• Guard vessels;<br>• Lighting and marking of the wind farm in accordance with IALA guidance;<br>• Minimum turbine blade clearance of 34.97 m LAT;<br>• Promulgation of information;<br>• Safe passing distance (advisory) around construction vessels; and<br>• Temporary Aids to Navigation. | Minor | Medium | Minor adverse | N/A | Minor adverse | N/A |
| 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). | • Guard vessels;<br>• Marine coordination; and<br>• 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 construction area for recreational and fishing vessels. | • Aids to Navigation Management Plan;<br>• Back-up power supplies and SCADA systems for turbines;<br>• Charting of Hornsea Three array area;<br>• Guard vessels;<br>• Lighting and marking of the wind farm in accordance with IALA guidance;<br>• Marine coordination;<br>• Minimum turbine blade clearance of 34.97 m LAT;<br>• Monitoring by AIS and VHF;<br>• Promulgation of information;<br>• Advisory safety distance around construction vessels; and<br>• Temporary Aids to Navigation. | Minor | Low | 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 pre commissioned structures (including subsea 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;<br>• Cable burial assessment;<br>• Charting of Hornsea Three array area, offshore HVAC booster station(s), export cables and array cables;<br>• Lighting and marking of the wind farm in accordance with IALA guidance;<br>• Minimum turbine blade clearance of 34.97 m LAT; and<br>• 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 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. |
| 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;<br>• Marine coordination;<br>• Promulgation of information;<br>• QHSE documentation; and<br>• Advisory safety distance around maintenance vessels. | Minor | Low | Minor adverse | N/A | Minor adverse | N/A |
| Presence of the Hornsea Three offshore HVAC booster station(s) may cause vessels to be deviated, leading to increased encounters and therefore increasing the vessel to vessel collision risk. | • Compliance with COLREGs and SOLAS;<br>• Marine coordination;<br>• Promulgation of information;<br>• QHSE documentation; and<br>• Advisory safety distance around maintenance vessels. | Minor | Medium | Minor adverse | N/A | 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;<br>• Application and use of safety zones of up to 500 m around structures during operation for manned platforms and major maintenance of structures;<br>• Back-up power supplies and SCADA systems for turbines;<br>• Charting of Hornsea Three array area and array cables;<br>• Guard vessels during major maintenance;<br>• Lighting and marking of the wind farm in accordance with IALA guidance;<br>• Minimum turbine blade clearance of 34.97 m LAT;<br>• Promulgation of information; and<br>• Advisory safety distance around maintenance vessels. | 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. |

| 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;<br>• Marine coordination; and<br>• Minimum turbine blade clearance of 34.97 m LAT. | Negligible | 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. |
| 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;<br>• Back-up power supplies and SCADA systems for turbines;<br>• Charting of Hornsea Three array area;<br>• Guard vessels during major maintenance;<br>• Lighting and marking of the wind farm in accordance with IALA guidance;<br>• Marine coordination;<br>• Minimum turbine blade clearance of 34.97 m LAT;<br>• Monitoring by AIS and VHF;<br>• Promulgation of information; and<br>• Advisory safety distance around maintenance vessels. | 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. |
| Presence of surface offshore HVAC booster station(s) within the Hornsea Three offshore cable corridor may increase vessel to structure allision risk for all vessels. | • Aids to Navigation Management Plan;<br>• Charting of Hornsea Three offshore HVAC booster station(s) and export cables;<br>• Lighting and marking of the offshore HVAC booster station(s) in accordance with IALA guidance;<br>• Promulgation of information; and<br>• Advisory safety distance around maintenance vessels. | Moderate | 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 subsea HVAC booster station(s) and cable protection within the Hornsea Three offshore cable corridor may increase vessel to subsea structure allision risk for all vessels. | • Aids to Navigation;<br>• Cable burial assessment;<br>• Charting of Hornsea Three offshore HVAC booster station(s) and export cables;<br>• Electronic interference minimisation;<br>• Guard vessels during major maintenance;<br>• Lighting and marking of the wind farm in accordance with IALA guidance;<br>• Promulgation of information; and<br>• Surface buoy (likely per structure) required where the under keel clearance is less than 30 m (indicated by TH). | Moderate | Medium | Moderate adverse | • If the maximum number of subsea offshore HVAC booster stations is built they should be aligned or grouped so as to be sympathetic to shipping;<br>• Following this assessment of maximum design scenario locations further consultation will be required with the MCA and TH regarding the final location with under keel allision risk modelling on the final locations; and<br>• The subsea offshore HVAC booster station(s) will require further Aids to Navigation (in consultation with TH) in water depths giving less than 30 m under keel clearance. | 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. |
| Presence of structures (including subsea elements) and cables may present an increased risk of gear snagging for commercial fishing vessels with mobile gear. | • Aids to Navigation;<br>• Cable burial assessment;<br>• Charting of Hornsea Three array area, offshore HVAC booster station(s), export cables and array cables;<br>• Lighting and marking of the wind farm in accordance with IALA guidance;<br>• Minimum turbine blade clearance of 34.97 m LAT; and<br>• 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. |

| Description of impact | Measures adopted for Hornsea Three | Magnitude of impact | Sensitivity of impact | Significance of effect | Additional measures | Residual effect | Proposed monitoring |
|---|---|---|---|---|---|---|---|
| Operation and maintenance activities may diminish emergency response capability (including SAR) within the Hornsea Three array area. | • Aids to Navigation;<br>• ERCoP;<br>• Guard vessels during major maintenance;<br>• Lighting and marking of the wind farm in accordance with IALA guidance;<br>• Functions and procedures in place for generator shut down in emergency situations as per MGN 543 (as of April 2018);<br>• PPE including PLBs; and<br>• Self-help capabilities. | Minor | Medium | Minor adverse | N/A | Minor adverse | N/A |
| *Decommissioning phase* | | | | | | | |
| 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. | • 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 offshore cable corridor may cause increased vessel to structure allision risk external to the array for all vessels. | • Aids to Navigation Management Plan;<br>• Application and use of safety zones of up to 500 m around structures during decommissioning;<br>• Back-up power supplies and SCADA systems for turbines;<br>• Buoyed decommissioning area;<br>• Guard vessels;<br>• Lighting and marking of the wind farm in accordance with IALA guidance;<br>• Minimum turbine blade clearance of 34.97 m LAT;<br>• Promulgation of information;<br>• Advisory safety distance around decommissioning vessels; and<br>• Temporary Aids to Navigation. | Minor | Medium | Minor adverse | N/A | Minor adverse | N/A |
| Presence of decommissioning infrastructure within the Hornsea Three array area and 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;<br>• Marine coordination; and<br>• Minimum turbine blade clearance of 34.97 m LAT. | Negligible | 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 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;<br>• Back-up power supplies and SCADA systems for turbines;<br>• Guard vessels;<br>• Lighting and marking of the wind farm in accordance with IALA guidance;<br>• Marine coordination;<br>• Minimum turbine blade clearance of 34.97 m LAT;<br>• Monitoring by AIS and VHF;<br>• Promulgation of information;<br>• Advisory safety distance around decommissioning vessels; and<br>• Temporary Aids to Navigation. | Minor | Low | Minor adverse | N/A | Minor adverse | N/A |
| Presence of decommissioned structures (including subsea elements) and cables (left in situ) may present an increased risk of gear snagging for commercial fishing vessels with mobile gear. | • Aids to Navigation;<br>• Lighting and marking of the wind farm in accordance with IALA guidance;<br>• Minimum turbine blade clearance of 34.97 m LAT; and<br>• Promulgation of information. | Minor | Medium | Minor adverse | N/A | Minor adverse | N/A |

## 7.17 References

Anatec (2011). *SNSOWF Navigational Assessment into Cumulative Issues*. Aberdeen: Anatec.

Anatec (2013). *SNSOWF Cumulative Navigational Issues in the Southern North Sea*. Aberdeen: Anatec.

DECC (2011a). *NPS for Renewable Energy Infrastructure*. London: DECC.

DECC (2011b). *Overarching National Policy Statement (NPS) for Energy*. London: DECC.

DONG Energy (now Ørsted) (2017). *Hornsea Project Three Offshore Wind Farm Preliminary Environmental Information Report: Chapter 7 – Shipping and Navigation*. London: DONG Energy (now Ørsted).

DONG Energy (now Ørsted) (2017). *Hornsea Project Three Offshore Wind Farm Preliminary Environmental Information Report: Annex 7.1 – Navigational Risk Assessment*. London: DONG Energy (now Ørsted).

IALA (2013). *O-139 the Marking of Man-Made Offshore Structures*. Edition 2. Saint Germain en Laye, France: IALA.

IMO (1972). *Convention on the International regulations for Preventing Collisions at Sea – Annex 3 (as amended)*. London: IMO.

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

IMO (2002). *Guidelines for Formal Safety Assessment (FSA) for use in the IMO rule Making Process*. London: IMO.

MCA (2005). *Offshore Wind Farm Helicopter Search and Rescue – Trials Undertaken at the North Hoyle Wind Farm Report of helicopter SAR trials undertaken with Royal Air Force Valley "C" Flight 22 Squadron on March 22nd 2005*. Southampton: MCA.

MCA (2008). *Marine Guidance Notice 372, Guidance to Mariners Operating in the Vicinity of UK OREIs*. London: MCA.

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

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

MCA (2017) *Safety Information.* Available at https://www.gov.uk/government/publications/maritime-and-coastguard-agency-mca-safety-bulletins [accessed 19 April 2017].

SMart Wind (2013). *Hornsea Offshore Wind Farm Project Two Environment Statement. Volume 2, Chapter 7: Shipping and Navigation.* London: SMW.