

The Great Grid Upgrade

Eastern Green Link 5 (EGL 5)

Preliminary Environmental Information Report

Volume 2

Part 3

Appendix 22.A Navigation Risk Assessment

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Contents

22.A Navigational Risk Assessment (NRA)	1
22.A.1 Executive Summary	1
22.A.2 Introduction	2
22.A.3 Approach to NRA	7
22.A.4 Data Sources	13
22.A.5 Consultations	16
22.A.6 Baseline Conditions	21
22.A.7 Formal Safety Assessment	38
22.A.8 Project Specific Recommendations	58
Annex 22.A.1 Hazard Log	69

Plate 22.A-1 Project context within the Humber region	22
Plate 22.A-2 Distribution of AIS vessel tracks by season and vessel type	29
Plate 22.A-3 AIS vessel tracks by vessel type	30
Plate 22.A-4 AIS vessel length by vessel type	32
Plate 22.A-5 AIS vessel DWT by vessel type	34
Plate 22.A-6 AIS vessel draught by vessel type	35

Table 22.A-1 Marine planning policies of relevance to shipping and navigation	4
Table 22.A-2 Severity of consequence of hazard criteria	10
Table 22.A-3 Likelihood / frequency criteria	11
Table 22.A-4 Risk Matrix	11
Table 22.A-5 Tolerability definitions	12
Table 22.A-6 Data Sources	13
Table 22.A-7 NRA consultation meetings	17
Table 22.A-8 Consultation summary	17
Table 22.A-9 RNLI lifeboat stations within 25 km of study area	27
Table 22.A-10 Vessel tracks per season	28
Table 22.A-11 AIS vessel tracks by type	30
Table 22.A-12 AIS vessel tracks distributed by vessel length	32
Table 22.A-13 AIS vessel tracks distributed by vessel DWT	33
Table 22.A-14 AIS vessel tracks distributed by vessel draught	35
Table 22.A-15 Embedded mitigation	39
Table 22.A-16 Vessel collision risk assessment summary (construction)	45
Table 22.A-17 Disruption risk assessment summary (construction)	46

Table 22.A-18 Interaction with vessel anchor risk assessment summary (construction)	47
Table 22.A-19 Fishing gear interaction risk assessment summary (construction)	48
Table 22.A-20 Vessel collision risk assessment summary (Normal Operations and Maintenance)	50
Table 22.A-21 Disruption risk assessment summary (normal operations and maintenance)	51
Table 22.A-22 Interaction with vessel anchor risk assessment summary (normal operations and maintenance)	52
Table 22.A-23 Fishing gear interaction risk assessment summary (normal operations and maintenance)	53
Table 22.A-24 Reduction in under-keel clearance risk assessment summary (normal operations and maintenance)	54
Table 22.A-25 EMF interference with marine navigational equipment risk assessment summary (normal operations and maintenance)	55
Table 22.A-26 Cost benefit considerations of additional risk reduction measures (RRMs)	56

22.A Navigational Risk Assessment (NRA)

22.A.1 Executive Summary

- 22.A.1.1 This Navigational Risk Assessment (NRA) considers the risks to shipping and navigation associated with the construction, maintenance, and decommissioning of the Eastern Green Link 5 Project, formerly AC4 (hereafter the 'Project'). The Project is a new primarily offshore high voltage electricity link, with associated onshore infrastructure, connecting Scotland to the Lincolnshire coastline at Anderby Creek. Once onshore, the proposed subsea High Voltage Direct Current (HVDC) cables would route to a single proposed converter station located either to the northeast of Bilsby or to the northwest of Huttoft, within East Lindsey. The assessment identifies hazards to shipping and navigation through desktop study, stakeholder consultations, and hazards workshops which form part of the wider Preliminary Hazards Analysis (PHA) process. As part of the Formal Safety Assessment (FSA), a risk matrix framework is used to determine requirements for risk reduction and to ultimately establish additional risk reduction measures to ensure that risks are As Low As Reasonably Practicable (ALARP).
- 22.A.1.2 As a basis for the assessment, extensive navigational baseline data has been compiled via a study of historical shipping and navigation data using a range of sources and is presented via a series of map figures and analysis. The shipping and navigation study area (hereafter the study area) comprises a 10-nautical-mile-wide corridor encompassing the full English Offshore Scheme (five nautical mile (NM) on each side of the draft Order Limits). This corridor intersects established high-density shipping lanes and lies in close proximity to key navigational constraints, including the Approaches to the River Humber International Maritime Organization (IMO) routing measure, designated anchorage areas, and existing Offshore Wind Farms (OWFs) footprints.
- 22.A.1.3 Using the baseline data and applying the FSA methodology, the appraisal identified impacts which are 'Tolerable if ALARP' and 'Broadly Acceptable' as according to the framework. The 'Tolerable if ALARP' and 'Broadly Acceptable' assessments are based principally upon the combination of existing legislation governing safe navigation practices, as well as regulations relating to fishing and anchoring near subsea infrastructure. They also reflect the reduction of the seabed hazard through cable burial and protections where required. The risk assessment output is captured in a hazard log annexed to this document which serves to provide hazard management traceability.
- 22.A.1.4 The assessment makes a number of recommendations to address the identified risks and in particular has recommended that communication plans are enhanced to ensure that those parties active in the areas affected by the operations, such as Traffic Separation Scheme (TSS) and Vessel Traffic Service (VTS) operators, Associated British Ports in the Humber region (Humber ABP), the Royal Yachting Association (RYA), and others, are kept aware of the operation schedule and location of the operation vessels at all times. Similarly, the assessment recommends that UK Hydrographic Office (UKHO) Temporary / Preliminary Notices should be issued to ports, harbours and pilots and other appropriate parties prior to post-lay / as-built survey such that the basic positions of the cables are established and awareness among mariners can be raised immediately. The report concludes that where these recommendations and others made in this assessment are implemented, the risks to shipping and navigation presented by the English Offshore Scheme can be considered ALARP.

22.A.2 Introduction

22.A.2.1 This NRA characterises the shipping and navigation surrounding activities and infrastructure of the English Offshore Scheme and assesses associated changes in navigational risk.

22.A.2.2 This chapter is supported by the following figures, **Volume 3**:

- **Part 3, Figure 22.A-01: Shipping and Navigation Study Area;**
- **Part 3, Figure 22.A-02: Ports and Navigation;**
- **Part 3, Figure 22.A-03: Military Practice Areas;**
- **Part 3, Figure 22.A-04: Recreation;**
- **Part 3, Figure 22.A-05: Other Navigational Features;**
- **Part 3, Figure 22.A-06: RNLI Search and Rescue;**
- **Part 3, Figure 22.A-07: Search and Rescue Helicopter;**
- **Part 3, Figure 22.A-08: MAIB Events;**
- **Part 3, Figure 22.A-09: Seasonal Vessel Track Density;**
- **Part 3, Figure 22.A-10: Busiest Day;**
- **Part 3, Figure 22.A-11: Vessel Tracks by Vessel Type;**
- **Part 3, Figure 22.A-12: Vessel Length;**
- **Part 3, Figure 22.A-13: Vessel DWT;**
- **Part 3, Figure 22.A-14: Vessel Draught;**
- **Part 3, Figure 22.A-15: Bivariate Analysis of Vessel Density and Mean DWT;**
- **Part 3, Figure 22.A-16: Time Spent at Anchor;**
- **Part 3, Figure 22.A-17: Fishing Vessels by Vessel Length and Subtype;**
- **Part 3, Figure 22.A-18: AIS Data Points with Status Set to Actively Fishing by Season;**
- **Part 3, Figure 22.A-19: VMS Density and Sightings; and**
- **Part 3, Figure 22.A-20: VMS by ICES Sub-Rectangle – Fishing Time by Gear Type.**

Overview

22.A.2.3 The Eastern Green Link (EGL) 5 (hereafter the 'Project') is a primarily offshore two Gigawatt (GW) High Voltage Direct Current (HVDC) electricity link, with associated onshore infrastructure, between Peterhead, Aberdeenshire and Anderby Creek, Lincolnshire. The Project comprises almost 600 kilometres (km) of subsea and underground HVDC cables between new converter stations at each end of the electricity transmission link, of which up to 431 km is within the English EGL 5 Project.

22.A.2.4 For the purposes of seeking the necessary consents, EGL 5 has been split into different 'Schemes', and this chapter is focused on the English Offshore Scheme. The English Offshore Scheme extends from Mean High Water Springs (MHWS) where the English Offshore Scheme makes landfall at Anderby Creek on the Lincolnshire coastline, to the border between English and Scottish adjacent waters. It is noted that the boundaries for the English Onshore Scheme and the English Offshore Scheme both overlap in the intertidal zone between Mean Low Water Springs (MWLS) and MHWS. The English Offshore Scheme would comprise the construction of up to 423 km of subsea HVDC cables from the Anderby Creek Landfall to the England – Scotland maritime border. The subsea cable system would consist of two bundled HVDC cables and a fibre optic cable (up to 140 km offshore) for control and monitoring purposes and associated external cable protection where burial of the subsea cable system in the seabed is not fully achieved i.e. due to ground conditions or the presence of existing infrastructure.

22.A.2.5 Full details of the Project can be found in **Volume 1, Part 1, Chapter 4: Description of the Project**. Interactions between the English Offshore Scheme and commercial fisheries and other sea users are covered in depth within specific chapters of the PEIR, namely **Volume 1, Part 3, Chapter 23: Commercial Fisheries** and **Volume 1, Part 3, Chapter 24: Other Marine Users**, which should be read in conjunction with this NRA.

22.A.2.6 A description of the shipping and navigation receptor baseline, as understood through desk-based review, is presented in the 'Baseline Conditions' section of this NRA. Risks to shipping and navigation, associated with the English Offshore Scheme, are assessed in the FSA section of this document to cover the construction (installation, commissioning and decommissioning) and normal operations (operational lifetime and maintenance activities) phases of the English Offshore Scheme. Where appropriate, proportionate measures to avoid, mitigate or compensate for any identified adverse effects are proposed.

Legislative Context

22.A.2.7 The following legislation informs the approach of the appraisal in this NRA:

- International Regulations for Preventing Collisions at Sea (COLREGS) 1972/78 (Ref 22.A.1), as implemented in the UK through the Merchant Shipping (Distress and Prevention of Collisions) Regulations 1996 (Ref 22.A.2);
- United Nations Convention on the Law of the Sea (UNCLOS) (1982) (Ref 22.A.3);
- Submarine Telegraph Act (1885) (Ref 22.A.4);
- International Convention for the Safety of Life at Sea (SOLAS) Chapter V (International Maritime Organisation, 1974) (Ref 22.A.5); and
- Marine and Coastal Access Act (2009), section 69 subsection (1)(c) (Ref 22.A.6).

Policy

22.A.2.8 A number of policies and regulations aim to ensure that shipping and navigation are taken into account during planning and execution of projects within UK waters. These include the UK Marine Policy Statement (MPS) (Ref 22.A.7) and the UK Marine Plans, specifically the North East Inshore and North East Offshore Marine Plan (Ref 22.A.8) and the East Inshore and East Offshore Marine Plan (22.A.9). These marine plans specifically address a number of relevant policies to shipping and navigation, as shown in **Table 22.A-1**.

22.A.2.9 More broadly, national planning policies relevant to shipping and navigation include:

- Overarching National Policy Statement for Energy (EN-1) (2021) Section 5.14 Traffic and Transport which states that “*the consideration and mitigation of transport impacts is an essential part of the Government’s wider policy objectives for sustainable development*” (22.A.10); and
- National Policy Statement for Electricity Networks Infrastructure (EN-5) (2011) (Ref 22.A.11) Section 2.10 which considers Electric and Magnetic Fields (EMFs).

Table 22.A-1 Marine planning policies of relevance to shipping and navigation

Topic	Policy code	Policy text	How and where it is considered
North East Inshore and North East Offshore Marine Plan			
Ports, harbour and shipping.	NE-PS-1	<p>In line with the National Policy Statement for Ports, sustainable port and harbour development should be supported.</p> <p>Only proposals demonstrating compatibility with current port and harbour activities will be supported.</p> <p>Proposals within statutory harbour authority areas or their approaches that detrimentally and materially affect safety of navigation, or the compliance by statutory harbour authorities with the Open Port Duty or the Port Marine Safety Code, will not be authorised unless there are exceptional circumstances.</p> <p>Proposals that may have a significant adverse impact upon future opportunity for sustainable expansion of port and harbour activities, must demonstrate that they will, in order of preference:</p> <p>a) avoid b) minimise c) mitigate</p> <p>- adverse impacts so they are no longer significant.</p> <p>If it is not possible to mitigate significant adverse impacts,</p>	<p>Relevant ports and harbours are described in section 22.A.6. No permanent static sea surface infrastructure will be in place for the English Offshore Scheme. However, operations will take place within a busy shipping area and risks associated with operations affecting ports and harbours have been considered at stakeholder consultation sessions (see section 22.A.5) and within the risk assessment and captured in assessment hazard log (see Annex 22.A.1: Hazard Log).</p>

Topic	Policy code	Policy text	How and where it is considered
		proposals should state the case for proceeding.	
Ports, harbour and shipping.	NE-PS-2	Proposals that require static sea surface infrastructure or that significantly reduce under-keel clearance must not be authorised within or encroaching upon IMO routing systems unless there are exceptional circumstances.	IMO routing systems are discussed in section 22.A.6. Under-keel clearance is identified as a potential hazard during stakeholder consultation (see section 22.A.5). The hazard is assessed in section 22.A.7. The assessment identifies potential minor reduction in under-keel clearance and recommends that the associated risk is suitably reduced if relevant harbour authorities and interested parties (specifically in the Humber region) are updated on any seabed changes as they develop (also see Recommendations section 22.A.8).
Ports, harbour and shipping.	NE-PS-3	Proposals that require static sea surface infrastructure or that significantly reduce under-keel clearance which encroaches upon high density navigation routes, strategically important navigation routes, or that pose a risk to the viability of passenger services, must not be authorised unless there are exceptional circumstances.	As above, under-keel clearance is identified as a potential hazard during stakeholder consultation (see section 22.A.5). The hazard is assessed in section 22.A.7. The assessment identifies potential minor reductions in under-keel clearance nearby the selected landfall at Anderby Creek. The assessment recommends that the associated risk is suitably reduced if relevant harbour authorities and interested parties (specifically in the Humber region) are updated on any seabed changes as they develop (also see Recommendations section 22.A.8).
East Inshore and East Offshore Marine Plans			
Ports and Shipping.	PS1	Proposals that require static sea surface infrastructure or that significantly reduce under-keel clearance should not be authorised in IMO designated routes.	As above under-keel-clearance is identified as a potential hazard during stakeholder consultation (see section 22.A.5). The hazard is assessed in section 22.A.7. The assessment identifies potential minor reductions in under-keel clearance nearby the

Topic	Policy code	Policy text	How and where it is considered
			<p>selected landfall at Anderby Creek. The assessment recommends that the associated risk is suitably reduced if relevant harbour authorities and interested parties (specifically in the Humber region) are updated on any seabed changes as they develop (also see Recommendations section 22.A.8).</p>
Ports and Shipping.	PS2	<p>Proposals that require static sea surface infrastructure that encroaches upon important navigation routes should not be authorised unless there are exceptional circumstances. Proposals should:</p> <ul style="list-style-type: none"> a) be compatible with the need to maintain space for safe navigation, avoiding adverse economic impact b) anticipate and provide for future safe navigational requirements where evidence and / or stakeholder input allows and c) account for impacts upon navigation in-combination with other existing and proposed activities 	<p>No permanent static sea surface infrastructure will be in place for the English Offshore Scheme however seabed hazards shall be appropriately marked.</p>
Ports and Shipping.	PS3	<p>Proposals should demonstrate, in order of preference:</p> <ul style="list-style-type: none"> a) that they will not interfere with current activity and future opportunity for expansion of ports and harbours b) how, if the proposal may interfere with current activity and future opportunities for expansion, they will minimise this c) how, if the interference cannot be minimised, it will be mitigated 	<p>No permanent static sea surface infrastructure will be in place for the English Offshore Scheme. However, operations will take place within a busy shipping area and risks associated with the operations affecting ports and harbours have been considered at stakeholder consultation sessions (see section 22.A.5) and within the risk assessment and captured in assessment hazard log (see Annex 22.A.1: Hazard Log).</p>

Topic	Policy code	Policy text	How and where it is considered
		d) the case for proceeding if it is not possible to minimise or mitigate the interference ¹	

Guidance

22.A.2.10 The appraisal methodology has been aligned to the following best practice guidance documents in so far as they are relevant to a cable project:

- IMO Revised Guidelines for FSA for Use in the Rule-Making Process (MSC-MEPC.2/Circ. 12/Rev.2) (Ref 22.A.12);
- Maritime and Coastguard Agency (MCA) Marine Guidance Notes (MGN) 654 (M+F) Offshore Renewable Energy Installations (OREI) safety response (Ref 22.A.13);
- Methodology for Assessing Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations (OREI) (Ref 22.A.14);
- International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Recommendation R1039, Edition 3.0, The Marking of Man-Made Structures (Ref 22.A.15);
- IALA Guideline G1162, Edition 1.1, The Marking of Offshore Man-Made Structures, Dec 2021 (Ref 22.A.16); and
- MCA MGN 661 (M+F) Navigation - safe and responsible anchoring and fishing practices (Ref 22.A.17).

Study Area

22.A.2.11 The study area comprises a 10-nautical-mile-wide corridor encompassing the full English Offshore Scheme (five NM on each side of the draft Order Limits) as shown in **Volume 3, Part 3, Figure 22.A-01**. The study area reflects the large potential Zone of Influence (Zoi) of the English Offshore Scheme in respect to shipping and navigation receptors. The study area considers the English Offshore Scheme only, from MHWS where the English Offshore Scheme makes landfall at Anderby Creek on the Lincolnshire coastline to the border between English and Scottish waters.

22.A.3 Approach to NRA

Methodology Overview

22.A.3.1 This NRA adheres to both MCA guidelines on NRA and IMO guidelines on FSA. Specific details of the approach adopted here are set out later in this section. The identification and appraisal of hazardous outcomes and mitigation measures are based on expert judgment following widely adopted risk appraisal frameworks and informed by consultation responses from a range of stakeholders.

¹ PS3 applies to the Inshore Marine Plan area only.

22.A.3.2 A Scoping Report, submitted to and consulted on by the Planning Inspectorate (Ref 22.A.18) identified aspects of the English Offshore Scheme that have the potential to affect shipping and navigation during the construction phases (covering installation, commissioning, and decommissioning), normal operations covering the operational life and maintenance of the cables. It is necessary to identify and assess the potential interactions, to understand the potential hazards, identify possible mitigation measures and ultimately demonstrate that the English Offshore Scheme will not adversely affect vessel traffic.

22.A.3.3 In line with NRA methodology, this appraisal comprises three principal elements:

- Baseline Conditions – summarising navigational baseline characterisation work to establish densities and types of traffic in the marine environment;
- Stakeholder Consultation – range of stakeholder consultation activities including hazards workshops; and
- FSA – Presenting the outcomes of Risk Assessment and hazard log.

22.A.3.4 Navigational features and patterns of vessel activity within the study area were assessed to establish baseline conditions (section 22.A.6) and inform the subsequent FSA. Key features located outside of the study area were also considered as required. Stakeholder consultation informed both the baseline understanding of shipping in the area and, through hazard workshops, the population and refinement of the hazard log. The FSA and hazard log (section 22.A.7 and **Annex 22.A.1: Hazard Log** respectively) have assessed hazards such as collision, snagging and disruption to shipping against risk categorisation, mitigation measures, and ultimately, acceptability, adhering to the FSA methodology. The outcome of these steps is the formulation of recommendations to inform decision-making for all relevant parties.

Baseline Conditions

22.A.3.5 The navigational baseline characterisation comprises the following four elements:

- Key navigational features;
- Emergency response overview;
- Maritime incident analysis; and
- Marine Traffic Study (MTS).

Key navigational features

22.A.3.6 The navigational baseline identifies key navigational features within the study area including ports, anchorage areas, IMO routeing, offshore pilot boarding and landing grounds, military practice areas and recreational features, as well as planned and existing offshore infrastructure.

Emergency response overview

22.A.3.7 An overview of the emergency response in the region is described, considering Royal National Lifeboat Institution (RNLI) and Search and Rescue by Helicopter (SARH) resources in proximity to the study area.

Maritime incident analysis

22.A.3.8 Maritime incidents recorded by the RNLI, SARH and the Marine Accident Investigation Branch (MAIB) in the vicinity of the study area have been reviewed. The occurrence of maritime incidents can give an indication of the general level of marine incident risk in this region, which may be relevant during the construction of the English Offshore Scheme.

Marine Traffic Study

22.A.3.9 The MTS uses vessel traffic data including Automatic Identification System (AIS) and Vessel Monitoring System (VMS) data to establish baseline vessel traffic conditions in the study area (five nautical miles buffer around the draft Order Limits), analysing such aspects as vessel type, size and status, as well as a section focussing on fishing traffic. A full year of AIS data has been selected, from 1 September 2024 to 31 August 2025, to cover four contiguous seasons. The data used in this MTS will be discussed in detail in section 22.A.4.3.

Assessment of Hazards through FSA

- 22.A.3.10 The FSA process provides a systematic method for evaluating and controlling risk, within a structured framework. Baseline shipping patterns and navigational features along with stakeholder consultation provide the basis for establishing potential hazards and their relevant details. These hazards are then characterised in terms of their severity of consequence and likelihood, which ultimately provides for risk categorisation against a risk matrix, to determine an outcome of either 'Unacceptable', 'Tolerable if ALARP' or 'Broadly Acceptable'.
- 22.A.3.11 In the case of 'Unacceptable' outcomes, additional risk reduction measures (RRMs) will be required to be made, comprising either changes to design or robust temporary measures imposed during the Project to control risk to an acceptable level. Where a 'Broadly Acceptable' initial assessment is determined no further measures are required as these are considered unlikely to provide substantial risk benefit. Additional RRMs are however identified to provide a reduction in risk where a 'Tolerable if ALARP' assessment is made and should be considered to be implemented if feasible.
- 22.A.3.12 The residual risk, with additional mitigation measures considered, is subsequently assessed to determine risk acceptability in accordance with the principles of ALARP. Where necessary or appropriate, qualitative cost-benefit analysis of mitigation measures is undertaken to determine / justify a basic ALARP position.
- 22.A.3.13 Cumulative effects from neighbouring developments are also considered to ensure any interactions and future situations with potential hazardous outcomes are captured and suitable recommendations can be made. This is captured in **Volume 1, Part 4, Chapter 27: Cumulative Effects** and is not part of this document.
- 22.A.3.14 The FSA therefore comprises the following elements:
- Hazard identification;
 - Initial risk assessment, considering existing or embedded mitigation measures;
 - Identification of additional risk mitigation measures and resulting residual risk; and
 - Cost-benefit analysis.

Hazard Identification

- 22.A.3.15 Considering the activities of the English Offshore Scheme, baseline information provided in the MTS, other consultation responses, professional judgement and industry experience, a list of hazards and their outcomes relevant to marine navigation was compiled and assessed through Hazards workshop sessions with relevant stakeholders (see section 22.A.5) which form part of the wider PHA process. The list was compiled considering all principal phases and elements of the English Offshore Scheme. Note that the “worst credible” and “most likely” outcomes were established to provide a comprehensive understanding of the hazards. The list was captured in a table, to be retained as an auditable hazard log (see **Annex 22.A.1: Hazard Log**).
- 22.A.3.16 In addition to hazards, the workshops identified mitigation measures considered as ‘embedded’ i.e., assumed to be existing, effective and therefore taken into consideration when determining risk. These were categorised as being specific to the Project or otherwise statutory or good industry practise. Any further risk reduction considerations, based on stakeholder expertise and local knowledge were also identified and captured in the sessions.
- 22.A.3.17 The potential consequences of the hazards and their likelihood were then assessed using a risk assessment matrix as part of a desktop exercise.

Risk Assessment

- 22.A.3.18 The risk assessment process is based on a classic matrix approach. The risk assessment categorisations directly reflect the UK Health and Safety Executive principles of ALARP and align with NRA terminology. Additionally, the approach is consistent with relevant marine guidance from the IMO (Ref 22.A.12) and the UK MCA (Ref 22.A.17). Each hazard is individually evaluated against specific criteria and assigned categories for severity as presented in **Table 22.A-2** and frequency / likelihood as presented in **Table 22.A-3**. The risk matrix which combines them is included in **Table 22.A-4**. The assessment assesses shipping and navigation risks across four categories of consequences: worst case personnel safety, damage to property (infrastructure / vessels), commercial impact (to industry / ports), and environmental consequences.

Table 22.A-2 Severity of consequence of hazard criteria

Severity	Description
High	<ul style="list-style-type: none"> Loss of a crew member, or multiple serious injuries; Major / Severe damage to infrastructure or vessel; Operations / activities halted indefinitely; Major commercial impact; and Tier 3 response – national assistance needed.
Medium	<ul style="list-style-type: none"> Serious injury to person; Notable damage to infrastructure or vessel; Protracted operational delays; Moderate commercial impact; and

Severity	Description
Low	<ul style="list-style-type: none"> • Tier 2 response – external assistance needed.
	<ul style="list-style-type: none"> • Minor injury(s) to person;
	<ul style="list-style-type: none"> • Minor / Local damage to equipment or vessel
	<ul style="list-style-type: none"> • Minor operational delays;
	<ul style="list-style-type: none"> • Minor commercial impact; and
Negligible	<ul style="list-style-type: none"> • Tier 1 response – local assistance needed.
	<ul style="list-style-type: none"> • No significant operational impacts; and • Minor environmental emissions, no spill response needed.

Table 22.A-3 Likelihood / frequency criteria

Likelihood / frequency	Criteria description
Remote	Never occurred during Company’s activities but has been known to occur in the wider industry.
Unlikely	Has occurred in Company’s activities in the past but as an isolated incident under exceptional circumstance.
Occasional	Has occurred on more than one occasion during Company’s activities in the past.
Likely	Occurs regularly during Company’s activities.

22.A.3.19 The likelihood and consequence categories are combined for each hazard using the risk matrix shown in **Table 22.A-4** which is used to derive a risk tolerability level of either Unacceptable, Tolerable if ALARP or Broadly Acceptable. Definitions of each risk tolerability level are provided in **Table 22.A-5** below.

Table 22.A-4 Risk Matrix

Likelihood / frequency	Likely	Broadly Acceptable	Tolerable if ALARP	Unacceptable	Unacceptable
	Occasional	Broadly Acceptable	Tolerable if ALARP	Tolerable if ALARP	Unacceptable
	Unlikely	Broadly Acceptable	Broadly Acceptable	Tolerable if ALARP	Tolerable if ALARP
	Remote	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable if ALARP
		Negligible	Low	Medium	High
Severity of consequence					

Table 22.A-5 Tolerability definitions

Tolerability	Definition
Broadly Acceptable (Low Risk - not significant).	Generally regarded as acceptable and adequately controlled. At these risk levels the opportunity for further reduction is limited.
Tolerable if ALARP (Moderate Risk - significant).	Typical of the risks from activities which people are prepared to tolerate to secure benefits. There is however an expectation that such risks are properly assessed, appropriate mitigation measures are in place, residual risks are ALARP and that risks are periodically reviewed to monitor if further controls are appropriate.
Unacceptable (High Risk - significant).	Generally regarded as unacceptable whatever the level of benefit associated with the activity. Significant risk mitigation or design modification required to reduce to tolerable (ALARP).

Identification of Additional Mitigation Measures

22.A.3.20 Where risks are assessed as being unacceptable or tolerable (significant) after factoring in the embedded mitigation measures already identified, further additional risk mitigation measures are identified and considered.

Cost-Benefit Analysis

22.A.3.21 In order to formulate recommendations for decision-making, any additional risk mitigation measures identified are subjected to a qualitative cost-benefit comparison in order to justify the measure and establish a residual risk categorisation and basic ALARP position.

Risk Assessment Table

22.A.3.22 The risk assessment outputs have been captured in a table such that the hazards for each of the English Offshore Scheme phases and the relevant embedded mitigation measures and any additional mitigation measures identified, are captured to provide an auditable hazard log.

Cumulative effects

22.A.3.23 The approach to Cumulative and In-Combination effects assessment is set out in **Volume 1, Part 4, Chapter 27: Cumulative Effects**.

22.A.3.24 The assessment is based on the best available data from other plans, projects and marine activities and associated information which is currently in the public domain or has been provided to the project team. The assessment assumes that publicly available information is accurate; the assessment is also reliant on collaboration with a range of statutory consultees to the Marine Licensing process, neighbouring authorities and other developers to identify changes in information which may be pertinent to the assessment. Where there are specific limitations associated with data, they will be highlighted as the assessment progresses.

22.A.3.25 A list of potential cumulative projects and activities has been compiled and includes offshore industry activities off the east coast of England. Each hazard has been qualitatively reviewed against the potential direct and indirect cumulative effects from any of the projects listed as well as general increases in traffic density. This process is

captured in **Volume 1, Part 4, Chapter 27: Cumulative Effects** and is not included as part of this NRA document.

22.A.4 Data Sources

22.A.4.1 Baseline conditions have been established by undertaking a desktop review of published information and through consultation with relevant organisations. An MTS has been undertaken and involved the acquisition of detailed AIS data for a five NM wide corridor around the draft Order Limits.

22.A.4.2 The data sources used to inform the baseline description and appraisal are set out in **Table 22.A-6**.

Table 22.A-6 Data Sources

Name	Description	Source authority	Year(s)
MHWS (Ref 22.A.19).	Mean high water boundary.	OS Terrain 50 (scale 1:50 000).	2024
World Port Index (Ref 22.A.20).	Location of the world's ports.	National Geospatial Intelligence Agency.	2019
Automatic Identification System (AIS) data (Ref 22.A.21).	AIS point data	Kpler.	2024 / 2025
Marine Themes Vector Data (Ref 22.A.22).	Marine Themes Vector data tiles including anchorage areas, marine use areas, aquaculture, navigational lines, navigational routes, beacons and buoys. (Deemed Marine License No. EMS-EK001-1071596)	OceanWise	Purchased in July 2025.
Admiralty Charts 2182A, 2182 B, and 1190 (Ref 22.A.23).	UKHO charts to provide context.	UKHO	December 2025.
Cables (Ref 22.A.24).	Cables, power, telecom, anchor, cable route, cable corridor, other.	European Subsea Cables Association (ESCA).	2025
Offshore Renewables Lease Data (Ref 22.A.25).	GIS data from The Crown Estate (TCE) including OWFs lease areas and cable areas.	TCE	2024
Wrecks and Obstructions (Ref 22.A.26).	UK wrecks and obstructions data.	UKHO	2024

Name	Description	Source authority	Year(s)
Oil and Gas Surface Structures and Pipelines Data (Ref 22.A.27).	Oil and gas surface installations and pipelines GIS data.	North Sea Transition Authority (NSTA).	2024
Marine Accident Investigation Branch (MAIB) Incident Data (Ref 22.A.28).	Maritime incidents reported to the MAIB within the study area.	MAIB	1992 - 2023
RNLI Incident Data (Ref 22.A.29).	RNLI callouts data within the study area.	RNLI	2000 - 2025
RNLI lifeboat station locations and SARH base locations (Ref 22.A.30)	RNLI and SARH station / base location	RNLI	2024
SARH taskings data (Ref 22.A.31).	SARH taskings data within the study area.	Department for Transport, MCA.	2015 - 2025
Routeing Measures (Ref 22.A.32).	UK Exclusive Economic Zone (EEZ) Ships' Routeing Measures as approved by the IMO, and / or the MCA.	UKHO	2024
Minerals (aggregates) site agreements (Ref 22.A.33).	Mineral, mining, mine, evaporite, aggregate, site agreement.	TCE	2023
Dredge spoil disposal sites (Ref 22.A.34).	Licensed Disposal Sites.	Centre for Environment, Fisheries and Aquaculture Science (Cefas).	2025
NP54 - Admiralty Sailing Directions: North Sea (West) Pilot (12 th edition) (Ref 22.A.35).		UKHO	2021
VMS point data (Ref 22.A.36).	Anonymised VMS point data for vessels of 12 m and above	MMO	2019 - 2023
International Council for the Exploration of the Sea (ICES) fishing activity (Ref 22.A.37)	Fishing activity for UK vessels 15 m and over ICES statistical subrectangle.	ICES	2010 - 2020
MMO sighting data (Ref 22.A.38).	Vessels sighted on surveillance flights.	MMO	2019 - 2022
RYA UK Coastal Atlas of Recreational Boating v 2.1 (Ref 22.A.39).	Mean intensity of recreational boating.	RYA	2019

Name	Description	Source authority	Year(s)
Port and harbour authority websites and documentation.		Various	2025

AIS data

22.A.4.3 The IMO requires that all ships of ≥ 300 gross tonnage engaged on international voyages, cargo vessels of ≥ 500 gross tonnage not engaged on international voyages, and all passenger ships built on or after 1st July 2002, regardless of size, are fitted with an AIS transponder. All European Union (EU) registered fishing vessels of length 15 m and above are required to carry AIS equipment by EU directive. Smaller fishing vessels (below 15 m) as well as recreational craft are not required to carry AIS although a proportion does so voluntarily smaller fishing vessels are likely to be under-represented in the AIS data.

22.A.4.4 AIS data has been used to assess the patterns and intensity of shipping activity in the vicinity of the shipping and navigation study area. A full year of AIS data has been selected, from 1 September 2024 to 31 August 2025 to cover all seasons. The AIS records were supplied by Kpler (industry standard commercial AIS data supplier) with all standard parameters (longitude, latitude, vessel Maritime Mobile Service Identity (MMSI) number, status, speed, course, heading and timestamp) and the following additional parameters:

- Deadweight tonnage (DWT);
- Vessel length;
- Vessel draught; and
- Vessel type.

22.A.4.5 The AIS data was provided in a raw, point-based format, as well as in a format converted into vessel tracks. The tracks were subsequently clipped to the 10 NM study area shown in **Volume 3, Part 3, Figure 22.A-01**. Vessel density grids for the wider area were produced by overlaying a 1.5 square kilometres (km²) hexagonal grid and determining the density of tracks within each cell. Vessel tracks were assumed to be wholly in the season or month in which the track started. Vessel speeds were calculated from the length of the track and the start and end times of that track.

VMS and Sightings Data

22.A.4.6 As mentioned above, AIS is only a requirement of larger vessels, or those carrying passengers, whereas fishing vessels <15 m length are exempt (although many carry AIS voluntarily for safety). As such, AIS data can underrepresent fishing activity. However, the EU requires that all EU, Faroese and Norwegian fishing vessels of 12 m and above are fitted with a VMS. Vessel positions are transmitted every two hours rather than every few minutes as for AIS data, so tracks cannot be readily reconstructed. Nevertheless, the data provides an informative overview of the distribution and density of fishing vessels over 12 m.

22.A.4.7 Two sets of VMS data were obtained:

- Anonymised VMS point data for the area of interest for 2019 - 2023 (no information on gear type or status, but vessel speeds can be used as a proxy for vessel fishing status, albeit with an inherent level of uncertainty); and
- Fishing activity for UK vessels 15 m and over by ICES statistical subrectangle (this includes data about time spent fishing and gear type; 2010 - 2020).

22.A.4.8 Additionally, MMO sightings data 2019 - 2022 representing vessels sighted on surveillance flights was sourced.

Additional Data Sources

22.A.4.9 Due to the likely under representation of small recreational vessels in the AIS data, additional data sources including the RYA Coastal Atlas have been used to validate the findings of the AIS analysis. Previous consultation with the RYA indicates that, although not all recreational craft are equipped with AIS, uptake has increased in recent years. The RYA therefore considers its intensity dataset to provide a robust representation of recreational boating activity within the region. Additional analysis considers key navigational features and fishing activity. Key navigational features were extracted from additional sources of data including Admiralty charts and Admiralty Pilot (Sailing Directions) books. Maritime incident data from the RNLI, SARH taskings data from the Department of Transport and MCA, and MAIB data have been utilised to assess the emergency response in the region.

Data Gaps and Limitations

22.A.4.10 As noted above in the 'AIS data' section (22.A.4.3), the temporal extent of the AIS data covered a full year from the beginning of September 2024 to the end of August 2025.

22.A.4.11 As also noted above in the 'VMS and Sightings Data' section (22.A.4.6), small fishing and recreation vessels are likely to be underestimated in AIS data. In order to mitigate this, analysis of VMS data has also been included in this chapter to capture a fuller picture of small fishing and recreation vessels. It should however be noted that VMS data does not cover vessels of <12 m in length, and in the case of the MMO fishing activity by ICES rectangle data, does not include vessels of <15 m in length. RYA Coastal Atlas data support the study of recreational activity in the region.

22.A.5 Consultations

22.A.5.1 In order to inform the shipping and navigation appraisal, consultation with key relevant maritime stakeholders was undertaken. Two dedicated consultation sessions were held via Microsoft Teams, each comprising the following elements:

- Introduction to team and summary of NRA process;
- EGL 5 Project overview;
- Navigational baseline summary; and
- Facilitated preliminary hazards assessment workshop.

22.A.5.2 It is also noted that consultation between the English Offshore Scheme and shipping and navigation stakeholders has been ongoing throughout the EGL 3 and EGL 4 Projects and the inputs have also been factored into the assessment in this NRA.

Consultation sessions

22.A.5.3 The NRA consultation meetings and consultees are summarised in **Table 22.A-7**.

22.A.5.4 Consultee input has been incorporated where appropriate into the NRA such that concerns and impacts are recorded and associated risks are addressed.

Table 22.A-7 NRA consultation meetings

Date	Meeting	Location	Attendees
8 December 2025	Statutory bodies.	Remote meeting.	MCA UK Chamber of Shipping (CoS). Trinity House (TH).
15 December 2025	Port and harbour authorities.	Remote meeting.	RYA National Federation of Fishermen's Organisations (NFFO). Humber ABP.

Consultation summary

22.A.5.5 The issues raised during consultation with marine stakeholders and where these issues are considered is detailed in **Table 22.A-8**.

Table 22.A-8 Consultation summary

Consultee and type of response	Issue raised	Response to issue raised / where considered in NRA
CoS – consultation meeting.	Expressed concerns about dredge spoil site overlapping draft Order Limits (potential heavy metal disturbance).	Environmental surveys will assess seabed disturbance; no burial concerns flagged to date.
CoS and Humber ABP – consultation meeting.	Anchoring outside charted areas must be considered.	This is addressed in Section 22.A.6.55.
MCA – consultation meeting.	Requested vessel size categories be split further (10–12m, 12–15m) for more precise assessment.	This has been captured in Volume 3, Part 3, Figure 22.A-14 .
MCA – consultation meeting.	Raised the issue of simultaneous operations (SIMOPS) as a potential hazard category and suggested to include SIMOPS as a mitigation	SIMOPS had been included as mitigation measure (see Table 22.A-15).

Consultee and type of response	Issue raised	Response to issue raised / where considered in NRA
	measure to reduce vessel-to-vessel collision risk.	
MCA and NFFO – consultation meeting.	Carbon capture projects in the area should also be considered.	This is captured in Volume 1, Part 4, Chapter 27: Cumulative Effects .
CoS – consultation meeting.	Asked the typical installation speeds (metres / hour) to assess exposure risk.	This will be captured by the Cable Burial Risk Assessment (CBRA) when produced.
MCA – consultation meeting.	Visibility restrictions: recommended suspension of Restricted in Ability to Manoeuvre (RAM) operations when visibility <two miles (case-by-case, dependent on traffic density).	This had been included as mitigation measure (see the Annex 22.A.1: Hazard Log).
MCA – consultation meeting.	Further engagement with Humber ABP is likely required to address communication protocols for managing potential impacts on the Humber approaches, particularly for vessels awaiting entry or bound for the Humber Deep Water Anchorage Area (Sand Hole, east of the TSS).	Noted, to be discussed with the relevant ports and harbours authorities.
RYA – consultation meeting.	Noted that the key issue with Notices to Mariners is not the volume issued but ensuring they reach the right people. He is preparing an article for the RYA Members' magazine encouraging greater use of Kingfisher resources and raising awareness of relevant notices.	The project acknowledges this information and will take it into account in the NRA.
Humber ABP – consultation meeting.	Noted that although the EGL 5 works fall slightly outside the Humber area, coordination would still be fully supported. As the Project passes the Humber VTS limits, Notices to Mariners would be issued in agreement with the Project team, and vessels could communicate with Humber VTS team based at Grimsby even when outside the immediate area. Given the volume of daily traffic (60 - 80 ships), VTS can act as an effective conduit to ensure information reaches the right mariners, with broadcasts issued every two hours. VTS would remain actively involved, ensuring commercial traffic is routed around work areas where advance notice is provided. Operational meetings and clear	Noted. From a risk-assessment perspective, advance notification to regular users is the primary mitigation.

Consultee and type of response	Issue raised	Response to issue raised / where considered in NRA
	communication lines would be established, with initial Notices to Mariners followed by dynamic updates to keep traffic informed of ongoing activities and requirements.	
Humber ABP – consultation meeting.	Noted that although the works lie outside their area, their main interest is simply being aware of the activity so it can be avoided. He added that issues have arisen in the past when works passed through their area without the usual management regimes for maintaining burial depth, but as this Project is outside their patch, the key requirement is clear awareness of the location and nature of the works.	The Project acknowledges this information and will take it into account in the NRA.
RYA – consultation meeting.	Highlighted that marking subsurface hazards with temporary buoys can itself introduce an additional navigational hazard, particularly as such buoys are not charted.	The Project acknowledges this information and will take it into account in the NRA.
Trinity House and Humber ABP – consultation meeting.	Enquired about the positions of EGL 3 and EGL 4 in relation to EGL 5, and their respective locations with respect to the Humber VTS limit.	This will be captured in Volume 1, Part 4, Chapter 27: Cumulative Effects .
MCA – consultation meeting.	Minimising Disruption in High-Density Areas: Need for procedures to minimise disruption in high-density shipping areas, including anchoring avoidance, installation vessel passage planning, and emergency response planning. Co-ordination for SIMOPs with other developers and offshore activities must also be undertaken prior to commencement of operations.	This will be captured by the CBRA when available.
CoS – consultation meeting.	Highlighted importance in considering the emergency anchoring for vessels, therefore having decent cable burial depth throughout the entirety of the route is a helpful mitigation.	This will be captured by the CBRA when available.
Trinity House – consultation meeting.	About the fishing gear interactions with cables, the temporary marking of cut cables ends could be included as mitigation.	Noted. Additionally, any jointing operations will be planned well outside of shipping lanes and other areas of concern.
NFFO – consultation meeting.	Highlighted that the current fisheries data for the EGL 5 route is likely to be outdated within six months due to the recent Stage 3 Marine Protected Area consultation, which results will	Noted. We will review the outcome of the consultation and update the NRA accordingly.

Consultee and type of response	Issue raised	Response to issue raised / where considered in NRA
	<p>be available early next year. This is expected to displace significant mobile-gear activity to the East Coast. Depending on the outcome of the MMO and Secretary of State decisions, this could substantially change fishing patterns in the area.</p>	
NFFO – consultation meeting.	<p>Emphasised that, within the risk log, the worst-case consequence of gear snagging on the cables should be recognised as potential loss of the vessel and loss of life, not only severe injury or vessel damage.</p> <p>Additionally noted that Kingfisher should be included not only under construction-phase mitigation but also for normal operations and maintenance.</p>	<p>The potential loss of the vessel and loss of life has been included as the worst-case consequence of gear snagging, and Kingfisher has been incorporated for normal operations and maintenance (Annex 22.A.1: Hazard Log).</p>
MCA – consultation meeting.	<p>About the reduction in Under Keel Clearance (cable / crossings), the primary concern is near the Humber Estuary, particularly within the 20 m contour and to landfall. Numerous cables and pipeline crossings. Depth reduction is a major hazard, and the project should ensure they minimise crossings and subsequent depth reductions where larger vessels operate. Vessel draught versus depth analysis will be needed. Particularly near the Humber TSS exits as well. Also be aware that the “reduction of less than five per cent” is only indicative.</p>	<p>Noted. We interpret the “reduction of less than five per cent” as indicative, acknowledging that there might be site specific tolerances relating to either the physical environmental conditions or the spread of vessels that that mean that more detailed investigations necessary.</p>
Humber ABP – consultation meeting.	<p>Noted that their main interest is understanding the final as-built depth of the cables. He commented that if the minimum depth is around 20 m, it is unlikely to pose an issue, but if it were closer to 14 - 15 m, it could become a concern. Clarification of the final burial depths would therefore be helpful in determining whether any risk remains.</p>	<p>The project acknowledges this information and will take it into account in the NRA.</p>
Humber ABP – consultation meeting.	<p>Regarding potential future vessel traffic, including expected vessel sizes and routeing patterns, the Humber ABP highlighted that vessels drawing more than 16 - 17 m cannot transit upriver, though deeper-draft options may exist further up the East Coast. They also added that off the Tees the route lies in significantly deeper water; while vessels up to 17m draft can transit locally, depth constraints</p>	<p>The project acknowledges this information and will take it into account in the NRA.</p>

Consultee and type of response	Issue raised	Response to issue raised / where considered in NRA
	are limited to the first few miles from shore, with ample depth available further offshore, meaning under-keel clearance is not expected to pose an issue.	
MCA - consultation meeting.	For the Electronic Magnetic Field study (EMF), MCA requires $\leq 3^\circ$ deviation for 95 per cent of the cable route and $\leq 5^\circ$ for the remaining five per cent. This must be confirmed through a desk-based study. If not achievable, a compass deviation assessment will be needed.	The project acknowledges this information and will take it into account in the NRA.
Humber ABP – consultation meeting.	Hopes the routing for this project will align with EGL 3 and EGL 4, as lessons learned through the original NRAs will be valuable. Also emphasised that early engagement is essential: the sooner proposals are raised, the sooner the team can identify whether they will work.	The NRA is taking into consideration the consultation outcomes from EGL 3 and EGL 4.
MCA – consultation meeting.	Expects all NRA figures to have admiralty charts in background and asks that the NRA text note the version of the admiralty charts used.	The project acknowledges this information and will take it into account in the NRA.

22.A.6 Baseline Conditions

22.A.6.1 This section covers the shipping and navigation baseline for the English Offshore Scheme. The navigational baseline characterisation comprises the following four elements:

- Identification of key navigational features;
- Emergency response overview;
- Maritime incident analysis; and
- Marine Traffic Study (MTS).

Overview

22.A.6.2 The study area is located off the east coast of England, extending from the selected Anderby Creek Landfall on the Lincolnshire coastline to the maritime boundary between England and Scotland. The English Offshore Scheme is up to 423 km in length and lies entirely within UK territorial waters, running parallel to the east coast. The study area passes the mouth of the Humber Estuary, which hosts several ports, including Grimsby, the closest to the study area at 21 km. Further north, additional port harbours are present, including the large Teesport (77 km), as well as the medium-sized harbours of Sunderland (81 km) and Tynemouth (80 km).

22.A.6.3 The region experiences a high intensity of marine traffic, including large vessels with restricted draughts. The Humber Estuary has depth constraints, meaning that vessels drawing more than 16 - 17 m cannot transit upriver; however, deeper-draft options are available further up the East Coast. Ports such as Tees and Immingham lie in significantly deeper water and are capable of accommodating vessels with high deadweight tonnage, as confirmed by harbour authorities during consultation. The area also supports recreational vessel activity. Additionally, the region's ports are increasingly being used as operational bases for existing offshore and marine renewables projects, for developments currently under construction, and for emerging carbon-related infrastructure, including the Endurance CO₂ Storage Facility and associated pipeline system located approximately 75 km east of Flamborough Head, off the Teesside coast.

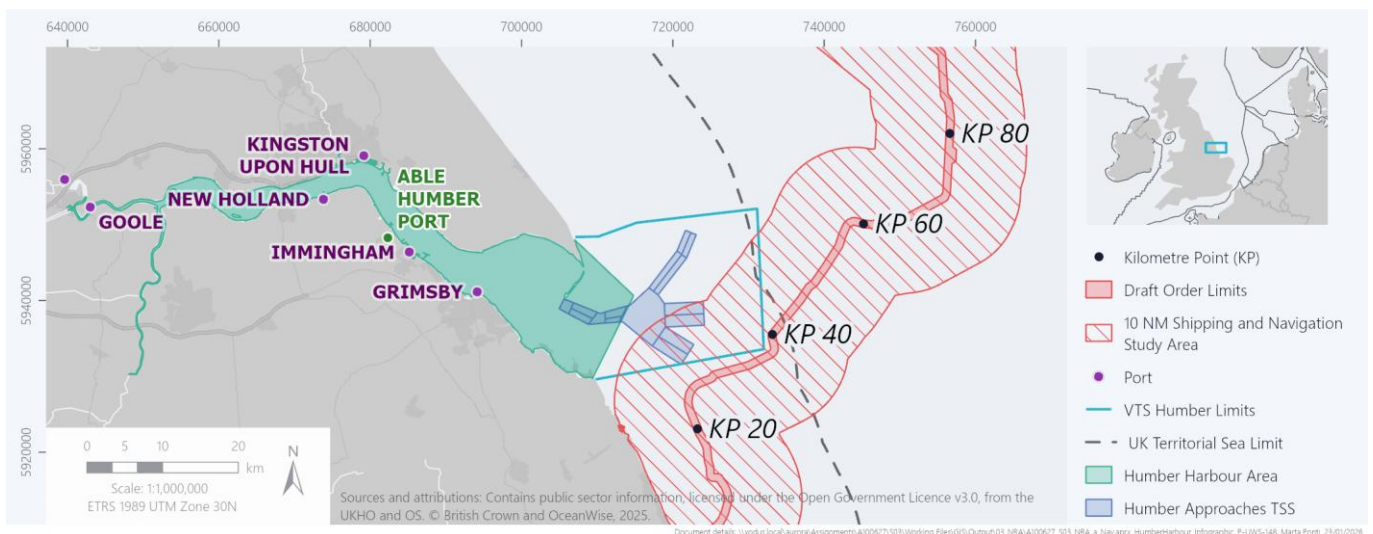
Key Navigational features

Ports and harbours

22.A.6.4 An admiralty chart with the main ports and harbours in the vicinity of the study area, as well as key navigational features is presented in **Volume 3, Part 3, Figure 22.A-02**.

22.A.6.5 As **Volume 3, Part 3, Figure 22.A-02** shows, there are no harbour authorities that directly overlap with the study area. However, the Humber Harbour Area is in close proximity to the selected Anderby Creek Landfall on the Lincolnshire coastline at 2.5 km from the study area at its closest point. The Humber Harbour Area is centred around the Humber Estuary, the largest coastal plain estuary on the east coast of Britain. The port complex is focused around the four locations of Hull, Goole, Immingham, and Grimsby, and it accounts for over 17 per cent of the nation's trade, with approximately 40,000 annual ship movements and 79 million tonnes of cargo. In addition to handling substantial cargo traffic, Able Humber Port, situated near Immingham, provides a strategic platform for the expanding marine renewable energy sector and a range of port-centric logistics functions (**Plate 22.A-1**). The Humber ABP comprises the ports of Hull, Goole, Grimsby and Immingham. ABP Humber Estuary Services (HES) acts as the Competent Harbour Authority, hereafter referred to as ABP HES.

Plate 22.A-1 Project context within the Humber region



22.A.6.6 Within the Humber channel, tidal streams are strong, the channel is continually evolving, and buoys are repositioned regularly to reflect these changes. Upstream of the Humber Bridge, the channel morphology alters so frequently that charts published by ABP, which present the results of the latest hydrographic surveys, should be consulted. ABP also prepares the Humber Passage Plan (Ref: 22.A.39) to manage the transit of 'Passage Plan Vessels' to and from Tetney Monobuoy, the various terminals at Immingham and Killingholme, and the Saltend Jetties.

22.A.6.7 Grimsby is a medium-sized commercial and fishing port specialising in short-sea trade with Europe and the Baltic, as well as supporting the OWF industry. Principal cargoes include cars, forestry products, and frozen food, including fish (Ref: 22.A.38). The docks and entrance are subject to continual dredging, and depths are liable to change. The harbour comprises the River Terminal and two enclosed dock complexes: the Fish Docks and the Commercial Docks.

22.A.6.8 Immingham is the centre of the Humberside chemical and oil-refining industries. It is a busy port primarily handling liquid and dry bulk commodities, while also supporting a substantial general-cargo trade. The port is based around a number of jetties and terminals extending for approximately three km along the southwest bank of the River Humber. In addition, there is an enclosed dock (Ref 22.A.39).

22.A.6.9 Multiple ports and harbours can be found in the wider regional context of the study area. A brief description of the nearest other port and harbour authorities in the region is provided below:

- The Port of Boston Authority lies to the south of the English Offshore Scheme landfall, located approximately 34.9 km to the southwest at its closest point to the study area. The Statutory and Competent Harbour Authority for the Port of Boston lies on the river Witham, overseeing safe navigation, pilotage, and all port operations. The port handles around 1.3 million tonnes of cargo annually and accommodates vessels up to 118 m in length within its enclosed docks. With seven dock berths, four river berths, and capabilities for handling steel, timber, bulk goods, agricultural products, and heavy-lift operations, it supports a diverse range of commercial activities within the Greater Lincolnshire port network;
- Proceeding north, the Bridlington port lies at the head of Bridlington Bay approximately 25.7 km west at its closest point to the study area. The small harbour is used solely by fishing vessels and recreational craft, and the town is primarily a holiday resort. The harbour dries, with a depth of approximately five metres alongside South Pier at MHWS. The mean spring tidal range is about 2.4 m (Ref: 22.A.38); and
- Further north, Scarborough is a small fishing and recreational harbour located at the northwest corner of Scarborough Bay, approximately 35.3 km west at its closest point to the study area. The harbour is formed by four piers which divide it into two independent basins: the Inner Harbour, the larger of the two at 125 m in length, with one half used by fishing vessels and the other occupied by a yacht pontoon area; and the Outer Harbour, which dries by two to five metres and is used as a small craft haven (Ref: 22.A.38).

Navigational features

22.A.6.10 The following navigational features have been considered and are presented in **Volume 3, Part 3, Figure 22.A-02**:

- IMO routing;

- Anchorage areas;
- Pilot boarding stations and grounds; and
- Navigational aids including buoys, beacons and navigation lines.

IMO routeing

22.A.6.11 The routeing measures “In the Approach to the River Humber” lies entirely within the Humber VTS limits and intersect the shipping and navigation study area (**Plate 22.A-1**). This includes three TSSs:

- New Sand Hole (northeast - southwest) which is the main approach channel, a deep and narrow depression with depths ranging from 10 - 43 m (Ref 22.A.40);
- Sea Reach, which is east / west and has a minimum water depth of 8.6 m; and
- Rosse Reach, which is southeast / northwest and has a minimum water depth of 6.9 m.

An outer precautionary area connects these TSSs and four pilot boarding stations located within it. Two smaller precautionary areas are located toward the entrance of the Humber River.

22.A.6.12 Recommended routes for OWFs transfer vessels have been established in the Humber Approaches. They should also be used by small craft entering and leaving the Humber. The routes are designed to avoid conflict with commercial traffic using the Humber Approaches TSS, bull Anchorage and Tetney Mono Buoy.

22.A.6.13 Depths within the district are continually changing, and the area is frequently surveyed. Buoyage is regularly adjusted, and dredging operations are routinely undertaken. At times, it may be necessary for a departing deep-draught vessel, constrained by its draught, to navigate against the general traffic flow within the section of the TSS between Spurn Point and Spurn Light Float.

Anchorage

22.A.6.14 The Humber Deep Water Anchorage, a designated anchorage recommended for large vessels bound for the Humber, is the only official anchorage area intersecting the study area and it is located approximately 9 km west of KP 50. The limits of the anchorage are marked by four light buoys (cardinal). It contains four designated anchor berths. Local experience indicates that, on occasion, the actual tidal stream can considerably exceed the predicted rate. Vessels anchoring in this area during strong tidal streams should maintain a wide clearance from other anchored vessels and from buoyage (Ref 22.A.39).

22.A.6.15 Several charted inner anchorages are located at the entrance to the Humber Estuary. The Bull Anchorage, situated 2.4 km southwest of Spurn Head, is the closest to the study area at approximately 9 km at its nearest point. It is a general anchorage comprising 25 designated anchor berths, each with a swinging radius of one cable.

Aids to Navigation

22.A.6.16 According to Marine Themes data, the study area contains 19 Aids to Navigation: four beacons and 15 buoys. All are located within the UK territorial sea limit, except for a buoy marking the easternmost point of the Deep Water Anchorage polygon. None overlap with the draft Order Limits (**Volume 3, Part 3, Figure 22.A-02**).

22.A.6.17 Three “Routes” intersect the study area in connection with the Approaches to River Humber IMO routeing scheme TSSs. All three provide access to and from the Port of Humber.

Pilotage

22.A.6.18 A number of pilot stations and boarding areas are present within the study area in the proximity of the Approaches to the River Humber IMO routeing measure. Humber Pilotage and VTS Operations Centre are based in Royal Dock, Grimsby. The Humber Pilotage limits encompass the approaches to the River Humber from seaward of Humber Light Float to Goole on River Ouse and Gainsborough on River Trent. Pilotage is compulsory for vessels of 60 m and over in length, and all vessels carrying dangerous substances in bulk when proceeding to and from the inner anchorages for the purpose of anchoring (Ref 22.A.39).

22.A.6.19 There are nine pilot boarding places in relation to the Approaches to the River Humber IMO routeing measure, five inward, three outward and one undefined. Pilot boarding and disembarkation positions are organised by vessel draught, weather and construction characteristics, a detailed description of requirements is available in the NP54 – Admiralty Sailing Directions: North Sea (West) (Ref 22.A.35).

Military practice areas

22.A.6.20 The majority of the shipping and navigation study area overlaps with 11 Military Practice Areas (PEXAs) (**Volume 3, Part 3, Figure 22.A-03**). These comprise five Areas of Intense Aerial Activity (AIAA) and six firing danger areas. Nine PEXAs intersect the draft Order Limits, including:

- Donna Nook firing range (D307) between KP 23–26;
- Four AIAAs (D323D, D323B, D323C and D323A), together with the Staxton firing danger area (D412), between KP 56–266;
- Druridge Bay areas (D513B and D513) between KP 269–339; and
- AIAA D613D, located at the England–Scotland maritime boundary, from KP 367 to the end of the English Offshore Scheme.

Recreation

22.A.6.21 Recreational traffic is observed routeing predominantly within 12 NM of the coast (**Volume 3, Part 3, Figure 22.A-04**). Designated General Boating Areas (GBAs) are located within and at the mouth of the Humber Estuary, overlapping the draft Order Limit from KP 0 to KP 34, as well as off the ports of Bridlington and Scarborough. Overall, boating intensity within the study area is lower than further inshore, although a medium level of activity is present between KP 23 and KP 28, associated with one of the inbound / outbound directions as part of the TSS to the Humber Estuary.

Other infrastructure and navigational features

- 22.A.6.22 **Volume 3, Part 3, Figure 22.A-05** illustrates the key navigational and infrastructure features within the study area and wider region. Several OWFs are present, with three intersecting the study area: Lincs, Inner Dowsing and Triton Knoll (all operational). A further three OWFs lie within 10 km of the study area: Lynn (operational), located 5.8 km south of Inner Dowsing; R4 Project 3 (pre-planning), 6.3 km south east of KP 70; and Humber Gateway (operational), situated just north of the Humber Estuary. In addition, the draft Order Limits intersect eight offshore wind cable agreements: four operational (Hornsea 1, Hornsea 2, Triton Knoll and Dogger Bank A), two consented (Dogger Bank and Sofia), one in planning (Ørsted Hornsea), and one under construction (Dogger Bank B).
- 22.A.6.23 Several offshore aggregate extraction and dredge spoil disposal sites are situated within the study area, with a particular concentration near the Anderby Creek Landfall. Notably, the now-closed Spurn Head dredge spoil disposal site overlaps the draft Order Limit in the proximity of KP 40.
- 22.A.6.24 Key navigational features within the shipping and navigation study area include charted wrecks and obstructions, which are distributed throughout the study area. These comprise 94 dangerous wrecks, 101 other wrecks, and 125 obstructions. A total of 13 charted wrecks and obstructions are located within the draft Order Limit, comprising seven dangerous wrecks, two non-dangerous wrecks, and four obstructions (**Volume 3, Part 3, Figure 22.A-05**). The dangerous wrecks within the draft Order Limit are situated near the Anderby Creek Landfall, between KP 40 and KP 50, and in the vicinity of KP 60. For further details on charted wrecks refer to **Volume 1, Part 3, Chapter 25: Marine Archaeology**. It should be noted that the study area adopted in this chapter is five NM on each side of the draft Order Limit (equivalent to an 9.26 km buffer), whereas **Volume 1, Part 3, Chapter 25: Marine Archaeology** considers the English Offshore Scheme Boundary plus a two km buffer on each side.
- 22.A.6.25 The study area contains 31 licensed oil and gas blocks and is intersected by 112 pipelines (active, not in use, and abandoned pipelines only). Of these, 29 also cross the draft Order Limits. The draft Order Limits also overlaps, just to the northeast an offshore oil and gas production area connecting the Amethyst platforms and the Helvellyn and Wollaston fields.
- 22.A.6.26 Furthermore, ESCA data indicate that the study area intersects ten existing subsea cables, six of which are active and the remaining decommissioned. **Volume 1, Part 3, Chapter 24: Other Marine Users** should be consulted for full details of other sea-user infrastructure, including oil, gas and telecommunications assets. Six subsea cables associated with cross-channel links to mainland Europe intersect the draft Order Limits. The active cables, listed from north to south, are:
- North Sea Link North (two interconnectors) (power);
 - No UK (telecom);
 - Havhingsten (telecom);
 - Pangea North (telecom); and
 - Viking Link interconnector (power).

Emergency Response Overview

22.A.6.27 This section considers the emergency response in the study area by the RNLI and by SARH including such data as:

- RNLI Stations; and
- SARH bases and radii of action.

RNLI

22.A.6.28 The RNLI has six regions; the study area overlaps with the 'North and East' region. The RNLI has 238 stations and more than 400 lifeboats, which are either all-weather lifeboats (ALB) or inshore lifeboats (ILB) (Ref 22.A.30). There are five RNLI lifeboat stations within 25 km of the study area, as presented in **Table 22.A-9** and shown in **Volume 3, Part 3, Figure 22.A-06**. Mablethorpe is within the study area.

Table 22.A-9 RNLI lifeboat stations within 25 km of study area

Station	Lifeboats	County	Division
Mablethorpe	ILB	Lincolnshire	East
Skegness	ALB	Lincolnshire	East
Cleethorpes	ILB	Lincolnshire	East
Flamborough	ILB	East Riding of Yorkshire.	East
Humber	ALB	East Riding of Yorkshire.	East

SARH

22.A.6.29 As part of the MCA, HM Coastguard initiates and coordinates Search and Rescue (SAR) response around the UK. Since April 2015, Bristow Search and Rescue has provided the helicopter SAR service on behalf of HM Coastguard, operating 10 helicopter bases around the UK (Ref 22.A.31).

22.A.6.30 The SARH base serving the shipping and navigation study area is Humberside (**Volume 3, Part 3, Figure 22.A-07**). The study area lies partially within the radii of action of nine SARH bases (Newquay is not included).

Maritime Incidents

22.A.6.31 A review of previous marine incidents within the study area can give an indication of the general level of marine incident risk in this region, which may be relevant during the installation phase of the English Offshore Scheme. This section considers such data as:

- RNLI Return to Service (launches in response to incidents);
- SARH taskings; and
- MAIB incidents.

RNLI

22.A.6.32 The RNLI keeps a record of call-outs to marine incidents. Those in the study area between 2020 and 2024, which were deemed not to be false alarms or hoaxes, are shown in **Volume 3, Part 3, Figure 22.A-06**. A total of 127 unique incidents were recorded between 2020 and 2024. Of those incidents, 14.2 per cent were due to machinery failure, and all the incidents were within two km of shore.

SARH

22.A.6.33 There were 86 SARH taskings in the study area between April 2015 and March 2025 (**Volume 3, Part 3, Figure 22.A-07**). Three incidents occurred within the draft Order Limits, two between KP 0 and 10 near the Lincolnshire landfall (reported on May 2018 and August 2019), and one just after KP 110 (reported on July 2023).

MAIB

22.A.6.34 The Marine Accident Investigation Branch works with the Department of Transport and investigates marine accidents involving all vessels within UK waters. The full dataset from 1992 - 2023 was analysed for this NRA. **Volume 3, Part 3, Figure 22.A-08** shows that incidents have occurred across the study area, with a higher concentration of occurrences near the Humber Estuary. There were 185 incidents recorded within the study area, the most frequent cause of which was loss of control (25.4 per cent) followed by collision with another vessel (17.8 per cent of all incidents).

Marine Traffic Study

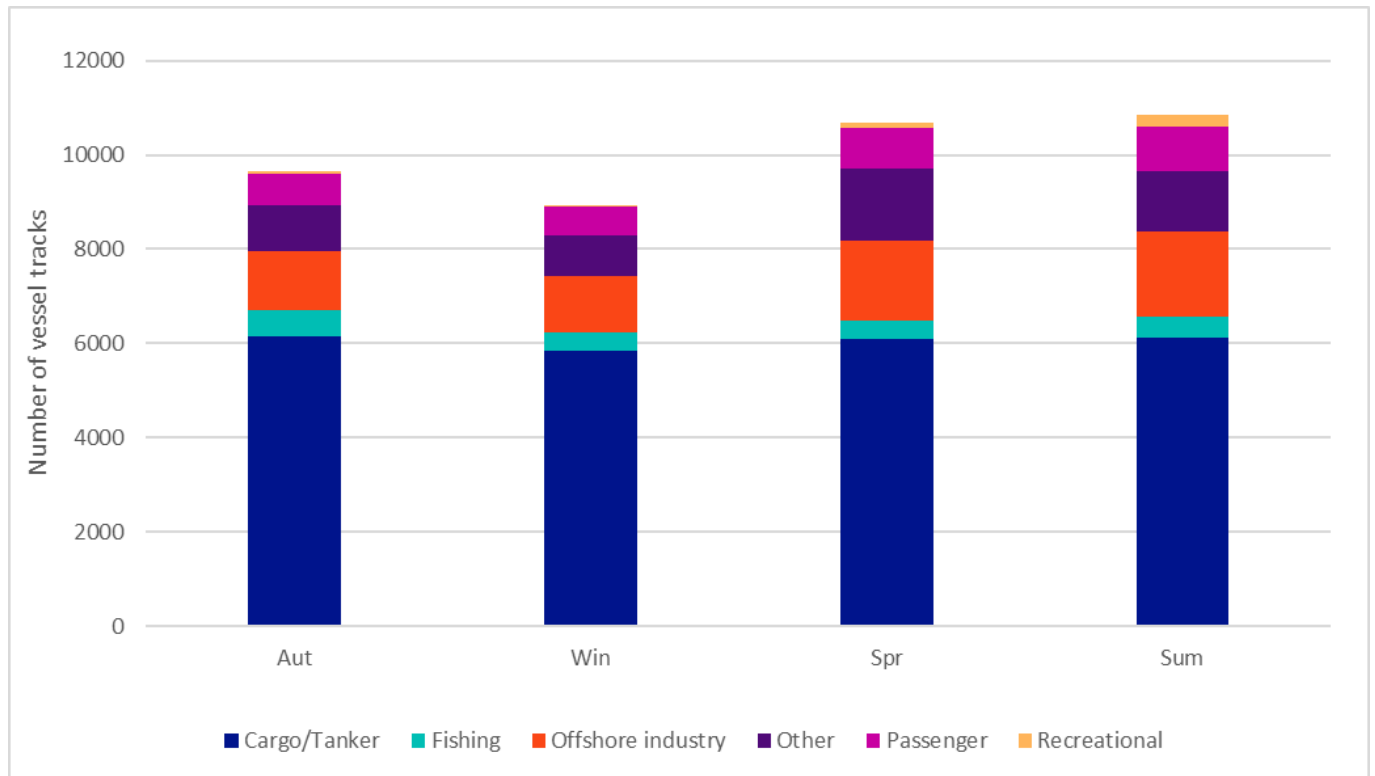
Automatic Identification System (AIS) overview and seasonality

22.A.6.35 A total of 40,092 AIS vessel tracks were recorded across the four-season study period within the study area. As shown in **Table 22.A-10**, there were 9,643 tracks in autumn (September to November), 8,897 tracks in winter (December to February), 10,693 tracks in spring (March to May), and 10,859 tracks in summer (June to August). July 2025 was the busiest month with the most tracks at 3,701, while December 2025 was the month with the least tracks at 2,743 tracks. Most categories of vessel type remain relatively constant throughout the seasons with a slight increase during the summer months. The predominant vessel type in the study area is “cargo / tanker”, which makes up 60.3 per cent of vessel traffic across all seasons, and is split relatively evenly over the four seasons, with an average of 6,044 tracks per season (**Plate 22.A-2**). The reason for these vessel patterns is likely to be due to the year-round nature of international shipping activity, and due to the importance of clement weather conditions for recreational vessel activity.

Table 22.A-10 Vessel tracks per season

Season	Count	Percentage of the total	Average tracks per day
Autumn	9,643	24.0%	105.7
Winter	8,897	22.2%	97.5
Spring	10,693	26.7%	117.2
Summer	10,859	27.1%	119.0

Plate 22.A-2 Distribution of AIS vessel tracks by season and vessel type



22.A.6.36 Seasonal AIS vessel track densities are displayed in **Volume 3, Part 3, Figure 22.A-09**. The patterns of vessel traffic are similar across the seasons, with high traffic intensities associated with movements into and out of the Humber Estuary. An additional area of high density forms a northwest – southeast route between KP 60 and 80, followed by a third route with the same orientation around KP 160 toward Whitby Port. Vessel traffic density is higher in spring and summer across all vessel types compared with autumn and winter, with peak values of 1,594 and 1,527 tracks per 1.5 km² grid cell in spring and summer, respectively, located at the entrance of the Humber Estuary.

22.A.6.37 The day on which most vessels began a journey or crossed into the study area was 11 April 2025 (**Volume 3, Part 3, Figure 22.A-10**), when 161 vessel tracks were recorded. Conversely, the quietest day was 8 December 2024 when only 36 vessel tracks were recorded within the study area and the study period.

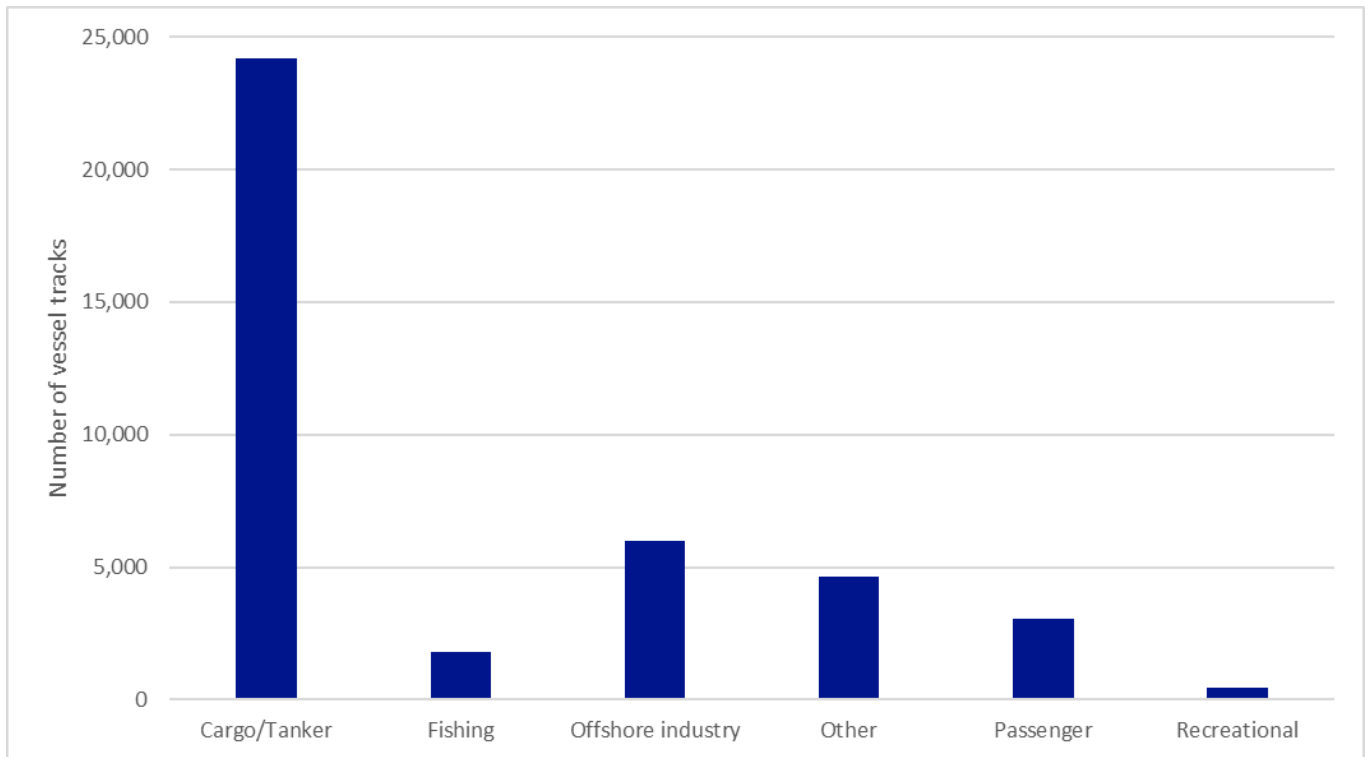
Vessel type

22.A.6.38 The most frequently recorded AIS vessel tracks in the study area were “cargo / tanker” vessels with 60.3 per cent of all tracks within the year (**Table 22.A-11** and **Plate 22.A-3**) “offshore industry” and “other” vessel tracks were the next most frequent vessel type with 14.9 per cent and 12.6 per cent of tracks respectively. “Passenger”, “fishing”, and “recreational” tracks were relatively low, at 7.7 per cent, 4.4 per cent and 1.1 per cent of all tracks, respectively.

Table 22.A-11 AIS vessel tracks by type

Vessel type	No of vessel tracks	Percentage of total
Cargo / tanker	24,177	60.3%
Fishing	1,781	4.4%
Offshore industry (including renewables).	5,982	14.9%
Other	4,646	11.6%
Passenger	3,069	7.7%
Recreational	437	1.0%
Total	40,092	100%

Plate 22.A-3 AIS vessel tracks by vessel type



22.A.6.39 Seasonal analysis of vessel activity indicates that Cargo / Tanker vessels remain the dominant category throughout the year, peaking in winter at 65.6 per cent and reducing to approximately 56 per cent during spring and summer. Offshore Industry vessels show increased activity in spring and summer, accounting for 15.8 per cent and 16.8 per cent respectively, compared with 13.1 per cent in autumn and 13.5 per cent in winter. “Other” vessels are most prevalent in spring (14.3 per cent) and least active in winter (9.8 per cent). Passenger vessel traffic increases modestly in summer (8.6 per cent) and spring (8.1 per cent). Recreational vessels display strong seasonality, representing 2.5 per cent of traffic in summer but almost absent in winter (0.06 per cent). Fishing vessel activity remains comparatively stable across the year, ranging between 3.7 per cent and 5.8 per cent.

22.A.6.40 The following sections describe the vessel activity across all seasons per vessel type. Fishing vessel traffic will be considered separately in the 22.A.6.57 fishing analysis section.

Cargo vessels and tankers

22.A.6.41 As shown in **Volume 3, Part 3, Figure 22.A-11**, cargo and tanker vessels intersect the study area across almost its entire extent, with notably higher concentrations between KP 40 and KP 180. Additional crossings from southeast to northwest are visible closer to the Scottish border beyond approximately KP 320.

Passenger vessels

22.A.6.42 Passenger vessel traffic is low compared with other vessel types within the study area, although it is present throughout (**Volume 3, Part 3, Figure 22.A-11**). Certain sections of the study area experience higher levels of passenger vessel activity, with crossings of the draft Order Limits occurring between KP 5 – 15, KP 30 – 40 (where a peak of 602 vessel tracks per grid cell is recorded), KP 65 – 70, and KP 155 – 165. These patterns are likely associated with UK–Europe ferry services and ports within the wider region. Passenger vessel traffic between KP 30 – 40 is primarily linked to the Rotterdam–Hull and Hoek van Holland–Killingholme routes. Activity between KP 5 – 15 is associated with passenger vessels arriving from or departing to Grimsby Port.

Recreational vessels

22.A.6.43 Recreational vessel traffic is also present throughout the study area, comprising predominantly sailing vessels (67.3 per cent of all recreational vessels), followed by pleasure craft (31.6 per cent) and yachts (1.1 per cent). Traffic intensity is higher within and intersecting the 12 NM limit, particularly between KP 20 - 30 and KP 40 - 50, although there is also evidence of UK–Europe recreational vessel movements. Recreational vessel activity is largely seasonal, occurring mainly during the spring and summer months, with July 2025 representing the period of highest recorded activity.

Offshore industry vessels

22.A.6.44 Offshore industry vessel activity is most concentrated on routes between Humber ABP, such as Grimsby, and offshore installations within the study area and the wider region. The draft Order Limits intersect an area of particularly high oil and gas activity between approximately KP 50 (near the Amethyst gas fields which contain four platforms currently undergoing decommissioning) and KP 135, due to numerous oil and gas platforms both to the east and west of the study area and within it. Distinct offshore industry vessel routing is also evident to the east of the draft Order Limits, likely associated with OWFs in the area, including Lincs, Inner Dowsing, Lynn, Race Bank, Triton Knoll, and others.

Other vessels

22.A.6.45 “Other” vessels include special craft, dredgers, port tenders, tugs, search and rescue vessels, military operations vessels, research and survey vessels, as well as vessels of unknown type. “Other” vessel traffic is present throughout the study area, with higher intensities observed near the entrance to the Humber River, where it crosses the draft Order Limits between approximately KP 5 and KP 50. Beyond this section, “Other” vessel presence is generally low across the remainder of the study area, with the exception of a few east to west routing patterns and a bird-nest-shaped pattern near KP 210.

Vessel size and status

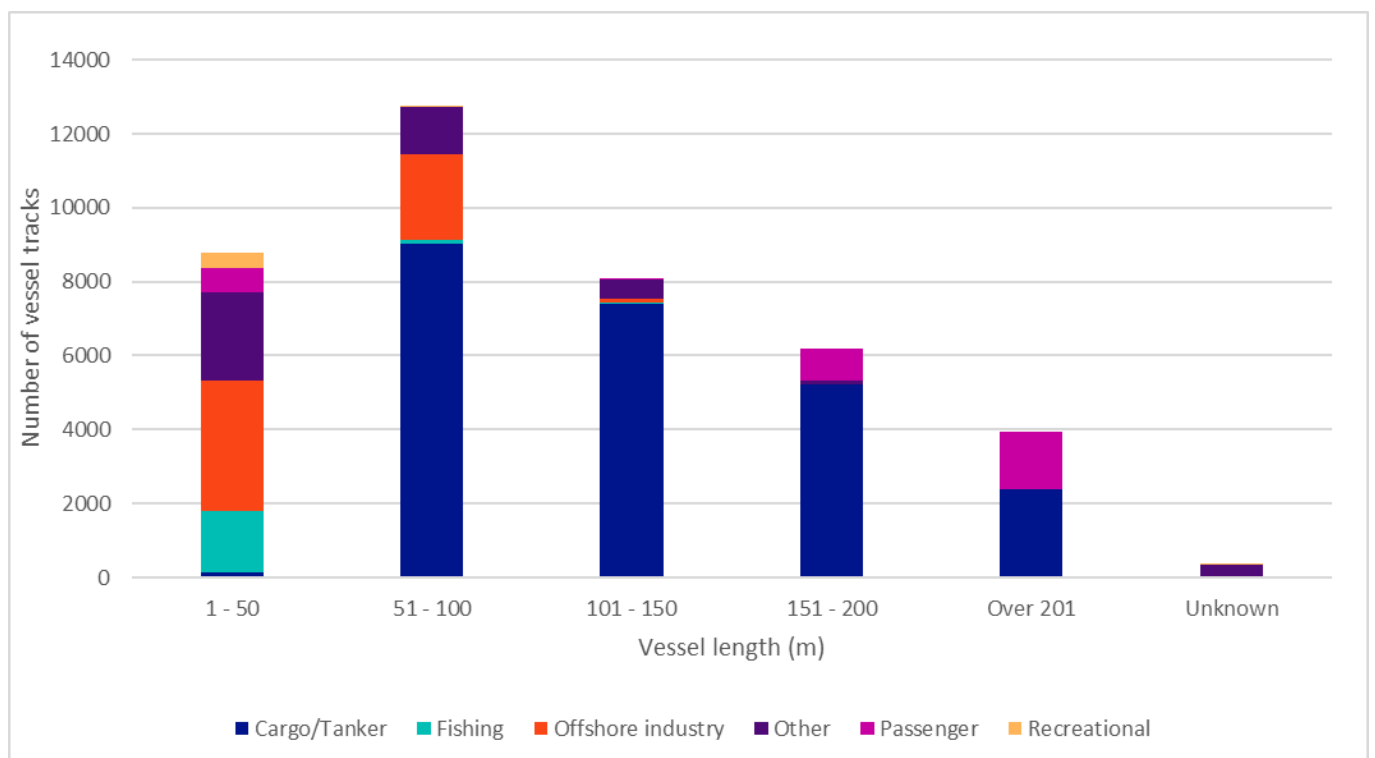
Vessel length

22.A.6.46 AIS data includes information on vessel length. As shown in **Table 22.A-12** and **Plate 22.A-4**, the most common length category is 51 - 100 m, accounting for 31.8 per cent of all tracks. This is followed by the 1 - 50 m category at 21.9 per cent, the 101 - 150 m category at 20.1 per cent, and vessels over 201 m at 9.8 per cent. **Volume 3, Part 3, Figure 22.A-12** illustrates how vessel types are distributed across the length intervals. Cargo and tanker vessels dominate all intervals except the 1 - 50 m range, where offshore industry vessels and other vessel types form the majority, representing 40.3 per cent and 27.3 per cent respectively.

Table 22.A-12 AIS vessel tracks distributed by vessel length

Length (m)	Vessel tracks	Percentage of total
1 - 50	8,768	21.9%
51 - 100	12,735	31.8%
101 - 150	8,064	20.1%
151 - 200	6,202	15.5%
Over 201	3,933	9.8%
Unknown	390	1.0%
Total	40,092	100%

Plate 22.A-4 AIS vessel length by vessel type



22.A.6.47 Spatial patterns in vessel length are presented in **Volume 3, Part 3, Figure 22.A-12**. The larger vessel length categories tend to follow defined routing patterns to and from the Humber and other ports, similar to those observed for cargo and tanker traffic. Vessels under 50 m in length are predominantly found closer to the coast.

Vessel Dead Weight Tonnage (DWT)

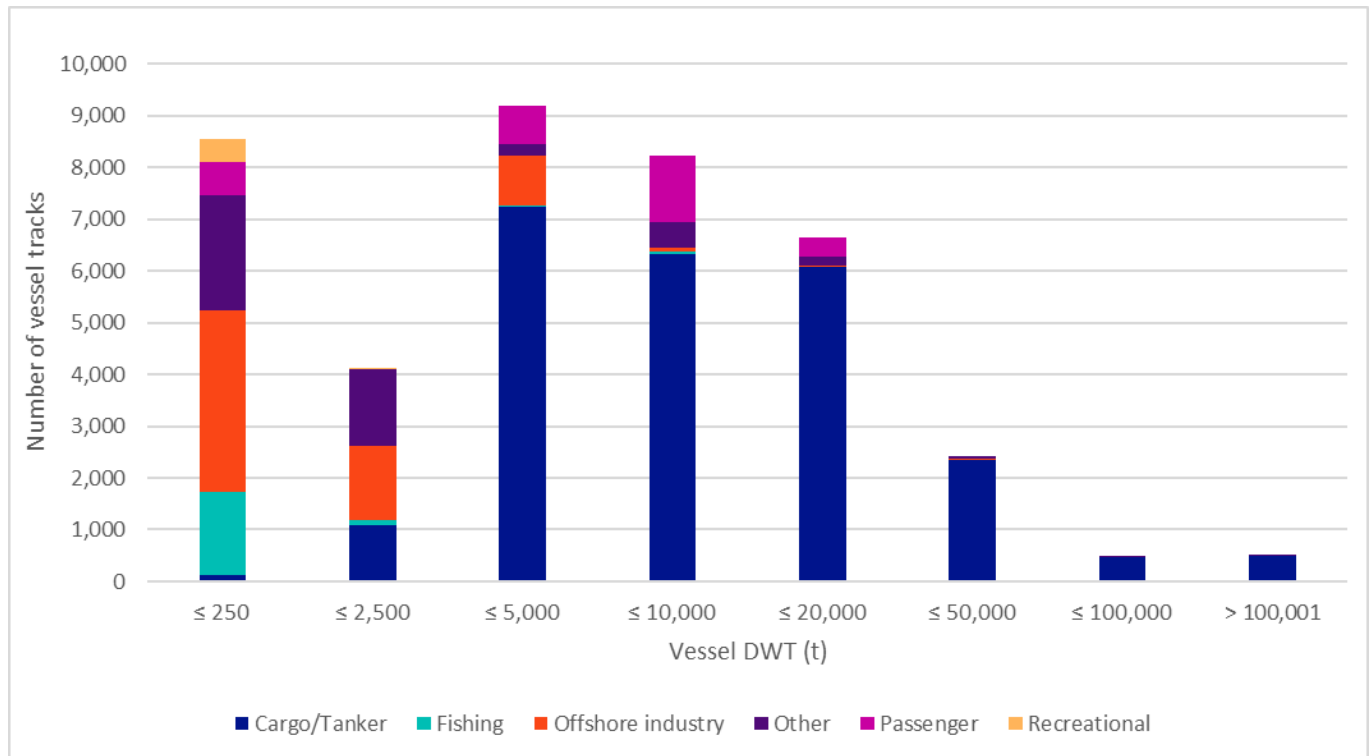
22.A.6.48 Dead Weight Tonnage (DWT) is an indication of vessel size as it refers to the carrying capacity of the vessel. There were 7,791 vessels missing DWT values in the AIS data for the study area, so a regression model was used based on the available data for each vessel type to calculate the missing values.

22.A.6.49 The distribution of AIS vessel DWT is presented in **Table 22.A-13** and **Plate 22.A-5, Plate 22.A-5** shows that the most frequent DWT classes were 2,501 - 5,000 tonnes (22.9 per cent) and 1 - 250 tonnes (21.3 per cent). "Cargo / tanker" traffic makes up the majority of the heavier DWT categories (2,501 tonnes and over). Regarding vessels with the greatest DWT, only the 2.4 per cent of vessel traffic was over 50,001 tonnes. As with vessel length, the smallest DWT category consists primarily of 'offshore industry' vessels, followed by 'other' and 'fishing'.

Table 22.A-13 AIS vessel tracks distributed by vessel DWT

DWT (tonnes)	Vessel tracks	Percentage of total
1 - 250	8,535	21.3%
251 - 2,500	4,112	10.3%
2,501 - 5,000	9,182	22.9%
5,001 - 10,000	8,230	20.5%
10,001 - 20,000	6,644	16.6%
20,001 - 50,000	2,412	6.0%
50,001 - 100,000	474	1.2%
Over 100,001	503	1.3%
Total	40,092	100%

Plate 22.A-5 AIS vessel DWT by vessel type



22.A.6.50 In terms of spatial distribution (**Volume 3, Part 3, Figure 22.A-13**), most activity involving vessels below 5,000 DWT occurs south of KP 240, where both defined routing patterns and localised “bird’s nest” movements are evident. Higher-displacement vessels (above 5,001 tonnes) also remain concentrated below KP 240 but show a wider spatial spread, extending northwards towards the Scottish border and forming clearer routing patterns between KP 340 and KP 400. Regardless of DWT category, the most pronounced routing patterns occur near the entrance to the Humber River, where traffic arriving from Europe converges from multiple directions to access the harbour.

Vessel draught

22.A.6.51 Vessel draught distribution within the study area is presented in **Table 22.A-14**. The most common vessel draught category is the 5.1 - 10 m category (66.0 per cent), with the vast majority of those vessels being cargo / tanker vessels.

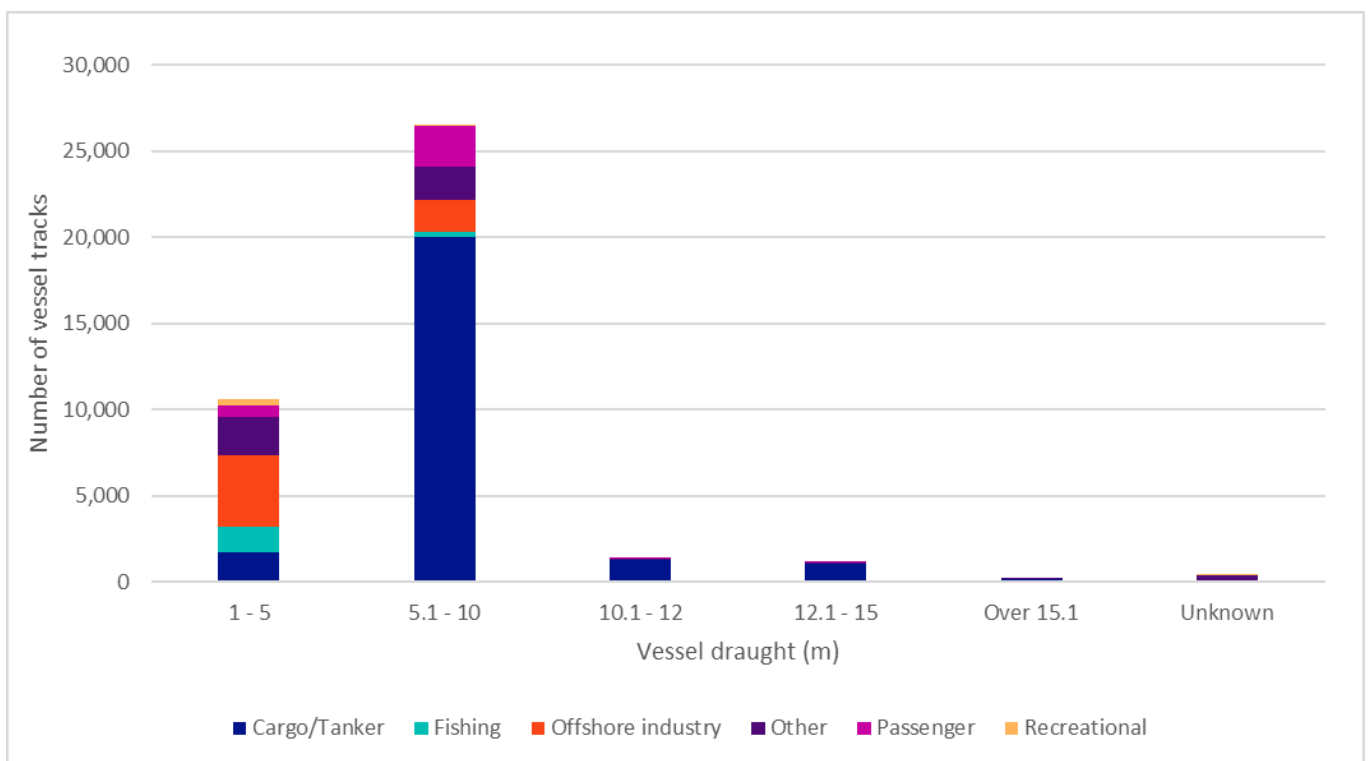
22.A.6.52 **Table 22.A-14** presents the vessel draught categories by vessel type and shows that taken together, 92.5 per cent of vessels had a vessel draught of under 10 m, and that these categories incorporate nearly all “fishing”, “offshore industry”, “other”, “passenger” and “recreational” category vessels.

22.A.6.53 In terms of the spatial distribution of draught categories (**Volume 3, Part 3, Figure 22.A-14**), vessels with the greatest draught (10.1 - 15 m) are largely confined to well-defined routing patterns, particularly on the approaches to the Humber Estuary from the north-east and east. Within the 5.1 - 10 m interval, passenger vessel routes to and from the Humber ABP, as well as to northern ports such as Whitby, are evident, crossing the draft Order Limits around KP 65 and KP 160. For the lowest draught category (one to five meters), local passenger vessels are observed transiting close to the coastline, just offshore from the Anderby Creek Landfall. Fishing vessels are also present within this interval, transiting in and out of the Humber ABP and operating along the study area, particularly around KP 160, KP 180, and between KP 200 and KP 220.

Table 22.A-14 AIS vessel tracks distributed by vessel draught

Draught (m)	Vessel tracks	Percentage of total
1 - 5	10,610	26.5%
5.1 - 10	26,460	66.0%
10.1 - 12	1,339	3.3%
12.1 - 15	1,120	2.8%
Over 15.1	175	0.4%
Unknown	388	1.0%
Total	40,092	100%

Plate 22.A-6 AIS vessel draught by vessel type



22.A.6.54 **Volume 3, Part 3, Figure 22.A-15** summarises the DWT of track lines and illustrates the relationship between vessel size and the number of tracks within 1.5 km² grid cells. Despite the high density of vessel track lines in the approaches to the Humber Estuary (south of KP 60), the average DWT per grid cell remains below 12,000 tonnes. Elevated route patterns, in terms of both the number of tracks and average DWT per grid cell, are observed between KP 80 and KP 100, at KP 150 and again in between KP 160 - 180.

Vessels at anchor

22.A.6.55 AIS data points include information on a vessel’s status, including whether it is recorded as ‘at anchor’. This status is manually set by the crew and is therefore subject to human error; however, it still provides a useful indication of anchoring activity within the study area. To improve reliability, points marked as ‘at anchor’ were filtered by speed, with those travelling at 0.5 knots (kts) or less considered likely to be genuinely anchored, and those above 0.5 kts considered more likely to have been incorrectly classified. **Volume 3, Part**

3, Figure 22.A-16 presents the total time (in days and weeks) that vessels spent at anchor within each 1.5 km² grid cell, both for the full study period and broken down by season.

22.A.6.56 The spatial distribution of vessels at anchor is concentrated in the nearshore area south of KP 120 and broadly corresponds to the inner and outer charted anchorage areas at the entrance to the Humber Estuary. The highest recorded time spent at anchor, 30.62 weeks per grid cell, occurs within the Humber Deep Water Anchorage, where anchoring activity appears to extend eastwards beyond the formal anchorage boundary. Immediately north of this area, vessels also appear to anchor regularly along a northeast to southwest polygon approximately 20 km in length and 6 km in height, which is not a charted anchorage area. Additional informal anchoring patterns outside of charted anchorage areas are evident along the draft Order Limits between KP 0 and KP 30, and around KP 100. These anchorage patterns are generally consistent across seasons, with slightly higher levels of activity observed during spring and summer.

Fishing analysis

22.A.6.57 This section presents an analysis of fishing vessels in the vicinity of the English Offshore Scheme, based on both AIS and VMS data. It should be noted that the AIS data used in this NRA provides detailed information on the specific trajectories of the vessels, but is likely to under-represent fishing activity, since fishing vessels under 15 m length are not obliged to carry an AIS transponder (though many do voluntarily for safety). VMS data is used to supplement the AIS data and provide a more comprehensive picture of fishing activity since vessels greater than 12 m are obliged to carry VMS equipment, however, there are still some limitations of this approach as the VMS data are not publicly available in a format that allows reconstruction of trajectories, and vessels under 12 m will not be represented. It should be noted that fishing is considered from a broad navigational perspective here, and the following PEIR chapter should be consulted for detailed fishing analysis and from a commercial fisheries perspective: **Volume 1, Part 3, Chapter 23: Commercial Fisheries.**

22.A.6.58 Three types of AIS vessel data have been used to gain insight into fishing activity in the study area:

- AIS fishing vessel tracks categorised by length;
- AIS fishing vessel tracks categorised by vessel subtype; and
- AIS data points with status set to “actively fishing”.

22.A.6.59 As detailed in section 22.A.4, three additional data sources of VMS data have been used to supplement the AIS data:

- Anonymised VMS point data during 2019 - 2023, which has been processed to provide density information for the study area. This data provides no information on gear type or fishing status, however, vessel speed can be used as a proxy for fishing status. Vessels travelling at speeds of < six kts are considered likely to be fishing;
- MMO sightings data between January 2019 and May 2022 representing vessels sighted on surveillance flights; and
- Fishing activity by ICES statistical rectangle distributed by the MMO. This data includes details about time spent fishing and gear type over the period 2010 - 2020, but is aggregated within each ICES statistical rectangle, so local patterns of activity cannot readily be discerned.

Fishing vessels in AIS data

- 22.A.6.60 Fishing vessel tracks classified by vessel length and subtype are presented in **Volume 3, Part 3, Figure 22.A-17**. As previously noted, vessels under 15 m in length are under-represented in the dataset. Fishing vessels are present within the study area, predominantly south of KP 240. North of this point, the activity appears to be largely associated with patrol and research vessels rather than commercial fishing. South of KP 240, most fishing vessels fall within the 16 - 30 m (52.9 per cent) and 1 - 15 m (36.8 per cent) length categories, with a concentration of larger vessels (> 50 m) just west of KP 140. Transit routes used by fishing vessels entering and leaving the Humber Estuary are also clearly visible.
- 22.A.6.61 “Fishing vessels” (a subset of the broader fishing category) and trawlers are the principal fishing subtypes recorded within the study area, accounting for 87.1 per cent and 10.8 per cent of all fishing-related traffic, respectively. Fishing vessel activity is sparse within the study area north of KP 240, whereas trawler activity is concentrated between KP 220 and KP 200, as well as west of KP 150 and around KP 100.
- 22.A.6.62 AIS points likely to represent fishing activity, based on vessel speed and / or AIS status, are shown in **Volume 3, Part 3, Figure 22.A-18**. Points associated with vessels travelling at speeds greater than 6 kts are assumed to indicate transit rather than active fishing. Actively fishing vessels are again predominantly located south of KP 240, with the highest levels of activity occurring in winter, followed by summer, spring, and autumn. During winter, AIS points likely to represent fishing activity within the study area are mainly concentrated between KP 150 and KP 220, whereas in summer the activity shifts west of KP 140 and KP 160.

VMS and sightings points supplement

- 22.A.6.63 This section utilised the point VMS and sightings data to supplement the use of AIS data in studying fishing activity, using anonymised VMS points from the MMO to explore density of slow-moving vessels, and 2019 - 2023 vessel sightings point data from the MMO to study vessel types, as mentioned previously.
- 22.A.6.64 Vessel density of slow moving (< six kts) vessels is displayed in the left panel of **Volume 3, Part 3, Figure 22.A-19**, giving an indication of the presence of vessels which are actively fishing. It can be assumed that those vessels travelling at more than six kts are not fishing and are likely to be in transit, whilst those travelling at less than six kts may be fishing or engaged in other activities (Ref 22.A.41). Vessel density patterns shown in **Volume 3, Part 3, Figure 22.A-19** display low to high vessel density between KP 0 and KP 160, low to medium vessel density between KP 160 and 220, and broadly low vessel densities north of KP 220 (with a notable exception at KP 370-385 where there is an area of high vessel density in the western part of the study area).
- 22.A.6.65 Sightings data (right panel of **Volume 3, Part 3, Figure 22.A-19** suggests that the vessels fishing between KP 0 and 120 are mostly potters or whelkers, whilst the vessels fishing between KP 120 and 200 are more diverse, and include potters / whelkers, trawlers, bottom seiners and dredgers. North of KP 200 only one vessel was recorded within the study area – a trawler.

VMS by ICES statistical sub-rectangle supplement

- 22.A.6.66 This section utilises fishing activity data available by ICES statistical sub-rectangle for the period 2010 - 2020 obtained from ICES. This data set provides summaries of fishing activity for commercial fishing vessels of 15 m and over in length that are deemed to have been fishing within a specified calendar year. This data has been aggregated to show the average annual time spent fishing by gear type from 2010 - 2020.
- 22.A.6.67 **Volume 3, Part 3, Figure 22.A-20** presents the mean time spent fishing using dredges and pelagic, otter and beam trawl gear types. The study area shows low levels of activity associated with dredges and pelagic trawls, and medium to high levels of demersal activity, specifically beam trawling and otter trawling. Beam trawl activity is highest near KP 100, while otter-trawl activity peaks just west of KP 140, with 327 hours of fishing recorded. Pelagic trawl activity is also elevated in this area, reaching peaks of 164 hours per year.

Future Baseline

- 22.A.6.68 This NRA baseline has been informed by the best available current and existing information at the time of assessment. However, there remains inherent uncertainty associated with future shipping patterns and navigational activity. In particular, further development of the marine environment, including potential offshore infrastructure such as carbon capture and storage projects, OWFs, and decommissioning of oil and gas infrastructure, may alter shipping routes, traffic density, and navigational practices from those described in this baseline. Additionally, there are Stage 3 Marine Protected Area consultation results which are planned for release in early 2026. These results are expected to displace significant mobile-gear activity and depending on the outcome of the MMO and Secretary of State decisions could substantially change fishing patterns on the East Coast of England. Consequently, the shipping and navigational baseline presented here should be considered subject to change. **Volume 1, Part 3, Chapter 24: Other Marine Users** should be referred to for further information on potential future offshore developments that may be consented and constructed within the region.

22.A.7 Formal Safety Assessment

Introduction

- 22.A.7.1 The following sections provide a risk assessment for identified shipping and navigation hazards, following the FSA framework as part of the wider NRA methodology. The assessment represents the development of the preliminary hazard identification conducted as part of stakeholder consultations (see section 22.A.5) providing a complete risk assessment and hazard log based on highly detailed baseline data, stakeholder expertise and local knowledge. The assessment therefore also includes relevant details or issues raised during the consultation process.
- 22.A.7.2 The risk associated with each hazard identified is assessed using the definitions of likelihood and consequence severity against the risk matrix in **Table 22.A-4** and assigned a risk ranking of 'Broadly Acceptable', 'Tolerable if ALARP' or 'Unacceptable', considering existing or embedded mitigations which are either part of the existing design or otherwise accepted industry practise. Where appropriate, additional risk reduction measures are identified, and a residual risk ranking is assigned. The assessments are summarised in a table in the relevant subsections and collated in the **Annex 22.A.1: Hazard Log**.

Assessment Basis

22.A.7.3 As detailed in section 22.A.7, the assessment follows an FSA approach. The approach is applied where appropriate using the details of the English Offshore Scheme found in **Volume 1, Part 1, Chapter 4: Description of the Project**.

Project Phases

22.A.7.4 In line with the preliminary hazard assessment approach each of the hazards are assessed against all elements of the English Offshore Scheme with only two broad phases of the scheme activities being addressed separately. Construction phases (covering all preparation, installation and commissioning works) as well as all decommissioning works, are considered to be broadly similar to each other in terms of the nature of activities which will take place and the associated potential hazards. Therefore, construction and decommissioning phases are assessed together. The operational phase of the English Offshore Scheme is assessed separately and also includes all foreseen maintenance activities.

Embedded mitigation

22.A.7.5 A range of existing risk mitigation measures and considerations have been established during preliminary hazard assessment, generally representing standard industry best practice, and are considered a part of English Offshore Scheme design and which mitigate shipping and navigation risks. The risk associated with each identified hazard is assessed in consideration of their mitigation effects. The embedded mitigation measures are captured in the **Annex 22.A.1: Hazard Log**. They are also identified in **Table 22.A-15** with greater detail.

Table 22.A-15 Embedded mitigation

Measure	Details
All project vessels must comply with the COLREGs (1972) (Ref 22.A.1), as amended, particularly with respect to the display of lights, shapes and signals. The masters of other vessels are expected to be familiar with and comply with the COLREGs. Additionally, project vessels would adhere to regulations relating to International Convention for the Prevention of Pollution from Ships (the MARPOL Convention 73 / 78) with the aim of preventing and minimising pollution from ships and the international Convention for the Safety of Life at Sea (Ref 22.A.5).	<p>The COLREGs are the international standards designed to ensure safe navigation of vessels at sea. All construction vessels are expected to adhere to these rules, including displaying appropriate lights and shapes.</p> <p>MARPOL Convention minimises potential for pollution from ships.</p> <p>SOLAS is an international maritime treaty which sets minimum safety standards in the construction, equipment and operation of merchant ships. The convention requires signatory flag states to ensure that ships flagged by them comply with at least these standards. In relation to the English Offshore Scheme its compliance will ensure navigational safety.</p>

Measure	Details
<p>Relevant information will be communicated to other sea users Notices to Mariners (NtM), Kingfisher Bulletins, Radio Navigation Warnings, Navigational Telex (NAVTEX) and Navigational Areas (NAVAREA) warnings and / or broadcast warnings.</p>	<p>Promotes navigational safety and minimises the risk of equipment snagging.</p>
<p>Guard vessel(s), using Radio Detection and Ranging (RADAR) with Automatic RADAR Plotting Aid (ARPA) to monitor vessel activity and predict possible interactions, will be employed to work alongside the installation vessel(s) during cable installation works and to protect any temporary cable exposures during installation.</p>	<p>A guard vessel, marshalling a 500 m Recommended Clearance Zone (RCZ) may be used during the construction campaign where a potential risk to the asset or danger to navigation has been identified.</p>
<p>A Fisheries Liaison Officer (FLO), and fisheries working group(s), will be maintained throughout installation to ensure project information is effectively disseminated, dialogue is maintained with the commercial fishing industry and access to home ports is maintained during the main fishing season. Details of the FLO are included in the Construction Fisheries Liaison and Coexistence Plan (FLCP). An outline FLCP has been prepared, which will be updated to the final FLCP post-consent (Volume 2, Part 3, Appendix 23.B: Outline Fisheries Liaison and Coexistence Plan).</p>	<p>The employment of a FLO is intended to ensure all commercial fisheries operators in the vicinity of the Offshore English Scheme will be proactively and appropriately communicated with in terms of the proposed operations.</p>

Measure	Details
<p>A CBRA will be undertaken to identify appropriate target depth of burial based on geology, water depths and AIS data. A risk based burial approach will be used, assessing cable protection risk factors such as sediment type, shallow geology, sediment mobility, fishing activity, shipping movements and anchor deployment along the route.</p> <p>The cables shall be buried in the seabed, except in areas where burial is not possible e.g., where ground conditions do not allow or at infrastructure crossings.</p> <p>External cable protection features would only be installed where considered necessary for the safe operation of the English Offshore Scheme in line with MGN 654. This includes the repair of cables due to accidental damage, where target burial depth is not achieved and at infrastructure crossings.</p>	<p>This would reduce the chance of interaction with other marine users, and as per the CBRA recommendations deeper burial or cover would be implemented in areas of high shipping activity to further reduce this risk.</p> <p>The cable burial and appropriately considered protection measures minimises the risk of snagging with anchors and fishing gear.</p>
<p>Procedures would be in place to minimise disruption near high density shipping areas. e.g., avoidance of anchoring near busy areas, passage planning of installation vessels, emergency response plan etc.</p>	<p>These contractor procedures represent a risk reduction measure to minimise collision risk and disruption to shipping and navigation.</p>
<p>As-built locations of cable and external protection will be supplied to the United Kingdom Hydrographic Office (UKHO) (Admiralty), The Crown Estate and Kingfisher (KIS-ORCA).</p>	<p>Ensure navigational safety and minimise the risk of equipment snagging.</p>
<p>An offshore Construction Environmental Management Plan (CEMP) including an Emergency Spill Response Plan and Waste Management Plan, Marine Pollution Contingency Plan (MPCP), Shipboard Oil Pollution Emergency Plan (SOPEP) and a dropped objects procedure would be produced prior to installation.</p>	<p>These plans would outline measures to be implemented to comply with legislation, include details of notices to be sent to marine users prior to activities being undertaken, secure project commitments and ensure awareness of the mitigation measures with the contractors.</p>

Measure	Details
<p>Where potential interaction between the English Offshore Scheme and other infrastructure, projects or marine activities are identified, owners / operators / licence holders will be consulted and standard legal agreements (such as crossing or proximity agreements) or SIMOPs procedures will be developed prior to the commencement of operations.</p>	<p>Avoidance of simultaneous operations with other developments represents a reduction in potential for collision and disruption impacts.</p>
<p>Cable jointing operations to be planned away from high shipping activity where possible.</p>	<p>This measure reduces time spent in such areas, thus reducing shipping and navigation risks, namely that of collision and disruption.</p>
<p>Where potential interaction between the English Offshore Scheme and other infrastructure, projects or marine activities are identified, owners / operators / licence holders will be consulted and standard legal agreements (such as crossing or proximity agreements) or SIMOPs procedures will be developed prior to the commencement of operations.</p>	<p>Crossings agreements would help ensure that the crossing height is designed to be as minimal as is practicable, reducing under keel clearance concerns.</p>
<p>In line with MCA guidance (MGN 654), it is not planned to reduce the existing navigable water depth by more than 5% along any section of the cable (with respect to Chart Datum). Any locations where this may not be the case should be discussed and agreed with the MCA and relevant Statutory Harbour.</p>	
<p>Project vessel compliance with MGN661 Navigation - safe and responsible anchoring and fishing practices.</p>	<p>In line with guidance provided by the UKHO and International Convention for the SOLAS it is recommended that fishing vessels should avoid trawling over installed subsea infrastructure.</p>
<p>Notification of regular runners including ferry operators.</p>	<p>Engagement with regular runners and specifically ferry operators ensures awareness of the installation details which minimises disruption.</p>
<p>Temporary aids to navigation may be used to guide vessels around areas of installation activity if agreed with Trinity House.</p>	

Measure	Details
<p>The presence of an established VTS in the area, and the advance notification of planned operations to VTS managers. A communication strategy with ABP Humber will be developed for the Project including communication protocols with VTS.</p>	<p>Shore-side systems which range from the provision of simple information messages to ships, such as position of other traffic or meteorological hazard warnings, to extensive management of traffic within a port or waterway.</p> <p>VTS managers will be consulted on the English Offshore Scheme and kept informed of construction plan details, and they may utilise VTS to additionally inform traffic as it enters or exits their VTS area, of the English Offshore Scheme activities during the construction phase. This would further increase vessel traffic awareness of the works and reduce risks of collision.</p>
<p>Magnetic compass deviation low (less than three degrees) for 100 per cent of the bundled section of the cable route.</p>	<p>Very low compass deviation occurs over bundled section of the English route. The bundled section of cable route has one point greater than three degrees at KP0.4, but below five degrees. The remaining bundled section results in compass deviations all below three degrees. The nearshore region from KP0.4 has not been included within the EMF assessment for EGL 5 as a design is yet to be finalised.</p>
<p>Establishment of Operations Weather Envelope Limits.</p>	<p>The English Offshore Scheme will establish a critical minimum operational envelope for relevant activities with regards to weather conditions and visibility and will monitor weather conditions during construction phase.</p>

Scenario Outcomes

22.A.7.6 As part of the preliminary hazard assessment the “worst-case” and “most likely” outcomes were recorded (see **Annex 22.A.1: Hazard Log**). This provides a balanced sense of the hazardous outcome for the purposes of hazard identification. However, it should be noted that the desktop risk assessment is based upon the realistic worst-case scenarios.

Risk Assessment

22.A.7.7 The following sections present the assessments of each of the hazards to navigation identified in the preliminary hazard analysis and developed as part of this desktop exercise. These correspond to the hazard log in **Annex 22.A.1: Hazard Log**. Each section presents a narrative summarising the analyses and capturing the most relevant aspects and considerations. The assessments are made according to two distinct phases. The construction phase includes activities covering installation, commissioning and decommissioning and normal operations and maintenance phase which covers the operational lifetime of the cables and any maintenance activities (excluding inspections). In addition, an accompanying summary table is included in each section for ease of use.

Construction phase

Vessel Collision

- 22.A.7.8 The construction phases of the English Offshore Scheme may require the use of heavy construction vessels, barges or otherwise large slow-moving vessels such as the cable-lay vessel, that will be constrained by their operations and hence restricted in their ability to manoeuvre. The potential presence of stationary barges and vessels involved in the preparation of landfall arrangements, as well as vessels associated with the progressive cables installation, will therefore present an obstacle to all passing traffic, and hence may increase the risk of collisions in the area. Vessel collisions can occur between passing vessels and the installation operation vessels or between two or more third party vessels due to for example the restriction in sea room caused by the operation.
- 22.A.7.9 The collision risk is likely to be greater where traffic density is highest. Particular areas of note are centred between KP 30 and KP 50, nearest the Humber VTS Limits where vessels may be transiting into and out of anchorages and TSS lane controlled areas. Additionally, vessels restricted in their ability to manoeuvre or constrained by their draught also present potentially raised collision risk in some inshore or otherwise shallow areas, and particularly where there are higher numbers of recreational vessels such as around KP 10 to KP 30 (see **Volume 3, Part 3, Figure 22.A-04**). However, almost the entire length of the English Offshore Scheme experiences some vessel activity, and the southern part is generally considered to be within a very busy shipping area. It is also noted that historic vessel to vessel collision incidents have been recorded along the English Offshore Scheme (see **Volume 3, Part 3, Figure 22.A-08**).
- 22.A.7.10 The use of embedded mitigations, including measures such as Merchant Shipping Notes (MSN), Notice to Mariners (NtM), Notification of Regular Runners, guard vessel patrol, Sécurité broadcasts on VHF, stakeholder consultations, and communication efforts, aim to increase awareness of operations among vessels in the area. For most vessels using the area, the risk of collisions is unlikely to significantly increase when navigating past the installation vessels. This is because these vessel categories adhere to standard navigational practices, follow collision avoidance guidelines, and exercise good shipping practices, such as complying with the International Regulations for Preventing Collisions at Sea (IRPCS). Additionally, the Humber Statutory Harbour Area contributes to a higher level of organisation and traffic discipline in the area, while associated VTS communications can further reduce risks. However, it cannot be assumed that all vessels using the locations will be aware of the presence of the installation vessels or their activity schedules.
- 22.A.7.11 Considering the limited spatial and temporal footprint of the installation operations at along the cable route, along with various mitigations in place such as increased awareness through notices and potentially also VTS communications, as well as the presence of guard vessels throughout the operations, the probability of vessel collision along the draft Order Limits is considered to be "Remote". However, it is important to note that the severity of a collision with any vessel or surface obstacle could lead to significant consequences, including potential pollution, the loss of crew and commercial impacts (access to ports and disruption to trade / industry, and related financial implications), among other outcomes in the worst-case scenario, so the severity of consequence is considered "High". Taking these factors into account, the initial risk ranking for this situation is categorized as "Tolerable if ALARP" meaning efforts should be made to reduce the risk further.

22.A.7.12 It is therefore necessary to consider potential risk reduction measures in addition to the embedded mitigation. Enhanced communication plans are recommended to ensure awareness of the operations and installation fleet locations between all relevant parties, including Harbour Master and VTS operators.

Table 22.A-16 Vessel collision risk assessment summary (construction)

Hazard	Likelihood	Consequence	Risk	Additional RRM	Residual risk
Vessel Collision	Remote	High	Tolerable if ALARP	Enhanced communication plans to include communications between Harbour Masters and VTS operators to ensure awareness of installation fleet locations among all relevant parties.	ALARP

Disruption to established vessel routes and areas

22.A.7.13 Some disruption to routine vessel routeing and any other scheduled activity is expected during the construction phases. The vessels used during these phases potentially include stationary barges and other vessels that are restricted in their ability to manoeuvre. In particular, stationary vessels at landfall areas or slow-moving vessels around Horseshoe Point near KP 20 and associated pilot stations (Spurn Point), for example, may present more disruptive deviations. As such, the operation will present temporary obstacles, and other vessels routinely operating in the area may be required to deviate from their planned routes or plan for longer transits in order to cross the operations' path or otherwise avoid the obstruction.

22.A.7.14 The draft Order Limits, and therefore the slow moving (0.5 - 5 km / day) cable installation operation, will pass the mouth of the heavily trafficked Humber Estuary. Although the draft Order Limits have been refined based on consultation with harbour authorities to minimise disruption, this still presents potential for disruption through restricting sea room in the most densely trafficked areas, as well as through disruption to associated pilot boarding activities in these areas.

22.A.7.15 Throughout most of the draft Order Limits, vessels making minor route deviation to avoid the installation operation will not suffer any significant operational impact. However, due to the channel traffic and vessel density in and around the Humber VTS limits, delays and disruption are considered possible for some vessel types at this and other potential locations in the draft Order Limits. Additionally, smaller craft may also be significantly disrupted in the Anderby Creek Landfall area due to the limited sea room and the potentially stationary obstacles required for activities associated with the landfall. This disruption may cause minor delays to trade and industry and therefore minor financial implications.

22.A.7.16 No pollution consequences are foreseen from this impact.

22.A.7.17 This hazard is assessed therefore as ‘Likely’ however given the footprint of the installation operation and the temporary impact at any given location a ‘Medium’ consequence severity is determined. This results in a “Unacceptable” assessment and thus the obligation to implement further risk reduction measures.

22.A.7.18 The English Offshore Scheme was designed with involvement from the operators and other stakeholders to minimise risk and disruption. However, there may still be some residual disruption that needs to be addressed. The most effective way to handle this is through clear and enhanced communication of the operation details, schedule, and protocols to those who are likely to be affected. It is recommended to develop communication plans that inform the local harbour authorities and Humber VTS operators, among others, about the operational developments well in advance of the operation. Additionally, protocols should be established for communication between these parties and the installation vessels to ensure that the location of operations is always identified. This will enable better planning to help mitigate disruption and facilitate effective communication and management of the affected vessels during the construction phase.

Table 22.A-17 Disruption risk assessment summary (construction)

Hazard	Likelihood	Consequence	Risk	Additional RRM	Residual risk
Disruption to established vessel routes and areas.	Likely	Medium	Unacceptable	Enhanced communication plans to include communications between VTS and TSS operators to ensure awareness of installation fleet locations among all relevant parties. UKHO Temporary / Preliminary Notices to be issued prior to installation.	ALARP

Interactions with vessel anchors

22.A.7.19 During the construction phase, there is a risk that a third-party vessel will drop anchor or lose its holding ground in adverse weather and subsequently drag its anchor over a section of exposed cables prior to any required protection being installed. In the case of an anchor snagging incident, it is possible, in the worst case, that smaller vessels could suffer a risk of foundering should they not be able to free themselves. Consequences could also include commercial effects as well as potential for pollution incidents.

- 22.A.7.20 The Humber Deep Water Anchorage is located approximately 9 km west of KP 50 (see **Volume 3, Part 3, Figure 22.A-02**). Chartered vessel anchoring areas located within and in close proximity to the study area is captured in **Volume 3, Part 3, Figure 22.A-02**. It is expected that anchor dragging will be a possible hazard to the cables based on the proximity to the designated anchorage area and to the Spurn Point pilot station. Additionally, the Baseline identifies potential anchoring activity outside of chartered anchorage areas, within the study area between KP 0 to KP 30. The relatively close proximity of these locations to the cable route presents an increased risk of damage by accidental anchor drop, anchoring outside of the anchorage area or dragging of anchors across the cables, due to bad weather and / or poor anchor penetration.
- 22.A.7.21 However, the risk-based cable burial approach and route selection process serve to reduce risks to both the cables and shipping by minimising vulnerabilities which include pre-lay preparations and reducing the time between cables lay and their burial. Awareness of the operation details and associated hazards among the harbours, ports and pilots will provide appropriate risk reduction. VTS operators' advice from vessel traffic operation management will provide guidance to sea users and deter vessels from anchoring in the vicinity of the cables. Additionally, consultation with ports and harbour authorities confirmed that uncharted anchoring within and outside the Humber VTS Limits is well known, particularly immediately north of the Humber Deep Water Anchorage, where vessels appear to anchor regularly. Notice to Mariners (NtM) and other communications provide additional raised awareness of the potential hazard and Industry guidelines, in particular MGN 661, are in place to deter vessels from anchoring in the vicinity of cables and other seabed hazards.
- 22.A.7.22 Snagging is therefore considered to be 'Occasional'. However, a consequence severity of outcome of 'Medium' is selected as the worst-case scenario where foundering leads to loss of crew. These combine to present an initial risk of 'Tolerable if ALARP' and the need to consider further risk reduction measures.
- 22.A.7.23 Therefore, it is recommended that UKHO temporary or preliminary notices are issued to relevant parties such that the basic location of the cables is captured prior to post-lay / as-built survey. Awareness among mariners can therefore be further increased, and industry guidance on anchoring in the vicinity of cables can offer maximum effectiveness during the construction phase.
- 22.A.7.24 Additionally, the use of aids to navigation should be considered where sections of the cables are expected to be exposed for significant lengths of time prior to burial. Marking requirements should be according to recommendations / approvals from Trinity House.

Table 22.A-18 Interaction with vessel anchor risk assessment summary (construction)

Hazard	Likelihood	Consequence	Risk	Additional RRMs	Residual risk
Vessel drags anchor across exposed cables.	Unlikely	High	Tolerable if ALARP.	UKHO Temporary / Preliminary Notice to be issued prior to post-lay / as-built survey. Consideration of the use of temporary aids to navigation for exposed cable sections.	ALARP

Interactions with fishing gear

- 22.A.7.25 Fishing vessels whose gear becomes snagged on the cables prior to burial or protection may sustain extensive damage or suffer foundering during the construction phases of the English Offshore Scheme, the consequences of which could include damage to or loss of vessels, potential harm to people or loss of life, commercial effects, as well as potential for pollution incidents. Pre-lay preparation such as ploughing may also result in the temporary creation of berms and rock displacement which presents additional seabed hazards to fishing gear. Baseline data shows that there are significant levels of actively fishing vessels between KP 0 and KP 200, whilst fishing activity is lower north of KP 200.
- 22.A.7.26 To mitigate the risk of fishing gear interactions during the construction phase, several measures have been planned to be implemented. These include the potential appointment of a Fisheries Liaison Officer (FLO) throughout the construction period, the issuance of Kingfisher notifications and NtMs, and the provision of other relevant marine warnings. These measures aim to effectively address the risk of fishing gear encountering potential seabed hazards prior to construction, ensuring that fishermen in the area are aware of these hazards. Additionally, a variety of vessels involved in cables laying and burial operations, with particular emphasis on guard vessels monitoring unprotected or unburied cable sections, significantly reduce the likelihood of such interactions.
- 22.A.7.27 Given the prevalence of fishing within and in the immediate vicinity of the study area, the risk of fishing gear interactions or snagging is considered to be medium. However, prior promulgation of information on the cables locations to fishermen, via the FLO, and other notices to mariners including the Kingfisher Bulletin, the probability of interactions with fishing gear is already considered to be suitably minimised. The presence of guard vessels also limits the likelihood of fishing gear interactions. Industry guidance on fishing in the vicinity of cables and subsea infrastructure further deters fishing in close proximity. The likelihood of gear snagging is therefore assessed as 'Unlikely'. The consequences of such an outcome can be severe and are assessed as 'High' due to the potential loss of crew members or vessel in the worst case. This results in an overall 'Tolerable if ALARP' assessment and the need to consider further risk reduction measures.
- 22.A.7.28 Therefore, it is recommended that UKHO temporary or preliminary notices are issued to relevant parties such that the basic location of the cables is captured prior to post-lay / as-built survey so awareness among mariners is further increased and industry guidance on fishing in the vicinity of cables and other associated seabed hazards offers maximum effectiveness. Additionally, the use of aids to navigation should be considered where sections of the cables are expected to be exposed for significant lengths of time prior to burial.

Table 22.A-19 Fishing gear interaction risk assessment summary (construction)

Hazard	Likelihood	Consequence	Risk	Additional RRM	Residual Risk
Fishing gear snagging.	Unlikely	High	Tolerable if ALARP.	UKHO Temporary / Preliminary Notice to be issued prior to post-lay / as-built survey. Consideration of the use of temporary aids to navigation for exposed cable sections.	ALARP

Normal Operations and Maintenance

Vessel collision

- 22.A.7.29 During the operational lifetime of the cables a number of inspections to examine integrity are foreseen. Such inspections and maintenance activities will likely include the use of operated underwater vehicles or ROVs, require slow-moving vessels, and constrain those vessels' manoeuvrability due to the nature of the operations. The presence of these vessels or any other required for maintenance activities associated with the cables, may present an obstacle to passing traffic and hence an incremental increase in the risk of collision.
- 22.A.7.30 Throughout the year, a large number and a range of vessel types cross the draft Order Limits in multiple locations. The collision risk is likely to be greater in higher density sections of the scheme or areas of restricted sea room and therefore particularly in and around Horseshoe Point and near the designated anchorages near the Humber ABP.
- 22.A.7.31 Embedded mitigation measures, such as NtM, and Notification of Regular Runners ensure that awareness of the operations among many of the vessels using the area will be suitably raised through the various promulgations and communications. However, guard vessel patrol may not be in place during inspection activities, and it cannot be presumed that all vessels using the locations will be aware of the presence of the maintenance vessels or their schedule of activities.
- 22.A.7.32 The time and number of vessels involved with inspection activities is likely to be significantly reduced compared to the construction phase, which in turn limits the risk of collision. However, the collision risk associated with maintenance activities is ultimately dependent upon details such as particular locations, durations and complexities of the associated operations.
- 22.A.7.33 The likelihood of vessel collision as a result of the maintenance activities associated with all elements of the English Offshore Scheme and at any point along the draft Order Limits is therefore considered to be 'Remote'. The severity of a collision with any vessel or surface obstacle may again result in a 'High' Severity / Magnitude consequence outcome (loss of crew, severe damage to vessel, major commercial impact and severe pollution incident among other consequences in the worst case). These combine to present an initial risk ranking of 'Tolerable if ALARP'.
- 22.A.7.34 It is therefore necessary to consider potential risk reduction measures in addition to the embedded mitigation. Suitable measures to raise awareness of the operations among sea users are already in place. The maintenance activities are generally expected to present minimal collision hazard under normal circumstances (i.e., inspection activity). Therefore, given that proximity and crossing agreements are expected to be arranged with interacting infrastructure operators where appropriate, it is proposed that a case-by-case risk assessment is made where maintenance activities, in addition to inspection, are required. This will ensure that details of unforeseen maintenance activities are considered such that any substantial increase in collision risk can be addressed without undue restrictions on normal activities.

Table 22.A-20 Vessel collision risk assessment summary (Normal Operations and Maintenance)

Hazard	Likelihood	Consequence	Risk	Additional RRM	Residual Risk
Vessel Collision.	Remote	High	Tolerable if ALARP.	Case-by-Case Risk Assessment to address collision risk of maintenance activities excluding inspections.	ALARP

Disruption to established vessel routes and areas

- 22.A.7.35 As described in section 22.A.7.29 above, during the operational lifetime of the cable, a number of inspections to examine integrity are foreseen. The presence of these vessels, or any other required for maintenance activities associated with the cable, may present an obstacle to passing traffic and hence an incremental increase in the risk of disruption.
- 22.A.7.36 Throughout the year, a large number and a range of vessel types cross the draft Order Limits in multiple locations. The risk of disruption is likely to be greater in higher density sections of the cable route or areas with restricted sea room, and therefore particularly in and around the Humber Approaches TSS.
- 22.A.7.37 Embedded mitigation measures, such as NtM, and Notification of Regular Runners, ensure that awareness of the operations among many of the vessels using the area will be suitably raised through the various promulgations and communications. However, guard vessel patrol may not be in place during inspection activities, and it cannot be presumed that all vessels using the locations will necessarily be aware of the presence of the maintenance vessels or their schedule of activities, particularly in the Humber anchorages.
- 22.A.7.38 Nonetheless, most of this traffic is unlikely to experience significant disruption in the unlikely case where they are required to navigate around maintenance vessels or marked seabed hazards, this being standard navigational practise for most of these vessel categories. They are likely to be aware of the cables and any cable protection due to the UKHO charting and marking of the infrastructure elements and locations. They are also likely to be prepared to navigate clear of the maintenance vessels due to the embedded mitigations promulgating the operation (MSN, NtM, Notification of Regular Runners, Port Communications) and are generally expected to apply good passage planning techniques and procedures.
- 22.A.7.39 Throughout most of the draft Order Limits, vessels making minor route deviation to avoid the inspection and maintenance activities will not suffer any significant operational impact, with the likelihood of no harm to people, and no significant commercial or environmental effects. Vessels required to navigate any marked unburied cable sections while using Humber ABP will be aware of the hazard which will be marked and managed by the ABP HES and its procedures. In the worst-case scenario, delays are considered possible and are assessed as 'Remote'. The consequence severity is assessed as minor or 'Low'. This results in a 'Broadly Acceptable' assessment and therefore no requirement to consider further risk reduction measures.

Table 22.A-21 Disruption risk assessment summary (normal operations and maintenance)

Hazard	Likelihood	Consequence	Risk	Additional RRM	Residual risk
Disruption to established vessel routes and areas.	Remote	Low	Broadly Acceptable.	N / A	Broadly Acceptable.

Interactions with vessel anchors

- 22.A.7.40 During the operational phase, there is a risk that a third-party vessel will drop anchor or lose its holding ground in adverse weather and subsequently drag its anchor over a section of cables and come into difficulty. In the case of such an anchor snagging incident, in the worst-case scenario it is possible that smaller vessels could suffer a risk of foundering should they not be able to free themselves. Consequences could include commercial effects as well as potential for pollution incidents.
- 22.A.7.41 The draft Order Limits pass to the east and south-east of the Humber Deepwater Anchorage, a designated anchorage area, with the minimum separation distance being approximately 9 km at around KP 50. AIS analysis indicates that vessels anchoring within the charted anchorage area extend further east than the published boundaries, approaching and at times overlapping with the draft Order Limits between approximately KP 40 and KP 48. Additionally, anchoring patterns not associated with any charted anchorage area are observed between KP 0 and KP 30.
- 22.A.7.42 The draft Order Limits lie to the east and south-east of the nearest Humber Approaches piloting boarding place, which is located approximately 11 km to the south-east of the draft Order Limits at around KP 30. The proximity of such features and activity indicates that anchor dragging is a potential hazard to the cables. The risk of accidental anchor strike or drag over surface-laid / exposed cable is highest in the operational phase, as cables exposures may have occurred due to mobile sediment / scour. However, it is very unlikely that an anchor would be deployed offshore in deeper waters and away from designated anchorage areas. The cables shall be buried and otherwise protected where necessary along the vast majority of their length. The target burial depth, protection measures and locations are expected to have been determined as far as practicable via risk-based cable burial approach. As such this hazard shall be appropriately minimised.
- 22.A.7.43 Additionally, industry guidance on safe anchor and fishing practises and provision of as-built locations of the cables and external protections to UKHO (Admiralty) and Kingfisher (KIS-ORCA), combine to reduce snagging risks significantly. VTS is also in place at ports to inform and deter vessels from anchoring near the cables. During the operational phase, cables locations will be marked on navigational charts and will be familiar to many regular users of the area.
- 22.A.7.44 The probability of an anchor interaction on the laid cables has been determined to be ‘Unlikely’ but remains a ‘High’ severity in the worst-case scenario where foundering leads to loss of crew, bringing the risk assessment to ‘Tolerable if ALARP’ and the need to consider further risk reduction measures. However, the risk-based cable burial approach (to be delivered in the forthcoming CBRA) comprises a detailed and comprehensive assessment of all factors affecting the burial and protection requirements across the operational lifetime of the cables, as well as detailed burial recommendations.

Table 22.A-22 Interaction with vessel anchor risk assessment summary (normal operations and maintenance)

Hazard	Likelihood	Consequence	Risk	Additional RRM	Residual risk
Vessel drags anchor across exposed cable.	Unlikely	High	Tolerable if ALARP.	None identified.	ALARP

Interactions with fishing gear

- 22.A.7.45 Fishing vessels whose gear becomes snagged on the cables or protections may sustain extensive damage or suffer foundering. Consequences of interactions with fishing gear could include damage to vessels, potential harm to people, commercial effects, as well as potential for pollution incidents. Cables lay activities may also result in the creation of berms and rock displacement which presents additional seabed hazards to fishing gear. Baseline data shows that there are significant levels of actively fishing vessels between KP 0 and KP 200, whilst fishing activity is lower north of KP 200.
- 22.A.7.46 The cables will be buried along the majority of the route. Further protection measures are also foreseen at specific locations such as cable crossings, which will be defined further as the design detail is developed. All external protection measures shall be designed to minimise the risk of snagging insofar as possible. Regular inspections and maintenance (as required) is intended to be conducted to ensure the cables remains in good condition and suitably protected throughout its operational life. Industry guidance recommends avoidance of demersal fishing over cables and other safe practises relating to seabed hazards. This embedded mitigation, combined with the provision of as-built locations of the cables and external protection to UKHO and Kingfisher (KIS-ORCA) represents substantial risk reduction. As such, the risk of snagging is considered to be suitably reduced. In addition, the potential appointment of a FLO during the construction phase provides substantial assurance that fishermen will be aware of the cables locations following the installation.
- 22.A.7.47 Given the risk based burial approach, prior promulgation of information on the English Offshore Scheme to fishermen via the FLO, and other notices to mariners including the Kingfisher Bulletin, the probability of interactions with fishing gear is already considered to be minimal. Industry guidance on fishing in the vicinity of cables and subsea hazards further advises against fishing in close proximity. As-built charting and promulgation of the cables locations is likely to prevent an increase to fishing in the immediate vicinity of the cables in the future. The likelihood of gear snagging is therefore assessed as 'Unlikely' given the expected continued avoidance of fishing in the cables vicinity. The consequences of such an outcome can be severe and are assessed as 'High' due to the potential loss of crew members or vessel. This results in an overall 'Tolerable if ALARP' risk, which warrants further risk reduction.
- 22.A.7.48 It is therefore necessary to consider potential RRMs in addition to those assumed to be in place, to reduce the risk to ALARP. Industry guidance on safe fishing practises combined with trenching and protection where required, represents a comprehensive range of snagging risk reduction measures. It is nonetheless recommended that detailed cable protection measures are determined with due consideration of the fishing intensity VMS data compiled in the baseline study.

Table 22.A-23 Fishing gear interaction risk assessment summary (normal operations and maintenance)

Hazard	Likelihood	Consequence	Risk	Additional RRM	Residual risk
Fishing gear snagging.	Unlikely	High	Tolerable if ALARP.	Further or detailed cable protection measures to consider areas of fishing activity in baseline data.	ALARP

Reduced under-keel clearance

- 22.A.7.49 Cable burial protections, cable crossings, displacement of rocks, including nearshore remedial rock dumps, and the creation of berms and other seabed disturbances during installation may present hazards due to reductions in under-keel clearance along the English Offshore Scheme.
- 22.A.7.50 The HVDC cables shall be buried along the vast majority of the English Offshore Scheme. The full details of the cable burial will be established by a CBRA which will be produced in due course, and once made available will be incorporated into this FSA. Regular inspections and maintenance activity will ensure that the cables remains buried or otherwise protected during its entire operational lifetime. In line with MCA guidance, it is not planned to reduce the existing navigable water depth by more than five per cent along any section of the cables (with respect to Chart Datum). It is therefore expected that under-keel clearance is only reduced at a very small number of locations, which are anticipated to be located close into shore and at cable crossings in shallower waters. Once produced, there will be a number of studies including the CBRA which will inform further on the expected cable crossing locations and identify those which may not meet the MCA’s five per cent requirement and would therefore require conversations with the MCA.
- 22.A.7.51 Other embedded mitigations such as post-lay survey and provision of the as-built locations of cables and external protection to UKHO and KIS-ORCA increase awareness of the cable route and cable crossings locations for all vessels and minimise the risk substantially. Additionally, the use of Horizontal Directional Drilling to bring the cables to land from under the seabed limits the potential for reductions in under keel clearance to the exit pit locations. The potential hazard to vessels due to reductions in under-keel clearance are therefore appreciably limited.
- 22.A.7.52 Reductions in under-keel clearance increase the risk of grounding with a rock berm or other protection feature of cable crossings which may result in injury and / or major vessel damage consequences, as well as commercial consequences of potentially limiting the size of vessels able to access the Humber Estuary and the ports within it, and the potential for a pollution incident, and is therefore assessed as being ‘High’. Vessels with deep draughts are expected to exercise particular diligence and care through the adoption of good passage planning techniques and procedures. However smaller vessels transiting near the cables landfall at Anderby Creek are not anticipated to experience elevated grounding or allision with any unburied cable sections and or protection measures nearby.

22.A.7.53 Nonetheless, embedded mitigations serving to notify mariners and marine authorities of the location of the cables and their protections will reduce the likelihood of grounding etc. Additionally, subsurface hazards will be marked and relevant authorities informed. Route planning and marking of cable crossings in shallow water should be considered where the cables will cross over existing cables / pipelines, ensuring that under-keel clearance is not reduced by more than five per cent in these instances. Where under-keel clearance may potentially be reduced by more than five per cent the English Offshore Scheme will engage with the MCA on these locations. Therefore, the likelihood is assessed as 'Occasional'. These combine to produce an overall assessment of 'Tolerable if ALARP' and further risk reduction measures should be considered.

22.A.7.54 During stakeholder consultation, Humber ABP requested to be kept informed of any reductions in depth and required protection measures which may affect the Humber Approaches TSS. It is therefore recommended that the ABP HES is kept informed of seabed hazards and changes as they develop. Communication with Humber ABP should be maintained to ensure they can respond to the proposals and any seabed changes and address associated hazards appropriately.

Table 22.A-24 Reduction in under-keel clearance risk assessment summary (normal operations and maintenance)

Hazard	Likelihood	Consequence	Risk	Additional RRM	Residual risk
Reduction in Under-Keel Clearance.	Occasional	Medium	Tolerable if ALARP.	ABP HES to be kept informed of proposed seabed hazards and changes as they develop.	ALARP

Interference with marine navigational equipment

22.A.7.55 Given the transmission characteristics of the EGL 5 cable, it is feasible that a zone of potential magnetic compass deviation from electro-magnetic field (EMF) effects could persist along the English Offshore Scheme. The EMF assessment for EGL 5 indicates that 100 per cent of the bundled section of the cable route is predicted to induce compass deviations below three degrees, demonstrating minimal magnetic influence across the English Offshore Scheme. One point greater than three degrees was identified at KP0.4, although it remains below five degrees and is not included in the EMF assessment, as the nearshore region from KP0.4 onwards has not yet been finalised in the design. Further details are provided in **Volume 2, Appendix 4.A: Electromagnetic Field (EMF) Study**.

22.A.7.56 Most commercial vessels use a range of instruments for navigation, particularly gyro compasses which are not affected by EMFs. However, some vessels (likely to be older recreational and leisure vessels) may rely solely on magnetic compass navigation and may experience misrouting where traveling in the direction of the cables and where the interference is most pronounced i.e. in shallow water / inshore. Vessels relying solely on a magnetic compass for navigation are also likely to navigate by visual landmarks in shallow water and inshore areas. However, poor visibility and challenging sea states may nonetheless result in misrouting towards otherwise obscured hazards or objects. This could result in damage to vessels or infrastructure, with associated commercial implications, harm to people, and the possibility of resulting in a pollution incident.

22.A.7.57 Embedded mitigation such as optimising cables configuration, separation distances to minimise compass deviation and burial, as far as practicable, will reduce the likelihood and severity of vessel misrouting. Additionally, magnetic compass deviation effects are limited to the immediate vicinity of the of the English Offshore Scheme, so effects on the limited number of vessels expected to rely solely on magnetic equipment will be short-lived, and only likely to result in minor course deviations. The consequence severity is therefore assessed as 'Medium' due to the increased hazard prevalence at inshore locations along the English Offshore Scheme, where more pronounced and persistent deviation could occur. However, complete reliance on magnetic compass navigation is considered very unlikely for any vessel in a given situation and location. Additionally, as most of the bundled cables arrangement will be laid in water deep enough to minimise EMF effects and achieve the MMO criteria for less than three per cent deviation over 95 per cent of the route, the probability of disruption is assessed as 'Remote'. These combine to produce a 'Broadly Acceptable' risk rating and no requirement for further consideration.

Table 22.A-25 EMF interference with marine navigational equipment risk assessment summary (normal operations and maintenance)

Hazard	Likelihood	Consequence	Risk	Additional RRM	Residual risk
EMF Interference with marine navigational equipment.	Remote	Medium	Broadly Acceptable.	NA	Broadly Acceptable.

Cumulative effects

22.A.7.58 As highlighted in section 22.A.3.23, a list of potential cumulative projects and activities will be compiled and addressed in **Volume 1, Part 4, Chapter 27: Cumulative Effects** of the PEIR.

Cost Benefit Analysis

22.A.7.59 In accordance with the principles of ALARP, a cost benefit justification of recommended additional risk reduction measures is used to determine their requirement for implementation. The principle of gross disproportion is used to ensure that the risk reduction benefit is proportionate to the cost of implementing a given measure. This appraisal assesses the risk to navigation rather than the public, or individual workers, for example. Similarly, as risks to navigation generally are being assessed, numerical frequencies for consequence outcomes cannot be determined and therefore detailed or numerical cost benefit calculations cannot be made here. Nonetheless, each of the additional measures recommended in the section above is addressed in this section to provide a basic justification of their implementation, or otherwise. **Table 22.A-26** therefore shows the identified hazards to navigation, additional risk reduction measures recommended and a qualitative justification to provide a basic ALARP position against each of the hazards. The outcomes are also captured with the **Annex 22.A.1: Hazard Log**.

Table 22.A-26 Cost benefit considerations of additional risk reduction measures (RRMs)

Hazard	Project phase	Additional RRM	Justification / details
Vessel Collision (Passing vessel collides with installation vessel).	Construction	Enhanced communication plans to include communications between VTS and TSS operators to ensure awareness of installation fleet locations among all relevant parties.	The cost associated with procedural measures such as enhancing communication plans is not considered grossly disproportionate and therefore the measure is justified.
Disruption to established vessel routes and areas.	Construction	Enhanced communication plans to include communications between VTS and TSS operators to ensure awareness of installation fleet locations among all relevant parties.	The cost associated with procedural measures such as enhancing communication plans is not considered grossly disproportionate and therefore the measure is justified.
		UKHO Temporary / Preliminary Notices to be issued prior to installation.	The cost associated with administrative measures such as issuing data are not considered grossly disproportionate and therefore the measure is justified.
Vessel drags anchor across exposed cable.	Construction	UKHO Temporary / Preliminary Notices to be issued prior to installation.	The cost associated with administrative measures such as issuing data are not considered grossly disproportionate and therefore the measure is justified.
		Consideration of the use of temporary aids to navigation for exposed cable sections.	Determination of marking requirements is considered part of detailed design process and does not therefore imply grossly disproportionate cost. Measure justified.
Fishing gear snagging.	Construction	UKHO Temporary / Preliminary Notices to be issued prior to post-lay / as-built survey.	The cost associated with administrative measures such as issuing data are not considered grossly disproportionate and therefore the measure is justified.

Hazard	Project phase	Additional RRM	Justification / details
		Consideration of the use of temporary aids to navigation for exposed cable sections.	Determination of marking requirements is considered part of detailed design process and does not therefore imply grossly disproportionate cost. Measure justified.
Vessel Collision (Passing third party vessel collisions).	Operation and Maintenance.	Case-by-Case Risk Assessment to address collision risk of maintenance activities excluding inspections.	The cost associated with risk assessment measures are not considered grossly disproportionate and therefore the measure is justified.
Fishing gear snagging.	Operation and Maintenance.	Further or detailed cable protection measures to consider areas of fishing activity in baseline data.	Consideration of fishing activity as part of detailed design is not considered to imply significant additional cost in itself therefore the measure is justified.
Reduction in Under-keel Clearance.	Operation and Maintenance.	ABP HES to be kept informed of proposed seabed hazards and changes as they develop.	The costs associated with communication and communication protocols are not considered to be grossly disproportionate to the risk benefit gained. Additionally, this aspect of communication can be captured as part of enhanced communication planning already recommended. Measure justified.

Residual Risk

- 22.A.7.60 Across all phases of the English Offshore Scheme, all initial hazards were assessed to be 'Unacceptable', 'Tolerable if ALARP' or 'Broadly Acceptable'. Following the implementation of the additional risk reduction measures identified in **Table 22.A-26** above the residual risk from all phases of the scheme can be considered ALARP.
- 22.A.7.61 As the English Offshore Scheme is still in development, it is necessary that the NRA retains a level of flexibility, in order that it can be updated as the English Offshore Scheme progresses. Updates based on further stakeholder consultation and the latest technical outputs and reports such as the CBRA report once available, would then be considered and findings and further details incorporated into the NRA where appropriate. The risk ratings and mitigation measures would also be reassessed as required upon availability of this information.

22.A.8 Project Specific Recommendations

22.A.8.1 The following recommendations resulting from the NRA have been made. These project-specific recommendations represent further mitigation measures which should be implemented to ensure that hazards to shipping and navigation from the English Offshore Scheme are reduced to ALARP. Where recommendations are not implemented, justification would be made and captured appropriately.

- Communication plans would include protocols or provision establishing effective communication between VTS and TSS operators to ensure ongoing awareness of the cables installation fleet locations during the operation among all relevant parties, and in particular to cover the proximity of the installation operation to the ABP HSE and the associated designated anchorages. The communication plans should cover appropriate communications with ABP HES.
- UKHO Temporary / Preliminary Notices would be issued to ports, harbours and pilots, and any other appropriate parties prior to post-lay / as-built survey such that the basic positions of the cables are established and awareness among mariners can be raised immediately.
- The use of temporary aids to navigation for exposed cable sections would be considered to reduce the risk of interactions with fishing gear vessel anchors particularly near designated anchorages. Details, extent and requirements of the markers if necessary would be confirmed / established with Trinity House.
- Risk assessment of maintenance activities (excluding inspections) would be undertaken to determine the collision risk level and suitable controls on a case-by-case basis such that both collision risk and disruption to maintenance activities are minimised.
- Cable protection measures would take due consideration of fishing activity in the baseline data such that those sections of the cable buried or protected within fishing grounds will minimise risk to gear snagging.
- Route planning and marking of cable crossings in shallow water would be considered where the cables will cross over existing cables / pipelines, ensuring that under-keel clearance is not reduced by more than five per cent as per the MCA's requirement, in these instances. Where under-keel clearance may potentially be reduced by more than 5 per cent the English Offshore Scheme will engage with the MCA on these locations.

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Annex 22.A.1 Hazard Log

22.A.8.2 This hazard log captures the assessment of hazards relevant to shipping and navigation resulting from the marine elements of the Project. The table includes all hazards identified as part of stakeholder hazard workshops and includes embedded and project specific mitigation identified during the sessions as well additional risk reduction measures identified as part of the desktop exercise, detailed in this report. Initial risk is captured based on embedded mitigation measures established during hazard identification sessions. A residual risk ranking is also captured based on the inclusion of any additional risk reduction measures. Detailed narratives supporting each assessment are captured in the main body of this report (section 22.A.5) however the table here provides a succinct and auditable record of the assessment outcome. Note that although both worst case and most likely outcomes are captured, the assessment is based on the worst case for each hazard.

Phase	Hazards	Statutory / Industry practice mitigation	Project specific mitigation	Worst credible outcome	Most likely outcome	Worst case likelihood	Worst case severity	Risk	Additional RRM	Residual risk	Consultation notes
Construction (Installation, Commissioning) and Decommissioning.	Vessel-Vessel Collision Risk (third-party to project). Passing vessel collides with installation vessel (restricted in its manoeuvrability including construction vessels).	COLREGS / SOLAS / MGNs (Marine Guidance Notes). Lights and Shapes. Port Byelaws and General Directions. VTS Communication / management relating to TSS. Bridge team management & Passage planning. Notifications including NAVTEX, NAVAREA Warnings, NtM (Notice to Mariners), Notification to RR's. Careful Route Selection. Safe clearance zone (500 m). AIS Broadcasts. Ops limits (including visibility scenarios).	Guard Vessels with ARPA. Avoiding cable joints in high density areas.	Loss of a crew member, or multiple serious injuries. Major / Severe damage to equipment or vessel. Wreck / Cargo release causes hazard and disruption to shipping (including any environmental or other clean-up operations). Major environmental impact. Major commercial impact.	Minor injury(s) to person. Minor / Local damage to equipment or vessel. Minor commercial impact. Minor environmental impact.	Remote	High	Tolerable if ALARP.	Enhanced communication plans to include communications between Harbour Masters and VTS operators, and to ensure awareness of installation fleet locations among all relevant parties.	Tolerable if ALARP. (Reduced to ALARP).	Horseshoe Point: MCA (EGL 3 – EGL 4) – Construction / burying of cable would be the main issue in this area, due to density of shipping. MCA (EGL 3 – EGL 4) worth noting that areas of high shipping density around Theddlethorpe on figures likely to be due to survey activities and the installation of Viking Link rather than any ongoing activities. Suggested simultaneous ops should be considered as a mitigation measure to reduce vessel-to-vessel collision risk. RYA (EGL 3 – EGL 4): Main discussion point was providing plenty of notice (to mariners). Additionally keeping the RYA up to date with any project updates. Use of RYA coastal atlas to supplement assessments for recreational vessels. Humber ABP (EGL 3 – EGL 4): The Humber is piloted from Spurn Point. Donna Nook and Theddlethorpe appear to be within Harbour limits however.

Phase	Hazards	Statutory / Industry practice mitigation	Project specific mitigation	Worst credible outcome	Most likely outcome	Worst case likelihood	Worst case severity	Risk	Additional RRM's	Residual risk	Consultation notes
											Ports prefer a seven day lookahead while working in the area, this has been requested for the future construction period especially. Communication daily to mariners, importance of knowing project operation in advance.
Construction (Installation, Commissioning) and Decommissioning	Vessel-Vessel Collision Risk (third-party to third-party). Passing third party vessels collisions.	COLREGS / SOLAS / MGNs. Lights and Shapes. Port Byelaws and General Directions. VTS Communication / management relating to TSS. Bridge team management & Passage planning. Notifications including NAVTEX, NAVAREA Warnings, NtM (Notice to Mariners), Notification to RR's. Careful Route Selection. Safe clearance zone (500m). AIS Broadcasts. Ops limits (including visibility scenarios).	Guard Vessels with ARPA. Avoiding cable joints in high density areas.	Loss of a crew member, or multiple serious injuries. Major / Severe damage to equipment or vessel. Wreck / Cargo release causes hazard and disruption to shipping (including any environmental or other clean-up operations). Major environmental impact. Major commercial impact.	Minor injury(s) to person. Minor / Local damage to equipment or vessel. Minor commercial impact. Minor environmental impact.	Remote	High	Tolerable if ALARP.	N / A	Tolerable if ALARP. (Reduced to ALARP).	Horseshoe Point: MCA (EGL 3 – EGL 4) – Construction / burying of cable would be the main issue in this area, due to density of shipping.

Phase	Hazards	Statutory / Industry practice mitigation	Project specific mitigation	Worst credible outcome	Most likely outcome	Worst case likelihood	Worst case severity	Risk	Additional RRM's	Residual risk	Consultation notes
Construction (Installation, Commissioning) and Decommissioning.	Disruption / reduced access to established vessel routes and activities. Disruption to multiple vessels due to installation activities using established routes Disruption to multiple vessels due to maintenance vessel activities using established routes.	VTS Communication management relating to TSS. MGNs. Careful Route Selection. Notifications including Notice to Mariners, Notification to RR's. Guard Vessels. AIS Broadcast. Ops limits (including visibility scenarios).	FLO Consultations	Significant delays and disruption to shipping and ports activities. Major commercial impact.	No significant operational impacts. Minor commercial impact.	Likely	Medium	Unacceptable	Enhanced communication planning.	Tolerable if ALARP (Reduced to ALARP)	Horseshoe Point: MCA (EGL 3 – EGL 4) – Construction / burying of cable would be the main issue in this area, due to density of shipping - would need be considered in NRA and would require further discussion Theddlethorpe: MCA (EGL 3 – EGL 4) – depends on availability of sufficient sea room if large vessels are caused to deviate from their route. – Keep it out of the key marine shipping routes. If there is a possibility of impacts to navigational aids – contact Trinity house . EGL 5 outside VTS communication areas.
Construction (Installation, Commissioning) and Decommissioning.	Anchor interactions with cable. Vessel drags anchor across exposed cable.	VTS Communication (advisory capacity). Cable burial and Protection Measures (partial). NtM Guard Vessels. Advice from VTS Ops management. MGN	Early stakeholder consultations.	Loss of a crew member, or multiple serious injuries. Major / Severe damage to infrastructure or vessel. Major environmental impact. Major commercial impact	Notable damage to infrastructure or vessel. Moderate commercial impact. Moderate environmental impact.	Unlikely	High	Tolerable if ALARP	UKHO Temporary / Preliminary Notice to be issued prior to post-lay / as-built survey. Consideration of the use of temporary aids to navigation for exposed cable sections.	Tolerable if ALARP (Reduced to ALARP)	Decent cable burial depth will be required (emergency anchoring).
Construction (Installation, Commissioning) and	Fishing gear interactions with cable. Fishing activity	VTS Communication (advisory capacity) Cable burial and	FLO 500 m safe clearance zone for	Loss of a crew member, or multiple serious injuries.	Notable damage to infrastructure or vessel.	Remote	High	Tolerable if ALARP.	Further or detailed cable protection measures to consider areas of	Tolerable if ALARP.	Scenario to be considered: emergency situation due to storm, cable lay vessel having to cut and lay the cable on seabed.

Phase	Hazards	Statutory / Industry practice mitigation	Project specific mitigation	Worst credible outcome	Most likely outcome	Worst case likelihood	Worst case severity	Risk	Additional RRM's	Residual risk	Consultation notes
Decommissioning.	conducted in vicinity of cable route leads to snagging.	Protection Measures (partial). NtM Guard Vessels. MGN	fishing vessels. Kingfisher Bulletins.	Major / Severe damage to equipment or vessel. Major environmental impact. Major commercial impact.	Damage or loss of fishing equipment. Moderate commercial impact. Moderate environmental impact.				fishing activity in baseline data.	(Reduced to ALARP)	NFFO (EGL 3 – EGL 4): publicly available data sources are often an under-representation of fishing activity.
Normal Operations and Maintenance	Vessel-Vessel Collision Risk (third-party to project) Passing vessel collides with installation vessel (restricted in its manoeuvrability including construction vessels) Passing vessel collides with Maintenance vessel (Potentially restricted in its manoeuvrability)	COLREGS / SOLAS / MGNs Lights and Shapes Port Byelaws and General Directions VTS Communication / management relating to TSS Bridge team management & Passage planning Notifications including NAVTEX, NAVAREA Warnings, NtM (Notice to Mariners), Notification to RR's Careful Route Selection Safe clearance zone (500m) AIS Broadcasts.		Loss of a crew member, or multiple serious injuries. Major / Severe damage to equipment or vessel. Wreck / Cargo release causes hazard and disruption to shipping (including any environmental or other clean-up operations). Major environmental impact.	Minor injury(s) to person. Minor / Local damage to equipment or vessel. Minor environmental impact. Minor commercial impact.	Remote	High	Tolerable if ALARP.	Case-by-Case Risk Assessment to address collision risk of maintenance activities excluding inspections.	Tolerable if ALARP. (Reduced to ALARP)	

Phase	Hazards	Statutory / Industry practice mitigation	Project specific mitigation	Worst credible outcome	Most likely outcome	Worst case likelihood	Worst case severity	Risk	Additional RRM's	Residual risk	Consultation notes
		Ops limits (including visibility scenarios).									
Normal Operations and Maintenance.	<p>Disruption / reduced access to established vessel routes, areas and activities.</p> <p>Disruption to multiple vessels due to installation activities using established routes.</p> <p>Disruption to multiple vessels due to maintenance vessel activities using established routes.</p>	<p>VTS Communication / management relating to TSS. MGNs.</p> <p>Careful Route Selection.</p> <p>Notifications including Notice to Mariners, Notification to RR's.</p> <p>Guard Vessels.</p> <p>AIS Broadcast.</p> <p>Ops limits (including visibility scenarios).</p> <p>Subsurface hazards marked and relevant authorities informed.</p>		<p>Delays</p> <p>Moderate commercial impact.</p>	No significant operational impacts.	Remote	Low	Broadly Acceptable.	N / A	Broadly Acceptable.	Avoid cable joints near the Humber IMO Routeing Measures.
Normal Operations and Maintenance.	<p>Anchor interactions with cable.</p> <p>Vessel drags anchor across exposed cable.</p>	<p>VTS Communication / Management relating to TSS.</p> <p>Cable burial and Protection Measures.</p> <p>Careful Route Selection.</p> <p>Notice to Mariners.</p> <p>AIS Broadcast.</p> <p>Notification to RR's.</p> <p>As-Built Locations</p>	<p>Risk Based Burial Approach.</p> <p>Target Cable Burial Depth.</p>	<p>Loss of a crew member, or multiple serious injuries.</p> <p>Major / Severe damage to infrastructure or vessel.</p> <p>Major environmental impact.</p> <p>Major commercial impact.</p>	<p>Notable damage to infrastructure or vessel.</p> <p>Moderate environmental impact.</p> <p>Moderate commercial impact.</p>	Unlikely	High	Tolerable if ALARP.	None identified.	<p>Tolerable if ALARP.</p> <p>(Reduced to ALARP)</p>	

Phase	Hazards	Statutory / Industry practice mitigation	Project specific mitigation	Worst credible outcome	Most likely outcome	Worst case likelihood	Worst case severity	Risk	Additional RRM's	Residual risk	Consultation notes
		of cable and protections supplied to UKHO (Admiralty). Advice from VTS Ops management.									
Normal Operations and Maintenance.	Fishing gear interactions with cable. Fishing activity conducted in vicinity of cable route leads to snagging.	Cable burial and Protection Measures. Notice to Mariners. AIS Broadcast. Notification to RR's As-Built Locations of cable and protections supplied to Kingfisher (KIS-ORCA) and UKHO (Admiralty).	Risk Based Burial Approach. Target Cable Burial Depth. Kingfisher Bulletins.	Loss of a crew member, or multiple serious injuries Major / Severe damage to infrastructure or vessel. Major environmental impact. Major commercial impact.	Notable damage to infrastructure or vessel Moderate environmental impact. Moderate commercial impact.	Remote	High	Tolerable if ALARP.	Further or detailed cable protection measures to consider areas of fishing activity in baseline data.	Tolerable if ALARP. (Reduced to ALARP)	NFFO (EGL 3 – EGL 4): publicly available data sources are often an under-representation of fishing activity.
Normal Operations and Maintenance.	Reduction in Under Keel Clearance (cable).	Subsurface hazards marked and relevant authorities informed. As-Built Locations of cable and external protections supplied to UKHO (Admiralty) and Kingfisher (KIS-ORCA).	Risk Based Burial Approach. Target Cable Burial Depth Risk Based Burial Approach. Target depth reduction of less than 5 per cent (with reference to chart datum) Target Cable Burial Depth.	Loss of a crew member, or multiple serious injuries. Major / Severe damage to infrastructure or vessel. Major environmental impact. Major commercial impact (reduced access to ports / disruption to vessel routes).	Major / Severe damage to infrastructure or vessel. Moderate environmental impact. Moderate commercial impact.	Occasional	Medium	Tolerable if ALARP.	Humber HES to be kept informed of proposed seabed hazards and changes as they develop.	Tolerable if ALARP. (Reduced to ALARP)	"Less than five per cent decrease in Under Keel Clearance" is just indicative, other considerations are needed depending on site specific details. Future vessel traffic, specifically size?

Phase	Hazards	Statutory / Industry practice mitigation	Project specific mitigation	Worst credible outcome	Most likely outcome	Worst case likelihood	Worst case severity	Risk	Additional RRMs	Residual risk	Consultation notes
Normal Operations and Maintenance.	Reduction in Under Keel Clearance (crossings).	Subsurface hazards marked and relevant authorities informed. As-Built Locations of cable and external protections supplied to UKHO (Admiralty) and Kingfisher (KIS-ORCA).	Risk Based Burial Approach. Target Cable Burial Depth Risk Based Burial Approach. Target depth reduction of less than 5 per cent. Target Cable Burial Depth.	Loss of a crew member, or multiple serious injuries. Major / Severe damage to infrastructure or vessel. Major environmental impact. Major commercial impact (reduced access to ports / disruption to vessel routes).	Major / Severe damage to infrastructure or vessel. Moderate environmental impact. Moderate commercial impact.	Unlikely	Medium	Tolerable if ALARP.	Humber HES to be kept informed of proposed seabed hazards and changes as they develop.	Tolerable if ALARP. (Reduced to ALARP)	There is an expectation of bundle construction for the cable.
Normal Operations and Maintenance.	EMF Interference with marine navigation, communications and position-fixing equipment.	Magnetic compass deviation low (less than three degrees) for majority (>95 per cent) of route. Range of Instruments used for navigation. As-Built Locations of cable and external protections supplied to UKHO (Admiralty) and Kingfisher (KIS-ORCA).	Bundled Cable Design minimises deviations.	Minor navigational impairments. Minor commercial impact.	No significant operational impacts.	Remote	Medium	Broadly Acceptable.	N / A	Broadly Acceptable.	

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