IMMINGHAM EASTERN RO-RO TERMINAL

Supplementary Navigation Information Report

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Contents

1 Section 1 – Introduction

1.1 In support of its application for the Immingham Eastern Ro-Ro Terminal ("IERRT") Development Consent Order ("DCO"), Associated British Ports (ABP) submitted a Navigational Risk Assessment (NRA) [APP-089], included as part of the submitted Environmental Statement ("ES").

1.2 A Statutory Harbour Authority (SHA) is the decision maker as to marine activities that can be undertaken within its respective harbour authority area – in the context of IERRT, the Port of Immingham SHA. Before authorising any such activities, however, the SHA must be satisfied that the proposed activities have been subjected to a risk assessment and the SHA must be satisfied that the risk assessment undertaken is appropriate and the conclusion reached satisfactory.

1.3 The decision as to whether risks are tolerable or intolerable and as Low as Reasonably practicable (ALARP) sits with the appropriate authority, namely in the case of the IEERT proposals, the Duty Holder through ABP's Harbour Authority and Safety Board (HASB).

1.4 In December 2022, prior to the submission of the IERRT DCO application, both the Port of Immingham SHA and the Humber SHA, namely the Statutory Conservancy and Navigation Authority ("SCNA") carefully considered and reviewed the Applicant's NRA and determined that the identified risks were capable of being mitigated to the point where safe operations could continue to occur at the port (i.e., all risks were considered tolerable and ALARP). This determination was made in relation both to existing operations and for the construction and operation phases of the IERRT project.

1.5 Since the submission of the IERRT DCO application and the commencement of the public examination on 25 July 2023, concerns have been raised by Interested Parties (IPs), including in particular the Immingham Oil Terminal (IOT) Operators and DFDS, as to the conclusions of the Applicant's NRA and the navigation simulations undertaken to support the development proposal.

1.6 The concerns regarding navigational simulations have been focussed on tidal flow data used in the simulation model, the scope of the simulations that have been run and the outcomes of that work in understanding navigational risk.

1.7 The concerns raised by the IOT Operators and DFDS have been articulated in alternative NRAs [REP2-064 and REP2-043, respectively] which have been submitted as part of the examination. The principal risks that have been identified in the alternative NRAs comprise essentially the following three risks:

- Allision of a Ro-Ro vessel with the IOT Trunkway;
- Allision of a Ro-Ro vessel with the Finger Pier; and
- Allision of a Ro-Ro vessel with the Eastern Jetty.

1.8 The purpose of this report is to collate all key information in respect of navigational issues and to identify the key matters that have arisen during the course of the examination in terms of navigational risk. This will enable the HASB, in its capacity as Duty Holder, to undertake a fresh review of all of the information that has been provided during the examination. In so doing, the HASB, as Duty Holder, will have to decide whether it wishes, in light of the concerns raised by the Interested Parties in the context of navigational risk, to reconsider its decision made at the meeting of the HASB on 12 December 2022, namely that the risks associated with the IERRT development, taking account of mitigation, are tolerable and ALARP.

1.9 The structure and content of the report is as listed below:

- Section 1 – Introduction;
- Section 2 – Explains ABP governance and processes in relation to the assessment of navigational risk in its ports.
- Section 3 – Provides a summary of the navigational simulation work to support the project and the key findings;
- Section 4 – Provides a review of the outcomes of the Applicant's NRA [APP-089] and each of the alternative NRAs submitted into the examination [REP2-043 and REP2-064]; and
- Section 5 – Sets out the conclusions reached in this report.

2 Section 2 – ABP Governance

2.1 ABP, the Applicant, is both the owner and operator of the Port of Immingham, and the SHA for the Port. To avoid any conflict between the two roles, which carry with them distinct statutory duties and obligations, ABP has created an independent Board, known as the Harbour Authority and Safety Board, ("HASB").

2.2 The HASB meets separately from the main ABP Board and has its own remit, which in the context of the proposed IERRT development is to:

- enable ABP acting in its capacity as SHA to take decisions independently from ABP's consideration as a commercial port operator;
- provide a forum for the Board to consider detailed group health and safety matters;
- oversee ABP's compliance with its obligations as Duty Holder under the Port Marine Safety Code (PMSC).

2.3 Whilst, as noted in the ABP Governance Note [REP1-014] already before the examination, the HASB has the same membership as the main ABP Board it also has a number of regular additional standing attendees, such as the Group Technical Marine Advisor (being also the "Designated Person" under the PMSC).

2.4 Most importantly in terms of the Proposed Development, the HASB fulfils its separate obligations as “Duty Holder” – a role entirely separate from the duties of the main ABP Board.

2.5 The HASB meets at least four times a year, with additional ad hoc meetings held on an as required basis.

3 Section 3 – Vessel Simulations

3.1 HR Wallingford were commissioned by ABP to support the design and feasibility of the IERRT project and to inform an assessment of the safe navigation of vessels to the IERRT. Numerous navigation simulation studies have been undertaken to support the initial design and feasibility of the project at a pre-application stage. Further simulation work has been undertaken at the request of the Examining Authority (ExA) and IPs to further test concerns that have been raised during examination.

3.2 The following sections provide a high-level overview of the work undertaken and the outcomes of the assessments.

Pre application

3.3 Between November 2021 and December 2022, HR Wallingford undertook a number of pieces of work on behalf of ABP considering flows and navigation at the proposed IERRT. Detailed reports have been separately provided at APP-090 and APP-091 (superseded by AS-022 and AS-023).

Design reviews and tidal analysis

3.4 An initial study was conducted in November 2021 to review early designs of the project and tidal flow data derived from an Acoustic Wave and Current (AWAC) buoy that had been deployed to collect data for the project. This was used to inform the design of the IERRT berths in terms of their orientation against the direction of tidal flows.

3.5 Following this, in April 2022, a detailed statistical analysis of the depth averaged tidal flows from the AWAC data in the vicinity of IERRT was completed. The analysis concluded that the tidal flows in the area are complex and differ with depth. As a result, it was considered important to verify the design and orientation of the IERRT berths. To do this, HR Wallingford undertook a quasi-stationary evaluation of the forces that will be experienced by vessels approaching the IERRT at various rotations from the mean flow direction. This analysis concluded that the optimum orientation for the new infrastructure is 300°.

3.6 Following some concerns that the AWAC data collected for the project was not representative of the direction of the tidal flows at Immingham, ABP commissioned a further flow survey using an Acoustic Doppler Current Profiler (ADCP) in October 2022 [see REP2-009, ExQ1 reference NS.1.18]. The ADCP data correlated closely with the previous data collected by AWAC and the HR Wallingford flow model. Specifically, the flow team at HR Wallingford concluded that the ADCP data confirmed that the data and flow model as applied to the project are fit for the purposes of input to navigation simulation and mooring analysis studies.

3.7 HR Wallingford were also commissioned in July 2022 to undertake a ship mooring analysis for IERRT. The report advised various modifications to the berthing arrangements to demonstrate that the design vessels specified could remain safely moored at IERRT.

Navigation simulations

3.8 HR Wallingford have undertaken a series of navigation simulation modelling studies to consider the design of the IERRT berths and the potential for safe operations at the IERRT. Navigation simulations were conducted in December 2021, April 2022, July 2022 and December 2022. Stakeholders from IOT Operators were invited to the simulations in April 2022. The study in July 2022 repeated the assessment undertaken in December 2021, but with the improved and more detailed flow models. The December 2022 simulations were specifically held to facilitate a programme of stakeholder demonstrations, supported by real time navigation simulation.

3.9 Each of the studies consisted of three phases of work:

- Preparation of the simulator and models including updating flow models;
- 3-day real time navigation simulation; and
- Analysis and reporting.

3.10 A wide range of vessels have been tested across the four simulation studies, bearing in mind that the maximum “Design Vessel” specified does not represent an actual vessel and is simply a set of dimensional parameters that have been used to establish the maximum extents of marine infrastructure:

- A Jingling class 237 m RoRo ferry – the model had been previously verified in a similar study on the Humber commissioned by ABP, and was specifically requested by the Head of Marine Operations on the Humber as representative of the size and class of ship potentially expected to operate at the Port;
- A Loya class product tanker – the model was regularly used by ABP Humber Estuary Services (HES) for their continuous professional development training at HR Wallingford, and the vessel represented the size and class of vessel routinely used at IOT;
- A 94 m product tanker ‘Thames Fisher’ – a vessel identified by ABP as a regular visitor to IOT;
- A 104 m product tanker ‘Thun Grace’ – identified by the IOT Operators as a regular visitor at IOT; the model for this vessel was specifically commissioned by ABP, based on APT ‘s request;

- A 212 m long RoRo ferry, based on the 'Stena Transporter', as requested by ABP;
- A 100 m long products tanker, based on the vessel 'Whisby Teak', as requested by stakeholders from IOT Operators;
- A 91.5 m long tanker, based on the vessel 'Thames Fisher', as requested by stakeholders from IOT Operators;
- A 59 m long bunker barge, based on the 'Rix Phoenix'.

3.11 The primary aim of the simulation studies was to test the feasibility of navigating to the IERRT berths in a safe manner, as well to test whether existing operations to the IOT can continue safely. Furthermore, the environmental conditions for the runs also concentrated on the levels of wind and current that would be considered challenging when combined. This was to help gain an understanding of the likely operational limits that the berths could operate in. The principal purpose of conducting the simulations was both to identify those runs which could be successfully completed and also to identify runs and conditions in which an approach or departure could fail.

3.12 The simulations were undertaken by a team of marine experts and stakeholder representatives. Every manoeuvre was briefed and debriefed and an evaluation which assessed the run as success, marginal or fail provided.

3.13 The key conclusions from the studies as a whole were:

- Successful manoeuvres to and from the IERRT berths were demonstrated in the most challenging tidal flows and concurrent winds;
- The proposed IERRT infrastructure will be acceptable to operate a 240 m Ro-Ro ferry safely;
- Navigation to and from the berths on the IOT finger pier will not be adversely affected by the proposed size and location of the new IERRT infrastructure; and
- Current manoeuvring practices to the IOT finger pier will have to be updated, taking into account the new IERRT infrastructure.

3.14 It was recognised that manoeuvring to and from the new infrastructure will require precise positioning of the vessel, tugs and their attitude to the tidal flow and the wind. As is normal practice with any new berth on the Humber, additional assessment and training will be undertaken and provided by the SCNA and the Port of Immingham SHA to identify the detail of recommended procedures and limits for all classes of vessel in a wide range of environmental conditions. This will be particularly pertinent to developing appropriate limits for an initial operating capability for IERRT.

3.15 During the simulations in December 2022, vessel breakdown of the Stena Transport vessel was also tested. During the two runs that simulated breakdowns, the vessel was stopped within 100 m of the position where the breakdown was initiated following the deployment of its anchor. To develop a scenario in which contact with the IOT would be likely, the vessel would need to be approaching significantly outside its normal line and at a point where the stern would normally be approximately 20 m from the desired berthing position.

3.16 **Stena T-class vessel** - As far as the T-Class vessel is concerned, it should be noted that the vessel operates with two main engines, two auxiliary engines (generators), two shaft generators, two bow thrusters and two anchors.

3.17 **Explanation of seamodes** – Applying the above to the practicality, for a normal crossing, the vessel will be running on both main engines and both the shaft generators will be feeding the main switchboard. If one of the main engines were to fail, the vessel will loose power on one half of the main switch board, but this will without delay be taken over by generator #1 or # 2 depending on which main engine fails. In other words, the vessel will lose half propulsion but there will be no blackout on other systems.

Examination

3.18 As part of the examination process for IERRT, ABP and stakeholders were requested by the ExA to consider whether further simulation work would enable a closer level of agreement on some of the navigational issues raised during examination.

3.19 As a consequence, ABP proposed a short study, held on 7 and 8 November 2023, to consider the following areas, focussing on areas of disagreement in the Issue Specific Hearings:

- The proximity of the Eastern Jetty in relation to the IEERT terminal, in particular during manoeuvres at IERRT berth 3;
- The effects of the current direction at IERRT berths 2 and 3; and
- The effect of the observed variation in the flow speed and direction in the main river area compared to HR Wallingford flow models for the same area.

3.20 Stakeholders raised several other areas for consideration in their responses to the invitation:

- Specific parameters for machinery use and abort procedures;
- Flows north of IOT should be set to 135 or 315 degrees true on the ebb and flood tide, respectively;
- Sensitivity testing of the outcomes to wind gusting and sheltering;
- Simulations conducted in as near to normal operating conditions as possible;

- Simulations with a Tug pontoon, moored tugs and a 185 m LOA MR2 tanker moored alongside the Eastern Jetty.
- Manoeuvring policy and procedures.

3.21 These issues were all addressed during the simulations. The stakeholders indicated that they were content with, or understood, the process and method in which they had been addressed. The runs demonstrated that a Stena Transit class vessel is able to operate safely and efficiently in normal operating conditions to IERRT berths 1, 2 and 3. Successful runs were also completed in selected extreme conditions.

3.22 Additionally, stakeholders raised further issues on which agreement was not reached during the simulations:

- The design vessel; and
- Discrepancy in the size of the pontoon from that originally simulated.

3.23 **Design vessel** - Paragraph 3.2.5 of Chapter 3 of the Applicant's Environmental Statement explains that *'The berthing facilities have been designed to handle vessels with a length overall (LOA) of 240 m, a breadth of 35 m, and a draught of up to 8 m'*. This has been mis-characterised by DFDS and the IOT Operators during the examination as being a set of fixed parameters for a future vessel that will operate at the IERRT. This is not the case. Rather, an envelope has been set to provide the parameters for the design of the IERRT infrastructure and to provide a robust envelope for the EIA. This was explained by the Applicant's representatives and HR Wallingford during the November simulations.

3.24 As explained by Mr Parr during ISH5, the Jinling vessel was considered appropriate to use in the simulations as it is a similar size in length and beam to the design parameters. A RoRo vessel with the exact dimensions of 240m x 35m x 8m does not exist in the HR Wallingford model. HR Wallingford require models to have been built and tested against real vessels to ensure the simulated manoeuvring capabilities accurately represent the vessel handling experienced in real life. Vessels used by HR Wallingford for the simulations are usually tested by pilots and masters so that there is a high level of confidence that the lessons from the simulations are reasonable.

3.25 Mr Parr explained that whilst it is possible to build a vessel which meets the criteria set out for the design of the infrastructure, there is no real-life RoRo vessel to truth-test the model against and HR Wallingford could be criticised for making the model more or less manoeuvrable. Therefore, the simulation model adopted provides a high level of confidence whilst applying conservatism.

3.26 **Pontoon size** – Following the identification that the pontoon layout and size used in the navigation simulations did not match that submitted in the DCO application, the opportunity was taken to review any changes to the flow with respect to previously observed accelerations around the pontoon structures during lower water levels.

3.27 The remodelled flows based on the larger pontoons indicate a subtle additional acceleration around the northern pontoon between the IERRT and IOT; this is apparent between low water and one hour after low water. The effect is to change a flow previously 310° at 1.3 knots to 315° at 1.5 knots.

3.28 Sensitivity analysis for manoeuvres at IOT 8 shows that this change does not affect departing vessels. Approaching vessels, however, are more challenging to operate in SW wind conditions at the current operating limit for the berth 26 knots (30 mph). The effect will be very limited in duration, for the first hour of strong flood tides and only in conditions which would already be deemed close to marginal for operations at the berth.

Proposed Changes

3.29 On 29 November 2023, a Change Request was submitted to the ExA to allow ABP to make a number of changes to the IERRT development proposal. In relation to navigation matters, Proposed Change 4 includes ‘enhanced operational marine controls and the provision for the possible inclusion of an additional impact barrier in front of the IOT finger pier’.

3.30 The barrier, if required to be installed, comprises a piled structure to protect the finger from potential vessel allision. The impact protection includes roller fenders to accommodate vessels sliding along the face of the berth before departure, and fendering to withstand an approaching vessel landing on the impact protection.

3.31 As a result of this change, further navigational simulations were completed to review whether the additional structures affect operations to and from the IOT finger pier. This was completed on 15 November 2023, and demonstrated that the new geometry does not affect operations to and from the IOT berths. It was noted, however, that the detailed design for the impact protection, if required in the future, will need to be subjected to further simulation studies in due course, as is always the case before new infrastructure becomes operational.

3.32 The effectiveness of tugs providing assistance to vessels which might suffer a total controls failure during an approach to IERRT was also simulated on 15 November 2023.

3.33 It was demonstrated that a single 50t Bollard Pull (BP) ASD tug will be an appropriate enhanced control measure to mitigate the risk of an allision with IOT infrastructure in the event of a Stena Transit Class vessel operating at IERRT Berth 1 in peak ebb flows with winds up to a mean 27.5 knots. It should be noted that this is on the basis that the vessel is following the approach guidelines provided by the SCNA, as is mandated on the Humber.

3.34 A sensitivity test using a vessel with a displacement of 46,000t indicates that 2 x 50tBP tugs would be required in similar conditions. This latter sensitivity test provides confidence that:

- A similar process can, in due course, be used for larger vessels that may be considered for operation at the berth.

- Enhanced control measures incorporating tugs that can be shown to be effective mitigations to protect IOT infrastructure.

Summary

3.35 In summary, extensive and repeated navigation simulations studies have been undertaken to support the development of the IERRT project. Indeed, the level of detail that been assessed goes beyond what would typically be expected for an equivalent port development. The more recent studies are more typical of what is undertaken immediately before new infrastructure becomes operational, with the objective of pilots and PECs training and operational readiness.

3.36 The simulation modelling that has been undertaken has repeatedly demonstrated the feasibility of operating IERRT safely and effectively for a full range of environmental and operational conditions.

4 Section 4 – Navigational Risk Review

4.1 This section of the report reviews the key navigational risks identified for the IERRT project in light of the evidence provided during the examination process.

4.2 The Applicant's NRA [APP-089] submitted as part of the IERRT DCO application is considered by the Applicant and its professional advisors ABPmer to be based on a robust assessment of navigational risk associated with the proposed IERRT development. A key element of the assessment was to consider the views of stakeholders with expertise and local knowledge of navigation at the Port of Immingham. A series of workshops were held with stakeholders to identify potential hazard scenarios, what might cause them to happen and how one might control or limit these causes. The NRA analysed the risks, which involved attributing risk outcomes (consequence and likelihood/frequency) to each risk in consultation with a diverse range of stakeholders and port users. This means that the outcomes of the assessment were based on the views of port stakeholders. The process also involved identifying ways to reduce risk by increasing safety and considering a wide range of potential controls. The Hazard Identification and Risk Analysis process adopted was in full compliance with the Port Marine Safety Code's Guide to Good Practice.

4.3 Further, the Applicant's NRA considered the identified risks against the appropriate standard of acceptability for the SHAs, the Harbour Authority and HASB's set 'tolerability' threshold. The controls identified for a hazard scenario were then considered, in consultation with the Humber Harbour Master and the Immingham Dock Master (amongst others), against the concepts of ALARP and 'tolerability'. This stage is known as Risk Assessment and in this instance was accompanied by a preliminary cost-benefit analysis assessment undertaken at a meeting convened to consider the issue (summarised in the Applicant's NRA). The NRA produced for the Applicant was intended to demonstrate to the Duty Holder, Designated Person, and SHAs that considerable effort and thought had been put into safely managing the risks identified by the stakeholders.

4.4 A review of and commentary on DFDS's alternative NRA [REP2-043] and the IOT Operators' alternative NRA [REP2-064] by ABPmer is provided at REP6-030 and REP6-031, respectively. Issues with the approach taken in those alternative NRAs have been highlighted, but of principal importance is the fact that engagement with wider port stakeholders is lacking and as a result the potential controls considered are limited. Furthermore, no consultation with or consideration for the SHA's tolerability means that any conclusion drawn from those alternative NRAs does not reflect the views of the SHA and simply represents the views of the authors of those alternative NRAs who are acting for the IPs who are objecting in isolation.

Note on COMAH

4.5 It is noted that during the course of the examination, issues have been raised by the IPs as to the operation of the IOT Operators' trunkway and finger pier in the context of COMAH. For the record, the Applicant's NRA fully considered the impact of the navigational risk to the IOT infrastructure as a COMAH site. The inclusion of the risk of allision with the IOT infrastructure is clearly addressed in the NRA, and the consequences (most likely and worst credible) recorded in the assessment reflect the fact that the IOT forms part of a COMAH site, in the context of navigational risk.

4.6 In the same context the NRA considered the impact to the wider operations/functions of the port from a marine navigation perspective by assessing the impact to:

- Port (wider port operations and associated functions);
- Property (infrastructure etc.);
- People (public, workers etc.); and
- Planet (environmental receptors).

4.7 Taking these assessments into account, it is clear to see that the NRA did indeed consider the wider impact on the port operations, including the consequences of impact on COMAH sites located within the port.

4.8 It should be noted, however, that the Applicant's NRA is not designed nor is it intended to assess Societal Risk and that is also the case for the Formal Risk Assessment (FRA) for Marine Operations which forms the backbone of the MSMS. This is the sole function of the COMAH Safety Plan owned and managed by the COMAH site operator.

4.9 The Applicant's NRA, therefore, identified, assessed, and proposed mitigation measures to ensure that the planned development does not have a significant impact on shipping and navigation receptors. The already implemented MSMS and underpinning FRA as outlined in the Port Marine Safety Code (PMSC), may be updated to reflect the information contained in the outcomes of the NRA. In turn the MSMS will feed into the wider port Safety Management System (SMS) and the wider port risk assessment and safety plans, which will include COMAH sites and the risks and mitigations that may arise following the assessment of the possibly changed navigational situation. It is then the responsibility of the COMAH site to undertake a societal risk assessment using HSE societal risk assessment methodology to ensure that the risks and consequences listed within the NRA are controlled to levels acceptable to maintain public safety as part of their legal requirement to hold a fully dynamic COMAH Safety Plan.

4.10 Each risk assessment area is unique and carries its own set of requirements and receptors, this is why navigation risk only focuses on navigational matters, marine risk covers wider marine functions, landside uses land-based assessments and COMAH sites focus on storage of hazardous substances and impact to public (societal), as required by law. In short, a risk assessment is only relevant for the area it is assessing, to assess using methods used for another area of risk assessment is inherently dangerous as this would apply incorrect assessment and could lead to neglecting to undertake the correct assessment by using data provided by the wrong process and/or methodology.

Review of key navigational risks

4.11 Despite the fundamental differences in approach between the Applicant's NRA and the alternative NRAs submitted by the IOT Operators and DFDS, the differences in terms of the results of the risk assessments (as opposed to the ultimate judgments) are limited. The principal risks that have been identified by the other IPs to be intolerable at the embedded control stage of the assessment are as follows:

- Allision of a Ro-Ro vessel with the IOT Trunkway;
- Allision of a Ro-Ro vessel with the Finger Pier; and
- Allision of a Ro-Ro vessel with the Eastern Jetty.

4.12 A detailed comparison of these risks compared with the Applicant's NRA is provided in REP6-030 and REP6-031. To inform the SHA's view on these risks in light of the views expressed by the IOT Operators and DFDS, the outcomes of the risks assessments (in terms of likelihood/frequency and consequence) are summarised below.

Allision of a Ro-Ro vessel with the IOT Trunkway

4.13 With respect to the risk of an allision of a Ro-Ro vessel with the IOT trunkway, the frequency and consequence outcomes of the Applicant's NRA, the IOT Operators' alternative NRA and the DFDS alternative NRA is provided in Table 1.

4.14 At the Embedded Control stage, (i.e., without any additional controls), the IOT, DFDS and the Applicant's NRA assess this risk as intolerable. This is based on the shared recognition that the consequences of the worst credible scenario if it were to occur would be 'extreme'/'major'/'catastrophic' and the likelihood of it occurring being 'possible' (Applicant's NRA), 'reasonably likely' (IOT NRA), or 'unlikely' (DFDS NRA).

4.15 To address this risk, each NRA included a similar set of Applied Controls, including berthing criteria, tug provision, and impact protection. In the case of the Applicant's NRA, the Applied Controls without impact protection were considered to make the risk both tolerable and ALARP. Impact protection measures were, therefore, only identified to be provided in the future if considered necessary as part of the *'project specific adaptive controls'*. Thus, if during the management of this risk in the future, either of the SHA's determines that (for example) to berth without tugs on an ebb tide would require impact protection as mitigation then this could be provided and the ability to provide such measures is included within the DCO application.

4.16 With these Applied Controls in place, the Applicant's NRA considers the worst credible scenario to be 'unlikely', and the consequence to be 'extreme' for all receptors. The IOT alternative NRA and DFDS alternative NRA similarly consider the frequency/likelihood to be 'unlikely' and 'remote' respectively, and the consequence to be 'serious' (less severe than that recorded in the Applicant's NRA). Following the Applied Controls, this risk is considered tolerable by all parties, noting that it is only the Applicant's NRA that applies the tolerability thresholds set by the SHAs/HASB who ultimately take responsibility for the risk.

4.17 In addressing why there are differences between the Applicant's NRA as to the risk being tolerable and ALARP with Applied Controls, one can note some important differences. For example, the 'causes' identified for this risk to occur (as identified in the Applicant's NRA based on the views of key stakeholders) include various causes which themselves are very unlikely to occur in a way that the incident itself would arise, such as 'anchors not clearing', 'inadequate number/type tugs', 'failure to comply with towage guidelines', 'adverse weather conditions', 'restricted visibility', 'incorrect assessment of tidal flow', 'vessel breakdown or malfunction', 'human error/fatigue', 'poor situational awareness', 'excessive vessel speed', 'inadequate bridge resource management', 'inadequate procedures in place onboard vessel', 'communication failure', and 'ship/tug/launch failure'. In order for this risk to occur (i.e., a Ro-Ro vessel alliding with the trunkway), a number, albeit not necessarily all, of these causes would have to materialise at the same time. For example, strong winds would have to be moving in a south easterly direction towards the IOT trunkway and there would have to be a fast-moving ebb tide. If a vessel experienced operational difficulties (for example, both independent engines break down and fail at the same time or an incorrect approach to the manoeuvre is adopted) and was unable to safely control the manoeuvre, it would still be the case that in order to allide with the IOT trunkway, the vessel would have to be aligned with the gap between the IERRT infrastructure and IOT finger pier (see paragraph below). At this point, a number of different circumstances would then have to come into play for the vessel to continue to move towards the IOT trunkway. For example, the tugs assisting the vessel would have to fail to arrest or control the vessel, the engines including the auxiliary engine would have to fail, and other potential control measures such as deployment of anchors would also have to prove ineffective. By any objective assessment, it would be reasonable to conclude that the combination of these causes for such an incident to occur are very unlikely given the Embedded Controls that already exist and are implemented at the Port, as well as the Applied Controls specified for the IERRT project.

4.18 Navigational simulations (see Section 3) support the conclusion of the unlikelihood of this risk manifesting itself following the implementation of Applied Controls. During the simulations in December 2022, it was shown that to develop a scenario in which a Ro-Ro vessel could contact the IOT trunkway, the vessel would need to be approaching significantly outside its normal line and at a point where the stern would be approximately 20 m from the desired berthing position in addition to all of the other failures that would be necessary. In this regard, the IERRT infrastructure offers protection to the IOT trunkway as it provides protection and reduces the existing level of risk of allision at the Port (which, incidentally, is currently deemed tolerable by the IOT Operators). It should also be noted that during the two runs that simulated vessel breakdowns, the vessel was also stopped within 100 m of the position where the breakdown was initiated by deploying its anchor.

4.19 Furthermore, simulations undertaken in November 2023 demonstrate that tug assistance is sufficient to safely prevent a Transit class vessel, even assuming a full control failure during operations to IERRT, from alliding with or posing a hazard to any IOT infrastructure. The application of tugs is, therefore, considered by the Applicant's professional advisors, to be an appropriate and effective control measure to mitigate the risk of an allision with the IOT infrastructure even further. It is considered that the navigational simulations undertaken, therefore, support the conclusions drawn originally in the Applicant's NRA, and the frequency and consequence attributed to this risk after the Applied Controls are considered to be conservative.

4.20 The Applicant has committed to the provision of enhanced operational marine controls, as detailed as part of Proposed Change 4 in a Change Request submitted to the ExA on 29 November 2023, that proposed change having been accepted for examination by the ExA on 6 December 2023. This includes the provision of tugs for vessels arriving at IERRT Berth 1 that would not normally be considered necessary in certain conditions, which would serve to further reduce the risk to a level considered beyond ALARP.

Table 1. Allision of a Ro-Ro vessel with the IOT Trunkway – comparison of assessment between Applicant, DFDS and IOT Operators

NRA	Embedded control stage		Embedded and Applied control stage	
	Frequency	Consequence	Frequency	Consequence
Worst credible				
Applicant	Possible (i.e., the impact of the hazard could very well occur, but it also may not (within the lifetime of the entity))	People – Multiple fatalities Property – Major, more than £8 million Planet – Major Port – Major, loss of revenue more than £8 million	Unlikely (i.e., the impact of the hazard might occur but is unlikely (within the lifetime of the entity))	People – Multiple fatalities Property – Major, more than £8 million Planet – Major Port – Major, loss of revenue more than £8 million
DFDS	Unlikely (i.e., an event that could be expected to occur once in 1,000 years)	People - Multiple fatalities Property - Major, more than £8 million; Planet - Major; Port – Major, loss of revenue more than £8 million.	Remote (i.e., an event that could be expected to occur once in > 1,000 years)	People – Serious injury Property – Serious, £4 million to £8 million Planet – Minor Port – Serious, loss of revenue more than £4 million
IOT	Reasonably likely (i.e., 1 in 10,000 to 1 in 100 chance per year)	People - Many fatalities Property – Catastrophic, >£10M; Planet – Catastrophic Port - Serious disruption to operations to port / ship register >£10million	Unlikely (i.e., 1 in 1,000,000 to 1 in 10,000 chance per year)	People – Serious injury Property – Major, £1 million to £10 million Planet – Major Port – prolonged closure or restrictions to port / ship register £1million - £10million.

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NRA	Embedded control stage		Embedded and Applied control stage	
	Frequency	Consequence	Frequency	Consequence
Most likely				
Applicant	Possible (i.e., the impact of the hazard could very well occur, but it also may not (within the lifetime of the entity))	People – Single fatality Property – Major, more than £8 million Planet – Major Port – Major, loss of revenue more than £8 million	Unlikely (i.e., the impact of the hazard might occur but is unlikely (within the lifetime of the entity))	People – Single fatality Property – Major, more than £8 million Planet – Major Port – Major, loss of revenue more than £8 million
DFDS	Possible (i.e., an event that could be expected to occur once in 100 years)	People – Single fatality Property – Major, more than £8 million Planet – Major Port – Major, loss of revenue more than £8 million	Unlikely (i.e., an event that could be expected to occur once in 1,000 years)	People – Serious injury Property – Moderate, £750k to £4 million Planet – No measurable impact Port – Moderate, loss of revenue £750k to £4 million
IOT	Not assessed	Not assessed	Not assessed	Not assessed

Allision of a Ro-Ro vessel with the IOT Finger Pier

4.21 With respect to the risk of an allision of a Ro-Ro vessel with the IOT finger pier, the frequency and consequence outcomes of the Applicant's NRA, the IOT Operators NRA, and the DFDS NRA is provided in Table 2.

4.22 At the Embedded Control stage, (i.e., without any additional Applied Controls) the IOT and DFDS alternative NRAs assess this risk as intolerable. All three NRAs consider the consequences of the worst credible scenario to be 'extreme'/'catastrophic', and differences expressing in the likelihood of it occurring being 'unlikely' (Applicant's NRA), 'unlikely' (DFDS alternative NRA), or 'reasonably likely' (IOT alternative NRA).

4.23 To address this risk, each NRA included a similar set of Applied Controls, including berthing criteria and tug provision. With these Applied Controls, the Applicant's NRA identifies this risk as tolerable and ALARP based on a worst credible scenario considered to be 'rare' and of 'moderate' consequence. The IOT alternative NRA and DFDS alternative NRA also included the relocation of the finger the pier as an Applied Control in order for the risk to be considered tolerable and ALARP. The Applicant considers this measure too onerous and not reasonably practicable in the context of the other controls applied (see below) and the Applicant's NRA considers the risk to be tolerable and ALARP.

4.24 As explained for the risk of allision with IOT trunkway above, it should be noted that the 'causes' identified for this risk actually to occur (as identified in the Applicant's NRA based on the views of key stakeholders) include the existence or conjunction of various causes which themselves are extremely unlikely to occur in such a way that the incident itself could actually arise, such as 'adverse weather conditions', incorrect assessment of tidal flow', 'restricted visibility', 'inadequate bridge resource management', 'failure to follow passage plan', 'inadequate procedures in place onboard vessel', 'manoeuvre misjudged', 'vessel breakdown or malfunction, 'ship/tug/launch failure', 'failure to comply with towage guidelines', 'inadequate number/type tugs', 'interaction with passing vessel', 'poor situational awareness', 'communication failure', 'excessive vessel speed', and 'human error/fatigue'.

4.25 By the application of objective assessment, it is considered reasonable to conclude that these causes are very unlikely to occur given the Embedded Controls that already exist and are implemented at the Port, as well as the Applied Controls specified for the IERRT project.

4.26 Navigational simulations support the conclusion of this risk being unlikely to occur following the implementation of Applied Controls (see Section 3). During the simulations undertaken between December 2021 and December 2022, it was repeatedly demonstrated that manoeuvres to and from the IERRT berths in challenging tidal flows and concurrent winds can be undertaken safely. It was also shown that navigation to and from the berths on the IOT finger pier will not be adversely affected by the proposed size and location of the new IERRT infrastructure (noting that current manoeuvring procedures will need to be updated to account for the new

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IERRT infrastructure – as is normal practice). This was completed for eight different vessel models.

4.27 Furthermore, simulations undertaken in November 2023 demonstrate that tug assistance would be sufficient to safely prevent a Transit class vessel, with a full control failure – which is of itself considered to be highly unlikely - during operations to IERRT, from alliding with or posing a hazard to any IOT infrastructure. The application of tugs has been shown to be an appropriate and effective control measure to mitigate risk of an allision with the IOT infrastructure even further. It is considered that the navigational simulations undertaken support the conclusions drawn in the Applicant's NRA.

4.28 The Applicant has also committed in principle to enhanced operational marine controls, as detailed as part of Proposed Change 4 in a Change Request submitted to the Planning Inspectorate on 29 November 2023 even though it had already identified the risk as tolerable and ALARP, thereby providing an enhanced level of safety. This now includes the provision of tugs for vessels arriving at IERRT Berth 1 that would not otherwise be considered necessary to make the risk tolerable and ALARP, which would serve to further reduce any residual risk. Change 4 also includes additional impact protection measures to the end of the IOT finger pier, which can be provided in the future if required – although such measures are not considered to be required to make the risk tolerable and ALARP. Thus, for example, if, during the management of this risk in the future, either of the SHA's determines that (for example) to berth without tugs on an ebb tide would require impact protection as mitigation then this is now included within the DCO application following the ExA's decision to accept the Applicant's proposed changes as noted above.

Table 2. Allision of a Ro-Ro vessel with the IOT Finger Pier – comparison of assessment between Applicant, DFDS and IOT Operators

NRA	Embedded control stage		Embedded and Applied control stage	
	Frequency	Consequence	Frequency	Consequence
Worst credible				
Applicant	Unlikely (i.e., the impact of the hazard might occur but is unlikely (within the lifetime of the entity))	People – Multiple fatalities Property – Major, more than £8 million Planet – Major Port – Major, loss of revenue more than £8 million	Rare (i.e., the impact of the hazard is realised but should very rarely occur (within the lifetime of the entity))	People – Serious injury Property – Serious, £4 million to £8 million Planet – Minor Port – Moderate, £750k to £4 million
DFDS	Unlikely (i.e., an event that could be expected to occur once in 1,000 years)	People - Multiple fatalities Property - Major, more than £8 million; Planet - Major; Port – Major, loss of revenue more than £8 million	Remote (i.e., an event that could be expected to occur once in > 1,000 years)	People - Multiple fatalities Property - Major, more than £8 million; Planet - Major; Port – Major, loss of revenue more than £8 million
IOT	Reasonably likely (i.e., 1 in 10,000 to 1 in 100 chance per year)	People - Many fatalities Property – Catastrophic, >£10M; Planet – Catastrophic Port - Serious disruption to operations to port / ship register >£10million	Unlikely (i.e., 1 in 1,000,000 to 1 in 10,000 chance per year)	People – One/few fatalities Property – Major, £1 million to £10 million Planet – Serious Port – temporary suspension of activities at port / ship register £100k to £1million

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NRA	Embedded control stage		Embedded and Applied control stage	
	Frequency	Consequence	Frequency	Consequence
Most likely				
Applicant	Possible (i.e., the impact of the hazard could very well occur, but it also may not (within the lifetime of the entity))	People – Serious injury Property – Serious, £4 million to £8 million Planet – Major Port – Serious, loss of revenue £4 million to £8 million	Unlikely (i.e., the impact of the hazard might occur but is unlikely (within the lifetime of the entity))	People – Minor injury Property – Moderate, £750k to £4 million Planet – Significant Port – Minor, loss of revenue £0 to £750k
DFDS	Likely (i.e., an event that could be expected to occur once in 10 years)	People – Serious injury Property – Serious, £4 million to £8 million Planet – Significant Port – Serious, loss of revenue £4 million to £8 million	Possible (i.e., an event that could be expected to occur once in 100 years)	People – Serious injury Property – Serious, £4 million to £8 million Planet – Significant Port – Serious, £4 million to £8 million
IOT	Not assessed	Not assessed	Not assessed	Not assessed

Allision of a Ro-Ro vessel with the Eastern Jetty

4.29 With respect to the risk of an allision of a Ro-Ro vessel with the Eastern Jetty, the frequency and consequence outcomes of the Applicant's NRA, and the DFDS NRA is provided in Table 3. The IOT Operators NRA did not assess this risk.

4.30 There is a good degree of alignment between the Applicant's NRA and the DFDS NRA on the perceived consequences of this risk if it were to occur (both for the most likely and worst credible scenarios), both recording the worst credible outcome as of 'extreme'/'major' consequence. Although a direct comparison cannot be made between the two likelihood/frequency scales, due to the use of alternative descriptors, the two organisations broadly consider this risk as 'unlikely' to occur. At the Embedded Control stage, the DFDS NRA assesses this risk as intolerable.

Moreover, both NRAs consider the risk tolerable and ALARP with Applied Controls in place. Similar Applied Controls are identified in each assessment (taken forward in the Applicant's NRA as berthing criteria, charted safety area, berthing procedures, and additional pilotage training/ familiarisation; taken forward in the DFDS NRA as berthing/unberthing criteria, standby tug provision, and deconfliction plan).

4.31 Navigational simulations support the conclusion that this risk is unlikely to occur or rare following the implementation of Applied Controls (see Section 3). As a result of discussions held during the examination, further stakeholder demonstrations were held in November 2023, these further tested manoeuvres to IERRT berths 2 and 3, including with a tug pontoon/berth, moored tugs and a tanker moored alongside the Eastern Jetty. As had been concluded in previous navigation simulations, the runs demonstrated that vessels are able to operate safely and efficiently in normal operating conditions to IERRT berths 1, 2 and 3. Successful runs were also completed in selected extreme conditions. Both the Applicant and DFDS have identified and agreed that a further control should include berthing criteria. These criteria will be informed, as part of the normal process operational within the port, from ongoing simulation studies and/or berthing trials, before becoming part of the evolving MSMS.

4.32 In addition, simulations undertaken in November 2023 have demonstrated that tug assistance is sufficient to arrest and control a Transit class vessel, with a full control failure during operations to IERRT. The application of tugs has, therefore, been shown to be an appropriate and effective control measure to mitigate the risk of an allision with port infrastructure. It is considered that the navigational simulations undertaken fully support the conclusions drawn in the Applicant's NRA.

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Table 3. Allision of a Ro-Ro vessel with the Eastern Jetty – comparison of assessment between Applicant, DFDS and IOT Operators

NRA	Embedded control stage		Embedded and Applied control stage	
	Frequency	Consequence	Frequency	Consequence
Worst credible				
Applicant	Unlikely (i.e., the impact of the hazard might occur but is unlikely (within the lifetime of the entity))	People – Multiple fatalities Property – Major, more than £8 million Planet – Major Port – Major, loss of revenue more than £8 million	Rare (i.e., the impact of the hazard is realised but should very rarely occur (within the lifetime of the entity))	People – Multiple fatalities Property – Major, more than £8 million Planet – Major Port – Major, loss of revenue more than £8 million
DFDS	Unlikely (i.e., an event that could be expected to occur once in 1,000 years)	People - Multiple fatalities Property - Major, more than £8 million; Planet - Major; Port – Major, loss of revenue more than £8 million	Remote (i.e., an event that could be expected to occur once in > 1,000 years)	People - Multiple fatalities Property - Major, more than £8 million; Planet - Major; Port – Major, loss of revenue more than £8 million
IOT	Not assessed	Not assessed	Not assessed	Not assessed
Most likely				
Applicant	Possible (i.e., the impact of the hazard could very well occur, but it also may not (within the lifetime of the entity))	People – Serious injury Property – Moderate, £750k to £4 million Planet – Major Port – Serious, loss of revenue £4 million to £8 million	Unlikely (i.e., the impact of the hazard might occur but is unlikely (within the lifetime of the entity))	People – Serious injury Property – Moderate, £750k to £4 million Planet – Significant Port – Serious, £4 million to £8 million

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NRA	Embedded control stage		Embedded and Applied control stage	
	Frequency	Consequence	Frequency	Consequence
DFDS	Likely (i.e., an event that could be expected to occur once in 10 years)	People – Serious injury Property – Moderate, £750k to £4 million Planet – Major Port – Serious, loss of revenue £4 million to £8 million	Possible (i.e., an event that could be expected to occur once in 100 years)	People – Serious injury Property – Moderate, £750k to £4 million Planet – Significant Port – Serious, £4 million to £8 million
IOT	Not assessed	Not assessed	Not assessed	Not assessed

Risk review summary

4.33 As noted above, the conclusions reached in the Applicant's NRA are based on the views of key stakeholders, including the Humber Harbour Master and the Immingham Dock Master (amongst others). The outcomes of the assessment are supported by the ongoing navigation simulation work that has been undertaken to support the IERRT project.

4.34 Whilst the risk assessment outcomes of each of the NRAs are broadly similar, the main difference between the alternative NRAs produced by IOT Operators and DFDS and the Applicant's NRA is the judgments made with regard to the "tolerability" of the assessed risks - in that the alternative NRAs do not apply the same tolerability thresholds as it is believed are required and applied by the SHA.

Cost-benefit analysis

4.35 The IERRT NRA approved by the HASB in December 2022, concluded that the risks assessed through the NRA process, following the implementation of both the Embedded and Applied Controls, were tolerable and 'as low as reasonably practicable' (ALARP), as required by the Port Marine Safety Code.

4.36 Whilst this remains the position of the IERRT project team, the project team has continued to engage with IPs (principally the IOT Operators and DFDS) during the course of the examination, in an effort to address their residual concerns regarding navigational safety of the proposed IERRT development.

4.37 As noted in the preceding sections of this report, three principal risks have been identified by the other IPs as intolerable at the embedded control stage of the assessment:

- Allision of a Ro-Ro vessel with the IOT Trunkway;
- Allision of a Ro-Ro vessel with the Finger Pier; and
- Allision of a Ro-Ro vessel with the Eastern Jetty.

4.38 Of these three risks, the IOT Operators have identified the need for additional control measures to reduce the risk of allision of a Ro-Ro vessel with the IOT trunkway and the finger pier to tolerable and ALARP, in the form of impact protection structures and finger pier relocation respectively.

4.39 An analysis of the anticipated costs as well as the associated benefits of both the Further Applicable Controls and Applied Controls taken forward by the Applicant has been undertaken and is provided below. A summary of this analysis is provided in Table 4.

4.40 Although focused on the process for formal risk assessment (FRA) for marine operations, the PMSC 2016 section 2.7 'Use Formal Risk Assessment' states:

4.41 *The risks associated with marine operations need to be assessed and a means of controlling them needs to be deployed. The aim of this process is to eliminate the risk or, failing that, to reduce risks as low as reasonably practicable. Formal risk assessments should be used to:*

- *Identify hazards and analyse risks;*
- *Assess those risks against an appropriate standard of acceptability; and*
- *Where appropriate consider a cost-benefit assessment of risk-reduction measures.*

4.42 The text from the PMSC carries over to the Guide to Good Practice for Port Marine Operations 2018 (GtGP). Both the PMSC and GtGP do not provide any further guidance on cost benefit analysis or prescribe a method of approach.

4.43 In the absence of a prescribed method, the following cost-benefit analysis principles have been applied:

- Costs and benefits are only monetised where there is a clear and appropriate methodology to do so. This is to make the outputs of the assessment as straightforward as possible to interpret;
- Any costs and benefits that are not monetised are still taken into consideration and are described in a qualitative manner; and
- The assessment considers the design life of the IERRT development (50 years).

Summary of Existing and Applied Controls

4.44 When assessing the potential impacts of including any further applicable controls, it is important to ensure the baseline of Embedded and proposed Applied Controls are fully understood. The extensive Embedded Controls, that safely manage tens of thousands of movements on the River Humber each year include measures as Vessel Traffic Services (VTS), Pilotage, weather limits, towage availability, training and port contingency planning. A full list of the Embedded Controls are listed in Tables 24, 25 and 26 of the Applicant's NRA [APP-089].

4.45 In addition to the extensive Embedded Controls that apply to marine operations on the Humber, a number of further applicable controls were considered during the Risk Assessment process, and captured as Applied Controls for those taken forward, as set out in Table 32 of the Applicant's NRA (updated version provided at Deadline 7).

Provision of impact protection measures to the IOT trunk way

4.46 In addition to the significant number of Embedded Controls that will apply, the Applicant's NRA identified both '*Specific berthing criteria for each of the three berths*' and '*Project specific adaptive procedures*' as further Applied Controls to be applied during the operation of IERRT to address the risk of allision of an IERRT RoRo vessel with the IOT trunkway. This includes adaptive procedures during a familiarisation period as operational experience is gained (e.g., tugs, tidal restrictions, delayed start of use of Berth 1 during a familiarisation period) and tidal limits for tug use applied to each berth. The application of these further Applied Controls reduces both the frequency (considerable) and consequence (fair) of the Worst Credible and Most Likely risk scenarios.

4.47 In order to illustrate the benefit of the proposed Applied Controls to key stakeholders, the proposed operational control measures to apply to IERRT were defined in the Applicant's Change Application, accepted into the examination on 06 December 2023. This included provision for a minimum of one tug forward on all arrivals to Berth 1. To illustrate the effectiveness of this Applied Control, further navigational simulations were undertaken by HR Wallingford in November 2023 (see Section 3). These simulations demonstrated that a single 50t Bollard Pull ASD tug was able to arrest a Stena Transit Class vessel operating at IERRT Berth 1 in peak ebb flows with winds up to a mean of 27.5 knots.

4.48 The costs associated with the provision of the proposed Applied Controls (incremental tug provision above that expected for similar vessels and operations on the Humber) have been assessed and are anticipated to be in the order of £200,000 to £300,000 per year, or the equivalent of up to a maximum of 200 additional tug movements annually. As an indication, the net present value of an annual operating expenses or expenditure (OpEx) spend of £300,000 per year over 50 years (assuming a discount cash flow rate of 8% real) is approximately £3.7 million.

4.49 The future provision of physical impact protection measures to the trunkway was considered and adopted within the Applicant's NRA. This is captured as an Applied Control in the Applicant's NRA as a '*project specific adaptive procedure'*. The cost of providing physical impact protection to the trunkway is estimated to be between £6 million and £12 million, and as stated in the IOT Operators' own NRA, this has a low cost/benefit ratio for low energy strikes (defined as 2 knots speed).

4.50 Whilst the future provision of physical impact protection has not been discounted from the Applicant's NRA, it is important to note that the provision of tugs as an Applied Control measure does not only mitigate risk to the IOT trunk way. The identified Applied Controls also contribute to the mitigation of risks to a number of other receptors including the IOT's finger pier, the IOT's main berths and the Eastern Jetty. It is, therefore, considered that the benefits of the use of tugs far outweighs the rather narrow benefit provided by a physical impact protection structure protecting the IOT trunk way.

4.51 It is, therefore, considered only to be necessary to install a physical impact protection structure to protect the IOT trunk way if there if the proposed Applied Controls that will limit or eliminate vessel approach speeds (e.g., the use of tugs during ebb arrivals to Berth 1) were to be removed.

4.52 This position is fully in accordance with the conclusion reached through the IERRT NRA process and has only been strengthened by the recent navigational simulations of the enhanced operational controls undertaken in November 2023. Through these simulations the application of tugs has been demonstrated to be an appropriate and effective Applied Control measure to further mitigate the risk of an allision with the IOT infrastructure to ALARP. The navigational simulations undertaken confirm the conclusions drawn in the Applicant's NRA and indicate that the Applicant's NRA is conservative in the benefits (reduction in frequency and consequence) attributed to the proposed Applied Controls.

Relocation of the IOT finger pier

4.53 As identified above with respect to the IOT trunkway, the Applicant's NRA identified Applied Controls for the risk of allision of an IERRT RoRo vessel with the IOT finger pier, consisting of '*Specific berthing criteria for each of the three berths'*, and '*Project specific adaptive procedures'*. As summarised in Section 3 of this report, the application of specific berthing criteria and the subsequent navigational modelling have together demonstrated the effectiveness of the proposed Applied Controls in relation to mitigating the risk of allision between an IERRT RoRo vessel and the IOT infrastructure.

4.54 Of all the potential controls identified during the extensive HAZID and Risk Assessment process that informed the Applicant's NRA, the only Further Applicable Control not taken forwards on the basis of a cost / benefit evaluation was the relocation of the IOT finger pier.

4.55 The relocation of the IOT finger pier was considered during the Cost Benefit Analysis meeting of 06 October 2022. At the time it was estimated that the reconstruction of the IOT finger pier would likely cost in the order of £35 million. In September 2023, an alternative proposal to the full relocation was put forward by the IOT Operators (the Beckett Rankine scheme). This involved extending the existing IOT finger pier and the construction of impact protection structures of significant size. The impacts of the design developed to meet the IOT Operators requirements are summarised in the submitted Change Request, allowed by the ExA on 6th December 2023. These included significant environmental, operational, and economic impacts and the cost of providing the infrastructure identified has been estimated to be approximately £35 million, equivalent to the estimated cost of relocating the IOT finger pier.

4.56 These cost estimates exclude the significant environmental impact and consequential mitigation costs associated with a construction of this nature and do not account for operational costs associated with any shutdown windows required for the decommissioning and recommissioning of the IOT finger pier. It is, therefore, anticipated that they represent a lower bound estimate of the potential cost of relocating or extending the IOT finger pier.

4.57 The benefits of this specific further applicable control must be considered in the context of the existing operational baseline at the Port of Immingham. Given the Embedded and Applied Controls that are adopted to manage the day-to-day risk of the business-as-usual operations within the Port of Immingham, the impacts and costs that are associated with the relocation of the IOT finger pier far outweigh the benefits. There is an existing risk associated with vessels arriving and departing from all operational berths within the Port of Immingham that is managed by existing Embedded Controls, such that operation safely occur, with risks managed to be tolerable and ALARP.

4.58 Given the efficacy that has been demonstrated of the Applied Controls proposed in the Applicant's NRA, the benefits of relocating the IOT finger pier are considered marginal and are considered to be neither proportional nor practicable to be delivered. This position is in line with the IOT Operators' NRA, which states that the relocation of the finger pier (at a stated cost of £25 million) has a cost-benefit ratio of less than 1 (0.46) for low energy strikes (defined as a 2 knot impact speed). This clearly illustrates the principal that it is far more effective from a cost-benefit perspective to reduce the frequency and consequence of a potential collision through controlling or eliminating the approach speed of a vessel (through tug usage), rather than relying on physical impact protection structures, which come at a significant capital and environmental cost.

4.59 In addition to the provision of tugs, captured as '*Specific berthing criteria for each of the three berths'*, a '*Project specific adaptive procedures*' of an impact protection structure to the IOT finger pier has also been considered and captured within the Change Request which the ExA have now allowed as part of the examination process. The basis for the provision of this '*Project specific adaptive procedures'* is to facilitate the possible future introduction of an operational window (e.g., when an ebb tide is less than 2.5 knots) for the removal of the proposed tugs for Berth 1. The basis of the design of the impact structure has therefore been defined to arrest the Stena Transit Class vessel travelling at 2.5 knots, as this reflects the upper limit of current speed, above which tugs would be employed during berthing operations.

4.60 The provision of an additional impact protection structure to the IOT finger pier would be expected to reduce the consequence of a vessel impact, when berthing without tug support. The cost of the additional impact protection structure has been estimated at between £10 million to £15 million, or approximately 10% of the overall currently projected capital cost of the project. Due to the efficacy of the proposed Applied Controls (specific berthing criteria and tug usage) which have been shown to fully arrest a vessel in the event of a total engine failure of both engines during an ebb tide, any additional benefit of implementing a vessel impact protection structure is considered marginal.

4.61 This assessment is in line with the IOT Operator's NRA, which states '*Impact protection is deemed to be of modest effectiveness against low speed impacts given that the potential damage from such an event is low.*' It is, therefore, considered entirely appropriate and reasonable to rely on additional tug usage to limit or eliminate vessel approach speeds in all conditions, and only rely on impact protection structures if the operational controls are relaxed in the future.

Conclusion of cost-benefit analysis

4.62 Based on the above analysis, the implementation of Enhanced Operational Controls from the start of operations (as advised in the IERRT NRA), whilst maintaining the ability to implement physical impact protection structures in the future if deemed necessary following a relaxation of the defined Applied Controls (enhanced tug usage) is considered to be entirely proportionate and reasonable in the context of ongoing marine operations at the Port. On this basis, risks associated with IERRT are considered tolerable and ALARP – as was determined by the Duty Holder at the meeting of the HASB on 12th December 2022 and reaffirmed by the Duty Holder at the meeting of the HASB on Friday 8th December.

Table 4. Summary of cost benefit analysis

Control	Relevant NRA Risks	Control Cost (£m)	Environmental Impact
Enhanced Operational Marine Control (minimum of one tug for every Berth 1 ebb tide arrival) - as part of the Project Specific Adaptive Procedures	1. Allision of a Ro-Ro vessel with the IOT Trunkway (NRA Risk ID O4) 2. Allision of a Ro-Ro vessel with the Finger Pier (NRA Risk ID O1); 3. Allision of a Ro-Ro vessel with the Eastern Jetty (NRA Risk ID O9).	£3.7m* *Considering upper bound value of £0.3m/annum for 50-year design life (discount cash flow)	This control has been fully assessed in the Applicant's ES. The overall impact is negligible when compared with existing environmental baseline whereby Embedded Controls apply to tens of thousands of vessel movement per annum.
Implementation of trunkway and finger pier impact protection measures (on basis these are deemed to be required by SHA) and a tug for Berth 1 arrivals in tidal conditions >2.5 knots – as part of Project Specific Adaptive Procedures	1. Allision of a Ro-Ro vessel with the IOT Trunkway (NRA Risk ID O4) 2. Allision of a Ro-Ro vessel with the Finger Pier (NRA Risk ID O1); 3. Allision of a Ro-Ro vessel with the Eastern Jetty (NRA Risk ID O9).	£1.2m* (tugs >2.5 knots Berth 1 ebb arrivals) + £10-15m (finger pier IP) + £6-12m (trunkway IP) (£17.2-£28.2m)** *Considering value of £0.1m/annum for 50-year design life (discount cash flow) **Does not capture costs associated with site investigations, ongoing inspection and maintenance costs, operational costs associated with any shutdown windows required for construction	This control has been fully assessed in the Applicant's ES. The key impact pathways include direct habitat loss from piled foundations and indirect habitat loss due to hydrology changes, noise and vibration during construction. Overall, the impacts have been assessed to be insignificant.

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Control	Relevant NRA Risks	Control Cost (£m)	Environmental Impact
Relocation of Finger Pier	2. Allision of a Ro-Ro vessel with the Finger Pier (NRA Risk ID O1);	£35m* *Does not capture costs associated with enabling works, such as structural inspections and assessments of the existing finger pier and topside infrastructure, site investigations, ongoing inspection and maintenance costs, operational costs associated with any shutdown windows required for the decommissioning and recommissioning of the IOT Finger Pier	This control has a greater environmental impact. For example, there will be increased direct habitat loss from piled foundations, changes in physical processes, increased noise and vibration and impacts associated with increased construction materials across the decommissioning and construction activities.
Beckett Rankine Scheme (developed further by the Applicant)	1. Allision of a Ro-Ro vessel with the IOT Trunkway (NRA Risk ID O4) 2. Allision of a Ro-Ro vessel with the Finger Pier (NRA Risk ID O1);	£35m* *Does not capture costs associated with enabling works, such as structural inspections and assessments of the existing finger pier and topside infrastructure, site investigations, ongoing inspection and maintenance costs, operational costs associated with any shutdown windows required for the decommissioning and recommissioning of the IOT Finger Pier	Significantly greater environmental impact arising from the direct habitat loss from caisson / cofferdam footprint (10x greater subtidal loss) as well as changes in physical processes, increased noise and vibration and impacts associated with increased construction materials across the decommissioning and construction activities. Substantial additional dredging volumes to be disposed of.

Control	Relevant NRA Risks	Control Cost (£m)	Environmental Impact
Trunkway impact protection	1. Allision of a Ro-Ro vessel with the IOT Trunkway (NRA Risk ID O4)	£6-12m* *Does not capture costs associated with site investigations, ongoing inspection and maintenance costs.	This control has been fully assessed in the Applicant's ES. The key impact pathways include direct habitat loss from piled foundations and indirect habitat loss due to hydrology changes, noise and vibration during construction. Overall, the impacts have been assessed to be insignificant.

5 Section 5 – Conclusions

5.1 This report collates the key information in respect of navigational issues and identifies the key matters that have arisen during the course of the IERRT examination. In light of the information provided in this report, it is considered that the risks associated with the IERRT development, taking account of mitigation are tolerable and ALARP.

5.2 The earlier decision in this respect taken by the Duty Holder at the meeting of the HASB on 12 December 2022 was reaffirmed in light of the additional documentation/information provided in this Supplementary Navigation Information Report and restructured NRA at the meeting of the HASB of Friday 8th December 2023.

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Appendices

Appendix A – Alternative Navigational Risk Assessment provided by Immingham Oil Terminal (IOT) Operators

IMMINGHAM EASTERN RO-RO TERMINAL NAVIGATION RISK ASSESSMENT

Immingham Oil Terminal Shipping and Navigation Support

Associated Petroleum Terminals (Immingham) Ltd

Document No: 22-NASH-0243-200 | R03-00

05-Sep-23

PROJECT INFORMATION

REPORT TITLE	Immingham Eastern Ro-Ro Terminal Navigation Risk Assessment
PROJECT TITLE	Immingham Oil Terminal Shipping and Navigation Support
CLIENT	Associated Petroleum Terminals (Immingham) Ltd
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EXECUTIVE SUMMARY

1. NASH Maritime Ltd have been contracted by Associated Petroleum Terminals (Immingham) Ltd operators of the Immingham Oil Terminal (IOT) to provide Shipping and Navigation subject matter expertise for the Immingham Eastern Ro-Ro Terminal (IERRT) Development which is proposed to be sited adjacent to the IOT and is being developed by Associated British Ports (ABP).
2. In relation to the proposed IERRT development then IOT is a piece of critical national infrastructure, and the Humber and Lindsey Oil Refineries account for 27% of the UK's refining capacity. Their operations are dependent upon the continued and safe operation of the: IOT river berths, IOT Finger Pier and IOT Trunkway flowing product from and to vessels and the refineries.
3. Due to the amount and type of product handled the IOT is classified as an Upper Tier site under the Control of Major Accident Hazards (COMAH) Regulations.
4. The IOT Operators have serious concerns with the shipping and navigation effects of the proposed IERRT Development which they do not consider have been adequately addressed by ABP as IERRT developers, particularly in relation to the adequacy of the IERRT Navigational Risk Assessment and the navigation safety effects on the IOT during both the construction and operational phases of the IERRT Development. These concerns, (see **Section 2**) have been raised with ABP but have yet to be satisfactorily addressed and relate to:
    a. A lack of clarity as to the NRA methodology, specifically how guidance documents and policies are used in the NRA and how the NRA meets the requirements of the named guidance and policies.
    b. Ambiguity as to why different AIS data sources were provided for the NRA than were provided for the HAZID workshops with stakeholders and a lack of quality checks having been undertaken for the IERRT NRA AIS data.
    c. Inaccuracies, overlooked key information and insufficient analysis within the description of the navigation baseline.
    d. A lack of clear definition of the proposed marine operations for IERRT.
    e. The absence of a future baseline specific to the berths at and around the IERRT.
    f. Concerns with the risk assessment methodology, particularly in relation to the lack of definition of likelihood parameters (which are entirely subjective in nature) and the calibration or risk appetite levels.
    g. The inclusion of insufficiently defined and overlapping additional risk controls that are either very similar to each other or very similar to embedded risk control measures (i.e., those measures that are already currently in place for the management of navigation risk in the area).
    h. An absence of detail describing the methodology, process used and outcomes of the Cost Benefit Analysis exercise, including the anticipated costs (quantitatively, or even qualitatively) and how these have been used to determine what could be considered appropriate.
5. IOT Berths 8 and 9, located to the south of the IOT Finger Pier are capable of handling vessels of 104m and 61m LOA respectively. Whilst smaller than the vessels on the main

river berths (which can be in excess of 300m), they are critical to the operation of the IOT and associated refiners handling refined products destined for England and Scotland. Access to Berth 8 is restricted to the flood tide only, requiring the ship's Master to balance the effects of wind and tide, and tankers may require the assistance of a workboat and/or tug to berth safely.

6. If developed, the IERRT would be a major 24hr 7 days a week Roll on – Roll Off ferry terminal with three berths handling vessels up to 240m LOA and with a beam of 35m. It is not clear what the detailed characteristics of these vessels would be, however, they will carry unaccompanied freight, accompanied freight and passengers. It is anticipated that there would be a minimum of one arrival (in the early morning) and one departure (in the early evening) per day per berth.

7. The space between the IOT Finger Pier and IERRT infrastructure would be 95m, within which a tanker of 104m, with associated tugs or workboats, will be required to manoeuvre with strong tidal flows and cross winds. Furthermore, up to three large RoRo vessels would be required to manoeuvre in close proximity to the IOT infrastructure and or vessels. A risk of contact of an IOT tanker or IERRT RoRo with the IERRT jetties, IOT finger pier and IOT Trunkway & pipetrack has therefore been highlighted as a credible and serious hazard.

8. To address these concerns IOT Operators have made it clear that specific mitigation (risk control) measures must be delivered as part of the IERRT development to address the shipping and navigation concerns raised including:

    a. The relocation of the IOT finger pier or a solution requiring the outer-most Immingham Eastern Ro-Ro Terminal Development berth (the northern berth of the northern pier) to be unused until such a time as alternative adequate arrangements have been put in place to reduce impacts on (safe) use by the IOT Operators of the Finger Pier;

    b. The provision of adequate vessel impact protection during the construction and operational phase of the proposed development (including ensuring the design of the IERRT Development can withstand impacts from vessels using the facility); and

    c. A detailed marine and liaison plan to be developed in conjunction with IOT Operators.

9. This report documents a shadow NRA (sNRA) to the IERRT NRA, focusing on addressing the shortcomings identified by the IOT Operators and navigation safety impacts brought about by the operation phase of the IERRT development (it does not deal with construction or construction / operation phases of the development).

10. IOT Operators have requested additional information and data from IERRT developers (e.g. the current navigation risk assessment for the area, design parameters of the IERRT infrastructure in relation to errant vessel impact design loadings, further details on historical incidents occurring in the area of the IERRT, etc.) which are necessary for an adequate risk assessment but were not included in the IERRT NRA and which have not been provided subsequently.

11. The following process was carried out in developing and documenting the findings of the sNRA:

    a. Review of IERRT NRA and Simulations.

b. Analysis of the marine operation of the IOT, particularly in relation to the Finger Pier.

c. Review of Legislation and Guidance related to Navigation Risk Assessments.

d. Presentation of the Navigation Risk Assessment process carried out for sNRA assessment which included:

   i. Specification of the risk assessment methodology;

   ii. Detailed analysis of the navigational baseline including:

      1. How vessel navigation in the area of the IERRT is currently managed.

      2. Vessel traffic analysis of current vessels in the area of the IERRT.

   iii. Historical incident analysis

e. Navigation Risk Assessments were undertaken as follows:

   i. Qualitative risk assessment for the proposed IERRT development to identify high risk hazards using IOT Operators risk matrix and descriptors.

   ii. Quantitative Risk Analysis for high-risk hazards derived from the qualitative risk assessment to mathematically quantify risk (this analysis is needed for a detailed cost benefit analysis to justify As Low As Reasonably Practicable (ALARP) requirements).

   iii. Review and determination of additional risk control measures over and above those that are embedded or proposed by IERRT Developers, to mitigate unacceptable risk levels.

   iv. Revised risk assessments (qualitative and quantitative) to determine the benefit of implementing the additional control measures.

   v. Cost benefit assessment using the results of the quantitative risk assessment for the additional risk control measures.

12. The results for the qualitative risk assessment shows that a total of 22 hazards were identified including collisions, contacts and breakaway hazard types. Based on a review of the collated data and taking information from Hazard Workshops conducted by IERRT and attended by IOT Operators, two of these hazards were scored as Intolerable risk, with the remaining 20 assessed as Tolerable if ALARP. Those scored as Intolerable were:

    a. Contact (Allision) - IERRT Ro-Ro Vessel with IOT Trunkway

    b. Contact (Allision) - IERRT Ro-Ro Vessel with IOT Finger Pier

13. The quantitative risk assessment focused on these intolerable hazards (identified as part of the qualitative navigation risk assessment) providing greater detail of the potential likelihood and consequences of their occurrence through use of event and consequence tree modelling. The modelling identified four scenarios with increasing magnitude of consequences and demonstrated that (the two) lower consequence scenarios fell within the high end of Tolerable if ALARP, and (the two) higher consequences scenarios breached the threshold for Intolerable risk.

14. A review of the additional risk controls provided both by IERRT NRA and by IOT Operators resulted in the three key IOT Operator risk control measures being assessed both in the qualitative and quantitative assessment of risk.
15. The results of the qualitative residual risk assessment with the three IOT Operators key risk controls in place resulted in 18 hazards being scored as Tolerable if ALARP, whilst four were scored as Broadly Acceptable. The two intolerable hazards were mitigated to a Tolerable if ALARP risk level.
16. Results for the residual quantitative risk assessment concluded that risk was reduced to below Intolerable limits with the IOT Operator control measures in place. Following this a cost benefit assessment of the three IOT Operator measures was undertaken with estimated costs for each mitigation related to the previously Intolerable hazards to determine whether they could be classified ALARP. The results of the cost benefit assessment are as follows:
    a. Impact protection has a relatively low-cost benefit ratio of 1.0 for low energy (consequence) strikes given the high cost and low benefit, however, for high energy (consequence) strikes this is significantly more effective, with ratios in excess of five. Therefore, the total benefit for impact protection is approximately 20 times the cost.
    b. Relocation of the finger pier is more expensive and therefore is only cost effective for preventing high consequence contacts of IERRT vessel with the IOT. Overall, this measure has a benefit of 2.7 times the cost.
    c. Marine operations and liaison plan is a low-cost risk control measure and therefore its modest benefits provide significant cost benefit, with a total benefit of more than 100 times the cost.
    d. On the basis of the findings of the cost benefit analysis. i.e. in the event of a high consequence hazard occurrence the benefits of the proposed measures out way the initial cost outlay, it is concluded that in order to reduce navigation risk levels to Tolerable (if ALARP) the three additional risk control measures assessed must be implemented.
17. In summary, this sNRA concludes, based on the information and data available, that the IERRT operations pose an unacceptable risk to IOT infrastructure (and consequently the refineries), although with the risk controls measures as specified by IOT in place the navigation risk to the IOT terminal (as critical national infrastructure) is mitigated to Tolerable (if ALARP) levels.

FIGURES

TABLES

APPENDICES

1. INTRODUCTION

1. NASH Maritime Ltd have been contracted by Associated Petroleum Terminals (Immingham) Ltd, operators of the Immingham Oil Terminal (IOT) to provide Shipping and Navigation subject matter expertise for the proposed Immingham Eastern Ro-Ro Terminal (IERRT) Development which is proposed to be sited adjacent to the IOT and is being developed by Associated British Ports (ABP).

2. The IOT Operators have raised concerns with the shipping and navigation effects of the IERRT Development which they do not consider have been adequately addressed. The IOT Operators' primary concerns relate to the:
   - Adequacy of the IERRT Navigational Risk Assessment (NRA) in relation to the:
     - Presentation of baseline and future navigation activities (during both construction and operation of IERRT);
     - Determination of safety thresholds / acceptability;
     - Risk assessment methodology (including risk matrix);
     - Identification and implementation of risk control / mitigation measures; and
     - Results and outputs of the assessment.
   - Actual navigation safety effects on the IOT during both the construction and operational phases of the IERRT Development include:
     - Allision (contact) of IERRT (and other) vessels with IOT infrastructure as a result of the development;
     - Collision between IERRT vessels (and other vessels including IOT vessels) as a result of the IERRT development; and
     - Impacts to the IOT Operators' Control of Major Accident Hazards safety case as a result if the IERRT development leading to unacceptable risk and associated need for mitigation;

3. In response to these concerns, the IOT Operators have requested that specific mitigation (risk control) measures must be delivered as part of the IERRT Development to address the shipping and navigation concerns raised. These are:
   - The relocation of the IOT finger pier or a solution requiring the IERRT Development's outer-most berth (the northern berth of the northern pier) to be unused until such a time as alternative adequate arrangements have been put in place to reduce impacts on (safe) use by the IOT Operators of the finger pier;
   - The provision of adequate vessel impact protection during the construction and operational phase of the IERRT Development; and
   - A detailed marine and liaison plan to be developed in conjunction with IOT Operators.

4. In reviewing the IERRT Developers Environmental Statement and NRA, none of the IOT Operators mitigation measures have been identified as necessary. As IOT Operators have concerns of the adequacy of the IERRT NRA and the IOT proposed mitigation measures are not mandated in the IERRT NRA, then IOT Operators contracted NASH Maritime Ltd

to undertake a shadow Navigation Risk Assessment (sNRA), to assess the actual navigation risk of the IERRT.

5. IOT Operators required that an independent sNRA is undertaken, as the location of the IERRT development falls within a Statutory Harbour Authority area owned and operated by ABP – Port of Immingham, a Competent Harbour Authority owned and operated by ABP, and that ABP is also the developer of the IERRT. Further the navigation risk consultants used by IERRT developers (ABP) are also a wholly owned subsidiary of ABP, ABPmer. IOT operators also required that the sNRA be conducted in line with the IOT risk assessment standards as the ABPmer IERRT NRA was not considered to comply with these standards.

6. This report documents the sNRA, which is focused on addressing the short comings identified by the IOT Operators of the ABPmer IERRT NRA and focuses on the operation phase of the IERRT development. This is because the IOT operators require that the navigational safety merits of the development should first address the intended operational phases of the project and also that insufficient information is available for assessing the construction phase and construction / operation phase.

1.1 BACKGROUND

7. NASH Maritime Ltd has been contracted to IOT Operators to provide Shipping and Navigation subject matter expertise and support to the IERRT project since April 2022, which corresponds to issue of the Preliminary Environmental Impact Report (PIER) Navigation Risk Assessment. Since April 2022 NASH Maritime have engaged with IERRT developers as follows:

- Attended the following Hazard Workshops chaired by ABP:
    - IERRT Hazard Workshop 2: 7-Apr-2022.
    - IERRT Hazard Workshop 3: 16 & 17-Aug-2022.
    - Letters issued by the IOT Operators on 26-Aug-2022 and 16-Sep-2022 outlining their concerns with the ABPmer IERRT NRA methodology following Hazard Workshop 3 are appended to IOT Operators Written Representation.
- Attended to observe the following elements of the ship bridge simulation sessions at HR Wallingford:
    - 11 April 2022 – arrivals and departures, IOT berth 8 (1 day)
    - 13 July 2022 - arrivals and departures IOT berth 8 (1 day)
    - 28-30 November 2022 – arrivals and departures IERRT berth 1 (1.5 days), arrivals and departures IOT berths 8 and 9 (1 day)
- Attended the following ad hoc meetings:
    - Arranged a meeting with ABPmer to discuss concerns on the NRA methodology being employed on the project 25-May-2022. (Notes of the meeting can be viewed in Appendix A)
    - Met with IERRT developers to discuss IOT Operators mitigation measures and how they could be taken forward, either as part of the IERRT development or in the case of relocation of the IOT Finger Pier, as part of

another development ABP are pursuing, the Immingham Green Energy Terminal – 19-Oct-2022.

1.2 DOCUMENT STRUCTURE

8. The structure of this report is as follows:

- Section 1: Introduction - Introduction to sNRA report and background to the assessment
- Section 2: IERRT Navigation Risk Assessment
    - Review of ABPmer IERRT navigation report including the NRA and Ship Bridge Simulations
    - List of clarifications requested of ABPmer on the NRA
- Section 3: Immingham Oil Terminal Operations - Overview of Terminal
- Section 4: IERRT Development – Overview of IERRT development and operations
- Section 5: Legislation and Guidance – Review of relevant NRA legislation and guidance
- Section 6: Risk Assessment Methodology – details of the assessment methodology employed as part of this sNRA.
- Section 7: Navigation Baseline – details of navigation in the area including vessel traffic analysis.
- Section 8: Incident Analysis – review of incidents in the area and associated with Ro-Ro vessels.
- Section 9: Qualitative Risk Assessment – IOT methodology using HSE / COMAH assessment.
- Section 10: Quantitative Risk Analysis – Detailed likelihood and consequence assessment for IERRT ship contact.
- Section 11: Additional Risk Control Measures – Review of ABP and IOT risk control measures
- Section 12: Residual Assessment of Risk – With IOT risk controls in place including a detailed Cost Benefit Assessment
- Section 13: Conclusions and Recommendations

2. IERRT NAVIGATION ASSESSMENT

9. The following sections provide a high-level review of the DCO Navigation Risk Assessment (NRA) (document TR030007-000369-8.4.10(b) and Vol3 Appendix 10.2: Navigation Simulation Study – Part 1). A list of clarification question issued to the IERRT developers, based on the review of documents, is then provided.

10. This section should be read in the context of Section 3 – Immingham Oil Terminal Operations and Section 7 – Navigational Baseline.

2.1 NAVIGATION RISK ASSESSMENT

11. The following review of the IERRT NRA is structured based on the contents of the report as follows:
    - Introduction
    - Data Sources
    - Navigation Baseline Information
    - Marine Development
    - Future Baseline
    - NRA Methodology
    - Hazard Identification Workshop
    - Risk Control Comments
    - NRA Discussion
    - Summary

12. For the reasons explained in the remainder of this section, it is judged that there are considerable issues with the ABPmer IERRT NRA that lead to a lack of clarity and consistency within the document making the document difficult for third parties to understand and assess.

2.1.1 Introduction

13. The proposed IERRT development is located within the Statutory Harbour Authority area of the Port of Immingham, and within the Competent Harbour Authority area of Humber Estuary Services. The relevant authority for navigation safety is therefore the Port of Immingham Harbour Master, commonly referred to as the Humber Dock Master (note - there is one Dock Master for the Humber, who is supported by local Deputy Dock Masters). It is not clear from the assessment whether the proposed IERRT terminal resides within the Vessel Traffic Services area for Humber Estuary Services or the Local Port Service area of the Port of Immingham.

14. The IERRT NRA details the Policy on which the assessment is based and identifies the National Policy Statement for Ports, the Port Marine Safety Code (PMSC), and two other guidance documents (IMO Formal Safety Assessment (FSA) guidelines and Maritime Coastguard Agency (MCA) Marine Guidance Note (MGN) 654 providing guidance to Offshore Renewable Energy installations). Where and how these policies and guidance documents are used in the NRA is not clearly stated (e.g., standards of acceptability are not defined for hazard risk scores), and it seems that various aspects from the different

guidance documents are drawn upon at various stages of the NRA with no overall coherent strategy. For example, Marine Guidance Note (MGN) 654 provides a checklist which can be used to ensure NRAs meet its requirements and this would be a helpful inclusion for the IERRT NRA.

15. The introduction also provides some commentary on As Low As Reasonably Practicable (ALARP) and Tolerability principles which are taken from the Guide to Good Practice on Marine Operations, a guide produced by the MCA, which accompanies the PMSC. This document is particularly focused on the requirement to undertake objective assessments, without being influenced by the financial position of the port.

16. The IERRT NRA documents the principle of Tolerability of risk, the point at which risk is acceptable, and defines what must be done to address intolerable risks. The IERRT NRA then identifies that for a level of risk to be acceptable, it must firstly be ALARP, and then it must be tolerable. The order this is presented is at odds with the PMSC, which identifies formal risk assessment should identify hazards / risks, access these against "standards of acceptability" and then where appropriate consider a cost benefit assessment of risk reduction measures (e.g., using ALARP) (through cost benefit) (See Section 2.7 of the PMSC - Use of Formal Risk Assessment):

17. The first test should therefore be whether risk is tolerable and only if not, then what can be done to mitigate it to tolerable levels using the ALARP principle.

18. A general comment on review of the NRA is that there is little in the way of standardisation of nomenclature and various terms are used in different context. A glossary is provided at section 13 but does not extend to common terms used throughout the assessment (e.g. "*Risk", "Risks", "Hazard(s)", "Embedded Controls" and "Further Controls", "Additional Controls*"). This makes the document difficult to follow and it falls short in terms of being transparent and clear to those seeking to read and understand it.

2.1.2 Data Sources

19. It is noted that the vessel traffic (AIS) data sources provided for the NRA are different to that provided to stakeholders for the HAZID workshops – it is not clear why this has occurred. It is not therefore possible to audit them or their comparability.
    - AIS data analysis provided in the PIER NRA and available for the hazard workshops was anonymised publicly available data from the Marine Management Organisation which is collected by the Maritime and Coastguard Agency from 2019 (see Section 2, Immingham Eastern Ro-Ro Terminal: Preliminary Environmental Information: Appendix 10.1: Preliminary Navigational Risk Assessment, January 2022).
    - AIS data sourced for the IERRT NRA is "from an in-house AIS database provided by Anatec Limited" a commercial provider, which covered 01 September 2021 to 31 August 2022

20. No quality checks on the IERRT NRA AIS data appear to have been undertaken (such as location of the receiving stations or details on any post-processing of data), or justification for the change in underlying data which was provided for use in the NRA by a third party, Anatec Ltd.

21. The authoritative source of information should be vessel data collected from Humber Estuary Services VTS (as the Vessel Traffic Services in the area of the proposed IERRT, which will be operated to IALA standards and hence data quality should be to the highest

standards) or confirmation/verification of third-party data sources against this where other data was necessary.

22. **Section summary**

  a. There is ambiguity as to why different AIS data sources were provided for the NRA than were provided for the HAZID workshops with stakeholders and a lack of quality checks undertaken for the IERRT NRA AIS data.

2.1.3 Navigation Baseline Information

23. The baseline information does not document or describe the marine infrastructure and associated vessel movements in the vicinity of the proposed IERRT; as such a clear baseline is not provided in the assessment on which a reader may make a judgement on the impacts on marine safety directly attributable to the proposed IERRT.

24. It is noted that the Port of Immingham and Humber Estuary Services have Marine Safety Management Systems (MSMS) in place that manage marine safety in the area, which are described as meeting the requirement prescribed by the PMSC. The PMSC mandates that MSMSs are based on a robust risk assessment conducted, and regularly reviewed / updated, with stakeholder consultation: see PMSC Para. 10 Bullet 6 & Section 2. It is understood that IOT Operators do not have records of attending hazard workshops for the Port of Immingham's PMSC-aligned NRAs and have no copies of the assessments that form the basis for managing navigation safety in the area or minutes relating to consultations on relevant port issues.

25. Further, under the requirement of the Pilotage Act 1987 and the MCA MGN 401 (Amendment 3 Navigation: Vessel Traffic Services (VTS) and Local Port Services (LPS) in the UK), risk assessments are required to determine the need and requirements of Pilotage and VTS.

26. Therefore, there are three requirements for the Port of Immingham to have a robust NRA in place for the area covering the IERRT, all of which require regular consultation with stakeholders such as the IOT Operators prior to and during the conceptual development of the IERRT. That consultation has not taken place.

27. In reviewing the baseline information, pilotage is noted as being provided. The Pilotage Act (1987) requires that Competent Harbour Authorities, in this case Humber Estuary Services, keep under consideration "*what pilotage services need to be provided to <u>secure the safety of ships</u> navigating in or in the approaches to its harbour*" (Section 2(1)(a)). As such, where pilotage is provided, it should be fit for purpose.

28. Generally, the analysis provided in the IERRT NRA (Section 3.7 Marine traffic analysis) shows only a high-level context of shipping and navigation for the area as a whole and does so primarily based on track plots (see Figure 1). The analysis presented also does not show the layout of the proposed IERRT development, making it more difficult to discern what the impacts to current vessel navigating in the area could be. Therefore the intricacies, complexities and details of how vessels currently navigate in close proximity to the proposed IERRT are not provided.

29. These track plots offer little in the way of context of sea room (swept path) currently used by vessels in this congested area, the dynamic / tidal nature of vessel transits in close proximity to the proposed IERRT, or the temporal disposition of navigation.

30. It is therefore unclear as to how vessels, of differing characteristics, may interact with the proposed IERRT infrastructure making it difficult to draw meaningful assumptions as to the navigational risks posed to baseline vessel traffic movements by the IERRT operation and infrastructure.

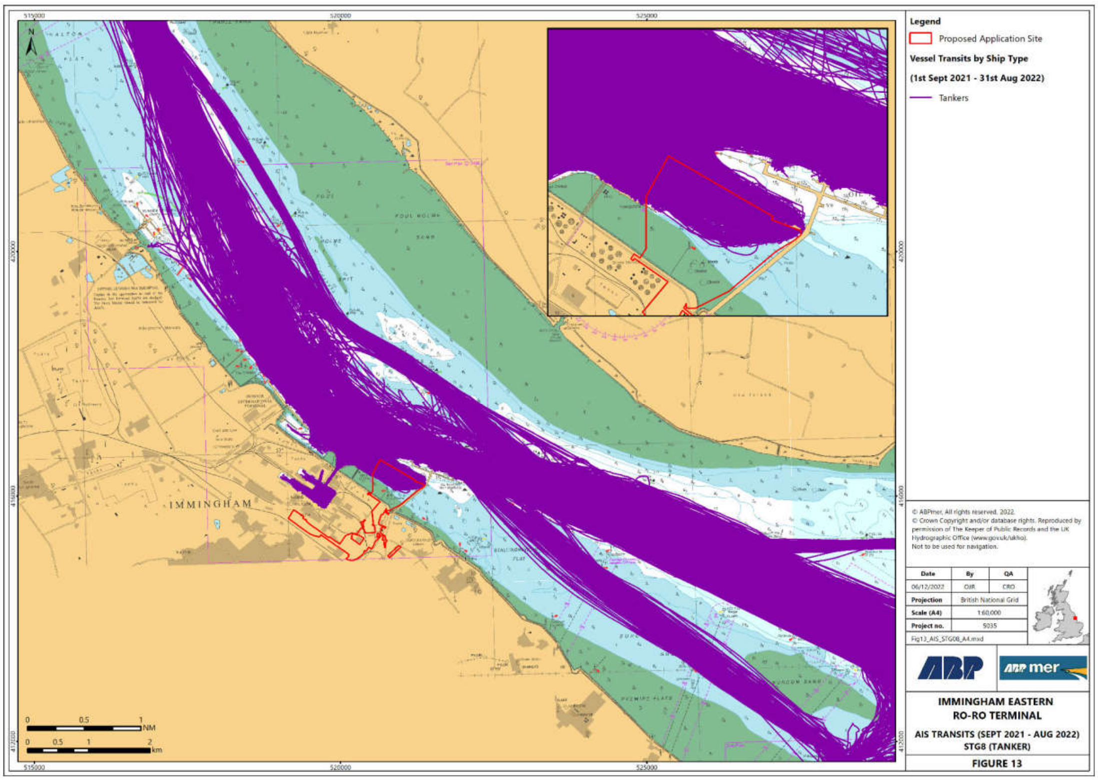


Figure 13 Vessel transits – Tankers

Figure 1: Figure 13 from the IERRT NRA showing track analysis of for Tankers.

31. Therefore, additional analysis is needed, focusing on the sea room currently used by vessels and their support craft (e.g., tugs) navigating in close proximity to the proposed IERRT development, particularly those vessels bound to/from the IOT Finger Berth, Immingham Eastern Jetty and other terminals in the area. This should be provided as individual and composite vessel swept path analysis by destination and vessel type and take into account adverse conditions such as high winds, restricted visibility and maximum water currents vessel may navigate in (e.g., tidal / fluvial water velocities).

32. The analysis and plots provided as part of the Navigation Baseline Information also do not show the proposed IERRT infrastructure, so even at the high level provided, impacts to passing vessels are difficult to discern. Such analysis was requested by IOT operators prior to both Hazard Workshops 2 & 3 (see Appendix A for meeting minutes and correspondence).

33. Incident analysis (see IERRT NRA Section 3.8 Marine accidents and incidents) provided is at a high level and fails to adequately provide context of incidents in the study area, particularly in relation to impacts with infrastructure and equipment failure on vessels, which are among the most frequent incident types and are of significant concern to IOT Operators for the ongoing safe operation of their terminal. No reference has been made to incidents elsewhere which may involve similar vessel types / navigation features (either nationally or internationally for the proposed class of vessel to use IERRT or incident data taken from Stena Line operations as the proposed operator of the facility), nor have the

magnitude of those incidents and the vessel types involved been identified in the NRA. This would be helpful in categorising incident likelihood and consequence for the IERRT. Similarly, historical incident analysis associated with ship collision/allision with oil terminals to ascertain hazard consequence has also not been provided and does not appear to have been undertaken.

34. **Section summary**

    a. There are inaccuracies, overlooked key information and insufficient analysis within the description of the navigation baseline information. It is therefore unclear as to how vessels, of differing characteristics, may interact with the proposed IERRT infrastructure making it difficult to draw meaningful assumptions as to the navigational risks posed to baseline vessel traffic movements by the IERRT operation and infrastructure.

    b. Further additional analysis is needed, focusing on the sea room currently used by vessels and their support craft (e.g., tugs) navigating in close proximity to the proposed IERRT development, particularly those vessels bound to/from the IOT Finger Berth, Immingham Eastern Jetty and other terminals in the area.

2.1.4 Marine Development

35. The proposed marine operations for the IERRT are not clearly defined in Section 4, which focuses on a cursory review of IERRT infrastructure and does not consider the marine operational concept for IERRT including sea room required and operational limitations (e.g., passage plan, tug use, berthing duration, metocean limits, etc.).

36. The inclusion of implicit impact protection in the IERRT design is not defined as part of the assessment and as such no designed-in impact protection is provided for within the IERRT infrastructure to protect the IOT and IOT Trunk Way.

37. Further, the details of the potential additional vessel impact protection provided to protect a section of IOT Trunk Way are not provided – e.g., design basis for vessel size, displacement and speed that the impact protection is designed to withstand.

38. There is also no clear design vessel specification provided within the NRA (e.g., vessel displacement, vessel windage, configuration such as propulsion type / engines / rudders / thrusters / machinery redundancy systems etc) provided. Given the complex nature of tide and challenging approach to the IERRT berths, then manoeuvring characteristics for the design vessel are necessary to assess likelihood and consequence of incident occurrence. Reference to vessel parameters is provided in the simulation reports, but these do not appear to be confirmed in the NRA. As such the specification of vessels visiting IERRT could well be less manoeuvrable and more difficult to handle than is inferred in the NRA and thus the likelihood of incident / accident occurrence could be more than the NRA depicts.

39. **Section summary**

    a. The IERRT NRA fails to provide a clear definition of the proposed marine operations for IERRT.

    b. Details of the potential additional vessel impact protection provided to protect a section of IOT Trunk Way are not provided.

    c. There is also no clear design vessel specification provided within the IERRT NRA.

d. The lack of clear definition limits an assessment of navigation risk as the complexities and nuances of the proposed operation and scheme design are not fully documented and understood.

2.1.5 Future Baseline

40. The future baseline contained within the NRA is generic and not specific to the berths at and around IERRT, and neither does it consider future developments such as Immingham Green Energy Terminal (IGET) – an ABP development in close proximity to IERRT (Scoping Report 30 August 2022) which is a Cumulative Tier 2 project[1] in the context of the IERRT.

41. The NRA should have undertaken an assessment of the cumulative effects of this project in relation to safety of navigation brought about by other proposed developments such as the Immingham Green Energy Terminal.

42. Projected increases in vessel traffic movements in the area over the life span of the IERRT infrastructure should be included in the assessment of navigation risk. The volume of future vessel movements, as presented in the NRA (Section 5) shows a marked increase across all vessel traffic in the study area and it is not clear how these increases in vessel traffic are considered within the assessment of risk for future scenarios and throughout the entire design life of the IERRT.

43. Construction of other facilities (noting that document *8.2.20 Environmental Statement - Volume 1 - Chapter 20 - Cumulative and In-combination Effects)* included only a superficial statement related to the Immingham Green Energy Terminal impact on the Shipping and Navigation Assessment and no identification of any relevant mitigation:

> *"Potential Significant Cumulative Effects: The only cumulative effect relevant from a commercial and recreational navigation perspective is the increased utilisation of the estuary as a result of greater vessel traffic. Existing embedded controls already in place for IMM [Port of Immingham] and HES [Humber Estuary Services] Marine Safety Management Systems mitigate risks associated with vessel movements on the estuary to an ALARP state already.*
>
> *Significance of Effect: Insignificant*
>
> *Residual Cumulative Effect: None / Insignificant."*

44. **Section summary**

a. The future baseline contained within the NRA is generic and not specific to the berths at and around IERRT, and neither does it consider future developments.

b. The volume of future vessel movements, as presented in the NRA (Section 5) shows a marked increase across all vessel traffic in the study area and it is not clear how these increases in vessel traffic are considered within the assessment of risk for future scenarios.

c. The NRA should have undertaken an assessment of the cumulative effects of this project in relation to safety of navigation brought about by other proposed developments.

[1] Advice Note Seventeen: Cumulative effects assessment relevant to nationally significant infrastructure projects | National Infrastructure Planning (planninginspectorate.gov.uk)

2.1.6 NRA Methodology

45. The NRA methodology is stated as complying with guidance provided in the PMSC, and that consideration had been given to MGN 654 and IMO FSA methods. However, the actual methodology deployed does not appear to be based on this or any other published NRA methodology relating to UK marine safety, and as such seems to have been developed for ABP specifically for the IERRT project.

46. The IOT Operators (as well as the UK Department for Transport as the government department with responsibility for the PMSC), consider that the basis of an NRA, both in terms of the overarching methodology and the provision of baseline understanding of risk (that is accurate, up-to-date and stakeholder-agreed), should be the NRA that the Port of Immingham already has in place as a requirement of the PMSC (and Pilotage and VTS provision) and underpins the Port of Immingham's MSMS.

47. Standards of acceptability (as mandated by the PMSC) have not been agreed with IOT Operators (and other stakeholders), and as such it is not clear what level of risk would be acceptable with the IERRT in place and operational. It is understood from the IERRT NRA that ABP, as Duty Holder for Port of Immingham, have determined what level of risk is acceptable, although the actual level is not documented within the NRA. As IOT Operators are a Control of Major Accident Hazards ("COMAH") site, it has HSE-imposed acceptability levels to risk which are referenced to clear likelihoods of occurrence for defined hazard consequences (e.g., fatality) – these have previously been provided to IERRT developers with the Standards of Acceptability to IOT Operators as a COMAH site under UK Health and Safety Executive regulations.

48. As set out in Section 6, the International Maritime Organisation (IMO) Formal Safety Assessment (FSA) approach, is mandated by the UK PMSC as the appropriate methodology for marine operations in UK ports and harbours. A summary of PMSC Risk Assessment requirements relating to the IERRT NRA is provided in Table 1 (a copy of the Port Marine Safety Code is included in REP1-015)

Table 1: PMSC Risk Assessment requirements.

PMSC Section	Comments on IERRT NRA
Executive Summary Para 10 (pg 8) **Risk Assessment**	
5. Ensure all marine risks are formally assessed and are eliminated or reduced as low as reasonably in accordance with good practice.	The focus on eliminated marine risk has not been prioritised and the NRA instead focuses on as low as reasonably in accordance with good practice.
6. Marine Safety Management System: Operate an effective MSMS which has been developed after consultation, is based on formal risk assessment and refers to an appropriate approach to incident investigation.	The Port of Immingham and Humber Estuary Services Marine Safety Management Systems are reference but not provided in the NRA. No formal details relating to consultation on the formal risk assessment has been shared with IOT Operators. Appropriate incident investigation should include notification to IOT Operators on findings of incident investigations related to IOT Operations / vessels (see Section 8.2.2 and 8.2.3 below.)
7. Review and Audit: Monitor, review and audit the risk assessment and MSMS on a regular basis – the independent designated person has a key role in providing assurance for the duty holder	The independent designated person has not attended IERRT hazard workshops or engaged with IOT Operators.
2. Key Measures to secure marine safety (pg 14)	
• **Use formal risk assessment:** Powers, policies, plans and procedures should be based on a formal assessment of hazards and risks and organisations should have a formal MSMS.	No details on the formal risk assessment Powers, policies, plans and procedures are provided for the Port of Immingham or Humber Estuary Services.
• **Implement a marine safety management system:** An MSMS should be in place to ensure that all risks are identified and controlled – the more severe ones must either be eliminated or reduced to the lowest possible level, so far as is reasonably practicable (that is, such risks must be kept as low as reasonably practicable or "ALARP"). Organisations should consult, as appropriate, those likely to be involved in, or affected by, the MSMS they adopt. The opportunity should be taken to develop a consensus about safe navigation. The MSMS should refer to the use of formal risk assessment which should be reviewed periodically as well as part of post incident/accident investigation activity.	Elimination of risk should be prioritised over application of the ALARP principle. Navigation risk associated with the IERRT development can be eliminated through implementation of impact protection and relocation of the IOT Finger Pier. Consultation with stakeholders such for the IERRT has been: • Hazard workshop 1: ABP only based on numerical NRA methodology. • Hazard Workshop 2: ABP and stakeholders based on numerical NRA methodology. • Hazard Workshop 3: ABP and Stakeholders based on a non-numerical NRA methodology.
• **Consensus:** The organisation should strive to maintain a consensus about	

PMSC Section	Comments on IERRT NRA
safe navigation. This can be achieved through formal programmes of stakeholder engagement a review of relevant risk assessments with users of the facility or harbour	No consensus on safe navigation was made, and the thresholds for acceptability of risk were not defined in hazard workshops.
Use formal risk assessment. 2.7 The risks associated with marine operations need to be assessed and a means of controlling them needs to be deployed. The aim of this process is to eliminate the risk or, failing that, to reduce risks as low as reasonably practicable. Formal risk assessments should be used to: • identify hazards and analyse risks; • assess those risks against an appropriate standard of acceptability; and • where appropriate consider a cost-benefit assessment of risk-reduction measures.	PMSC prioritises elimination of risk, which can be provided for IERRT through implementation of the impact protection and relocation of the IOT Finger Pier. Identification of hazards within the IERRT NRA does not follow a structured approach with hazards defined in an ad hoc manner. Analysis of vessel tack data and incident data is provided, but at a basic level, which does not adequately detail the types, sizes, and searoom taken up by vessel navigating to and from the IOT. The assessment *of risk against an appropriate standard of acceptability* has not been provided in the IERRT NRA. No quantitative details on the acceptability of risk to ABP is provided and no consultation with stakeholders, who will be impacted by the hazards, was undertaken in relation to acceptability of risk. Consideration of cost benefit assessment of risk reduction measures is provided in the IERRT, however no quantification of cost or benefit is provided.
Use formal risk assessment. 2.8 Risk assessments should be undertaken by people who are competent especially when deciding which techniques to use and when interpreting the results. Risks should be judged against objective criteria, without being influenced by the financial position of the authority, to ensure they are reduced to the lowest possible level, so far as is reasonably practicable (that is such risks must be kept as low as reasonably practicable or "ALARP"). The greater the risk, the more likely it is that it is reasonable to go to the expense, trouble and invention to reduce it. There is a hierarchy of risk control principles: a. minimise risks – by suitable systems of working; b. combat risks – by taking protective measures to prevent risk; and c. eliminate risks – by avoiding a hazardous procedure or substituting a less dangerous one.	The IERRT NRA has been undertaken by a team from ABPmer, a wholly owned subsidiary of ABP, who are also the developers of IERRT and the harbour authority charged with maintaining navigation safety in the area. The credentials of the ABPmer consultants who undertook the NRA have not been provided. The PMSC requires that risk assessments should not be influenced by the financial position of the authority and therefore the cost benefit assessment should be open and transparent, which is not the case in the IERRT NRA. The hierarchy of control principals indicate that elimination of risk should be prioritised.
Use formal risk assessment. 2.9 The process of assessment is continuous so that both new hazards to navigation and marine	The existing NRA undertaken by the harbour authority (Port of Immingham / Humber estuary

PMSC Section	Comments on IERRT NRA
operations and changed risks are properly identified and addressed. Where appropriate organisations should publish details of their risk assessments.	Services) for the area have not been published or shared with key stakeholders such as IOT Operators.
Use formal risk assessment. 2.10 Risk assessments should be reviewed on a planned periodic basis. The MSMS should prescribe the organisation's policy on review frequency as well as any related procedures or processes. The MSMS should also refer to a procedure which ensures that risk assessments are reviewed appropriately in the following circumstances: • on a planned periodic basis; • post-incident/accident; and • post-review of relevant marine accident or health check trend report.	MSMS procedures for the area have not been provided in the IERRT NRA. Neither is it clear that risk assessments have been reviewed and updated on a planned, post incident or post review/ audit report.
Use formal risk assessment. 2.11 Risk assessment reviews are best conducted by utilising user groups or representatives who use the harbour or facility regularly. This helps to ensure that practical and relevant experience can be captured, promotes good consultation and demonstrates the organisation's commitment to engaging with users.	No formal review of the harbour authority (Port of Immingham / Humber estuary Services) existing baseline NRAs has been undertaken with IOT Operators.

49. **Section summary**

a. There is a lack of clarity within the ABPmer IERRT NRA as to the NRA methodology, specifically how guidance documents (e.g. PMSC) and policies are used in the NRA and how the NRA meets the requirements of the named guidance and policies.

b. There is a lack of transparency and clarity in regard to the definition of Standards of acceptability (as mandated by the PMSC).

2.1.7 Risk Assessment methodology

50. Section 6 and 7 of the IERRT NRA details the risk assessment methodology, risk matrix and the Hazard Identification Workshops for the NRA .

51. It stated (at para. 6.3.4) that the consequence categorisation definitions used within the NRA are taken from ABP's MSMS – presumably the MSMS's baseline NRA for the Port of Immingham as mandated by the PMSC. These provide a range for each category, and it is not clear whether these have been calibrated to the risk appetite of ABP or stakeholders such as IOT Operators, e.g. the highest Consequence Descriptors: Port, which is defined as "Extreme" consequence relates to "*Major (Negative national and international publicity. Major damage to reputation. Major loss of revenue, > £8 M)*" – it is not clear whether this relates to IERRT operations (ABP or Stena Line) or IOT operations (see IERRT NRA Tabe 15: Consequence Descriptors).

52. The likelihood (termed "frequency") categorisation definitions (as presented in Table 16 and reference in para. 6.3.5 of the IERRT NRA) do not appear to have a source of reference and are specific to the IERRT project – i.e., they do not appear to be taken from

the existing Port of Immingham NRA or the reference guidance documents presented, or any other maritime guidance publication on navigation risk. The frequency and associated descriptions do not relate to specific mathematical probabilities (e.g., such as return periods) and are therefore entirely subjective in nature.

53. Further the IERRT PIER NRA used different likelihood descriptors, and whilst no definitive guidance is provided within the PMSC, the MCA MGN 654 does reference IMO Formal Safety Assessment Likelihood/Frequency Index likelihood descriptors at MGN 654 Annex 1 Methodology for assessing marine navigational safety & emergency response risks of OREIs.

54. In the context of the IERRT NRA then word-based frequency descriptors are used based on the lifetime of the operation being assessed which are then combined with consequence criteria to produce a risk classification using the tolerability matrix (see Figure 2). The frequency descriptors are as follows, and if related to the lifetime of the entity (e.g., the IERRT) then could be determined to have the following mathematical return periods (probabilities):

- Operation Phase – 50 years duration:
  - Rare – <1 in 1,000 years
  - Unlikely – 1 in 100 years 14to 1 in 1,000 years
  - Possible – 1 in 50 years to 1 in 100 years
  - Likely – 1 in 10 years to 1 in 50 years
  - Almost Certain – >1 in 10 years
- Construction phase - 2 years duration:
  - Rare - < 1 in 10 years
  - Unlikely – 1 in 4 years to 1 in 10 years
  - Possible – 1 in 2 years to 1 in 4 years
  - Likely – 1 in 2 years
  - Almost Certain – >1 in 1 years

55. As a result, the mathematical return periods (probabilities) for the IERRT Frequency Descriptors are not definitive and would likely be interpretated differently by different individuals.

56. Based on the IERRT NRA Figure 26 People Tolerability Matrix, multiple fatalities that occur for the operation phase as “Unlikely” Frequency are considered Tolerable – this could relate to a mathematical return period of between 1 in 100 years to 1 in 1,000 years per occurrence. However, for the construction phase the same likelihood, for multiple fatalities would be a 1 in 4 year to 1 in 10 year per occurrence.

57. Also, when reviewing the Tolerable area on the IERRT NRA Figure 26 People Tolerability Matrix for an “Unlikely” frequency hazard, then it would be scored as a “Medium risk” for a single fatality and the same for a multiple fatalities’ consequence.

58. Thus, there appears to be variable tolerability to hazards between the construction, construction/operation and operation phases of the IERRT, and none of the tolerability thresholds appear to have been benchmarked to any Standards of Acceptability as required by the PMSC or as specified in MCA MGN 654.

Classification	Outcome
Very High Risk	Very High
Significant Risk	Significant
Medium Risk	Medium
Low Risk	Low
No Practicable Risk	No Practicable Risk

Descriptor	Frequency
The impact of the hazard is realised but should very rarely occur (within the lifetime of the entity)	Rare (1)
The impact of the hazard might occur but is unlikely (within the lifetime of the entity)	Unlikely (2)
The impact of the hazard could very well occur, *but it also may not* (within the lifetime of the entity)	Possible (3)
It is quite likely that the impact of the hazard will occur (within the lifetime of the entity)	Likely (4)
The impact of the hazard will occur (within lifetime of entity)	Almost Certain (5)

Likelihood	Consequence: Negligible (No Injury)	Minor Injuries	Serious Injuries	Single Fatality	Multiple Fatalities
Rare	No Practicable Risk				
Unlikely		Low	Tolerable		
Possible			Medium		
Likely				Significant	
Almost Certain			Intolerable		Very High

Figure 2: Extract from IERRT NRA report: Top left: Table 16 Frequency Descriptors, Bottom Left: Table 17 Risk classification and right Figure 26 People Tolerability Matrix.

59. Further a recent Navigation Risk Assessment for the Able Marine Energy Park Development Consent Order[2] provides different likelihood probabilities which are more closely aligned to HSE standards (see Section 5.2 below).

60. The IERRT NRA methodology approach also does not allow for an informed Cost Benefit Analysis (CBA) as required when using the ALARP principle (PMSC Section 2.7) as the effectiveness of risk controls cannot be quantified empirically against a change in likelihood. For example, using the IERRT Frequency descriptors (as specified in Table 16 Frequency Descriptors of the IERRT NRA), a risk control measure that reduces the likelihood of a hazard occurring from a "Possible" to "Unlikely" frequency level, corresponds to hazard likelihood change of "an impact of a hazard could occur" to the "impact of a hazard might occur". As there is no mathematical basis to the frequency descriptors it is not possible to undertake a cost benefit assessment and therefore hazards defined as Acceptable if ALARP using cost benefit cannot be determined using the methodology employed.

61. The risk matrix employed, which brings together consequence and likelihood classifications to determine a risk score, also has no source defined. For example, the PEIR for the Immingham Green Energy Terminal[3] shows a different risk matrix, albeit is only listed as an example risk matrix, but it does not align with that chosen for the IERRT NRA. The loose definitions of likelihood and the classification within the risk matrix allows for considerable flexibility in resulting risk scores, which has the potential to significantly underplay risk levels. The categorisation of risk is also questionable when considering it's alignment with ABP's tolerability threshold – for example, an "*extreme*" consequence that results in multiple fatalities that is *"unlikely*" (but still "might" occur in the 50yr-life of the project) is only regarded as a medium risk and is considered to be tolerable; and a "*serious*" damage to port reputation resulting in £8M loss of revenue that is "*quite likely*" to occur is regarded as a significant risk yet is still tolerable. In the context of HSE standards of acceptability the risk of these hazards would likely be interpreted as unacceptable (see Section 5 below). The lack of any quantitative analysis / modelling or numerical approach

[2] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR030006/TR030006-000135-TR030006-APP-6A-14-1.pdf
[3] [redacted]

to hazard likelihood means that the NRA cannot be benchmarked to any guidance on standards of acceptability as required by the PMSC.

62. **Section summary**

   a. In general, the likelihood definitions used within the IERRT NRA are overly simplified, entirely qualitative/subjective in nature, are different for the construction, construction/operation and operation phases of the IERRT, are not referenced to IOT COMAH Safety Plan likelihood classifications (as previously provided to ABP), do not appear to be based directly on the current baseline risk assessment for the area as required by the PMSC and do not allow any meaningful quantified/probabilistic basis for assigning a category for the likelihood of hazard occurrence.

   b. It is not clear from the IERRT NRA report how the tolerability / acceptability of risk for hazards using the ALARP has been defined. Although reference is made to a Cost-Benefit Analysis and Tolerability workshop held by ABP on 6 October 2022 (see para. 7.1.13 of the NRA) although no minutes or details are provided) and neither were Stakeholders (who would be impacted by the IERRT development) consulted or invited to attend.

   c. Further, the tolerability workshop was undertaken retrospectively following the hazard workshops, so during the workshops no attendee was aware of whether the scoring they had applied would result in acceptable or unacceptable hazard outcomes, especially when considering the subjective and qualitative nature of the method employed, particularly the likelihood parameters.

2.1.8 Risk Control Comments

63. The risk control section of the IERRT NRA considers measures that can be put in place to minimise risk, either through a reduction in the likelihood of a hazard occurring, or a reduction in the magnitude of hazard consequences. The IERRT NRA, however, considers a number of further risk control measures that are either very similar to each other or very similar to embedded risk control measures (i.e., those measures that are already currently in place for the management of navigation risk in the area).

64. An example where further risk controls are similar to embedded risk controls is Additional Pilotage Training / Familiarisation (see Table 29 Construction-Operation - Further Applicable risk controls of the IERRT NRA) which is the same as provision of Pilotage – which should be an embedded risk control. IOT Operators consider that the assessment of risk undertaken for the IERRT hazard workshops considered the provision of pilotage for IERRT vessels (either in the form of an authorised pilot or Pilot Exemption Certificate (PEC) holder). The Pilotage Act requires that where pilotage is provided, it must do so to ensure safety and, as a result, additional training / familiarisation should be considered as an embedded measure – taken as a matter of course. This is because IOT Operators consider that pilotage (where provided) should already be to the requisite standard, and therefore don't consider that risk reduction applied to this control should be applied to hazards to reduce risk in the NRA.

65. An example of further risk control measures which are similar, the operational phase of the IERRT includes "Berthing Criteria (which includes implementing other potential weather limits (e.g. high winds), "Tidal Limitation / Weather Restrictions", and "Berth Specific Weather Parameters" (which also is assumed to relate to weather limits) – these are essentially the same risk control measure and IOT Operators would consider that they

should be embedded measures and not further measures. This is because all berths and terminals should have operational procedures in place which should include weather limits – which at this stage of the IERRT development should be well known as it impacts the design and operability of the terminal. It is also standard practise in risk assessments to have clearly defined measures which are commonly attributed to multiple hazards, this makes the NRA process more structured and easier to follow. The IERRT NRA instead relies on ad hoc requests and comments raised at the hazard workshops and judgement of the ABPmer consultants with little consolidation and refinement on risk control definition undertaken. This has the potential to both confuse the reader obfuscating the actual level of risk reduction applied by particular controls and may result in double accounting of risk reduction. Also, in attending the hazard workshops, it was not made clear to the IOT Operators that the risk was being assessed without some or all embedded controls in place.

66. In relation to the IOT Operators proposal to relocate the Finger Pier, then this is identified as a highly effective risk control listed as a “very substantial” control measure by eliminating risk completely; however, this further risk control has not been carried through during the assessment of residual risk and the reason given was to allow assessment of the other identified mitigations. Specifically, it is not shown for hazard O1 (Table C1) and is greyed out for Hazard O2 and O3 (Tables C2 and C3). The IERRT NRA states the Cost Benefit Assessment (CBA) and ALARP assessment considered this further risk control as “not reasonably practicable” (see Para. 9.9.21 of the IERRT NRA) and it was subsequently dismissed, however, there is no detail justifying this decision and no prior consultation was undertaken with IOT Operators to understand the nature and extent of the operations at the Finger Pier and if/how they could be maintained through other means. The justification of “not reasonably practicable” is therefore premature without detail being provided which can be reviewed by IOT Operators.

67. Impact Protection for the IOT Trunk Way is identified (see para. 9.9.24 of the IERRT NRA) to provide protection to a portion of trunk way south of the IOT Finger Pier. However, this does not provide protection against collision of an IERRT vessel with a tanker or barge berthed at the IOT Finger Pier, nor allision with the finger pier itself, which would require re-locating the finger pier. The Impact Protection risk control was also not considered as required within the IERRT NRA, and instead its construction is placed at the discretion of the ABP Harbour Master for the Port of Immingham – again, no details have been provided to justify the decision by IERRT developers.

68. **<u>Section summary</u>**

    a. The identification, specification and application of further risk controls proposed by the IERRT NRA is difficult to understand and flawed in many aspects. The justification for which further controls are adopted is also unclear and not documented.

    b. It is therefore difficult to assess the effectiveness of the proposed IERRT NRA risk controls and to quantify the impact of the proposed risk control measures in reducing levels of navigation risk.

2.1.9 NRA Discussion

69. There is discussion of a CBA having been conducted throughout the IERRT NRA but there is no detail describing the methodology and process used, nor the outcomes of the CBA exercise, including the anticipated costs (quantitatively, or even qualitatively) and how

these have been used to determine what could be considered appropriate. The judgement on CBA and tolerability is therefore highly subjective and determined solely by ABP as developer of the IERRT.

70. Further, in the IERRT NRA what is reasonably practicable is not directly related to what is tolerable and the measure of practicability is not clear. It would be expected that tolerability and ALARP levels should already be established as part of the Port of Immingham's MSMS or it is determined / agreed in consultation with the relevant stakeholders in the same way that the NRA that underpins the MSMS would be and that this would precede and be known to stakeholders prior to the hazard workshop. In this way the appetite for risk between different stakeholders can therefore be considered in setting acceptable risk levels, this is commonly referred to as calibrating the risk matrix / appetite (e.g. see UK Government Risk Appetite Guidance Note [4]).

71. A fundamental issue within the IERRT NRA is that ABP/ABPmer have calibrated the assessment against their own risk appetite levels and have not considered the risk appetite of IOT Operators or other stakeholders, nor has the risk appetite level been based on accepted marine guidance or even the existing level used by ABP operationally for other PMSC NRAs. In consideration of acceptability of risk, then ABP, as IERRT developers, must consider the risk appetite of IOT Operators as a top tier COMAH site and critical national infrastructure site for distribution of fuels, operated/owned by oil majors with highly developed and detailed policies and procedures in place for the management of risk.

2.1.10 IERRT NRA Summary

72. The NRA report summary is brief and does not summarise what further risk control measures will be implemented for each of the Construction, Construction/Operation and Operation stages of the IERRT.

73. It also recommends that the IERRT NRA is used "to inform amendments to the Marine Safety Management System that is currently in place at the Port of Immingham to ensure that risks are appropriately captured, monitored, and updated as required based on the latest information available as time goes on." That Marine Safety Management System is not being made available as part of the DCO application. Nor is the Port of Immingham's NRA undertaken in compliance with the PMSC which informs the port's Marine Safety Management System. It is therefore impossible for stakeholders engaged in the DCO application (or the Examining Authority) to understand what those amendments should be, what their effect would be, and what all of that might mean for the remainder of the assessments which have been made by the Applicant in their DCO Application (including for example, their Environmental Statement).

2.2 IERRT SIMULATIONS

2.2.1 Background

74. ABP commenced IERRT feasibility simulations at HR Wallingford (HRW) during 2021 and continued these simulation studies periodically during 2022 to study tidal flow, design, orientation, and dredged area of the proposed Ro-Ro facility. A real time navigation simulation study was commenced with the objective of understanding the navigation operations and to ascertain the likely operating limits of design vessels using the facility. Supplemental to this, simulations also studied the potential effects of the presence of the

[4] Risk Appetite Guidance Note (publishing.service.gov.uk) accessed 24-Aug-2023

proposed terminal on the arrival and departure of ships using the adjacent IOT, in particular the IOT Finger Pier. Output from the simulations was used to inform the NRA. APT and NASH Maritime Ltd (NASH) representatives were invited to observe elements of the simulation sessions as follows:

- Session One: 11th April 2022 (1 day)
- Session Two: 13th July 2022 (1 day)
- Session Three: 28th to 30th November 2022 (2.5 days)

75. During all sessions, HRW staff plus employee representatives from ABP Humber, ABP Projects, ABPMer, Stena Line and SMS Towage were present. During sessions one and two, APT (Immingham) Ltd as IOT Operators and NASH were the only observers. For Session three, in addition to IOT Operators and NASH, ABP had also invited Brian Greenwood (specialist in planning law at Clyde & Co) and representatives from DFDS plus, at the request of IOT Operators, Captains from James Fisher Everard (JFE) and Rix Shipping, both holding a Humber Pilot Exemption Certificate (PEC).

2.2.2 Session One

76. The intention for Session One was to simulate vessel movements to and from the IOT Finger Pier berth 8 which, at 94m minimum distance from the closest point of the proposed IERRT infrastructure, was deemed to be potentially the worst affected of the IOT berths.
77. The orientation of IERRT jetties for this study was 298° with a four-berth configuration which has since been superseded with a three-berth configuration.
78. The proposed tanker vessel model was '*Thun Grace*', but this ship model was subsequently found not to respond accurately, therefore a model of '*Thames Fisher*' was used. A total of 10 arrival and departure manoeuvres were conducted by highly experienced, senior Humber Pilots in moderate and strong NE'ly and SW'ly beam winds.
79. It was concluded from these simulations (especially in some wind conditions) that the currently practiced departure manoeuvre(s) would need to be modified due to the presence of IERRT's linkspan and berth. Notwithstanding the constrained approach presented by IERRT Berth 1 and its alongside vessel, berthing and departure was possible with care, utilising the existing workboat and tug resources available for ships berthing at the IOT.

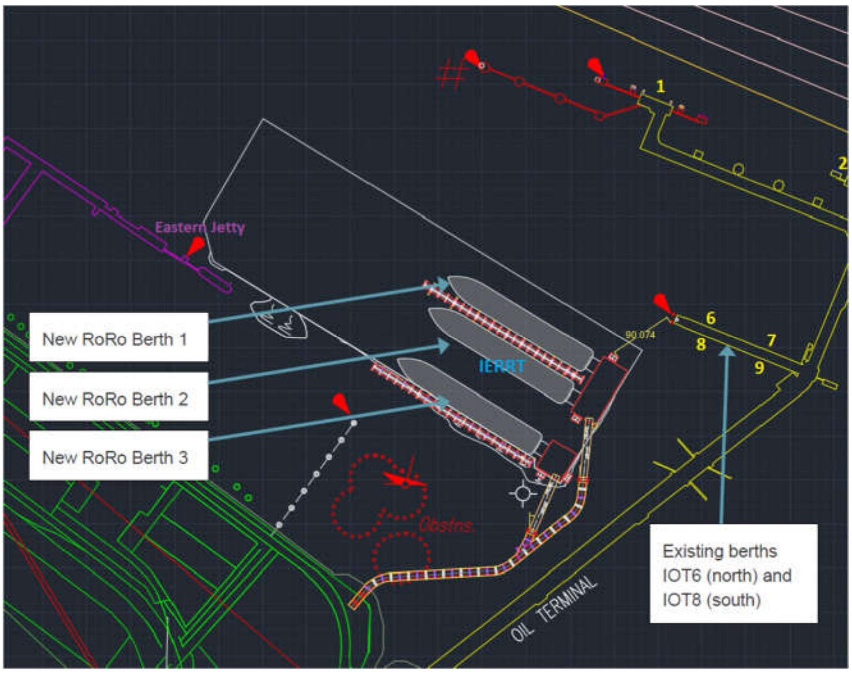


Figure 3: IERRT layout (from simulation report).

80. However, these simulations were undertaken without wind shielding enabled, and as a result the berthing scenarios are not realistic, because in real life there would be an added degree of difficulty and risk caused by rapid variations in forces acting on the vessel as a result of wind shielding, at a crucial time during the final approach to the berth. The April 2022 HRW report noted '*it is considered that during southerly winds, a combination of wind sheltering and funnelling could increase the complexity of berthing at berths 6 and 8'*.

81. Furthermore, the '*Thames Fisher*' class of ship is currently undergoing disposal and was more representative of a ship of the past visiting IOT, rather than a more modern ship with potentially larger Gross Tonnage and increased windage area (hence, many current and future vessels visiting the IOT Finger Pier will be significantly more susceptible to wind and wind shielding effects).

82. From hands-on knowledge, the '*Thames Fisher'* is known as a highly manoeuvrable vessel with a large ballast capacity (resulting in less windage area when approaching the berth) and a large bow thruster (resulting in increased manoeuvrability and response). Importantly, the ship's propeller transverse thrust acts 'left-handed' when the engine is operated astern whereas most ships act 'right-handed' (resulting in opposite vessel yaw rotations when propellor thrust in an astern direction is ordered), therefore its handling characteristics differ from the vessels which are expected to use the facilities it is therefore not a suitable model to use for a feasibility study, nor is it a conservative vessel suitable to be defined as a design vessel which should be reasonably worst case.

83. Furthermore, the ship's relatively small Gross Tonnage (GT) was not representative of a more modern, wide beamed vessel, neither is its shorter length (91m versus the longer Berth 8 design vessel length of 105m). For example, '*Wisby Teak'* and '*Wisby Argan'* regularly use the berths and are 4776 Gross Tonnage (GT) versus Thames Fisher's 2760 GT, hence are 'heavier' and larger vessels to manoeuvre, with higher windage and less able to be adequately controlled by the available workboat.

2.2.3 Session Two

84. For session two, the IERRT orientation had been changed from 298° to 300° and the minimum distance to IOT finger pier reduced from 94m to 90m, with a three-berth configuration (see Figure 3).

85. Again, highly experienced senior Pilots were used to conduct the simulation runs. The '*Thun Grace'* model had been corrected and was found to be broadly representative of the real ship. At 104m in length, the vessel is near design length for the IOT Finger Pier berths and has slightly higher GT than '*Thames Fisher*'. It is also a 'right-handed' acting ship, therefore more suitable (normal) for the study than the 'left-handed' '*Thames Fisher*'. It was also noted that the '*Thun Grace*' ship class is also old and currently being disposed of, therefore a larger tonnage model would still be preferable to assess the largest vessels likely to use the IOT Finger pier, which would also allow room for a small amount of future conservatism associated with the trend of vessel sizes increasing.

86. In total 11 arrival and departure runs were completed, of which all except one (run 10) proved to be feasible within the wind and tide limits simulated. Run 10 resulted in a heavy landing on Berth 8 which HRW described as '*Pilot error due to fatigue'*.

87. Again these simulations were not undertaken with wind shielding enabled, and therefore the study was not representative of the typical challenges of ship handling which actually occur.

2.2.4 Session Three

88. Session three was likely facilitated to try to appease other port users who had their own reservations regarding the feasibility of IERRT. At the request of ABP, Brian Greenwood (Clyde & Co) was present throughout. IOT Operators had requested ABP to invite an experienced James Fisher Everard (JFE) Master and Rix Shipping Master who hold a Pilot Exemption Certificate (PEC). At the suggestion of IOT Operators and NASH, ABP had requested HRW to model '*Wisby Teak'* and '*Rix Phoenix',* these simulating a larger tonnage vessel within the 104m IOT Finger Pier berth design length and an inland trading oil distribution (bunker) vessel, both of which are regular callers at IOT.

89. Day 1 and the morning of day 2 were dedicated to Ro-Ro manoeuvres to and from IERRT berth 1. DFDS had made comment regarding the inappropriate use of their highly manoeuvrable Jinling class ships which would never visit the proposed terminal (e.g. '*Humbria Seaways*'), therefore the existing Stena T class model '*Stena Transporter'* was used for IERRT runs during this session. Stena T class are 212m in length versus Jinling class 238m (the latter being design length for IERRT and thought to be the approximate length of the replacement generation of Stena T class ships) with considerably less beam and displacement, and therefore could be deemed easier to manoeuvre into IERRT than the larger ships that would be expected to service the proposed IERRT in the future.

90. Two highly experienced Stena Captains (also Humber PEC holders) conducted arrival and departure manoeuvres, one of whom had previously conducted some 70 simulated manoeuvres at IERRT during previous simulation sessions and was noticeably more practiced in the skills required than the other. It was clear that the approach angle and positioning of the vessel in relation to the tide and wind are critical to a safe and timely outcome. Run 11a was terminated due to the vessel's suboptimal positioning in the main channel and the time taken to manoeuvre clear of the main shipping channel, rather than letting the run complete. However, this aborted manoeuvre was recorded in the simulation report as 'no particular issues identified'.

91. Captains were pushed by the attending ABP HES Harbour Master, to vacate the main channel and lock bell mouth approach area as quickly as possible and manoeuvre within the confined water space between Immingham Lock approach, Eastern Jetty, IOT and the proposed IERRT. This additional pressure introduces an additional risk during poor weather or at a busy shipping period.

92. A total of 12 arrival and departure manoeuvres were concluded over 1.5 days which, despite the vessel being highly manoeuvrable, resulted in the model often being close to its engine and bow thrust operating limits. In addition, some manoeuvres, particularly departures during strong ebb tide, highlighted the vulnerability of tugs, especially the forward tug when secured to the vessel's bow. The combined effect of a 4 knot ebb and the vessel moving ahead at 3 knots over the ground results in a water speed of 7 knots. If a vessel is moving ahead through the water a tug needs to use a proportion of its power to match the speed of the ship, thus leaving only a proportion of its power to be available for manoeuvring the ship, therefore the tug is much less effective as speed increases and is of little or no effect once a large ship reaches 5 to 6 knots water speed. Additionally, water flow between a tug and the ship's bow causes a low-pressure area, which results in the tug getting sucked in towards a ship's bow, potentially losing control and colliding. This hydrodynamic effect is exponentially related to water speed. The effectiveness of a ship's bow thrust is similarly downgraded as the ship's speed increases.

93. Therefore the use of tugs in these situations needs to be considered in relation to how effective they would actually be; this further increases risk associated with manoeuvres in limit state conditions.

94. Two 'emergency' scenarios were conducted with a simulated total loss of power during the approach to IERRT Berth 1 on a spring ebb tide. In the opinion of NASH, APT and DFDS, these scenarios were scripted in detail prior to the run, conducted at too low a ground speed and commenced with the pre-planned response of dropping both anchors (using bridge control) within 15 seconds of alarm. This well-rehearsed and unrealistically quick response resulted in a successful simulated outcome whereby the anchors held, and the vessel's speed was arrested. The reaction time to these 'emergencies' was unrealistically fast compared to that likely in a real-life incident; additionally, most ships do not have the benefit of bridge control of anchors and are not manned to a level to be able to let go two anchors simultaneously. Due to the nature of the trade, RoRo ferries rarely use anchors, therefore it is reasonable to conclude that deploying them is likely to take longer than on a ship where they are regularly used.

95. Quick reaction time in loss of power scenarios is key to a good outcome, because the longer the vessel has to gain speed and momentum in a strong tidal current the longer and more difficult it is to stop and the less likely the anchors are to hold or quickly arrest the vessel. Kinetic energy, being related to speed, squared is exponential not linear – e.g. stopping power required at 2 knots is 4 times that required at 1 knot and at 4 knots is 4 times that required at 2 knots.

It can be concluded therefore that these brief 'emergency' scenarios cannot be regarded as a realistic representation of the likely outcome of real-life emergency and that the associated level of risk has not been adequately identified or addressed in the NRA.

96. During the afternoon of day 2 and the morning of day 3, simulations of tankers to IOT Finger Pier Berth 8 were conducted by a senior Humber Pilot using '*Wisby Teak'.* The wind shadowing feature of the simulator was switched on, which proved that the berthing manoeuvre in a strong SW'ly wind with a ship alongside IERRT berth 1 was indeed more challenging than without wind shadowing enabled. Despite good prediction of the timely need for assistance from the workboat and tug, berthing manoeuvres to Berth 8 during strong SW'ly winds resulted in landings which were heavier than would be routinely acceptable, leaving little margin for error or contingency. The ship's bow thruster was less able to cope with the additional windage caused by the wind funnelling effect introduced by the presence of nearby IERRT infrastructure and moored Ro-Ro. By using the larger 40t bollard pull tug on the bow rather than the stern and the workboat pushing aft, a lighter landing was achieved, however only one simulation was conducted using this tug allocation and therefore inconclusive without further trials. However, the availability of 40t bollard pull tugs is currently limited on the Humber Estuary.

97. Rix PEC Captain conducted runs using '*Rix Phoenix*'. A technical issue not apparent from the ship's bridge was discovered by HRW staff which explained why the first two runs had failed. Thereafter, although the model was not deemed fully representative of the handling characteristics of the real ship, two successful manoeuvres were conducted to Berth 9. The Rix PEC Captain observed that the reduction in manoeuvring space due to IERRT infrastructure would result in him being unable to carry out some of the manoeuvres that are currently routinely carried out during strong tides and winds.

2.2.5 Summary

98. There was discussion among the stakeholders attending the simulations during all sessions regarding the accuracy of the tidal modelling. For session three, the modelling had been further updated and it was stated by HRW that the updated tidal model better represented the actual tide experienced by Pilots and PEC holders. The complexities are enhanced because the spring and neap tide flows are not in exactly opposite directions - flood and ebb are not 180° opposed - plus, at differing states of the flood and ebb tides, flow directions differ due to whether water is flowing around mud banks (nearer low tide) or over them (nearer high tide). Flow around the IOT Finger Pier will be altered by the proposed dredged area of IERRT and the proposed infrastructure itself is likely to further impact what is currently experienced, particularly in way of the link span construction close to IOT berth 8.

99. It was stated by HRW that to add a conservative approach to the simulation studies, simulated tidal flows have been increased by about 15% compared to tidal flow modelling – this may not however be representative of the tidal flow directions and velocities experienced once the IERRT is constructed. Fluvial run down can also considerably increase the rate of ebb flow which has not been taken into account in simulations.

100. There was verbal agreement, during simulation attended by IOT Operators, from HRW and ABP Humber that the proposed IERRT design presents a challenging berthing scenario which would require careful planning and meticulous manoeuvring, especially in strong tide and/or wind. This theme was reflected in the simulation report. HRW in TR030007-000369-8.4.10(b) (Navigation Simulation Study – Part 2) concludes that IERRT should be subject to potentially onerous limiting wind parameters due to limited manoeuvring space and that operations would be challenging. Manoeuvres would require precise positioning of the vessel, tugs and their attitude to tidal flow and wind.

101. Therefore, if the development was to go ahead, there would be inherent risks which would result in a significant and ongoing training burden for Pilots and PEC holders as well as an increased risk to the IOT Finger Pier due to the proximity of IERRT infrastructure. This increased risk would be due to the increased technical difficulty of berthing ships at IOT 8 and 9 and the berthing of RoRo's at IERRT.

102. Spring ebb tide is generally seen as the main challenge for the IERRT berths particularly berths 2 and 3, where reduced wind parameters are recommended due to the reduced effectiveness of a ship's thrusters and tugs due to the vessel's headway through the water. In a strong (4 knot) ebb current when stationary over the ground or moving ahead the effects would require utmost caution.

103. It is envisaged that most vessels calling at IERRT will have regular masters who have Pilotage Exemption Certificates. This means that Humber pilots will seldom have the opportunity to gain experience of the berths. Given ship's staff turnover, the occasionally limited availability of ship's PEC holders and the potential use of unfamiliar chartered vessels, pilots will occasionally be required. The likely limited experience of individual Humber pilots to the proposed development is a risk.

104. The 'significant and ongoing' training burden referred to above is likely to be impractical, resulting in pilots insufficiently familiar or experienced with the IEERT berths and approaches being allocated to ships destined for the terminal, with the resultant risk of a failed or delayed manoeuvre.

105. The simulations observed (noting that these were to berth 1 only and not the more challenging berth 2 and 3) demonstrated that operations were technically feasible, within certain metocean limits, on a well-designed and well-resourced ship (e.g. Stena T class has 50t bow thrusters, twin propellers and flap rudders) but with propulsion equipment operating at 100% capacity for extended periods of time and minimal margin for error or redundancy.

106. Of course, not all ships likely to use IERRT during its lifetime are so well resourced. The DFDS Jinling class vessel model used for earlier simulations are also purpose designed, very powerful, highly manoeuvrable North Sea trailer ferries. TR030007-000369-8.4.10(b) states on page 3 that '*the proposed berths are acceptable for safe manoeuvring of a 240m long RoRo vessel*', however this general statement is flawed because it makes the incorrect assumption that all 240m RoRo vessels are similarly well resourced to the models used in simulations. Page 4 concluded that it would be necessary to run more specific simulations to identify the detailed procedures and limits for all future classes of vessel, in a wider range of environmental conditions. TR030007-000371-8.4.10(c) (Navigational Simulation – Stakeholder Demonstrations Report) amplifies this point further by concluding that '*any new class of vessel and potentially individual ships within a class will need operating limitations and procedures reviewed and developed*', which '*due to the precise navigation required, combined with strong currents at the site make this a particularly critical feature'*.

107. This highlights the marginal nature and viability of operations at IERRT, and therefore infers that significant unmitigated risk remains, which is the primary concern raised by IOT Operators.

108. In general, the conditions simulated were falsely sterile with the use of highly experienced, senior Pilots and Masters operating in a rehearsed, simulated environment, lacking dynamic variations, and having no other moving traffic, external time pressures, or the unpredictability and distractions regularly experienced on the bridge of a ship in a busy, fast flowing river. The conditions are falsely sterile because the human element and machinery reliability are not 'sterile' in practice.

109. Simulations were made with simulated mean winds up to 30 knots, without significant gusting. In practice, in mean winds of that strength, gusting occurs well above the 5 knot gusts said to be simulated; importantly it is not the mean winds which generally result in

damage to a jetty or loss of control of a vessel, it is the gusts. A gust is usually defined as lasting less than 20 seconds, but maybe longer, and is more than 10mph above the mean wind. This is critically important, because the force of wind acting on a ship is not linear but is exponential; the effect varying with the square of the wind speed. Using the formula [F=(V^2/18,000) x windage area], where F is the wind force in tonnes/m^2, wind is m/s and area in m^2, it can be seen that if a ship is exposed to a mean wind of 30 knots and then a gust of 40 knots, this 33% increase in wind force results in a near doubling of the wind effect (30x30=900, 40x40=1600).

110. Therefore, if a ship's manoeuvre is marginal in a 30 knot mean wind, it is likely not to be feasible in a 40-knot gust and the limits should therefore be accordingly set as being the maximum gust and not the mean wind. It follows that the assumptions resulting from the simulations regarding feasibility and operational limits are flawed and do not demonstrate that worst case scenarios have been considered.

111. In addition, to further amplify the short comings of the simulation, it is usual for simulation software to use a recognised basis for wind gusting, for example the Davenport Spectrum, which uses randomised gusting with varying duration and intensities. There is no evidence regarding how gusting is applied in the simulations, further evidencing that the simulations are not fit for purpose. Simulation run telemetry shows a flat line wind strength and, even when the use of 5 knot gusting is said to have been applied, this is not shown in the wind graph of the simulation plots. It may be that only the mean wind set by the simulation operator is shown on the plots, however it is essential to be able to quantify the gusting speeds and durations actually experienced in simulation and then compare this to real wind data of the area to ensure that the increases used for gust speed and the duration are adequately realistic. Otherwise, all wind limitation assumptions based on simulation outputs are further flawed. It is considered that ABP's weather analysis has not been sufficiently thorough to understand what the actual gusting in that immediate area should look like and, again, the simulations cannot be relied on to accurately demonstrate the true windage.

112. As a result of global warming and increased sea temperatures, weather systems now have more energy, resulting in squalls which can be far more intense and prolonged than gusts, thus further increasing risk.

113. In summary, in a sanitised and predictable environment the simulations demonstrated that the vessels modelled are technically able to berth and depart IERRT berth 1. This is, however, inadequate and not reflective of the dynamic environment in which ships operate. As with the Finger Pier simulations, wind shielding was not enabled for all but a few simulation runs and the variation & duration of wind gusts is not recorded. It is therefore difficult to place any degree of confidence in the simulation results.

114. Even so, the simulations highlighted significant vulnerabilities, especially in reduced margin for error when considering the variabilities that real world and future scenarios will introduce such as, commercial pressure, additional traffic, limited availability of the specific size and type of tugs required, time pressures and vessel sizes. It is worth noting that the proposed operation involves vessels carrying in excess of 300 passengers (truck drivers) and time sensitive 'just in time' trailer cargos, therefore the commercial pressures for the vessels to berth on time, whatever the weather, will be enormous.

115. As a result, these simulations do not provide sufficient evidence that the IERRT development is inherently safe with any margin for error and are likely to be less so when considering the reality of berthing at the IERRT. There are significant risks that still exist which would require very robust controls in place to mitigate such risks to levels regarded

as acceptable to all stakeholders. The presence of IERRT would also introduce significant additional navigational risks to existing IOT infrastructure downstream of and adjacent to the development, to vessels alongside Immingham Eastern Jetty and to those vessels using Immingham lock.

116. Additionally, the arrival and departure manoeuvres to IOT Finger Pier Berth 8 and 9 would be compromised by the reduced available water space. In particular, the approach angle to IOT Berth 8 and 9 currently used by tankers in strong SW'ly winds would not be possible due to the structure of IERRT Berth 1, its Ro-Ro pontoon and associated ship alongside.

117. In a wind between S'ly and WNW'ly the presence of a ship on IERRT Berth 1 would provide a sheltered approach to IOT Finger Pier Berth 8 and 9, meaning that an approaching tanker would not have time to 'balance' the forces of true wind and tugs during the approach to the berth, nor would it have time once emerging into the wind to abort the approach if deemed necessary/unsafe. Once committed in the final stage of approach, particularly to IOT Finger Pier Berth 8, when a tanker emerges from the shelter of the vessel alongside IERRT, the full force of the wind is suddenly experienced close to the berth giving the Pilot no time to balance the forces of available thrusters and tugs, and no chance to abort the manoeuvre if the ship's manoeuvring characteristics or towage resources prove inadequate. This would lead to heavy landings on the berth, especially the upstream knuckle of berth 8, with significant risk of damage to the jetty, ship and causing downtime of the IOT facilities (immediate berth downtime and potential terminal downtime to facilitate repairs).

118. HRWs conclusion that navigation to and from berth 8 is not adversely affected is therefore incorrect.

119. The extent of commercial impact on other port users was also noted from other participants during the simulations. From commencement of the IERRT approach manoeuvre in the vicinity of IOT Berth 2, the time taken for a ferry to be in position alongside IERRT Berth 1 – the quickest and simplest operation – was in the region of 25 minutes.

120. If using tugs, this time would be increased significantly, not least due to the fact that the tugs would not be released until a ferry was fully secured, and then the same two tugs have to proceed to the main channel to await the next vessel. Assuming that if one ferry requires tugs, then the others bound for Berths 2 and 3 would also have a similar or greater need. The time window, assuming 3 consecutive ferry arrivals, whereby tankers could not approach or depart IOT Finger Pier due to water space congestion could in the order of 1.5 – 2 hours or more. It is possible that this could also impact on main berth operations, depending on where inbound ferries have to wait. Similarly, a mooring gang can only service one vessel at a time, meaning that one vessel must complete mooring before being able to depart for another vessel.

121. Given an operating window of low water + 1 hour to high water (about 5.5 hours) the impact on IOT vessel movements would, on days when flood tide coincided with IERRT vessel movements, be significant.

122. It is also likely that current operating parameters would have to be reduced for barge operations on Berth 9 due to the limited manoeuvring space presented with IERRT structure in place, resulting in commercial impact on both IOT and the berth users. This is not accurately reflected in HRW report.

2.3 IERRT NRA CLARIFICATIONS

123. The following requests for further information were made to assist the drafting of this NRA (reference to the document they relate to):

- Background / basis of assessment
    a. Provision of a copy of the Port of Immingham's Statutory Harbour Authority's (SHA) Marine Safety Management System (MSMS). *(Vol3 Appendix 10.1 Navigation Risk Assessment 3.2.5)*
    b. Provision of a copy of the Humber Estuary Services (SHA/CHA/VTS are) Marine Safety Management System (MSMS). *(Vol3 Appendix 10.1 Navigation Risk Assessment 3.2.5)*
    c. Provision of a copy of the Port of Immingham's Statutory Harbour Authority's (SHA) current baseline Navigation Risk Assessment (NRA) (according to PMSC requirements). *(Vol3 Appendix 10.1 Navigation Risk Assessment 3.2.5)*
    d. Provision of a copy of the Humber Estuary Services current baseline Navigation Risk Assessment (NRA) (according to PMSC requirements) which covers the IERRT DCO area and approaches to it. *(Vol3 Appendix 10.1 Navigation Risk Assessment 3.2.5)*
    e. Provision of a copy of the Humber Estuary Services Pilotage Operations Manual for berths in vicinity of proposed IERRT (e.g. Immingham Bellmouth & Lock Entrance, Immingham East / West Jetty, Immingham Outer Harbour, Immingham Oil Terminal). *Not referenced in Vol3 Appendix 10.1 Navigation Risk Assessment but should be contained within 3.5.2.*
    f. Provision of a copy of the Humber Estuary Services Towage Operations manual for berths adjacent to proposed IERRT (e.g. Immingham Bellmouth & Lock Entrance, Immingham East / West Jetty, Immingham Outer Harbour, Immingham Oil Terminal). *Not referenced in Vol3 Appendix 10.1 Navigation Risk Assessment but should be contained within 3.5.3.*
    g. Provision of a copy of the Basis of Design Documents for IERRT for design vessel specifications document (including limits of vessel size and manoeuvrability) for marine operations at IERRT, including operational profile for the IERRT in relation to throughput, vessel frequency, downtime, operational and leave-berth limits (weather, etc). – *Chapters 2 and 3 of Volume 1 of the ES for the IERRT project (Application Document Reference Number 8.2).*
    h. Provision of a copy of the Emergency Response Plan for IERRT (to include 3rd party emergencies) – not provided although reference is made in Vol3 Appendix 10.1 Navigation Risk Assessment Section 12 to HESMEP: Humber Estuary Serious Marine Emergency Plan.
    i. Provision of a tidal data assessment and any tidal flow modelling information or reports (such as those used to inform Basis of Design documents). *Only limited Tidal information is provided at Vol3 Appendix 10.1 Navigation Risk Assessment Section 3.3.4 related to levels, but not velocities or directions for various tidal states.*

j. Provision of full incident data in relation to "Local port marine accident incident reporting database (MARNIS)" to facilitate IOT Operators Navigation Risk Assessment. Vol3 Appendix 10.1 Navigation Risk Assessment Section 2.6.1.

- NRA Methodology

  a. Definitions

     i. Definitions for commonly used terminology within the report (e.g., "Risk", "Risks", "Hazard(s)", "Embedded Controls" and "Further Controls", "Additional Controls", etc. – not provided within Vol3 Appendix 10.1 Navigation Risk Assessment.

     ii. Information on the data source used for the NRA Vessel Traffic Analysis and any reviews of data quality undertaken. – not provided within Vol3 Appendix 10.1 Navigation Risk Assessment 2.2, only that it has been sourced from an in-house AIS database provided by Anatec – Section 2.2.1.

  b. Risk Control Options

     i. Basis of Design Documents for IOT Trunk Way impact protection. – no details provided except at Vol3 Appendix 10.1 Navigation Risk Assessment Section 4.2.7.

     ii. Basis of Design Documents in relation to implicit impact protection for IERRT infrastructure. – *no details provided in Vol3 Appendix 10.1 Navigation Risk Assessment*

     iii. Further details on risk controls including specification and parameters. Limited details are provided on risk control measures in terms of when and how they will be implemented.

  c. Cost Benefit

     i. Details of Cost Benefit Analysis (CBA) undertaken, including inputs methodology and findings. Vol3 Appendix 10.1 Navigation Risk Assessment Section 9.7.2 - 9.7.4 (e.g. minutes of the Risk Assessment Meeting held on 04 October 2022 and the Cost-Benefit Analysis meeting held 06 October 2022).

     ii. Definitions for and the Tolerability thresholds used in the NRA and equivalent thresholds previously used in development of the Port of Immingham and Humber Estuary Services baseline NRAs. – *not provided in the Vol3 Appendix 10.1 Navigation Risk Assessment.*

124. As at 05-Sep-2023, none of the documentation has been provided by IERRT developers, however correspondence was received indicating that the requests were "*Potentially misleading information*", "*Publicly available information"*, "*Premature information"*, "*Unnecessary information"* or "*Irrelevance".* Further requests, stating why they are necessary have been made to IERRT Developers, however in the meantime this assessment has progressed based on the best available information and not on the actual assumptions used by ABP and its consultants.

3. IMMINGHAM OIL TERMINAL OPERATIONS

3.1 OVERVIEW OF TERMINAL

125. The IOT Operators are joint venture companies owned equally by Phillips 66 Limited (“Phillips 66”) and Prax Lindsey Oil Refinery Limited (“Prax”). Phillips 66 is the owner of the Humber Refinery and Prax is the owner of the Lindsey Oil Refinery.

126. The Humber Refinery is a nationally significant piece of infrastructure and is one of the most complex refineries in Europe. It provides highly skilled and high value roles for 1,100 employees and contractors and injects over £200 million on an annual basis into the region’s economy.

127. The Lindsey Oil Refinery is one of the most advanced refining and conversion processes in Europe and is highly valuable to the region’s economy and employs approximately 400 staff and another 400 contractors.

128. Together, the Humber Refinery and Lindsey Oil Refinery make up approximately 27% of the UK’s refining capacity. The importance of the refineries to the region and wider country’s economy is expressly acknowledged in a wide range of economic and development plan policy documents.

129. The activity of the IOT Operators is almost entirely in response to the requirements of Phillips 66 and Prax for marine movements of feedstock and products to and from the two refineries. The IOT Operators operate marine terminals and much of the pipeline system between the IOT and the refineries.

130. The marine components of the IOT include the following:

- Trunkway: Carries all product (via a pipe rack located on the upstream side of the trunk way (see Figure 4)) from and to vessels and provides access to Finger Pier and River Berths.
- Finger Pier: These berths mostly export refined product from the refineries in coastal product (coastal) tankers mostly exporting to UK and near European ports. Smaller bunker barges, servicing shipping on the Humber Estuary also visit the finger pier.
- River Berths: These berths are primarily used for the import of feed stock to the refineries.

Figure 4: Top left aerial view of IOT berths (source: humber.com), Top right: Nautical chart showing Trunkway, finger pier and river berths, and Bottom: close up aerial view showing the finger pier (showing berths 8 and 6 occupied by coastal tankers and berth 7 occupied by a bunker barge), Trunkway (pipe tracks are white/light grey) and small workboat berth opposite the finger pier.

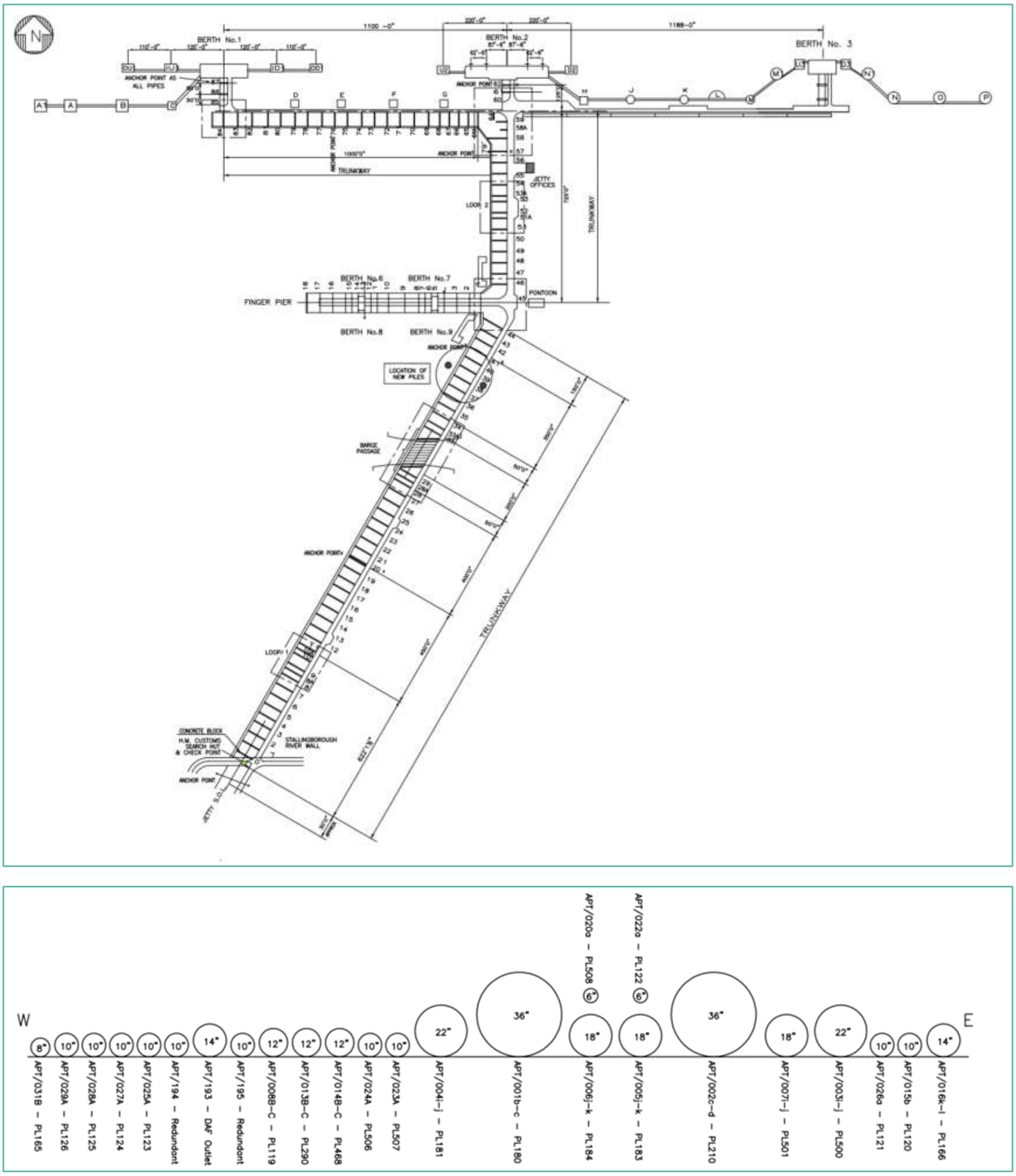


Figure 5: IOT layout (top, layout and bottom, pipe track on Trunkway).

131. The Trunkway is orientated across the tidal flows and extends first to the Finger Pier and then to the River Berths. The pipe rack carries 25 pipes of varying diameters to and from the Finger Pier and River Berths. The pipes contain the following types of products:

- Crude Oil;
- Kerosine;
- Motor Spirit;
- Gas Oil;
- Cracked Fuel Oil; and

- Heavy Fuel Oil.

132. Each IOT berth has a limit on the size and type of vessel that it can accommodate, which is as shown in Table 2.

Table 2: IOT Berth limits (* = Displacement, note Berths 6 and 8 are coastal tanker berths and 7 and 9 are estuarial barge berths only).

IOT Berth	1	2	3	6	8	7	9
	Main Berth	Main Berth	Main Berth	Finger Pier	Finger Pier	Finger Pier	Finger Pier
Minimum Summer Deadweight Tonnage	12,000	5,000	2,000				
Maximum Summer Deadweight Tonnage		284,480	80,000	8,500*	8,500*	1,000	1,000
Max Displacement on arrival (MT)	172,720	172,720	110,000	5,500	5,500		
Max Length Overall	350m	--	--	104m	104m	61m	61m
Minimum Ballast Flatside	73m	55m	42m				
Maximum Draft	14.0m	14.0m*	12.8m	7.0m	7.0m	5.0m	5.0m

133. Workboats, supplied by Briggs Marine, who are APT's current marine contractors, provide line handling and light towage duties to the IOT. They are all restricted to pushing duties only, no lines can be secured to the ship and therefore no pulling or towing can be provided. The service craft include:

- Bull Sand 1 (used the most)
- Spurn Sand
- Haile Sand
- Trinity Sand (not used for finger pier movements)
- Ross Point (not used for finger pier movements)

134. The workboats are the only craft that use the Mooring Pontoon (located immediately downstream/opposite of the IOT Finger Pier) or the Barge Mooring Buoy located upstream of the IOT Trunkway and inshore of the IOT Finger Pier. The workboats can also use the Barge Passage under the Trunkway to move around from upstream to downstream of the IOT Trunkway

3.2 BERTH OPERATIONS

135. All Finger Pier berths are used regularly, although berths 8 and 6 are the most heavily used berths. The Finger Pier is used by two types of vessels, coastal tankers and river trading (estuarial) barges.

136. Seagoing tankers of the size arriving and departing berths 6 and 8 are required to engage the services of a licensed ABP Humber pilot. Regularly trading ships with a Master familiar with the port may, subject to the requirements of the Humber Pilotage Directions, apply and be examined for a Pilotage Exemption Certificate and thereafter conduct the

pilotage themselves. Skippers of trading barges using berths 7 and 9 are required to hold a PEC, as they contain dangerous goods in bulk.

137. Under normal circumstances berthing will not be allowed if the “off-berth” mean wind speed is forecast to exceed 40mph or if the on-berth mean wind speed is forecast to exceed 30mph. There are occasions where a vessel may be berthed outside these criteria (e.g. it may be safer to allow the vessel to berth rather than return to an anchorage). The APT Berthing Master will make the decision in consultation with the vessel’s Master and/or Pilot.

138. Coastal Tankers are small product tankers, generally within the range 80m – 100m in length which trade predominantly to UK and near European ports distributing refined oil products and fuels. The largest vessel to visit the IOT recently was the WISBY ARGAN (see Figure 6) with the following parameters:

- Summer Deadweight Tonnage of 7,200t
- Length 99m
- Breadth 18m
- Year 2009
- Capacity 6,000MT of mineral oil.

139. The WISBY ARGAN is a regular visitor to IOT Finger Pier and visited as follows during a two week period this as follows:

- 07/06/2023
- 12/06/2023
- 16/06/2023
- 21/06/2023

140. The WISBY ARGAN berths at either berth 6 or berth 8 of the Finger Pier and generally stays alongside for approximately 24 hours per visit (note arrivals and departures are limited to flood tide only, which applies to all coastal movements on and off the Finger Pier).

Figure 6: Wisby Argan (Source fleetmon.com).

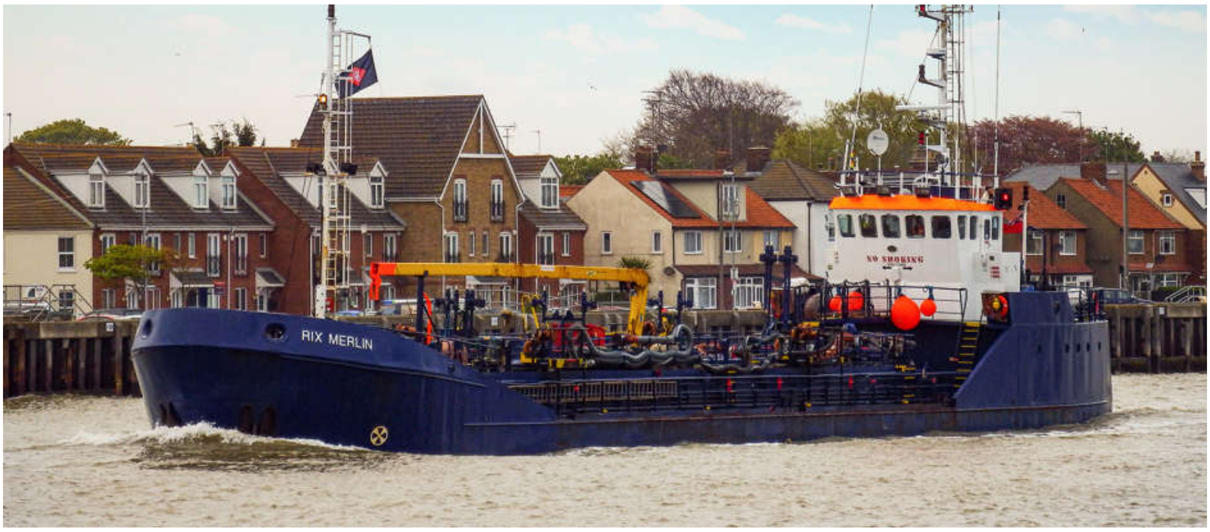


Figure 7: Rix Merlin (Source maritimebunkering.co.uk).

141. Estuarial Barges are frequent visitors and predominantly berth at berths 7 and 9 of the Finger Pier. These vessels are a mixture of estuarial barges which ply their trade on the Rivers Humber, Ouse and Trent, one of which can trade to coastal ports and harbours, subject to sea state limitations. Their trade comprises distribution of refined products to terminals further inland and direct delivery of bunker fuels to ships in Hull, Immingham and Grimsby. Rix Shipping provide the barges and their principal dimensions are as shown in Table 3.

Table 3: Rix Shipping Estuarial Barges.

Name	Length	Breadth	Capacity
RIX MERLIN	53.00m	7.9m	794 CuM
RIX PHOENIX	58.85m	7.6m	618 CuM
RIX OWL	60.80m	7.6m	777 CuM

3.2.1 Coastal Tanker Passage Plan

142. Historically, small tankers using berths 6 and 8 were allowed to berth on an outgoing (ebb) tide. However due to several incidents and near misses, the berthing and departure windows were (and remain) restricted to incoming (flood) tide only for vessels over 1,300t dwt; this being between the times of 'Low Water Immingham + 1hr through to the time of High Water Immingham. Vessels must berth bow to tide, therefore those mooring at berth 6 are starboard side to the jetty and those mooring at berth 8 are port side to the jetty. The restrictions were put in place by the harbour authority and agreed by IOT Operators.

143. The northwestern extremity of the Finger Pier houses a wheel fender which is designed to be used by arriving and departing vessels to 'slide' along the jetty. Arriving vessels transit the River Humber from sea, passing the IOT outer berths, rounding the northwestern end of berth 1 prior to setting their approach to the finger pier. The flood tide does not run parallel to the Finger Pier but runs with an approximate 6 to 10 degree offset, therefore the approach has to allow for a set off berth 6 and a set onto berth 8. An allowance for vessel drift due to wind also has to be factored into the approach course.

144. A small, terminal workboat tug is available 24 hours a day at IOT. The tug will be in attendance during all movements on and off the Finger Pier for use at the discretion of the tanker's Master, Pilot and APT Berthing Master. Due to manoeuvring and crew limitations, this small tug can only be used for pushing; it cannot be secured by a line to tow or pull.

145. For berth 6, tankers generally head for the jetty end knuckle and, when close, allow the vessel to set north, securing a forward spring line and a stern line as soon as possible. The small terminal tug stands by as directed by the Master/Pilot to push amidships and thereby hold the vessel onto the jetty.

146. For berth 8, tankers generally head slightly to the south of the knuckle endeavouring to keep head to tide so as not to be pushed onto the berth too early. In the event of a strong south westerly wind, the vessel will approach from a direction further to the south to allow for the effect of lateral drift during the approach. The small terminal tug is used on the port shoulder of the vessel to hold the bow up into the wind, sliding astern as the vessel's bow approaches the berth and allowing the vessel to land on the roller wheel fender. In strong winds where the power of the terminal tug is likely to be insufficient, tankers may contract the services of a 40t ASD tug in addition, usually from SMS Towage. This additional tug is generally secured to stern of the tanker by means of the tug's towing line and can be used for pushing or pulling/lifting as the Master/Pilot deems necessary.

147. During the approach to the berth, the Master/Pilot must balance the effect of tide and wind against the power available from the tug(s), leaving sufficient room to appraise the situation and abort the berthing if the prevailing weather proves to be beyond safe limits.

148. When departing berths 6 and 8, also on the flood tide only, tankers must proceed stern-first from the berth, turning around in a location of the Master/Pilot's choosing, normally dependent on the proximity of other traffic in the immediate area, the strength and direction of the wind. The small terminal workboat tug is available to be used to assist the departure and turn if required. In conditions of extreme wind, the services of a larger tug may be requested. Standard procedure is currently to turn using the water space proposed to be occupied by the IERRT development for vessels arriving and departing berth 8 and 9 of the finger pier.

3.2.2 Estuarial Barges Passage Plan

149. Barges using berths 7 and 9 are currently under 800t dwt, are highly manoeuvrable and are thereby permitted to berth on an ebb or flood tide. The regular Masters are used to the strong tidal flows, which can reach up to 4 knots on a spring ebb tide, pushing vessels towards the Trunkway, but they may avoid berthing on the strongest of tides, dependent on wind conditions. Barges usually berth 'head out', bow up river (i.e. stern to the Trunkway). Due to the minimal ballast capacity of the barges, their arrival draft is shallow, meaning that they are highly susceptible to the effect of wind. Therefore, current practice when arriving at berth 9 is to make a wide approach using the area of water between IOT finger pier and the river shore to turn and manoeuvre onto the berth, this being the area of water proposed to be occupied by IERRT. As with the larger coastal tankers at berths 6 and 8, the small terminal tug is available for barge arrivals and departures at berths 7 and 9.

150. When departing, barges are 'head out', therefore there is no need to turn after departure. Therefore, subject to weather and traffic, departures are generally relatively straight forward.

4. IERRT DEVELOPMENT

4.1 INTRODUCTION

151. The IERRT development is for a freight and passenger roll on / roll off (Ro-Ro/Ro-Pax) ferry facility, with a river terminal located immediately upstream of the IOT and downstream of Immingham Inner Docks bell mouth and Immingham East Jetty. Dedicated freight (truck) ferries with driver accommodation capacity over 12 are classed as passenger ships, even if they do not offer passenger only or car crossings. Drivers are not permitted to remain with their vehicles during a crossing. The current T-Class Stena ferries offer a driver passenger capacity of 300 in 150 twin berth cabins.

152. The physical characteristics of the development are detailed in the IERRT ES Chapters 2 and 3 (Environmental Statement: Volume 1 Chapter 2: Proposed Development - Document Reference: 8.2.2 and Environmental Statement: Volume 1 Chapter 3: Details of Project Construction and Operation - Document Reference: 8.2.3).

153. The IERRT marine facility comprises three in-river berths, orientated upstream and nominally in line with the tidal flows. It will operate 24 hours a day, seven days a week and it is understood (based on discussions at Hazard Scoring and Simulation meetings) that it will be operated by Stena Line. It is envisaged that Stena Line will operate a liner service from the IERRT to near European Ports (similar to that already provided from existing terminal berths in the River Humber).

154. The IERRT is designed to accommodate three vessels simultaneously (one at each berth) and it is understood that Stena Line will provide night crossings of the North Sea to the destination ports. This is similar to current Humber ferry operations where ferries have a similar scheduled arrival time on berth and means that the IERRT berths will likely be occupied during the day, with ferries arriving at set times in the morning and departing in the evening. It is also feasible that additional services could arrive in the evening and depart the following morning.

155. According to the ES IERRT berthing facilities have been designed to handle vessels with a length overall (LOA) of up to 240m, a breadth of 35m, and a draught of up to 8m. No further details on the specification of vessels have been provided including vessel:

- Number, type and rotation direction of propellers
- Engine Power;
- Thruster Power;
- Rudder Type;
- Windage area; and
- Displacement tonnage.

156. The IERRT vessels will carry accompanied freight (this includes goods vehicles and their drivers), unaccompanied freight (this includes heavy goods trailers) and passengers (this includes members of the public travelling in a motor vehicle – i.e., foot passengers will not be allowed). It is not clear what the limit of accompanied freight would be, although the ES states that there will be a limit of 100 members of the public embarking on any one day.

157. Based on numbers of members of the public known at 100 and the unknown limit for drivers of accompanied freight, the vessels servicing the IERRT will be passenger vessels

and should therefore follow the representative legislation for passenger vessels. Total passengers on board could therefore be in the order of 300.

4.2 LAYOUT

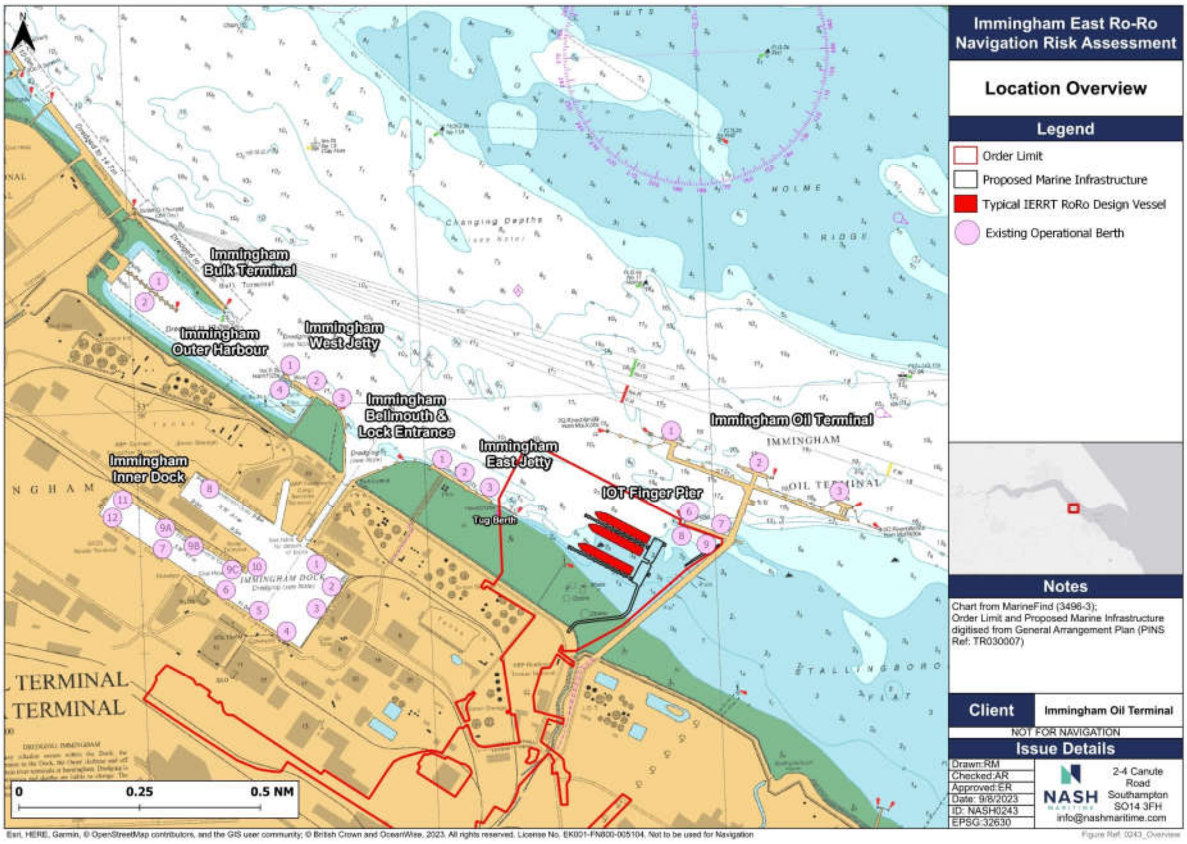
158. A detailed chart showing the location of the IERRT Marine Infrastructure is presented in Figure 8 which shows IERRT infrastructure geo-referenced manually on a navigation chart. The plot shows three 240m LOA and 35m breadth vessels alongside as would likely be the case during the day.

159. The following key dimensions are noted in relation to vessels bound to and from IOT Finger Pier Berths 8 and 9:

- The shortest distance between the IERRT and the IOT Finger Pier is 95m and is between the outer berth (berth 1) pontoon pile and the IOT Finger Pier berth 8 knuckle.
- Whilst the shortest distance is 95m, the cross-track width (the available sea room for the swept path of a vessel to navigate within) available to vessels servicing berths 8 and 9 is reduced to 79m, this being complicated due to the alignment of the finger pier and IERRT being different (292 degrees versus 300 degrees).
- Should a vessel of 18m beam be alongside the IOT Finger Pier berth 8, then the cross-track width is further reduced to approximately 68.5m, as shown in Figure 9.
- Further, given prudent mariners would require a nominal buffer to a fixed object (generally 2 x breadth of a vessel as a minimum for slow speed manoeuvres such as approaching a berth under pilotage), then the cross-track width is further reduced. As such the cross-track margin for Coastal Tankers would be 20m and the cross track for Estuarial Barges would be 40m. There is no industry standard for lateral distance between vessels, but if close, a passing vessel can be liable to detrimental effect on the ability to maintain directional stability due to discharges from a moored vessel (e.g. cooling water outflows, ballast outflows). Additionally, water flow around vessels' hulls causes a high-pressure area around the bow and stern and a low-pressure area towards the centre. This can also result in difficulty maintaining directional stability, resulting in an unwanted sheer or loss of control of a passing vessel.

4.3 OPERATIONS

160. Freight ferries serve the 'just-in-time' distribution concept whereby minimal stock of produce is kept in the marketplace. Hence businesses rely on daily, predictable, on-time delivery of goods whether it be perishable fresh produce, furniture or manufacturing components. Generally, the system relies on freight arriving in UK early in the morning (e.g. 05.00 - 06.00), with drivers rested overnight during the crossing, to be offloaded very quickly and on the road to the UK destination. Some will use the UK as a land bridge and board a west coast ferry to Ireland. There is significant commercial pressure for ships to maintain a rigidly timed liner service and therefore to discharge the cargo on time, which can add to the pressure experienced by ship's Masters to keep to the schedule as planned, despite the potential disruption of high winds or poor visibility.



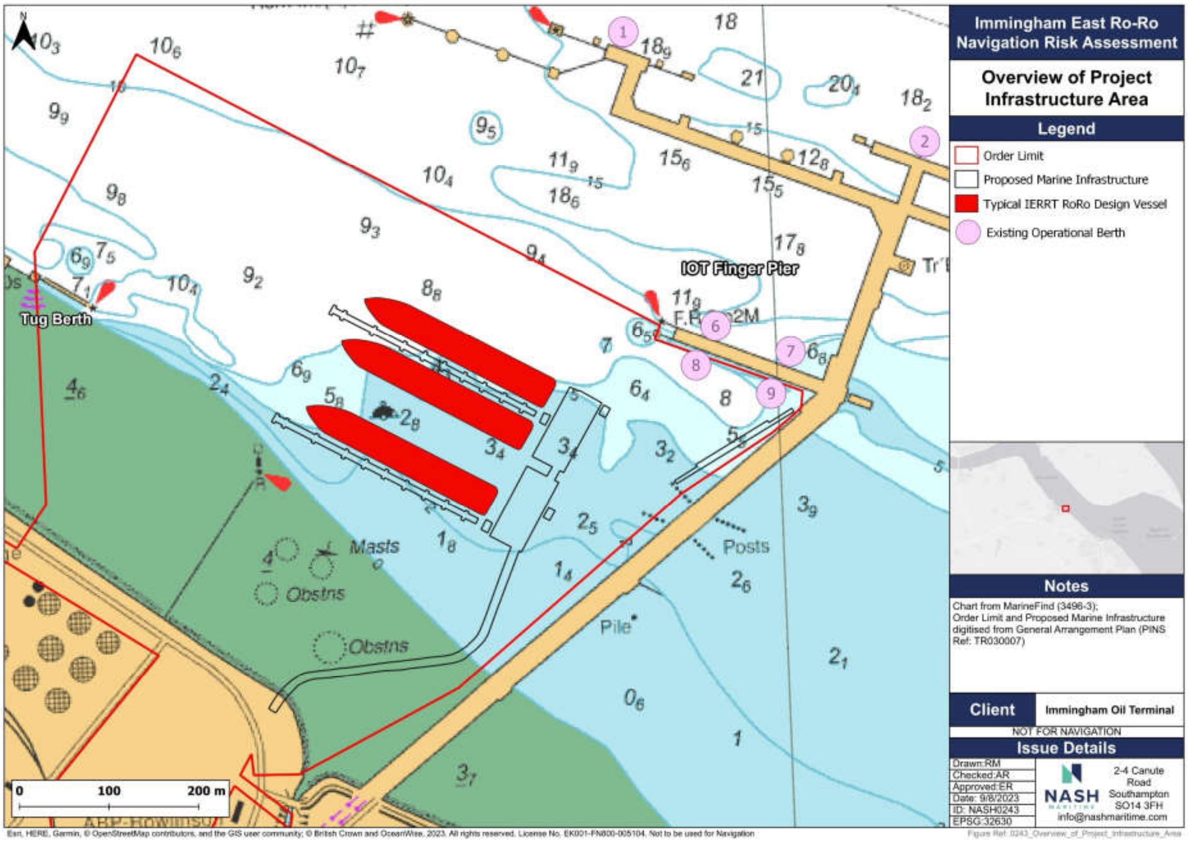


Figure 8: Overview of proposed IERRT Marine Infrastructure.

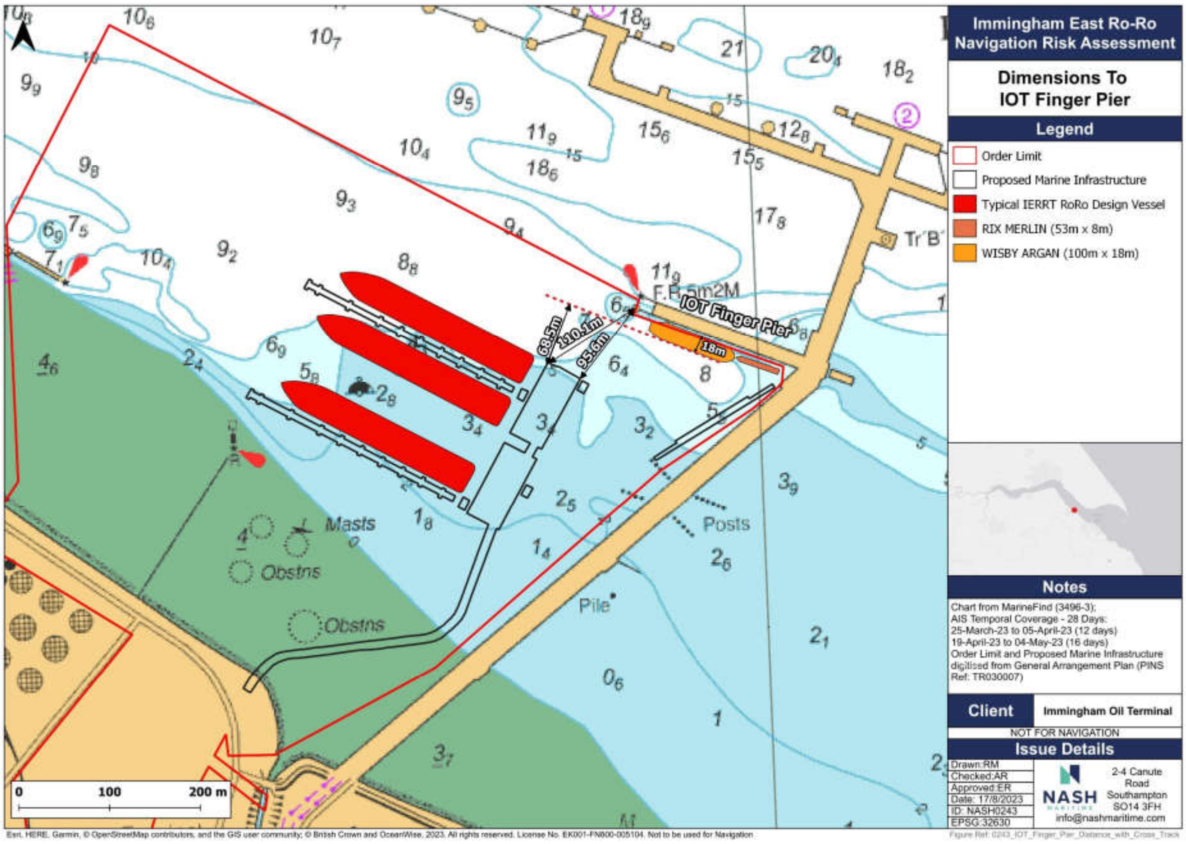


Figure 9: Dimensions of IERRT to IOT Finger Pier.

161. The River Humber is home to a large, busy and diverse port network including the enclosed docks of Hull, Immingham and Grimsby plus a multitude of river berths. Therefore, ferries engaged in daily liner services have to compete for slot times (and tugs/pilots where required) not only with ferry services operated by competitors, but with other commercial traffic. This ranges from very large tankers and bulk carriers which will be tidally constrained, to container ships, car carriers, chemical & gas carriers and various smaller commercial vessels, some of which will also be tidally constrained (e.g. small product tankers using IOT finger pier).

162. Given that inbound ferries arriving at IERRT and other similar ferry facilities elsewhere in the Humber would be required to be on berth at broadly the same time each day, congestion is a risk which would require careful co-ordination and deconfliction by VTS, especially when the river is busy with other traffic and/or during periods of high winds or poor visibility. The area immediately adjacent to IERRT, comprising Immingham Lock Bell Mouth, Eastern Jetty and the 9 berths comprising IOT is currently compact, extremely busy and often congested. The presence of IERRT would only add to this congestion and associated risk.

163. From the runs observed during simulation (noting that these only comprised simulations of ferries destined for IERRT berth 1, the simplest and quickest berthing operation of the three proposed jetties), a swift vacation of the main channel is required in vicinity of IOT Berth 1 in order to free up the main channel for the uninterrupted inward and outward passage of other shipping. The duration of the manoeuvre from IOT 1 area to being secured on the berth took approximately 30 minutes at best case. During periods of high winds, consecutive vessels would likely all require the assistance of tugs, meaning

that a second or third inward vessel would have to delay arrival to allow for the ferry ahead to complete mooring, to release the tugs and for the tugs to return to the main channel east of IOT to meet the next vessel. Given the time necessary for safely completing this scenario, a gap of at least 45 minutes between IERRT vessels would be prudent. Last minute delays would be difficult to manage and would add to main channel congestion.

164. The River Humber is well known for its 7-metre spring tidal range and the resulting exceptionally fast tidal flow, especially during the ebb tide. It is also openly exposed to the effects of wind. The jetties' vessel ramp pontoons would be designed to float, secured by piles, but the Finger Jetties at IERRT would be fixed structures. Moored vessels need to keep mooring winch brakes firmly secured and any required tending of moorings as the ship rises and falls with the tide must be undertaken with extreme care to avoid the vessel parting lines and/or the ship breaking away from the berth.

4.4 VESSELS

165. Ferries with driver/passenger accommodation capacity over 12 persons are classed as passenger ships, even if they do not offer passenger only or car crossings. Passenger ships are constructed under more stringent regulations to facilitate greater 'survivability' by the vessel in the event of fire or collision. Aboard any sea going ferry, drivers are not permitted to remain with their vehicles during a crossing. The T-Class Stena ferries currently operating to the Humber are envisaged to initially use IERRT prior to larger, replacement tonnage being delivered. The 212m x 27m T-Class currently offer a passenger accommodation capacity of 300 in 150 twin berth cabins. These are functional but the accommodation offers few facilities other than a 'embark, meal, sleep, meal, disembark routine.

166. Stena E-Flexer Class, 215 loa x 28 beam, the latest ferry design developed by Stena, currently in use by Stena on the Irish Sea, chartered to DFDS on the Dover Calais route, and Brittany Ferries on UK – Europe routes have a passenger capacity of 1,000.

167. DFDS Jinling Class at 238m loa x 34m is amongst the largest class of freight ferry currently used in UK-Europe North Sea trades and is more representative of the size of vessel envisaged for IERRT. Of broadly similar capacity, the largest current ferry operated by CLdN, a major North Sea operator, is the G9 class at 234m x 35m. Both the Jinling and G9 Class vessels are designed for unaccompanied freight (trailers) and therefore are classed as cargo ships with a maximum passenger capacity of 12.

Figure 10: Stena Transit - 'T' Class (Source: fleetmon.com).

Figure 11: Stena Estrid – E-flexer Class (Source: shipspotting.com).

Figure 12: Humbria Seaways – Jinling Class (Source: shipspotting.com).

Figure 13: Celine – G9 Class (Source: shipspotting.com).

4.5 PASSAGE PLAN

168. Given the proposed location of the IERRT jetties and the general agreement from simulations that ship handling at the proposed site would be challenging at best, the approach and departure manoeuvres would require precise initial positioning of the ferry in the river, the correct angle across the tide and highly accurate vessel manoeuvring. The differences in tidal set (the direction at which tidal vectors impacts on a vessel) between the strong flood and ebb tidal regime, would require a significantly different approach and departure plan and manoeuvres in strong winds would be increasingly complex. Given its more open location, arrival and departure from berth 1 would pose complex challenges and provide little margin for human misjudgement or a technical glitch, but berth 1 manoeuvres would be much less onerous than those at berths 2 and 3 where the room for manoeuvre and the margin for error is significantly less.

169. Arriving ferries would be required to reduce speed prior to passing the IOT outer berths such that speed over the ground when clearing IOT1 is less than 3 knots. Tugs, when required, would need to meet the vessel to seaward of IOT to allow adequate time for lines to be secured. Speed when securing and working with tugs should generally be less than 7 knots through the water.

170. Arrival and departure manoeuvres would require deconfliction from other traffic in the busy main channel and lock bell mouth area and there would be a need, due to commercial pressure and other vessel traffic, to vacate these areas as quickly as possible. Any delay in the arrival of tugs, for example, would add to the challenge in this busy but compact area of water.

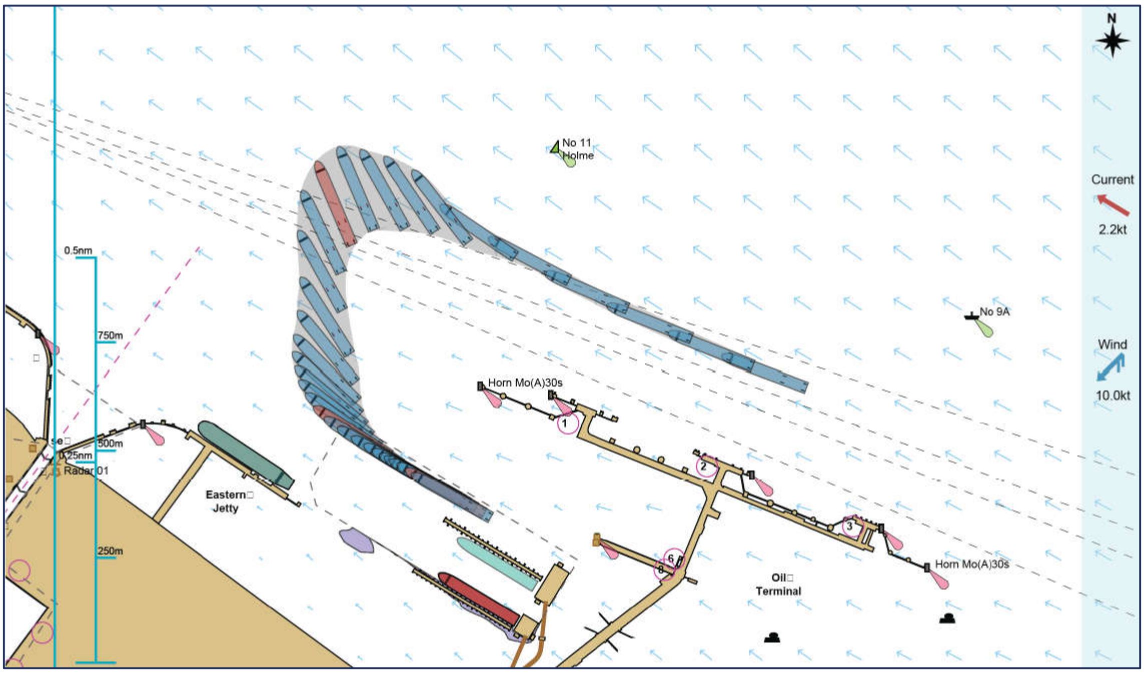


Figure 14: Flood tide berthing, 10kts NE'ly wind (extract from IERRT simulation report).

171. In this example (see Figure 14) of a flood tide arrival the ship obstructs the main channel for 15 minutes. It is essential to angle the vessel and keep the flood tide on the starboard side whilst operating propulsion astern. The resulting vector pushes the ship towards the berth. It can be seen that this arrival manoeuvre would be more challenging for berths 2 and 3, especially with a ship alongside the Eastern Jetty and/or when berthing with the additional footprint of tugs.

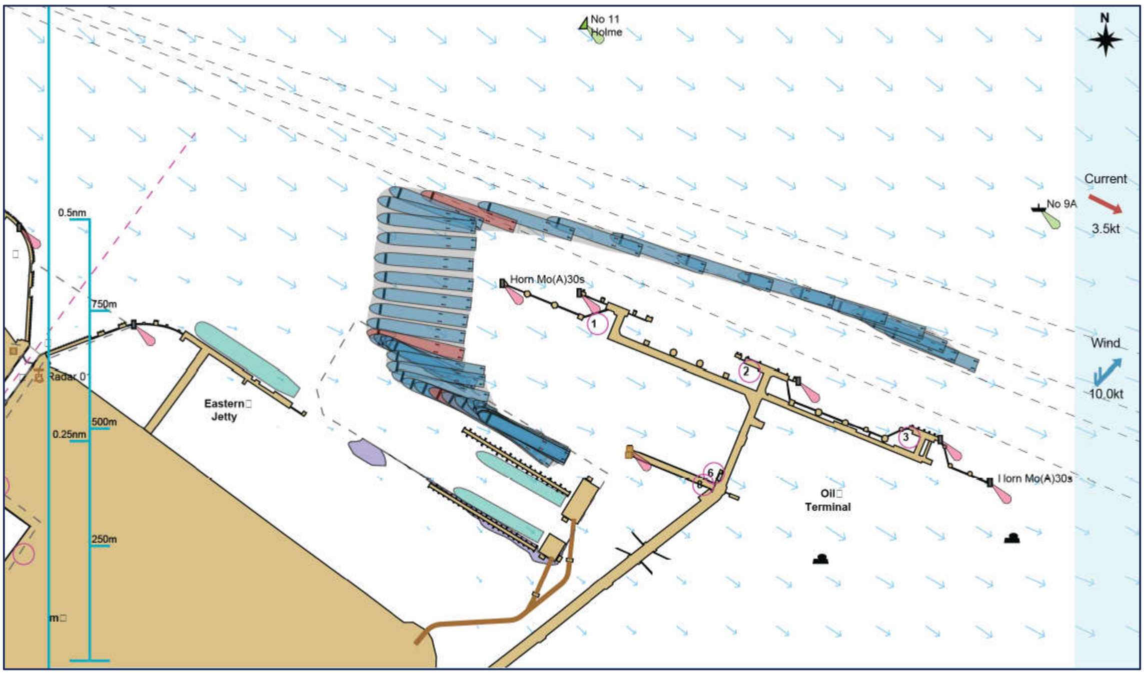


Figure 15: Ebb tide arrival berthing, SW'ly 10kts wind (extract from IERRT simulation report).

172. During an ebb tide arrival, loss of speed when approaching IOT 1 is easier than during a flood tide arrival (see Figure 15). In the ebb tide scenario, the IERRT ferry would need to be angled such that tidal flow remained on the vessel's starboard side, whilst operating propulsion ahead to stem the tide and therefore crab sideways in relation to the ground. Again, it can be seen that the manoeuvre would present more challenge when berthing at berths 2 or 3 because of the need to keep the tide just a few degrees off the bow and the distance between the NW end of IERRT and the SE end of Eastern Jetty being only marginally greater than the length of the ship (too great an angle would result in loss of control of the ship in the strong tide).

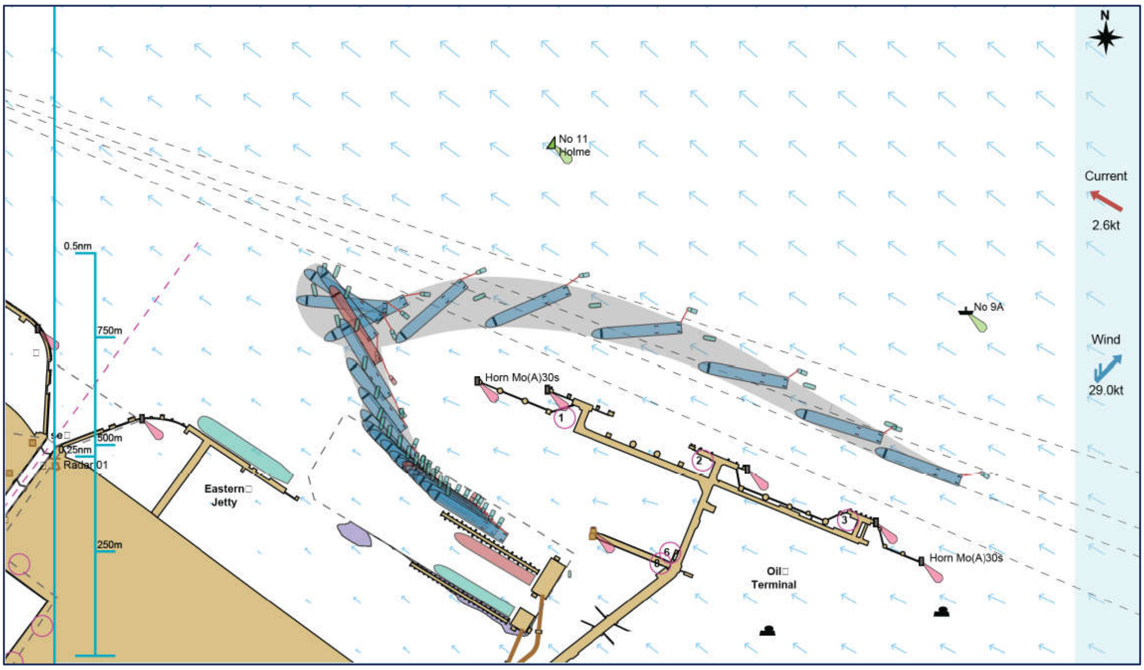


Figure 16: Flood tide arrival with tugs, SW'ly 30kts wind (extract from IERRT simulation report).

173. For an arrival scenario with 30kts SW'ly wind (see Figure 16), the vessel would require the services of 2 tugs. Due to the wind strength and direction it is necessary to drive the ship towards the jetty, into the wind, then align the flood tide on the ship's starboard side. The ship would then operate propulsion astern, with the tugs pushing or holding the ship up into the wind. It is a question of balancing the effect of wind and tide whilst delivering an appropriate force with tugs and the ship's bow thrusters in order to safely berth the ship. This is a highly skilled manoeuvre in which the Master or Pilot commence the approach by applying the forces which they intuitively feel are correct and then adjusting those forces to fine tune a delicate balance as the ship approaches the berth.

174. Departure on the flood tide (see Figure 17) is generally more challenging than on the ebb tide, especially in strong winds. In this example in a strong NE'ly wind, it proves difficult to lift the ship's bow into the wind as the ship moves ahead and the stern is taken through the wind using the aft tug. The ship is set north-west into the lock bell mouth by the flood tide during the manoeuvre. Again it can be envisaged that departure from berths 2 or 3 in such a scenario would be considerably more difficult.

175. During an on-berth wind it is necessary to keep a vessel up wind and gradually ease the vessel onto the berth with tug/workboat countering the effect of the wind (see Figure 18). It can be seen that during a strong SW'ly wind, even without a Ro-Ro berthed on IERRT 1, there is insufficient room for a tug to safely operate when in position to lift the stern, due to the presence of the planned IERRT linkspan infrastructure. When a Ro-Ro is in position on IERRT 1, it is necessary to leave a distance of approximately two ship's beam widths between a moored vessel and a passing ship due to hydrodynamic effects of increased water flow between vessels. The high-pressure areas around a ship's bow and stern, plus low-pressure area towards the centre when making way through the water or moored in a tidal flow can cause repulsion or attraction resulting in loss of directional stability of the passing vessel. It can therefore be seen that when passing at marginal distance from the Ro-Ro, there is insufficient room between vessels to allow a tug, whether used on the bow or stern, to be positioned ready to lift the tanker up into the wind.

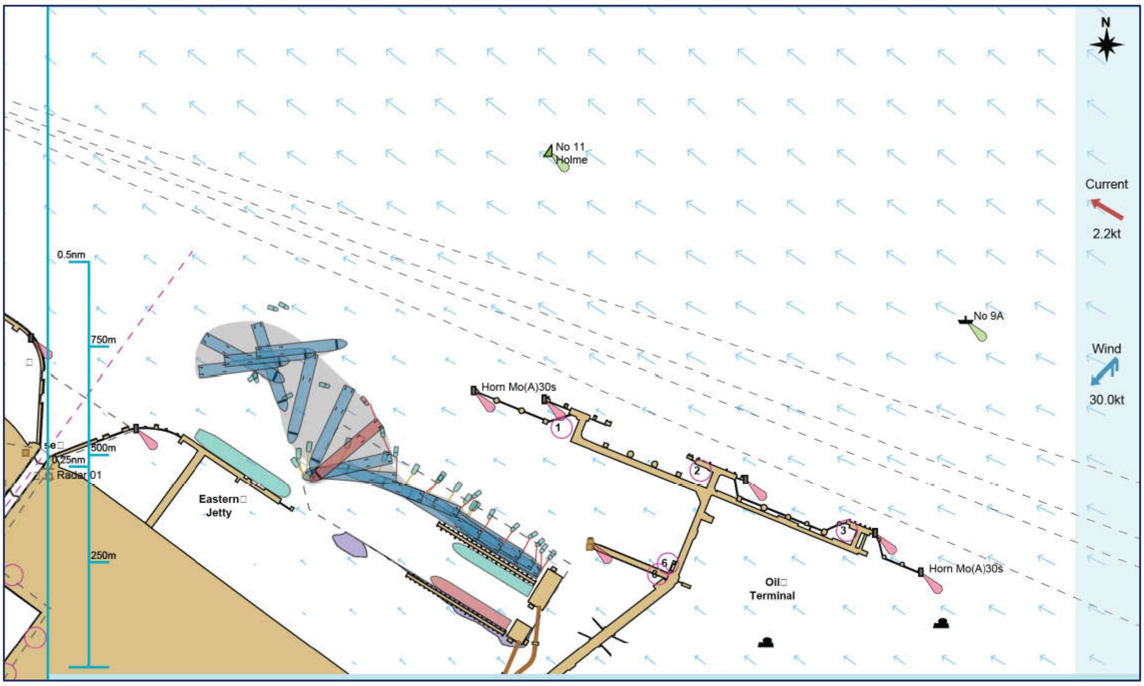


Figure 17: Flood tide departure, NE'ly 30kts wind (extract from IERRT simulation report).

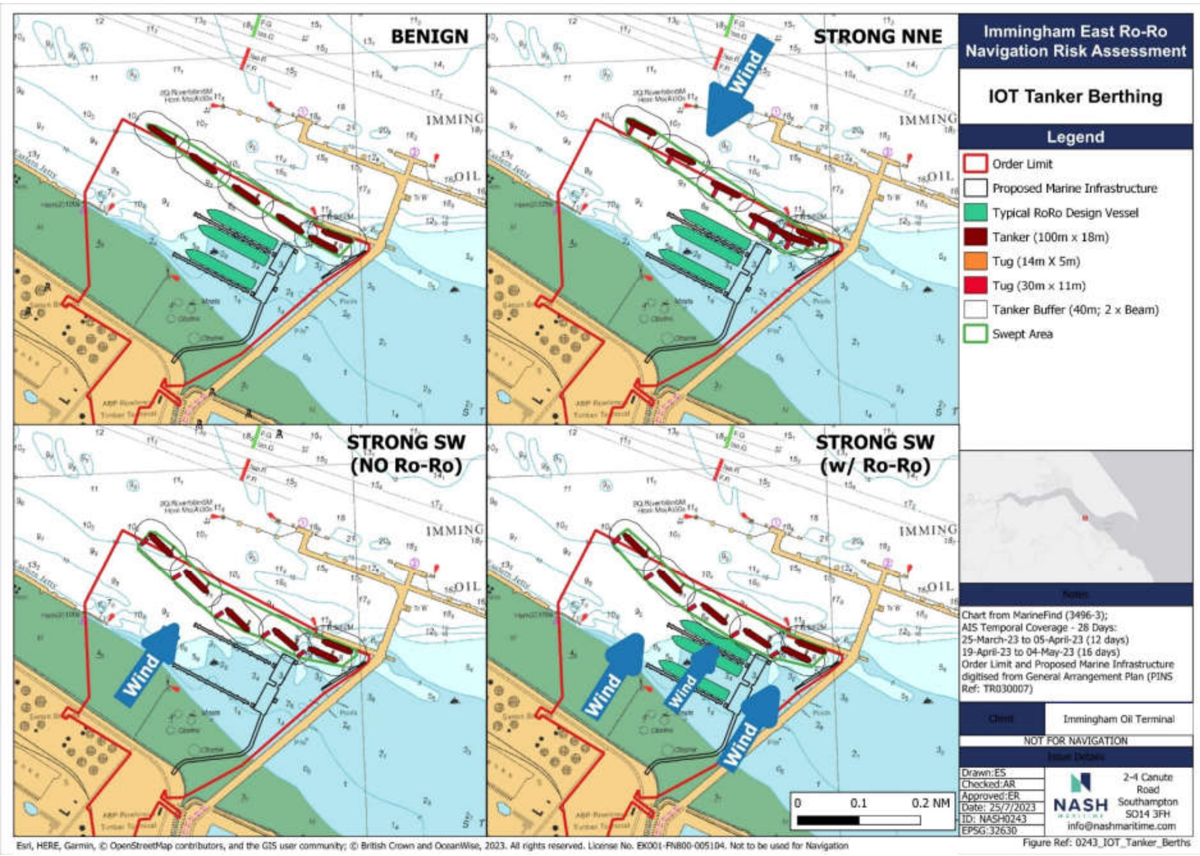


Figure 18: Berthing of Coastal Tanker with IERRT.

5. LEGISLATION AND GUIDANCE

5.1 INTRODUCTION

176. The following sections provides an overview of the legislation and guidance related to the IERRT development in close proximity to the IOT. This includes a high-level review of:

- Control of Major Accident Hazards (COMAH) Regulations 2015 Requirements.
- Port Marine Safety Code.
- Marine Guidance Note 654.

5.2 CONTROL OF MAJOR ACCIDENT HAZARD

5.2.1 Control of Major Accident Hazards (COMAH) Regulations 2015 Requirements

177. The Control of Major Accident Hazards (COMAH) Regulations 2015 aims to prevent and mitigate the effects of major accidents involving dangerous substances which can cause serious damage/harm to people and/or the environment. Regulation 4 of the COMAH Regulations requires Operators to "*take all measures necessary to prevent major accidents*". and limit the consequences to people and the environment of any major accidents which do occur.

178. IOT Operators are defied as an Upper Tier COMAH site and as required by Regulations 8 and 9 and Schedule 3 of the COMAH Regulations 2015 must have a:

- Major Accident Prevention Policy.
- Safety Report, which should include:
  - a description of the establishment and its environment including the geographical location, meteorological, geological, hydrographic conditions and, if necessary, its history;
  - a description of processes, in particular the operating methods, where applicable, taking into account available information on best practices;
  - a description of dangerous substances, including their classification under the Classification Labelling and Packaging Regulations and an inventory of dangerous substances;
  - a detailed description of the possible major accident scenarios and their probability or the conditions under which they might occur including a summary of the events which may play a role in triggering each of these scenarios, the causes being internal or external to the installation;
  - a policy on how to prevent and mitigate major accidents;
  - a safety management system for implementing that policy;
  - an effective method for identifying any major accidents that might occur;
  - measures (such as safe plant and safe operating procedures) to prevent and mitigate major accidents;

- information on the safety precautions built into the plant and equipment when it was designed and constructed;
- details of measures (such as fire-fighting, relief systems and filters) to limit the consequences of any major accident that might occur;
- identification of neighbouring establishments, as well as sites that fall outside the scope of these Regulations, areas and developments that could be the source of, or increase the risk or consequences of a major accident and of domino effects;
- information about the emergency plan for the site, which is also used by the local authority in preparing an external emergency plan;

- Prepare and test an internal emergency plan;
- Supply information to local authorities for external emergency planning purposes; and
- Provide certain information to the public about their activities.

5.2.2 IOT COMAH Safety Report: Ship Impact

179. The IOT Operators have provided the following information in respect of the IOT's COMAH classification:

- APT Immingham Oil Terminal is an upper tier COMAH establishment, due to the amount of hydrocarbon fuels stored on site. To comply with the COMAH regulations, APT must identify the major accident hazards that the site and its operations create.
- APT is also a COMAH "Domino site" define as those sites where the likelihood or consequences of a major accident may be increased because of the location and close proximity of other COMAH establishments and the dangerous substances present there.
- The level of risk that these hazards present to people and the environment must be assessed and compared to accepted tolerability criteria. This process is reviewed on a five yearly cycle by the Competent Authority (CA).
- At each cycle, the CA require APT to have thoroughly examined their operation and implement relevant safeguards to reduce operational risk to levels that are Broadly Acceptable or As Low As Reasonably Practical (ALARP).
- In the current cycle, APT has and is expected to spend significant resources on risk reduction measures identified as part of the COMAH process. This takes up a significant portion of the Safety and Projects teams time and effort, in addition to the financial costs associated.
- In operating a Marine Terminal for the transfer of fuels, there may be the risk of loss of oil from the infrastructure to the water. A ship collision has been identified as one of the potential causes of such an event. This could be a ship impacting on the jetty (allision) or a collision between vessels where one is berthed at the APT jetty.
- Ship collision leading to the loss of life or damage to the environment has been assessed as part of the COMAH process. The last submission was made to the

CA in 2019. From the data in that submission the chance of a spill capable of leading to a major accident hazard as a result of a collision can be calculated as 1.7E-02/yr, or about one in every 60 years.

- One of the major safety factors utilised to reduce this risk of allision with the IOT trunk way is that the coastal tankers using the Finger Pier are limited to a maximum displacement during arrival and departure tonnage of only 5000mt (compared to Ro-Ro vessels with a tonnage of 50,000mt). These coastal tankers are only permitted to berth or sail from the finger Pier during a “Flooding tide”. This ensures that should an engine or manoeuvring failure occur during the berthing / sailing of these vessels, they are carried upstream by the tide- away from the finger Pier infrastructure.
- While APT already employ’s various detailed measures to reduce the initial risk and consequence of any collision, there must still be an acceptance that a certain portion of the residual risk is outside of APT’s control, i.e. other vessels operating in the Humber.
- Should the IERRT development proceed, without extensive and substantial modification and preventative barrier protection to the IOT finger Pier and main Trunk way, the proximity of the IERRT and the size of the vessels using it would significantly increase the chance of allision to vessels using the Finger Pier and Collision to the IOT jetty.
- As such, it would be necessary for APT to re-evaluate the level of risk that ship collision would pose to people and the environment. The results would shift APT’s priorities on where to focus risk reduction effort and result in potentially significant time effort and financial resources being borne by the Terminal.

180. An extract of the IOT Operators COMAH Safety Report that details ship impact and collision risk to the IOT was provided to IERRT developers on 25 July 2022 (see Appendix B).

5.2.3 Guidance on ALARP Decisions in COMAH – Individual Risk

181. The Health and Safety Executive (HSE) document "*Reducing Risks Protecting People*"[5] was republished as an information document on the 13th December 2001. The purpose of the document is to address external stakeholders about HSE`s approach to regulatory decision making. The information document details the following statements of principle:

- Principle 1: "*HSE starts with the expectation that suitable controls must be in place to address all significant hazards and that those controls, as a minimum, must implement authoritative good practice irrespective of situation based risk estimates*".
- Principle 2: "*The zone between the unacceptable and broadly acceptable regions is the tolerable region. Risks in that region are typical of the risks from activities that people are prepared to tolerate in order to secure benefits in the expectation that*

[5] Reducing Risks: Protecting People - HSE's decision making process (Accessed 10-Jul-2023)

- *the nature and level of the risks are properly assessed and the results used properly to determine control measures;*
- *the residual risks are not unduly high and kept as low as reasonably practicable (the ALARP principle); and*
- *the risks are periodically reviewed to ensure that they still meet the ALARP criteria, for example, by ascertaining whether further or new controls need to be introduced to take into account changes over time, such as new knowledge about the risk or the availability of new techniques for reducing or eliminating risks."*

- Principle 3: "*both the level of individual risks and the societal concerns engendered by the activity or process must be taken into account when deciding whether a risk is acceptable, tolerable or broadly acceptable' and 'hazards that give rise to …. individual risks also give rise to societal concerns and the latter often play a far greater role in deciding whether risk is unacceptable or not*".

182. In the context of COMAH sites "*Reducing Risks Protecting People"* is accompanied by a Semi Permanent Circular "*Guidance on ALARP Decisions in COMAH*" [6] (SPC/Permissioning/37), which aims to give guidance specifically on ALARP demonstrations.

183. The guidance identifies three levels of risk:

- ***Intolerable Risk***: *Clearly, if the risk is in this region then ALARP cannot be demonstrated and action must be taken to reduce the risk almost irrespective of cost.*
- ***Tolerable if ALARP Risk***: *If the risks fall in this region then a case specific ALARP demonstration is required. The extent of the demonstration should be proportionate to the level of risk.*
- ***Broadly Acceptable Risk***: *If the risk has been shown to be in this region, then the ALARP demonstration may be based on adherence to codes, standards and established good practice. However, these must be shown to be up-to-date and relevant to the operations in question.*

184. The Semi Permanent Circular shows types of ALARP demonstrations and associated risk of death per annum (see Figure 19). This reiterates the HSE "*Reducing Risks Protecting People"* definition relating to be acceptable levels of risk; "**Broadley Acceptable**" - fatality rate of less than 1 x 10^{-6}, "**Tolerable if ALARP**" – fatality rate of less than 1 x 10^{-4} (public) and 1 x 10^{-3} (workers), and "**Intolerable**" risk is greater than these. It relates however to risk to individuals and not societal risks.

[6] Guidance on ALARP Decisions in COMAH - SPC/Permissioning/37 (hse.gov.uk) (Accessed 10-jul-2023)

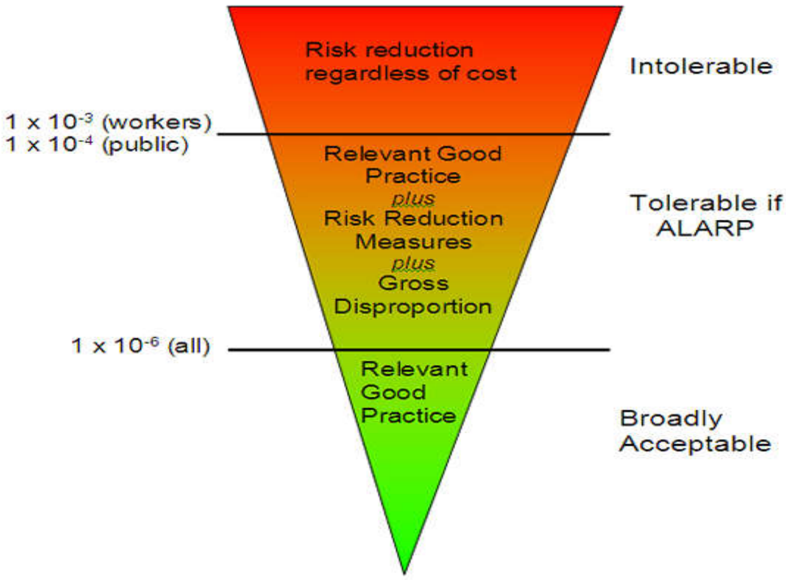


Figure 19: Types of ALARP Demonstration (Figure 1: Guidance on ALARP Decisions in COMAH - SPC/Permissioning/37).

5.2.4 Guidance on ALARP Decisions in HSE – Societal Risk

185. The HSE guidance notes that some risks give risk to societal concerns, which might take the form of a single event with multiple fatalities. Societal risk is particularly relevant for transportation activities which have the potential for multiple fatalities, but which spread their risks over a constantly changing population of passengers and people and therefore the individual risks to any specific person is relatively low.

186. Societal risk is often displayed through the use of so-called FN-curves which are obtained by plotting the frequency at which such events might kill N or more people). Whilst no FN curve is given within the HSE guidance HSE's (2001) Reducing Risks, Protection People states that "HSE proposes that the risk of an accident causing the death of 50 people or more in a single event should be regarded as intolerable if the frequency is estimated to be more than one in five thousand years". Translating this to the acceptability of societal risk for an individual fatality then it would relate a single fatality in one hundred years.

5.3 PORT MARINE SAFETY CODE

187. The Port Marine Safety Code(PMSC) [7] provides a national standard for marine safety in ports, harbours, marine terminals and marine facilities. Its aim is to enhance safety for everyone who uses or works in the UK port marine environment. The PMSC notes that the responsibility for maintaining port marine safety is governed not only by marine legislation, such as the Pilotage Act 1987 and Merchant Shipping Act, but also by general legislation, such as the Health and Safety at Work Act 1974 (which includes COMAH Regulations) and the Corporate Manslaughter and Corporate Homicide Act 2007.

188. Of the 10 keys measures of the port marine safety code three are recommended as the very minimum requirement for compliance, these are

[7] Port Marine Safety Code (publishing.service.gov.uk) (Accessed10-Jul-2023)

- **Measure 4:** Duties and Powers: Comply with the duties and powers under existing legislation, as appropriate.
- **Measure 5:** Risk Assessment: Ensure that marine risks are formally assessed and are eliminated or reduced to the lowest possible level, so far as is reasonably practicable, in accordance with good practice.
- **Measure 6:** Marine Safety Management System: Operate an effective MSMS which has been developed after consultation, is based on formal risk assessment and refers to an appropriate approach to incident investigation.

189. Through implementation of “Measure 5: Risk Assessment” and “Measure 6: Marine Safety Management System” the PMSC requires “all risks are identified and controlled – the more severe ones must either be eliminated or reduced to the lowest possible level, so far as is reasonably practicable (that is, such risks must be kept as low as reasonably practicable or “ALARP”). Organisations should consult, as appropriate, those likely to be involved in, or affected by, the MSMS they adopt. The opportunity should be taken to develop a consensus about safe navigation. The MSMS should refer to the use of formal risk assessment which should be reviewed periodically as well as part of post incident/accident investigation activity.”

190. At section 2.7 of the PMSC formal risk assessments are required to:

- *identify hazards and analyse risks;*
- *assess those risks against an appropriate standard of acceptability; and*
- *where appropriate consider a cost-benefit assessment of risk-reduction measures.*

191. The PMSC requires that risks are assessed against an appropriate standard of acceptability, and in this context then IOT Operators are required by the Health and Safety at Work Act to defer to the standards defined in the COMAH regulations (see Figure 19), which put the threshold of “Broadley Acceptable” of a fatality rate per year of less than 1 x 10^{-6}, and the threshold for “Tolerable if ALARP” at a fatality rate per year of less than 1 x 10^{-4} (defined as the limit for members of the public, as IERRT vessels will be carry up to 120 passengers). This relates to individual risk, however for societal risk then a figure of one fatality in 100 years could be adopted (see above).

5.4 MARINE GUIDANCE NOTE 654 (M+F)

192. MGN654, and its associated annexes, was developed by the MCA (2021) as the primary guidance for developers conducting NRAs of offshore renewable energy installations. The guidance clearly sets out the expectations of data gathering, consultation, analysis and assessment of these NRAs. Much of the underlying assessment approach is consistent with the IMO’s Formal Safety Assessment. Failure for developers to follow the guidance principals of MGN654 may result in delays and objections from stakeholders within the licensing and consenting process.

193. Whilst MGN654 is not explicitly developed for use in NRAs in other applications, the MCA have consistently accepted the use of MGN654 for undertaking NRAs on a wide range of topics (such as oil and gas, offshore infrastructure, and port infrastructure).

5.5 LEGISLATION AND GUIDANCE SUMMARY

194. In summary, there is adequate existing legislation and guidance to enable a robust and evidence-based navigation risk assessment of IERRT to be undertaken. Based on a

review of the available legislation then an appropriate standard of acceptability for societal risk, in relation to harm to people is a figure of one fatality in 100 years could be adopted, which is the limit between Tolerable subject to ALARP and Intolerable. An appropriate and robust Navigation Risk Assessment should therefore adopt these parameters.

6. RISK ASSESSMENT METHODOLOGY

6.1 FSA METHODOLOGY

195. The scope for this sNRA commissioned by IOT Operators is to address the shortcomings identified in the ABP provided IERRT NRA. The underlying methodology for the sNRA is the International Maritime Organisation (IMO) Formal Safety Assessment (FSA) approach, which is referenced (PMSC Para. 4.3.20) by the UK PMSC as the appropriate methodology for marine operations in UK ports and harbours. It is also the same approach as is mandated by Maritime Coastguard Agency in MGN 654 (M+F).

196. This methodology involves a structured process for identification and analysis of hazards and scenarios with scoring of risk, before taking action to reduce intolerable risk to 'As Low As Reasonably Practicable (ALARP)' and to a level that is acceptable to stakeholders, (see Figure 20)

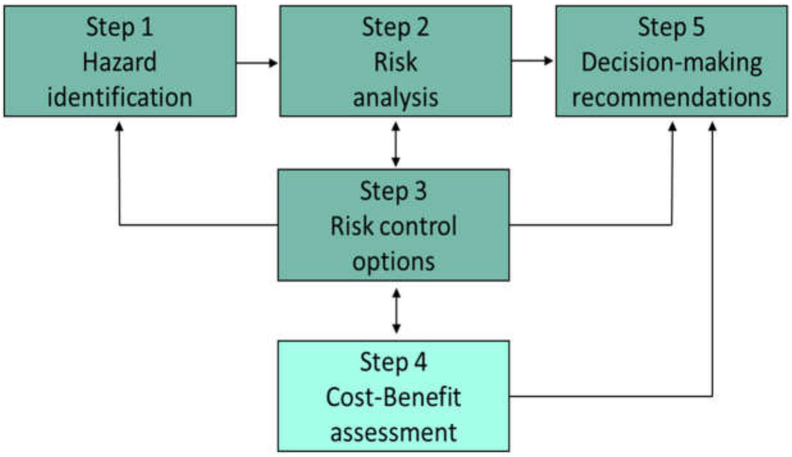


Figure 20: IMO Formal Safety Assessment process

197. The individual steps of the sNRA are as follows:

- **Step 1:** Hazard identification based on detailed description of current and future navigation baseline for the area of the proposed IERRT (see Sections 7, 8 and 9), based on:
  - Quantification of current baseline navigation disposition including:
    - Use of composite swept path analysis from AIS data collected at IOT.
    - Review of historical incidents (both in the area, with similar vessel types elsewhere, and to oil terminal infrastructure).
  - Future navigation disposition:
    - Cross reference to the IERRT NRA documentation.
  - Consultation with stakeholders (and regulators such as Harbour Master for the port of Immingham); and
  - Detail a robust sNRA methodology appropriate to IERRT and IOT operations based on accepted guidance. This includes review of current baseline NRAs for the area (yet to be provided by ABP) – principally, the current MSMS NRA.

- **Step 2:** Risk analysis (see Section 10) to inform hazard scoring including quantitative:
  - Likelihood modelling; and
  - Consequence modelling.
- **Step 3:** Identification and specification of risk control measures (see Section 11.
- **Step 4:** Cost benefit assessment using ALARP principles for intolerable hazards (see Section 12).
- **Step 5:** Decision making recommendations (see Section 13).

6.1.1 Consultation

198. Consultation with stakeholders is included in this assessment based on the attendance at and outputs of the second and third hazard workshops undertaken by IERRT developers and attended by the IOT operators, giving particular regard to information raised by navigation users of the area. The first hazard workshop was conducted by ABP personnel only and IOT operators were not invited to attend, so no consultation results are drawn from this workshop.

199. The following hazard workshops were as follows:

- Hazard Workshop 1: 29 October 2022

  ABP personnel only to inform the Preliminary Environmental Impact Report Navigation Risk Assessment;
- Hazard Workshop 2: 7 April 2022

  IOT Operators and other stakeholders in attendance,
- Hazard Workshop 3: 16 - 17 August 2022

  IOT Operators and other stakeholders in attendance.

6.2 QUALITATIVE ASSESSMENT (HSE / COMAH)

200. The following section outlines the parameters of the risk assessment methodology which has been adopted as the qualitative NRA methodology for this assessment in order to determine the baseline and residual navigation risk posed by the IERRT. It uses the same risk matrix as adopted by IOT operators for their COMAH safety plan.

201. As the IOT is a COMAH site, it has HSE-imposed acceptability levels to risk which are referenced to clear likelihoods of occurrence for defined hazard consequences (e.g. a fatality) – these have previously been provided to IERRT developers with the Standards of Acceptability to IOT Operators as a COMAH site under UK Health and Safety Executive regulations.

202. The IOT Operators COMAH risk assessment methodology was utilised to establish a benchmarking basis for navigation risk posed by the IERRT development which is consistent with how the IOT Operators currently assess and understand risk.

203. In this sNRA the following definitions apply:

- **Hazard** - an unwanted event resulting in adverse consequences;
- **Likelihood** - a determination of how likely a hazard is to occur;

- **Consequence -** the magnitude of adverse outcomes should a hazard occur;
- **Risk** – a non-dimensional measure of hazard frequency and consequence based on a qualitative risk matrix;
- **Embedded risk control measures** – a risk control measure that is already in place;
- **Additional risk control measures** – a risk control measure that is put in place specifically for the project scheme under consideration;
- **Baseline Assessment of Navigation Risk** – an assessment of hazard risk with the proposed operation occurring including existing ("Embedded") risk control (or mitigation) measures.
- **Residual Assessment of Navigation Risk** – an assessment of hazard risk with the proposed operation occurring including existing ("Embedded") risk control (or mitigation measures), and "additional" project / risk control (or mitigation) measures.

204. The risk assessment methodology requires that marine hazards are identified and assessed in relation to likelihood and hazard consequence to generate a hazard risk score. The likelihood classification is assigned based on the likelihood of the occurrence of the level of harm (severity) specified e.g. injury, not the likelihood of an initiating event e.g. adverse weather.

205. The hazard likelihood categories are summarised in Table 4 which are the same as the IOT COMAH safety plan. A cross reference is also included to IERRT Frequency Descriptors based on the mathematical likelihoods.

Table 4: IOT COMAH Hazard Likelihood Categories.

Rank	Description	Typical Frequency Range (of specific scenario being considered on the site)	Cross reference to IERRT Hazard Frequency for Operations
1	Very unlikely	< 1 in a million chance per year	Rare
2	Unlikely	1 in 1,000,000 to 1 in 10,000 chance per year	Rare
3	Reasonably likely	1 in 10,000 to 1 in 1,00 chance per year	Unlikely / Rare
4	Likely	1 in 1,00 to 1 in 1 chance per year	Likely / Possible
5	Very likely	> 1 in 1 chance per year (> 1 per plant year)	Almost certain

206. Hazard consequence classifications are shown in Table 5 and relate to hazard outcomes to people, property, environment and Port Business.

207. The IOT COMAH risk assessment methodology outlines consequences in terms of people and environment as follows:

- Consequences to people are derived from HSE imposed acceptability levels.
- Consequences to the environment are defined in terms of potential to cause a Major Accident to the Environment (MATTE). For a MATTE to occur there must be a release of material from site that causes sufficient environmental damage to

one or more environmental receptors. The severity of damage and the length of time the damage occurs are significant in determining a MATTE.

208. Consequences to property and business are not outlined in the COMAH risk assessment methodology. The NASH Maritime team therefore undertook a benchmarking exercising utilising internationally recognised consequence classifications used in NRA methodologies, such as MCA MGN 654, and methodologies utilised by UK SHAs to determine appropriate consequence classifications for property and business.

Table 5: Hazard Consequence Classifications.

Rank	Description	Definition: People	Property	Environment	Business
1	Moderate	Potential for minor injury on site.	£10,000-£100,000	Environmental impact but below the major accidents to the environment (MATTE) threshold	Local negative publicity, short term loss of revenue to port / ship register £10,000-£100,000
2	Serious	Potential for serious injury / injuries on site.	£100,000-£1million	Department of the Environment, Transport and the Regions (DETR)[8] criteria – the lowest level of harm that can be considered a MATTE	Widespread negative publicity, temporary suspension of activities at port / ship register £100,000 Local publicity -£1million
3	Major	Potential for some (one/few) fatalities / many serious injuries on site, some potential for minor injury off site.	£1million-£10million	Catastrophic environmental impact on 2 or more MATTE categories over the designated threshold and for greater than 1 year (widespread, requires long term additional resources considered a MATTE on 2 or more environmental receptors	National negative publicity, prolonged closure or restrictions to port / ship register £1million National publicity -£10million
4	Catastrophic	Potential for many fatalities on site or potential for serious injury or fatality off site	>£10million	DETR criteria – the highest levels of harm to the receptor (long term/permanent/widespread damage)	International negative publicity, serious disruption to operations to port / ship register >£10million International publicity

[8] Department of the Environment, Transport and the Regions (DETR), 1999, Guidance on the interpretation of Major Accident to the Environment for the purposes of COMAH regulation.

209. A risk matrix is then used to combine the likelihood and consequence scores for each identified hazard to generate a baseline assessment or risk. Based on the evaluation of the impact of the proposed IERRT operation, each hazard is scored using the matrix as defined in Table 6. This is the same risk matrix as used by IOT in its safety plan.

Table 6: Risk Matrix.

Risk Matrix						
Likelihood	Very likely	5	**5**	**6**	**7**	**8**
	Likely	4	**4**	**5**	**6**	**7**
	Reasonably unlikely	3	**3**	**4**	**5**	**6**
	Unlikely	2	**2**	**3**	**4**	**5**
	Very unlikely	1	**1**	**2**	**3**	**4**
			1	2	3	4
			Moderate	Serious	Major	Catastrophic
			Consequence			

210. Hazard risk scores are assessed for the “worst credible” outcome of an individual hazard. The following classifications for consequence are:

- People;
- Property;
- Environment; and
- Port business.

211. Hazard risk scores for each individual hazard consequence score are then brought together using a weighted averaging formula to give a single overall risk score. The averaging formula, which generates a single risk score on a scale of 1 to 8 is generated by taking the average of the four assigned consequence scores plus the maximum consequence scores divided by two. This provides a weighing towards the more riskier consequence classifications. An example calculation is as proved below:

- Hazard Likelihood Category “*Reasonably unlikely - 1 in 10,000 to 1 in 1,00 chance per year* ” = 3
- Hazard Consequence Category

- People: “Serious” = 2
- Property: “Major" = 3
- Environment: “Major” = 3
- Port business: “Catastrophic” = 4

- Risk Score (using the risk matrix)
  - People: Risk Score 4
  - Property: Risk Score 5
  - Environment: Risk Score 5
  - Port business: Risk Score 6
  - Overall risk score 5.5 (which is average risk score (5) plus maximum risk score (6), divided by 2)

212. Based on the resulting risk scores, hazards are defined as either “Broadly Acceptable”, “Tolerable if ALARP” or “Intolerable” (corresponding to the red / yellow and green colouring in the risk matrix at Table 6). As described in **Section 5.2.4**, HSE (2001) guidance states that risks are intolerable if the hazard could result in more than 50 fatalities and would occur more than once in 5,000 years. This equates approximately to a consequence score of 4 and a frequency score of 3, and therefore a risk score on the matrix of 6. Risk matrices assume that likelihood and consequence scale comparatively across the matrix and so a threshold of 6 is defined as the threshold for intolerable risk. Following a review of risk matrices, it was concluded by the project team that the same hazard could be defined as Broadly Acceptable if it was more than two orders of magnitude lower in likelihood than an Intolerable hazard, and as such any hazard which scores a 3 or below is deemed to be Broadly Acceptable. Any hazard which falls between 3 and 6 is therefore Tolerable, provided that the risk is As Low As Reasonably Practicable (ALARP).

213. Hazards with risk scored at “Broadly Acceptable” would be deemed acceptable, which puts the acceptability threshold at risk scores lower than 4 (see Table 7 for risk score classifications). Where hazards are scored between 4 and 5.99 (Tolerable if ALARP) then additional control measures are necessary unless their cost is disproportionate to their benefit – e.g. following the As Low As Reasonably Practicable (ALARP) principle. Where hazard risk scores are greater than or equal to 6 (“Intolerable”), additional risk controls must be identified and allocated to hazards to reduce risk. Hazard risk scores are then recalculated using the same method as above and a residual assessment of risk determined.

Table 7: Hazard Risk Score Classifications.

Risk Scores	Tolerability
0 to 3.99	Broadly Acceptable
4 to 5.99	Tolerable if ALARP
Greater or equal to 6	Intolerable

6.3 QUANTITATIVE ASSESSMENT

214. Having identified the list of hazards and prioritised the key scenarios by risk level, detailed risk analysis is undertaken to investigate the likelihood and consequences of the highest priority hazards. A Quantitative Risk Assessment (QRA) is undertaken to provide evidence-based, numerical values to the causes and consequences in each scenario.

215. The primary method of undertaking this is through an event tree, whereby the causal sequence of events which might cause a hazard to occur are mapped, with the probabilities that certain branches occur estimated. Following this, consequences to people, property, environmental and the economy are modelled for each scenario.

216. The resulting risk scores are then benchmarked against published acceptability criteria established by the HSE (2001), IMO (2008) and other industry sources.

217. The details of the QRA are contained in Section 10.

7. NAVIGATION BASELINE

7.1 INTRODUCTION

218. The Humber Estuary is located on the east coast of the UK between Yorkshire and Lincolnshire. It is currently the busiest shipping estuary in the UK according to Department of Transport UK data on port ship arrivals by port[9].

219. The location of the IERRT development is approximately 0.5nm from the entrance to Immingham impounded dock system, immediately upstream of the IOT Trunkway. The Department for Transport data shows that the Port of Immingham and Grimsby (accounted for together due to historical reasons), is the busiest port for ship arrivals in the UK except for the Port of Dover, which has higher numbers due to it ferry operations.

220. The Admiralty Sailing Direction: (North Sea (West) Pilot notes that tidal streams off Immingham have a spring rate for the in going stream of 3.5kn and for the outgoing stream 4.5kn, and that whilst rates off the jetties and terminals in the area are similar, they can at times reach 4kn for incoming tides and 7kn for outgoing tides.

221. Essentially the area around the Immingham is amongst the busiest in the UK and has arduous and complex tidal flows, which makes navigating vessels in the area difficult. To a degree this is brought out in the incident rates for the Humber Estuary, and Immingham in particular, which are also amongst the highest in the UK.

222. The following section provides context on the navigation baseline for the area close to the proposed IERRT development, in terms of the

    - Marine environment;
    - Management of Navigation;
    - MetOcean data;
    - Vessel Traffic Movement Analysis;
- Vessel frequency analysis; and
- Berth utilisation at IOT finger pier.

7.2 OVERVIEW OF MARINE ENVIRONMENT

223. The location of the IERRT is shown on an Admiralty navigation chart in Figure 8. The figure also shows nearby terminals. Of particular interest to IOT Operators is the proximity of the proposed IERRT infrastructure in relation to the IOT Finger Pier (Berths 6, 7, 8 and 9), Trunkway and for IERRT vessels on transit to the IOT river berth.

7.3 MANAGEMENT OF NAVIGATION

224. The management of vessel navigation on the Humber Estuary, and in the area of the proposed IERRT is undertaken by ABP as follows:

    - Statutory Harbour Authority for IERRT Development – ABP Port of Immingham;
    - Statutory Harbour Authority for Humber outside of ABP Port of Immingham area including the Humber Estuary – ABP Humber Estuary Services;

[9] port0602.ods (live.com) Accessed 21-07-2023.

- Competent Harbour Authority (provision of pilots) – ABP Humber Estuary Services;
- Vessel Traffic Services / Local Port Service – ABP Humber Estuary Services / ABP Port of Immingham; and
- Local Lighthouse Authority – ABP Port of Immingham

7.3.1 Statutory Harbour Authority

225. SHAs are Statutory Bodies responsible for the management and running of a harbour. The powers and duties in relation to a harbour are set out in local Acts of Parliament or a Harbour Order under the Harbours Act 1964[10]. The Port of Immingham under the Harbours Act 1964 and various Harbour orders is responsible for management of navigation in the area proposed for the IERRT development.

226. All UK SHA's (and other types of marine facilities) are requested by the Department for Transport to follow the UK PMSC (see Section 5.3) which requires SHAs to have a number of key requirements in place including a Marine Safety Management System based on a formal assessment of risk. According to the IERRT NRA the Port of Immingham has a Marine Safety Management System in place:

227. "Section 10.1.3 It is recommended that this risk assessment is used to inform amendments to the Marine Safety Management System that is currently in place at the Port of Immingham to ensure that risks are appropriately captured, monitored, and updated as required based on the latest information available as time goes on."

7.3.2 Competent Harbour Authority

228. The PMSC states that Under the Pilotage Act 1987, a Competent Harbour Authority (Humber Estuary Services) has a duty to assess what, if any, pilotage services are required to secure the safety of ships, and to provide such services as it has deemed necessary, and that Competent Harbour Authorities should determine these matters through risk assessment.

229. The Competent Harbour Authority for vessels bound to and from the IERRT and adjacent berths is ABP Humber Estuary Services, who have published "*Pilotage Directions For Ships To Be Navigated Within The Humber Pilotage Area*"[11]. Pilots are assigned to vessels based on the size of vessel (e.g. there are four classes of pilot; 3rd, 2nd, 1st and Very large Ship) and whether they are authorised for a particular berth or terminal.

230. Humber Pilotage Directions also allow for Pilotage Exemptions Certificates (PECs) to be issued which allow vessels not to take a pilot. PECs are issued to deck officers of vessels who frequently visit the estuary and are generally restricted to specific vessels and specific berths / terminals. The PECs are issued to specific deck officers who "*must satisfy ABP by examination that they have a sufficiently high level of skill, experience and local knowledge for them to be capable of piloting that ship*" and must also demonstrate that they have undertaken a number of trips in and out over the part of the pilotage area that the certificate covers.

231. It is anticipated that due to the repeat nature of specific vessels arriving and departing the proposed IERRT that a PEC will be mostly used rather than a Humber Estuary Services pilot.

[10] Harbour Orders - GOV.UK (www.gov.uk) Accessed 21/07/2023
[11] [redacted] Accessed 21/07/2023

7.3.3 Vessel Traffic Services / Local Port Services

232. Humber Estuary Services provides a Vessel Traffic Service (VTS) to the requirements of competent authority - Maritime Coastguard Agency Marine Guidance Note 401. A VTS is defined as service designed to improve the safety and efficiency of vessel traffic and to protect the environment. The service should have the capability to interact with the traffic and respond to traffic situations developing in the VTS Area.

233. The Port of Immingham provide a Local Port Service (LPS), a lower level of service compared to a VTS, which covers the SHA area. Where the requirements of a VTS are specified internationally and cascaded through national competent authorities to VTS areas (such as the Humber VTS area managed by Humber Estuary Services), the specification and requirements for LPS are defined by the organisation that has set it up (e.g. Port of Immingham). The overlap and interface between the Humber Estuary Services VTS and the Port of Immingham LPS is not clearly defined in available literature / documents.

7.4 METOCEAN DATA

234. Wind information in the IERRT NRA was derived from Humberside Airport, which is located some distance from the proposed IERRT development at a location chosen for the construction of an airport (which presumably has constant and manageable wind speed). In ABP's Written Summary of the Applicant's Oral Case at Issue Specific Hearing 2 For Deadline 1: 15 August 2023, a wind rose from June 1999 – June 2000 was provided for Immingham Dock. Whilst the Immingham Dock wind rose is over 20 years out of date, it does show differences between that provided in the IERRT NRA (such as the IERRT site having high wind speeds when wind is from the NE - perpendicular to the IERRT infrastructure - and the prevailing wind being more from the south than the south west), albeit it the legend in the Immingham Dock wind rose is largely eligible.

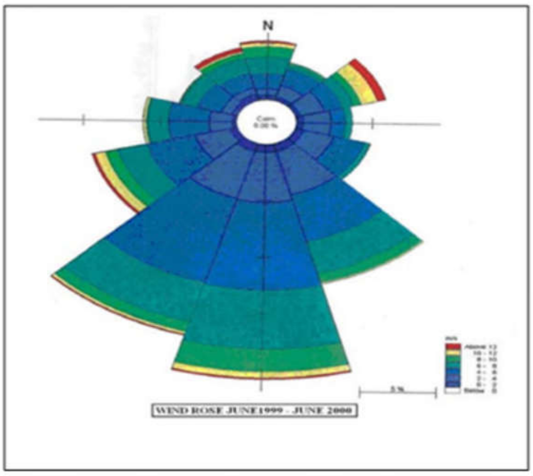


Fig 1 (Immingham Dock)

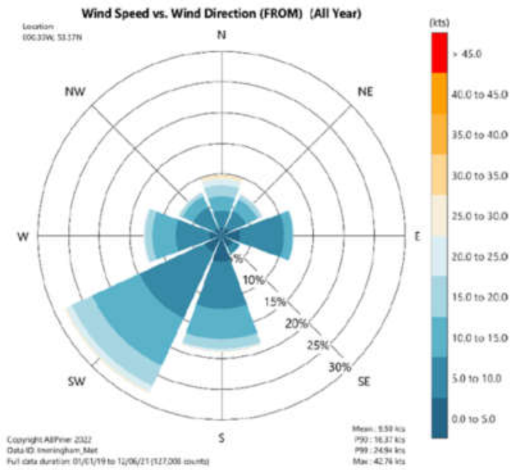


Figure 2 **Wind Speed and Direction at 10 m Above Sea Level, Rose Plot**

Figure 21: Left Immingham Dock wind data from 1999 to June 200 and Right. Wind Rose from Humebrside Airport as presetned in IERRT NRA.

235. Tidal velocities and directions are complex in the vicinity of the IERRT development, however no detailed high resolution stream atlas's are provided in the IERRT NRA which show the direction and strength of the tide at incremental stages through the tidal cycle.

7.5 VESSEL TRAFFIC ANALYSIS

7.5.1 Data

236. AIS is an automatic tracking system fitted to vessels which broadcasts information about the vessel and its activities through VHF to other vessels and shore stations. AIS broadcasts includes dynamic information (location, speed, course etc.) and static information (name, size, type etc.). AIS is required on all commercial vessels over 300 gross tonnage and may be carried by smaller craft such as fishing boats and recreational craft. The transmission rate of the dynamic information varies best on activity but is in the region of two to 10 seconds for a navigating vessel and up to three minutes for a vessel moored or at anchor.

237. The following section describes vessel traffic analysis based on AIS data collected from an AIS receiving station located on the IOT from March to June 2023. The receiver was positioned in a location with good coverage and line of sight of the study area and therefore the data quality is considered to be high.

7.5.2 Overview

238. The area close to the IERRT is primarily used by commercial vessels including cargo, tanker, and tug & service vessels. The Humber River is transited by vessels travelling on an east/west route. The total Humber transits at this section of the river was 1,439 in 28 days, with 1067 of these transiting within 0.5nm of the Immingham IOT (74%).

7.5.3 Cargo Vessels

239. Figure 22 shows the AIS tracks of cargo vessels operating in the study area. The majority of cargo vessels visiting the Immingham site are using either the Immingham Dock or the Outer Harbour, as seen in the southwest and west region of the plot, respectively.

240. Over the 28 days of AIS data coverage, the Immingham Dock experienced 286 cargo vessels transits (arrival and departure), this consisted of all vessels of <= 100m (75 transits) and 101m – 150m (109 transits). Cargo vessels of 151m – 200m use both the Immingham Dock (103 transits) and Outer Harbour (54 transits). All 68 transits of vessels 201m-260m visiting Immingham use the Outer Harbour.

241. Figure 23 illustrates that the areas with highest vessel traffic are in the approaches to both the Immingham Dock and Outer Harbour, and the region to the north of the IOT where vessels are transiting East / West. With 47 transits the cargo vessel with the most frequent visits is the bulk carrier FEDERAL DART (MMSI: 538007827).

7.5.4 Tankers

242. Figure 24 shows AIS data of tanker vessels transiting close to the proposed IERRT. There are currently three areas of primary use: the eastern side of the Outer Harbour, the existing IOT Finger Pier, and the access of the IOT river berths. Tanker vessels of <=100m are the most common, generally visiting either the existing IOT Finger Pier (79 transits) or the eastern side of the Immingham East Jetty (18 transits).

243. There are also sporadic uses of other areas, with four transits at the West Jetty, six transits at the Eastern Jetty, and 2 uses of the Immingham Dock. Tanker vessels of 101-150m are more evenly distributed amongst the available berths, with 25 transits using the

IOT river berths; 20 transits at the Immingham West Jetty; 10 transits at the Eastern Jetty, and six using the Immingham Dock.

244. All 151m – 200m tankers use one of the three IOT river berths, consisting of 20 transits in the recorded 28 days. Similarly, vessels of 201m-260m also only use the IOT river berths, accounting for all 18 transits. Figure 25 shows the density of tanker vessel transits in the study area, the two areas exhibiting the most concentrated traffic are just north of the IOT, and either side of the existing Finger Pier. With 33 vessel transits, the Oil Tanker SHANNON FISHER (MMSI: 30839000) is the most frequent user of the Immingham site. The EAGLE BRISBANE (MMSI: 563053500) has a length of 250m, making it the largest vessel that entered the study area.

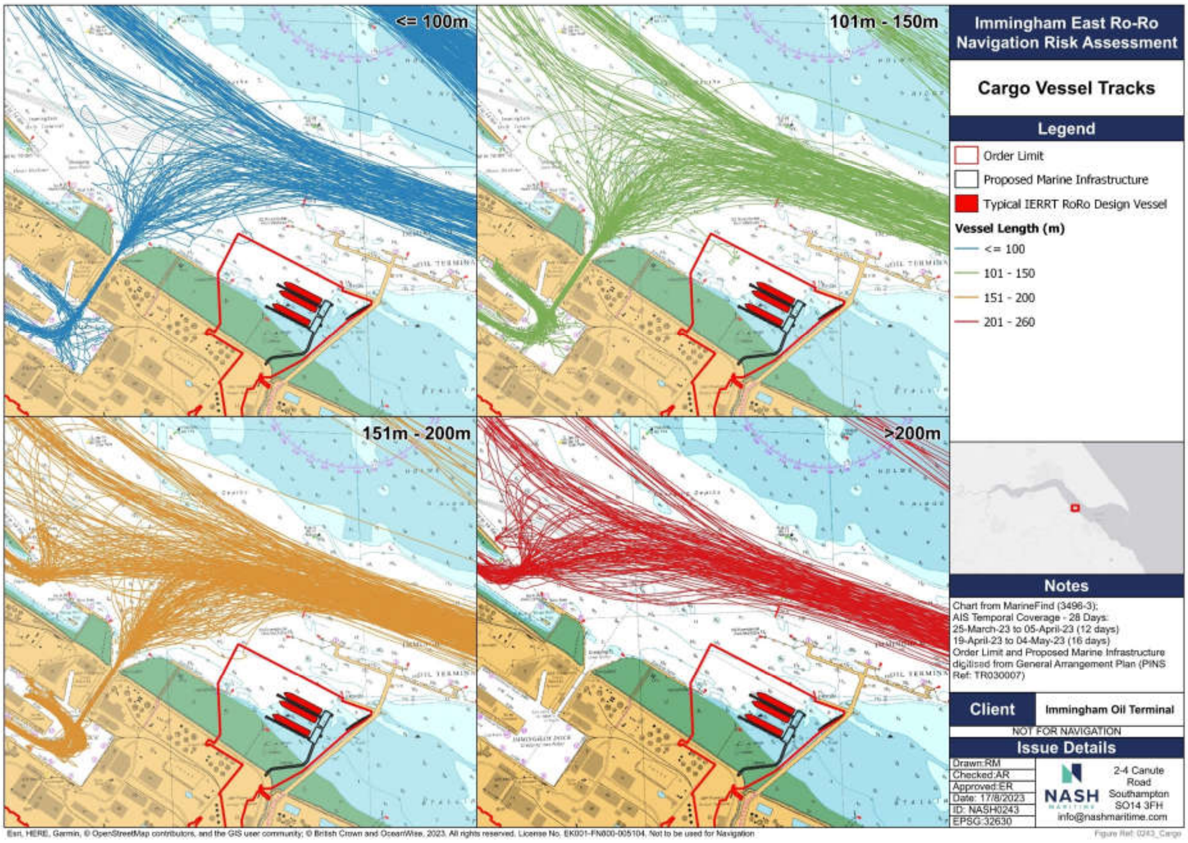


Figure 22: Cargo vessel tracks.

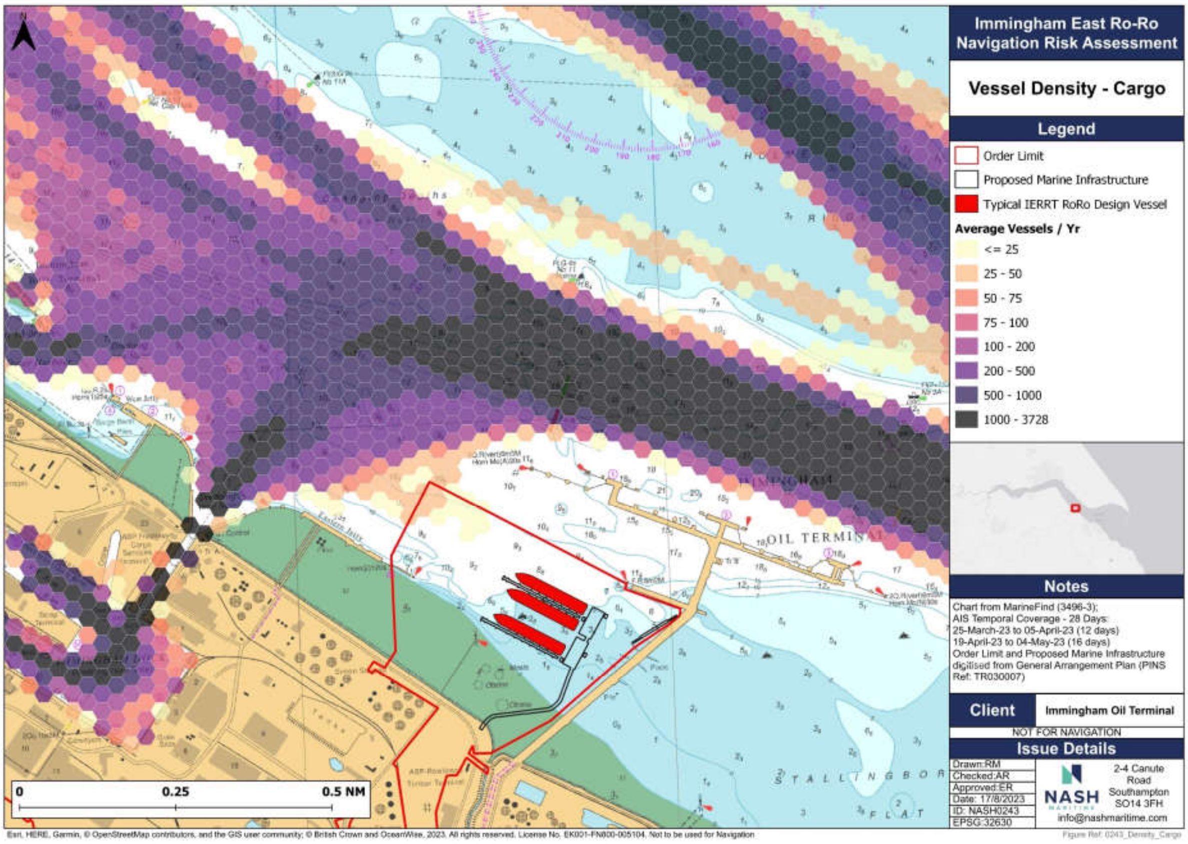


Figure 23: Cargo track density (28 days).

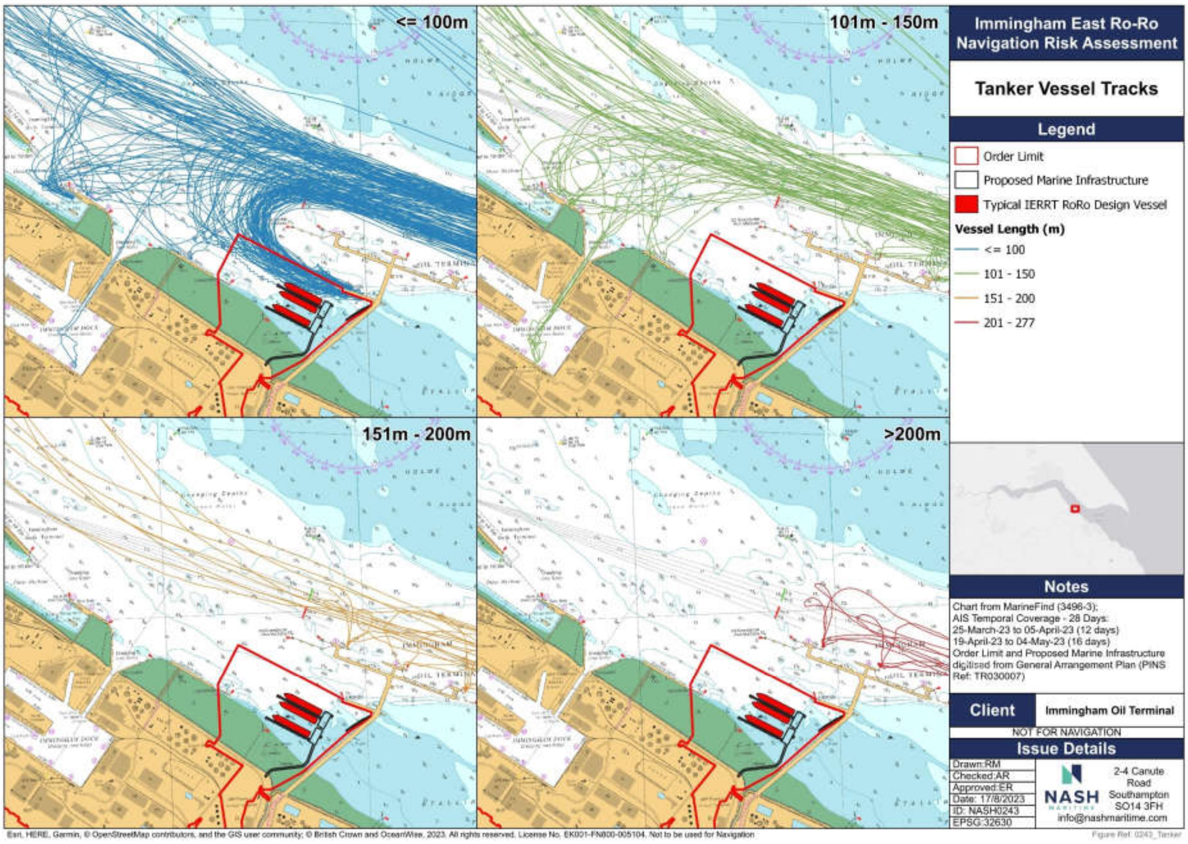


Figure 24: Tanker vessel tracks.

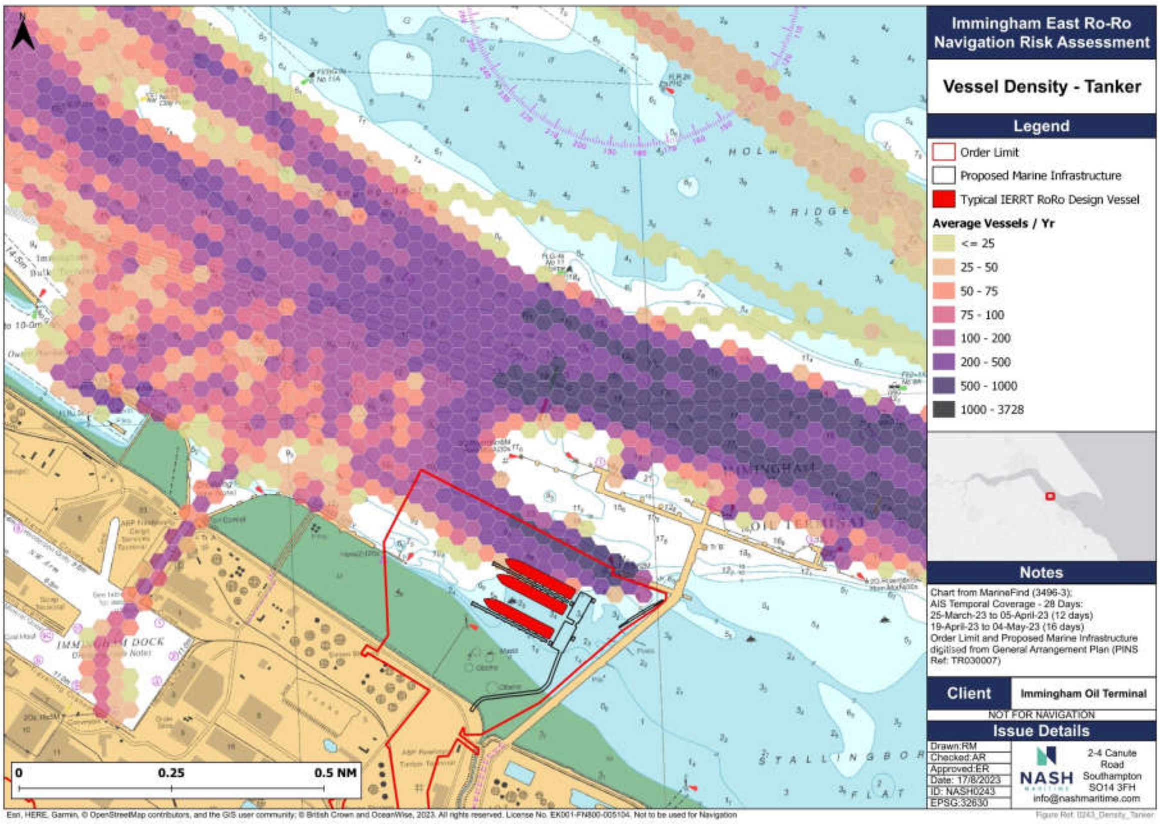


Figure 25: Tanker track density (28 days).

245. Figure 26 and Figure 27 show swept path analysis of the WISBY ARGAN, the largest Gross Tonnage coastal tanker visiting the IOT Finger Pier during the data period. The swept path analysis shows the sea room taken up by a vessel's outline as it navigates, which is more detailed than the presentation in a track plot which shows only the line taken by the ship's AIS antenna. The analysis demonstrates the approach to the berth on two separate days, 25 April 2023 and 6 May 2023. The weather conditions on these days were benign with wind speeds of less than 12 knots and good visibility reported at Humberside Airport. For these swept path plots the IOT workboats are not included. For both arrivals, even in benign conditions, it is evident that the WISBY ARGAN transits close to or through the proposed IERRT location. In more challenging weather conditions, especially when requiring the use of the workboat (and possibly tug) the combined swept path is likely to be significantly greater further to the south than that shown.

246. Swept path plots of other coastal tankers THUN BLYTH and DEE FISHER arriving at IOT Finger Pier berth 8 are provided in Figure 28 and Figure 29.

247. A compositive swept path plot are presented in Figure 30 and Figure 31, which shows the cumulative swept paths for all tankers using berths at the IOT Finger Pier. This plot shows the sea room currently used by tankers arriving and departing the IOT Finger Pier. It is evident from this analysis that the footprint proposed to be taken up by the IERRT is commonly used during the approach to and departure from the IOT Finger Pier. When considering the requirement for the master to use a safe distance of minimum two ships' beam widths clear from a moored vessel, then the available sea room for manoeuvring on and off the IOT Finger Pier is reduced significantly more.

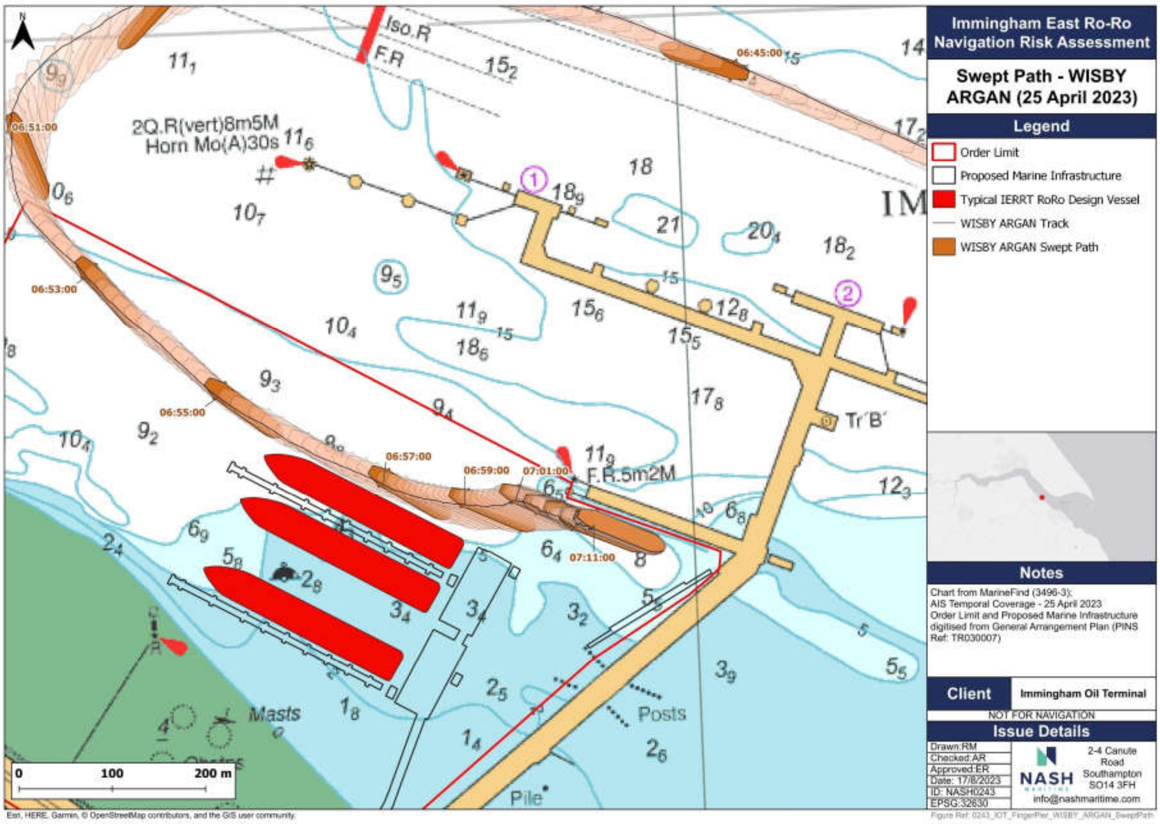


Figure 26: WISBY ARGAN swept paths (25-Apr-2023).

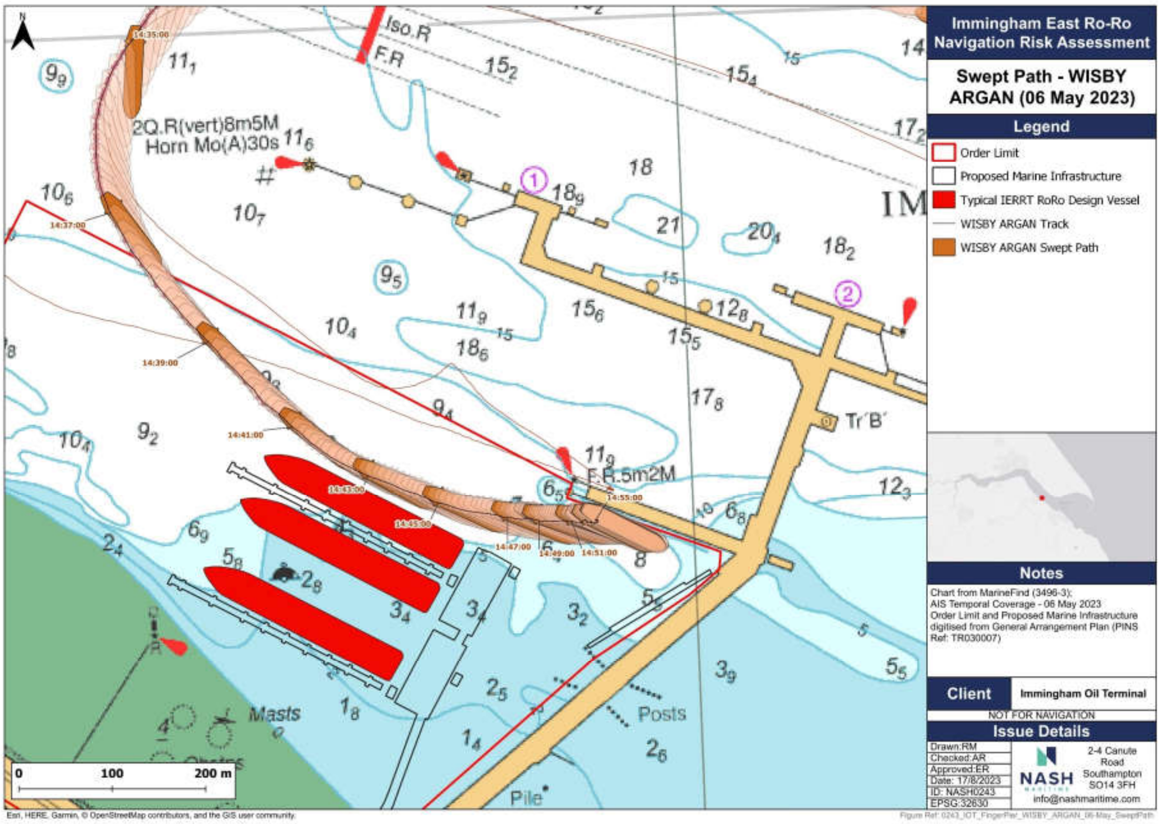


Figure 27: WISBY ARGAN swept paths (06-May-2023).

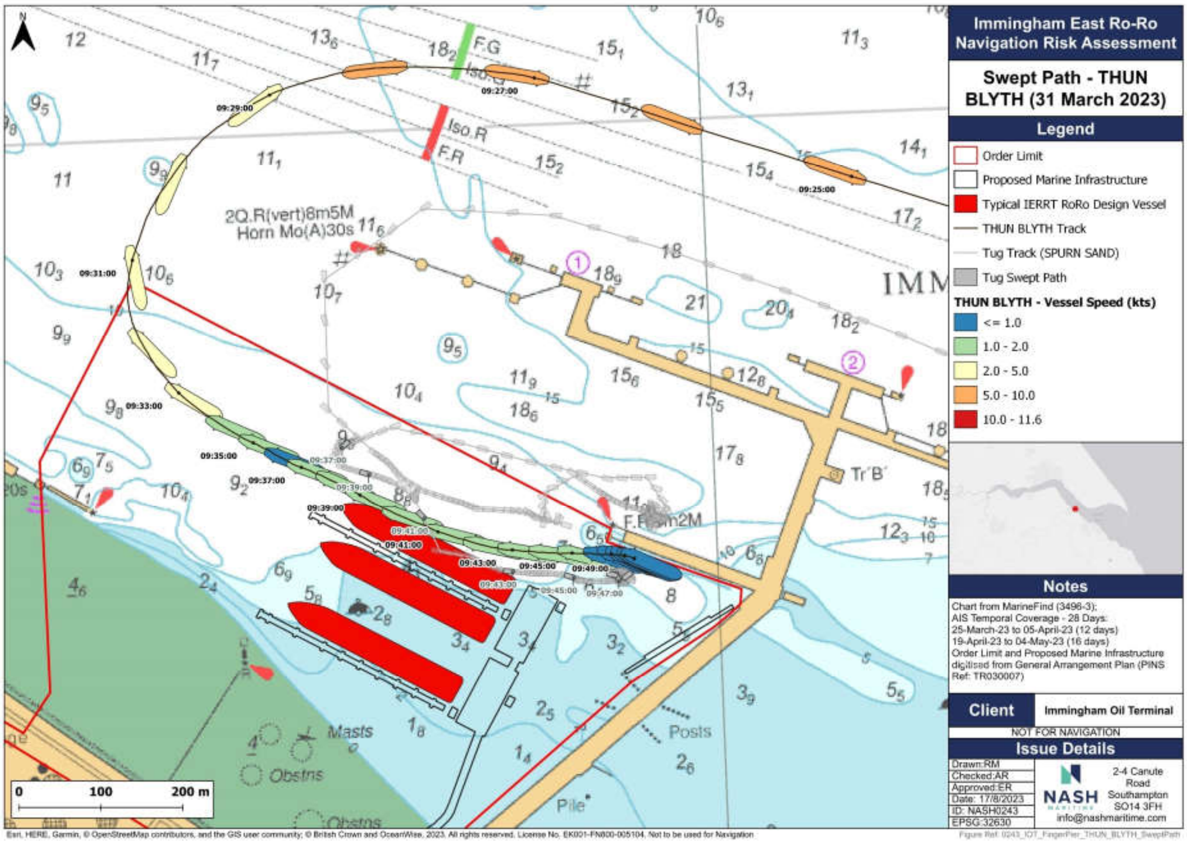


Figure 28: Thun Blyth swept paths (31-Mar-2023).

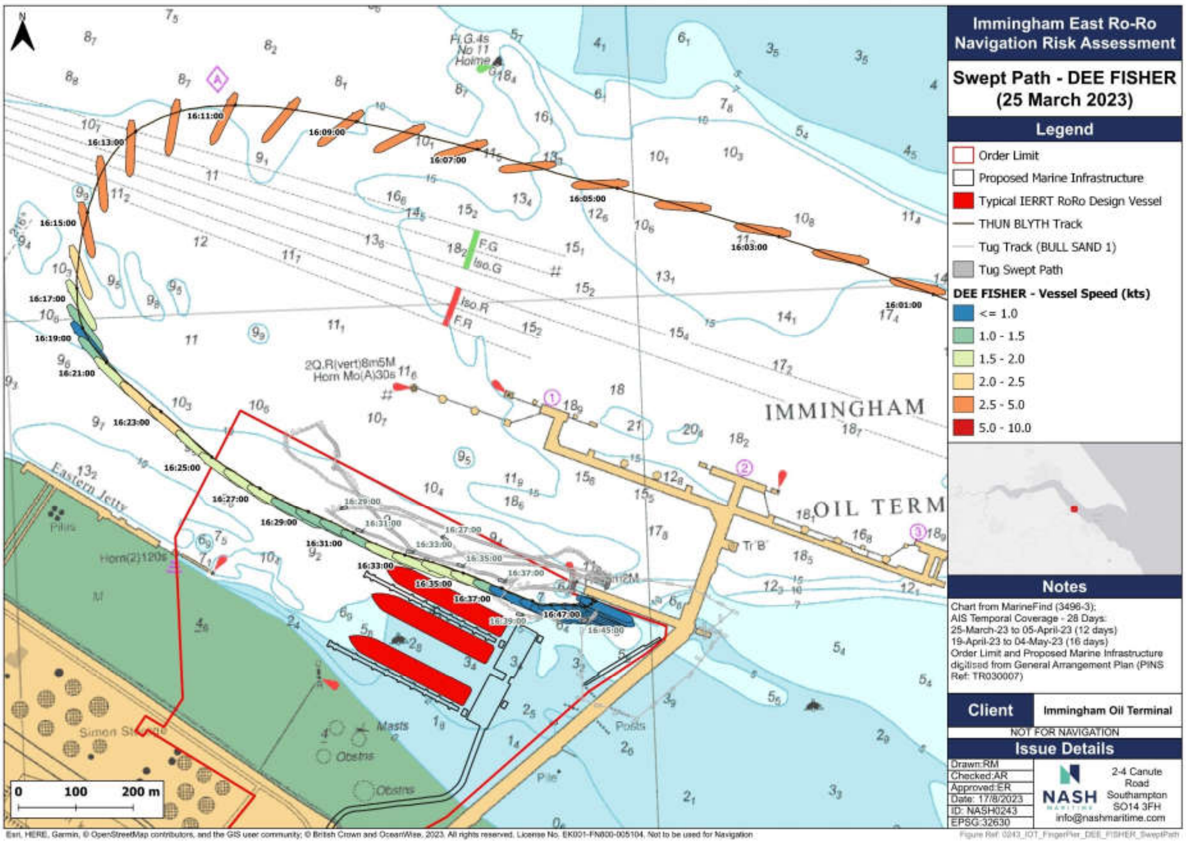


Figure 29: Dee Fisher swept paths (25-Mar-2023).

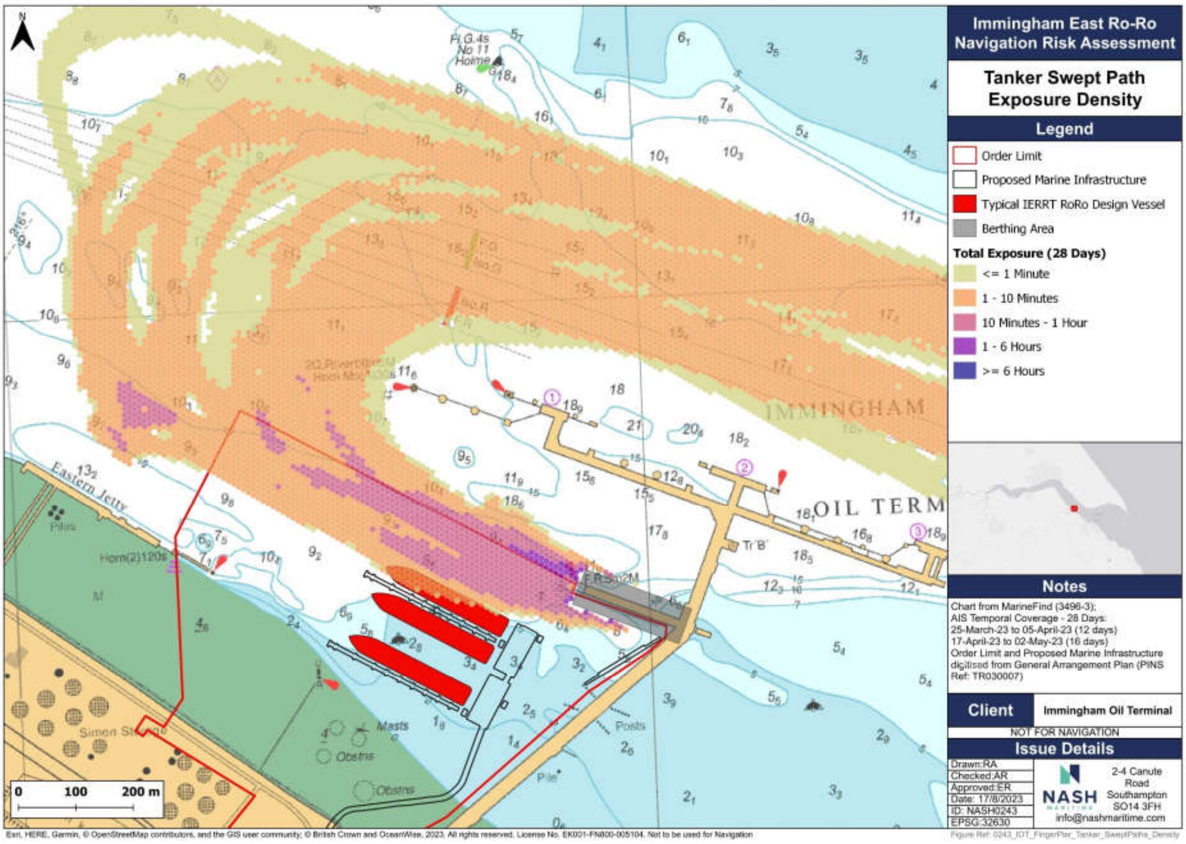


Figure 30: Tanker swept path exposure density (28 days).

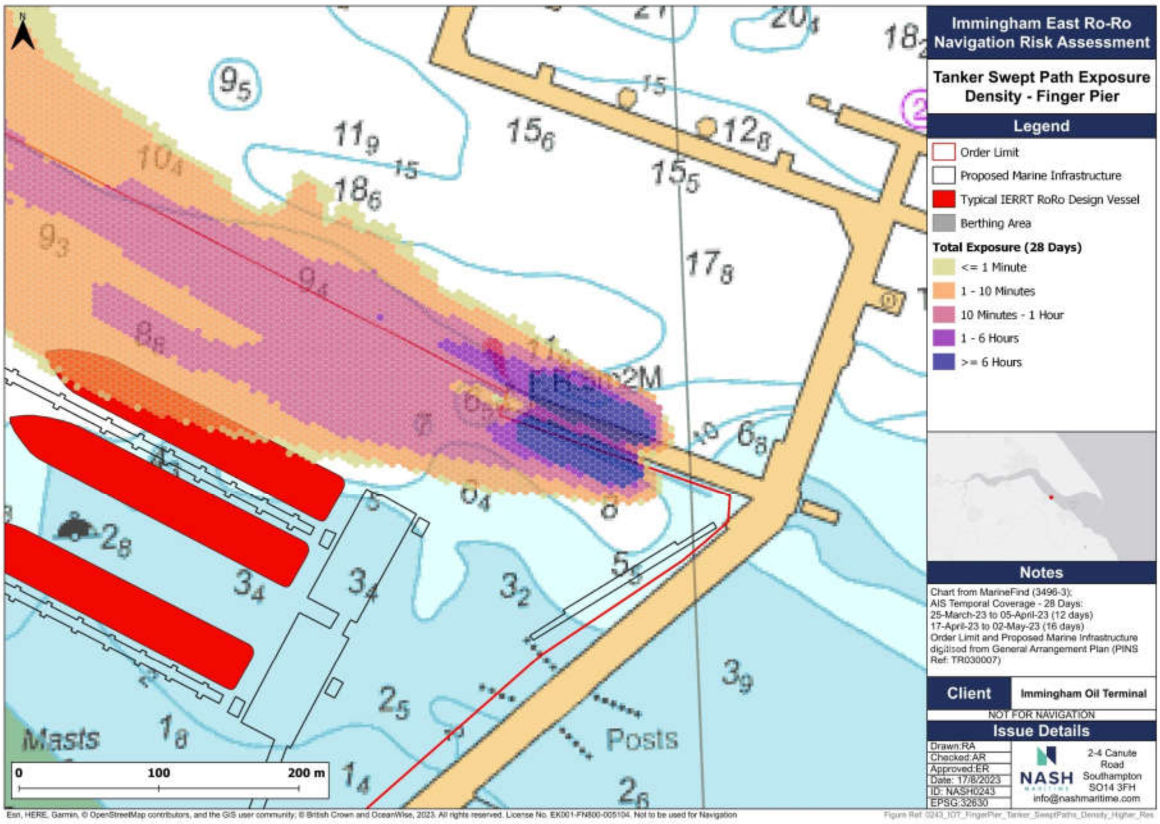


Figure 31: Tanker swept path exposure density (28 days) (zoomed in).

7.5.5 Barges

248. Figure 32 shows that barges primarily use the current IOT Finger Pier and the Immingham Dock. The barges using the IOT Finger Pier are the Rix Merlin (MMSI: 235030851)(8 transits), Rix Owl (MMSI: 235030995) (14 transits), and the Rix Phoenix (MMSI: 232003150) (8 transits). These same vessels operate in the Immingham Dock but with greater frequency, with 21 transits by the Rix Merlin, 21 by the Rix Owl, and 31 by the Rix Phoenix. As shown in Figure 33, the area that experienced the most transits by these estuarial barges is the entrance to the Outer Harbour.

249. To demonstrate the manoeuvring of barges using the current IOT Finger Pier, the RIX MERLIN was selected for swept path analysis (see Figure 34, Figure 35and Figure 36).

250. The RIX MERLIN is a "*class B.V. I + Hull, + Mach, Oil Tanker ESP, Unrestricted Nav, Aut— UMS, Strengthened bottom*" (Rix Shipping, 2023). The vessel has a LOA of 53m, a beam of 7.9m and a draft of 7.9m. The RIX MERLIN was assisted in this manoeuvre by the mooring vessel, BULL SAND 1 (MMSI: 235030851).

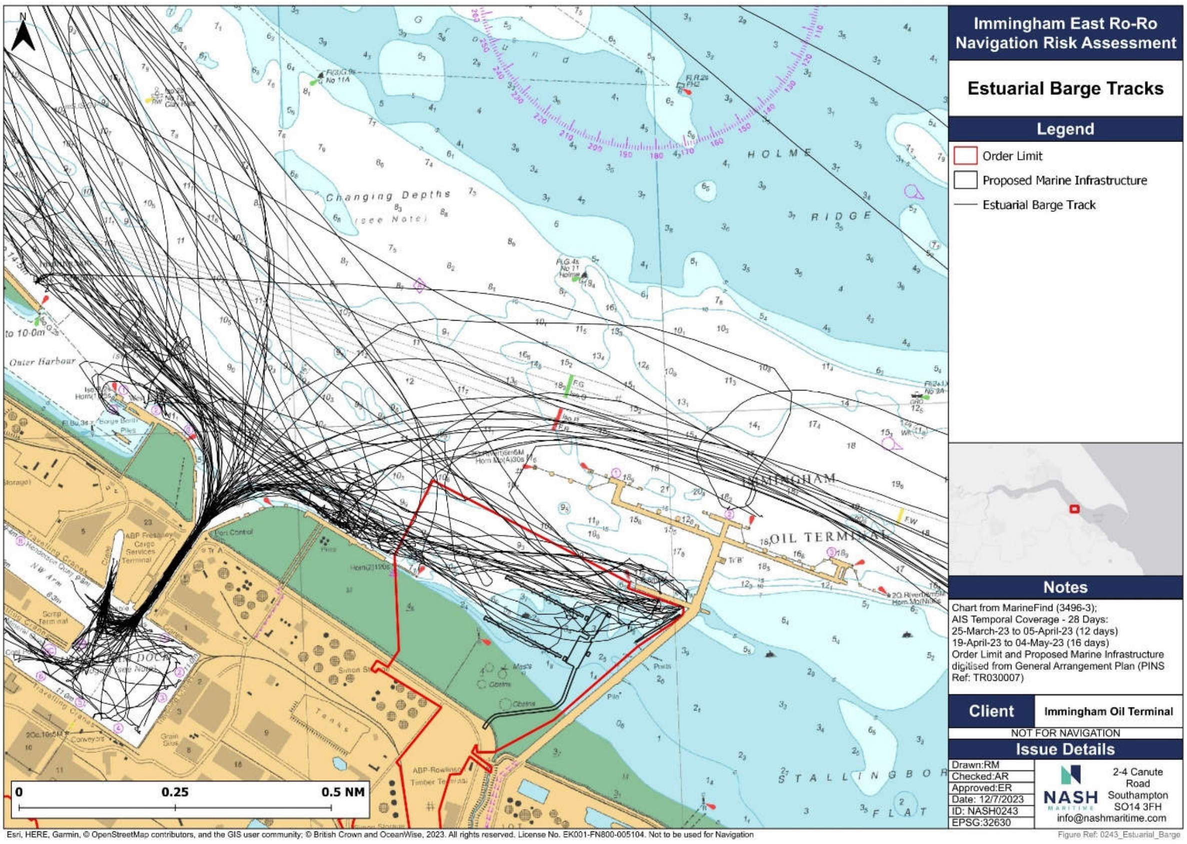


Figure 32: Estuarial barge vessel tracks.

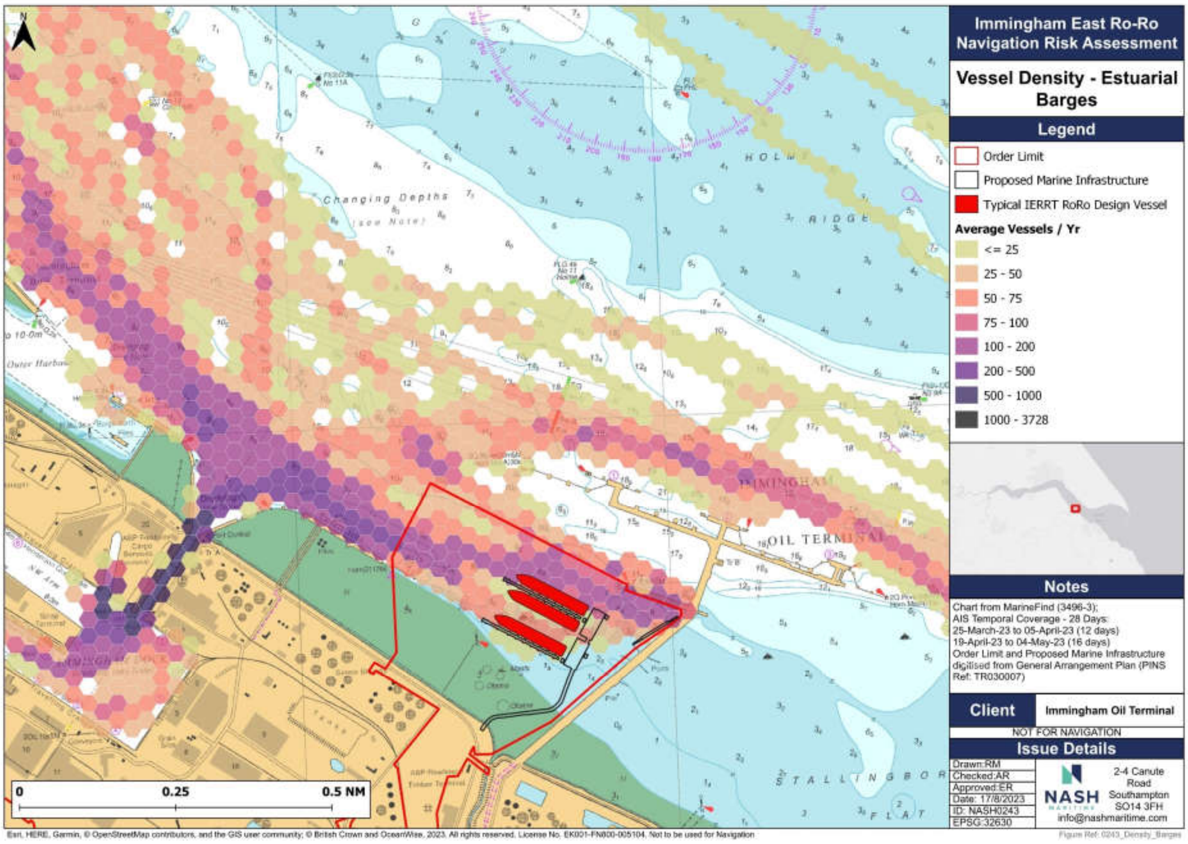


Figure 33: Estuarial barge track density (28 days).

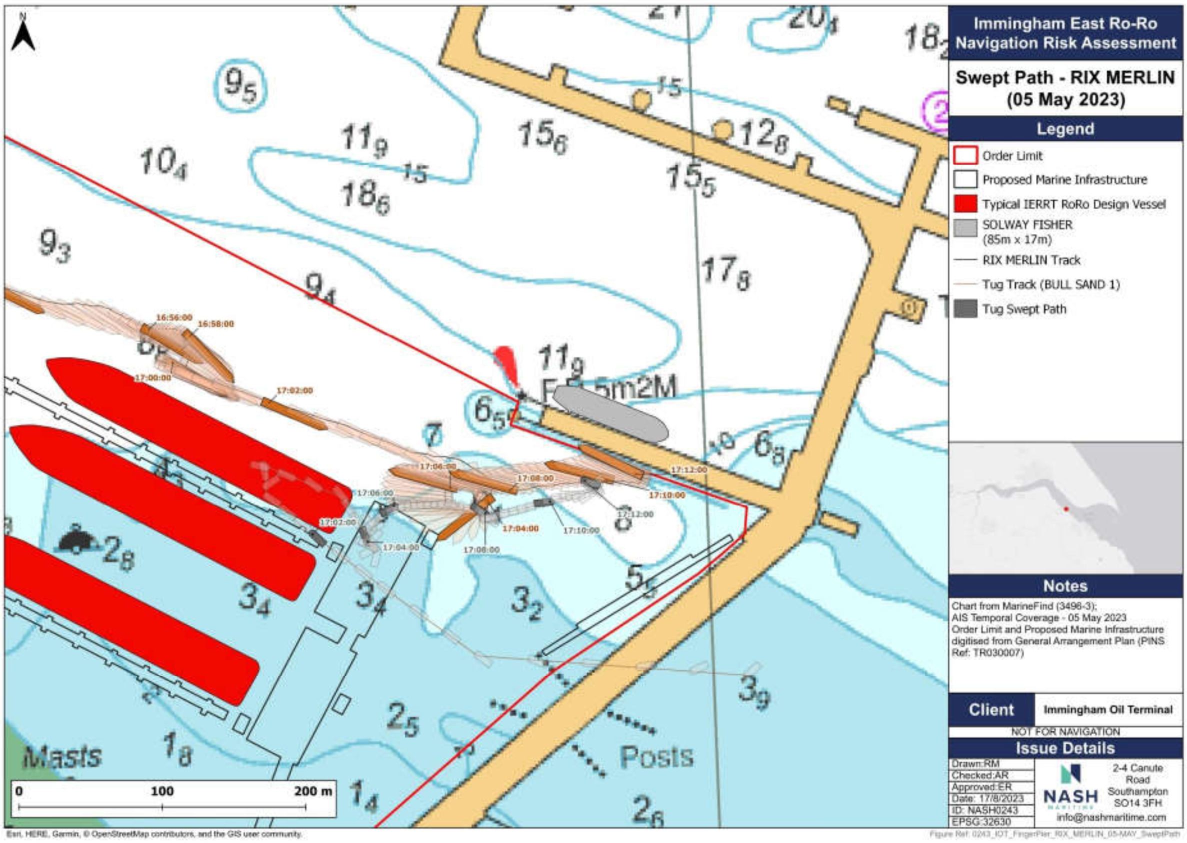


Figure 34: RIX MERLIN swept paths (05-May 23).

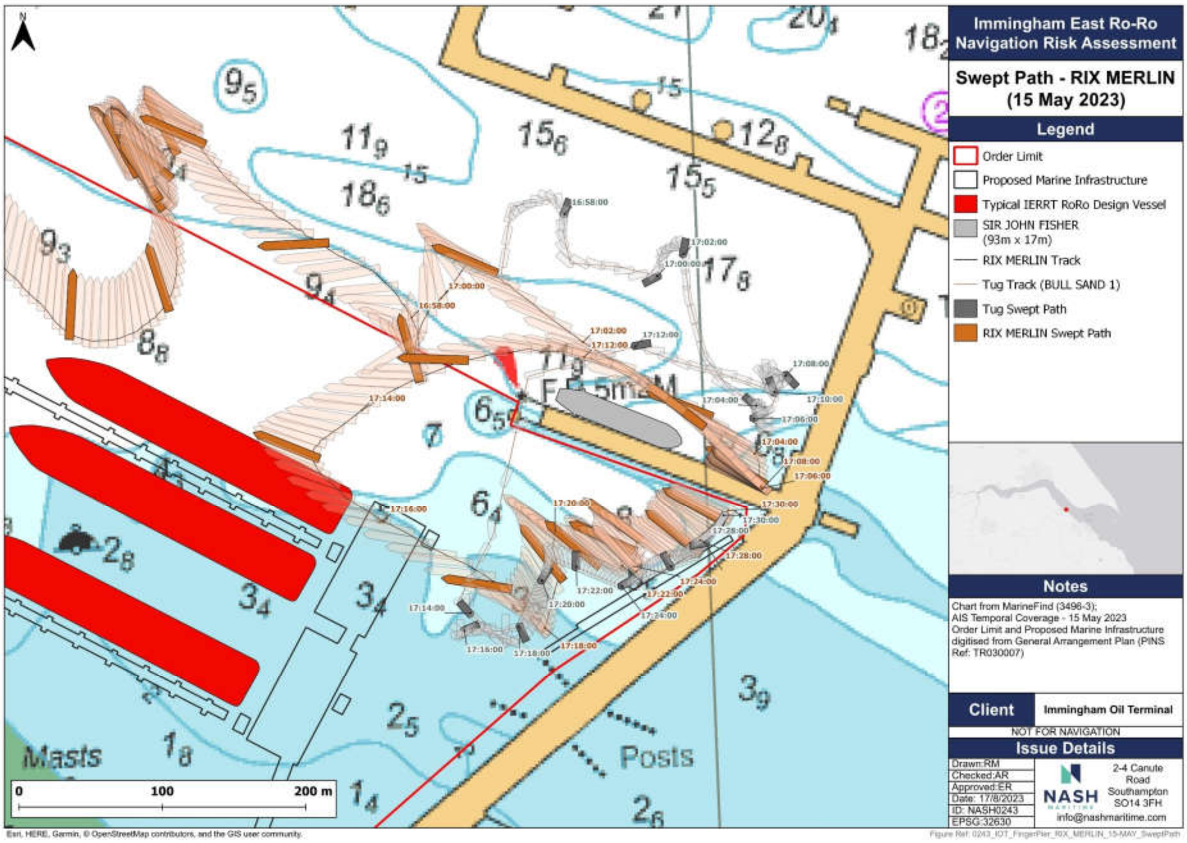


Figure 35: RIX MERLIN swept paths (15-May 23).

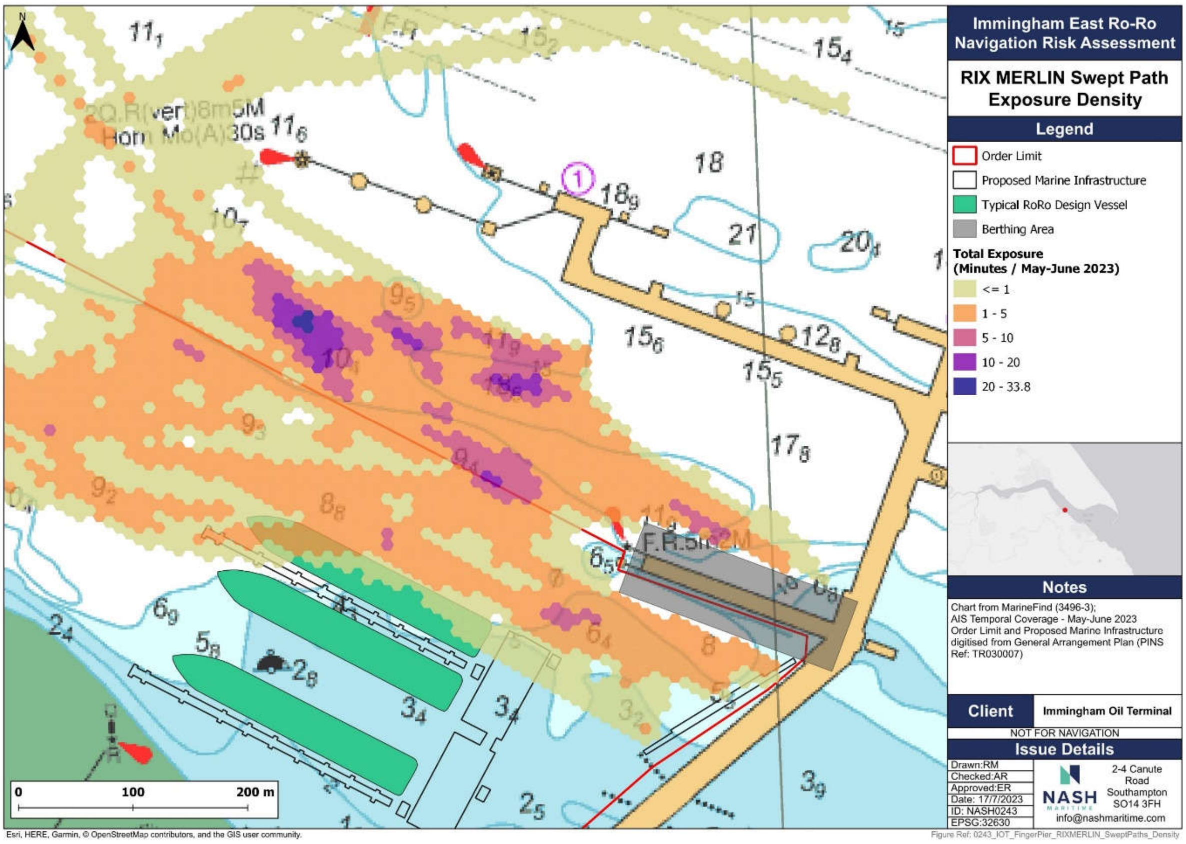


Figure 36: RIX MERLIN swept path exposure (May-June 23).

7.5.6 Tug and Service

251. Figure 37 shows the distribution of vessel transits by tug & service vessels. Tug & Service activity is present across all berths at the Immingham site and is mostly characterised by tug boats supporting the arrival and departure of cargo and tanker vessels. Figure 38 shows the density of tug & service vessels, indicating that the most densely transited areas are just north of the IOT (435 transits), the Immingham Dock (393 transits), and the eastern side of the Outer Harbour (295 transits). The most regular tug & service vessels using the Immingham site are the tug boats MANXMAN (58 transits), PULLMAN (49 transits), and SVITZER LAURA (48 transits).

7.5.7 Passenger

252. Passenger vessel activity is shown in Figure 39. Other than five transits by the Ro-Ro/ Passenger vessel PATRIA SEAWAYS (MMSI: 277291000) entering the Immingham Dock, all passenger vessels transited on an east-west route, north of the Immingham site. The 112 transits were made by four Ro-Ro/ Passenger vessels. The PRIDE OF HULL and the PRIDE OF ROTTERDAM are P&O ferries, currently operating between Hull port and Rotterdam port, each vessel transited north of the Immingham site once a day for the 28 day period. The STENA TRANSPORTER and STENA TRANSIT are ferries operated by Stena Line. Currently these vessels are operating between the port of Killingholme and the port of Hoek Van Holland. Similar to the P&O ferries, these vessels transited north of the IOT once a day for the duration of the time extent. As shown in Figure 40, the area most travelled by passenger vessels was approximately 0.8nm from the north of the IOT.

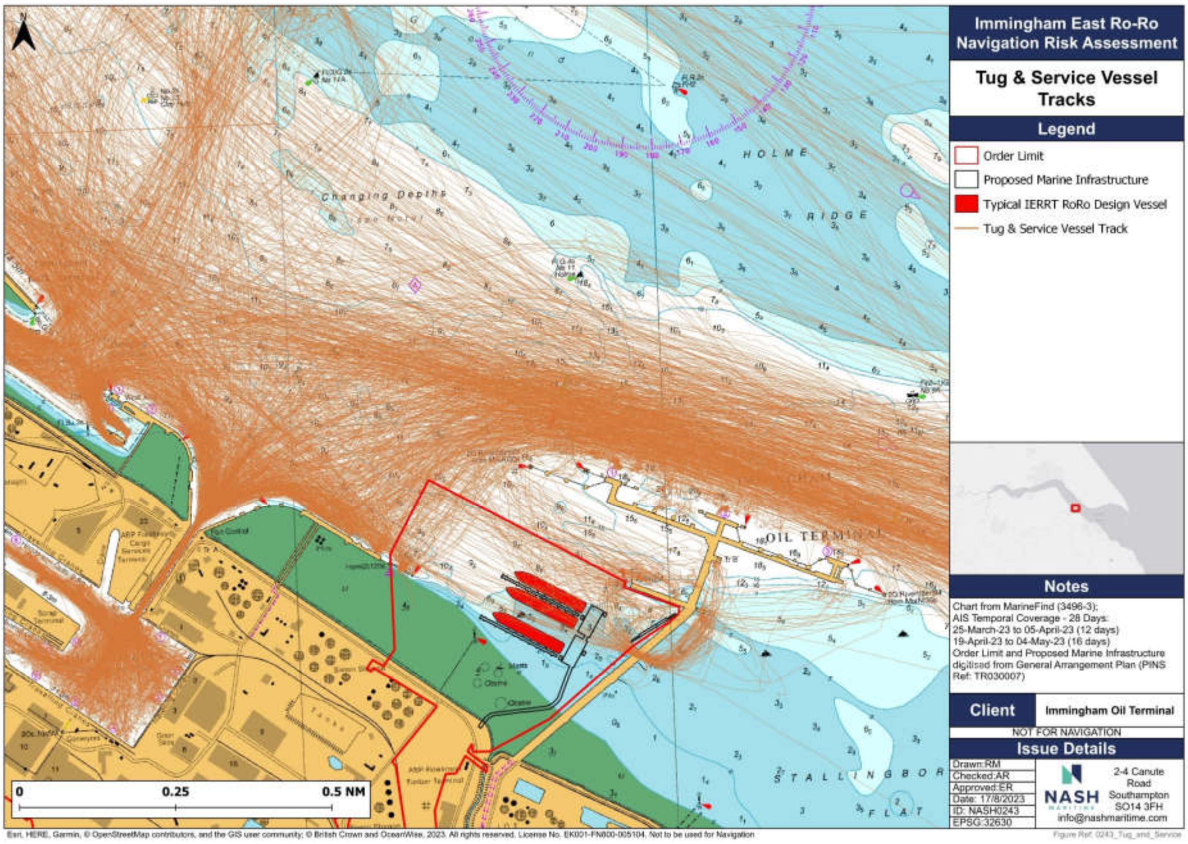


Figure 37: Tug and Service Craft Tracks.

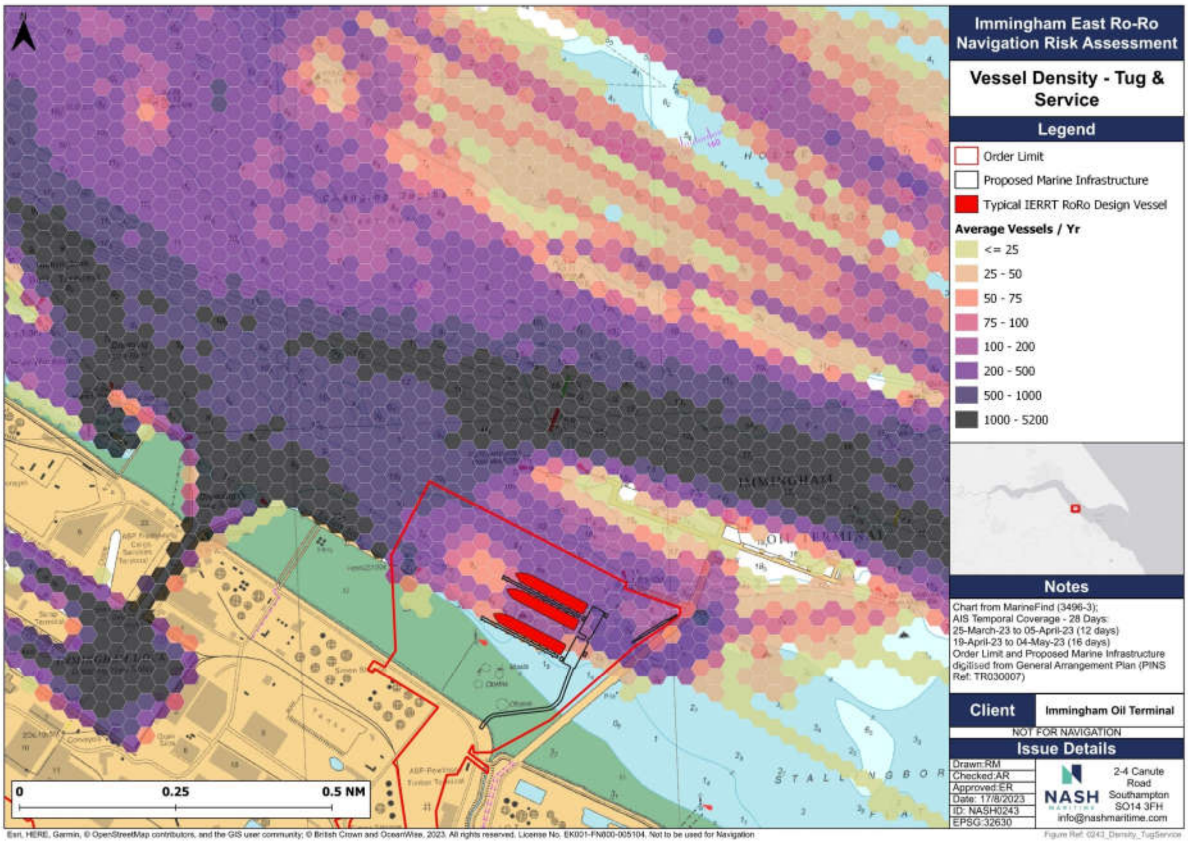


Figure 38: Tug and Service Craft Density.

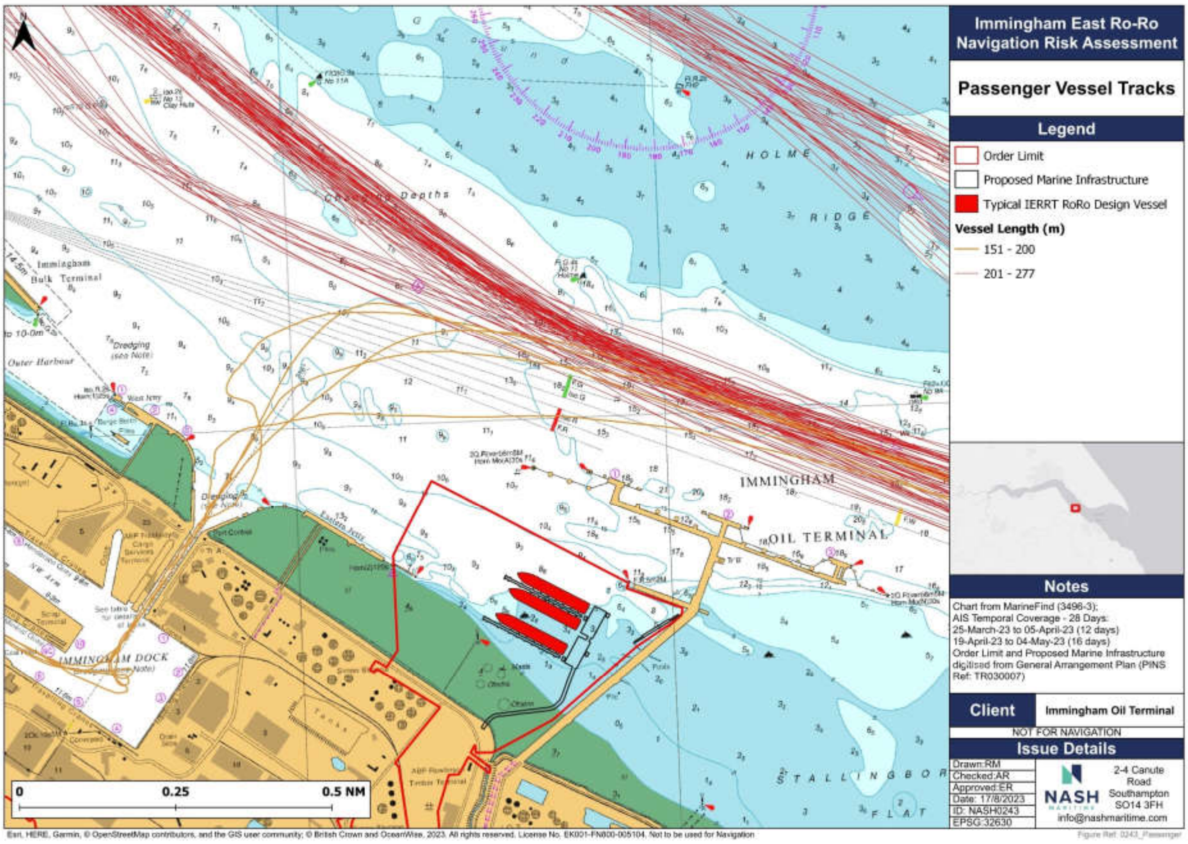


Figure 39: Passenger Tracks.

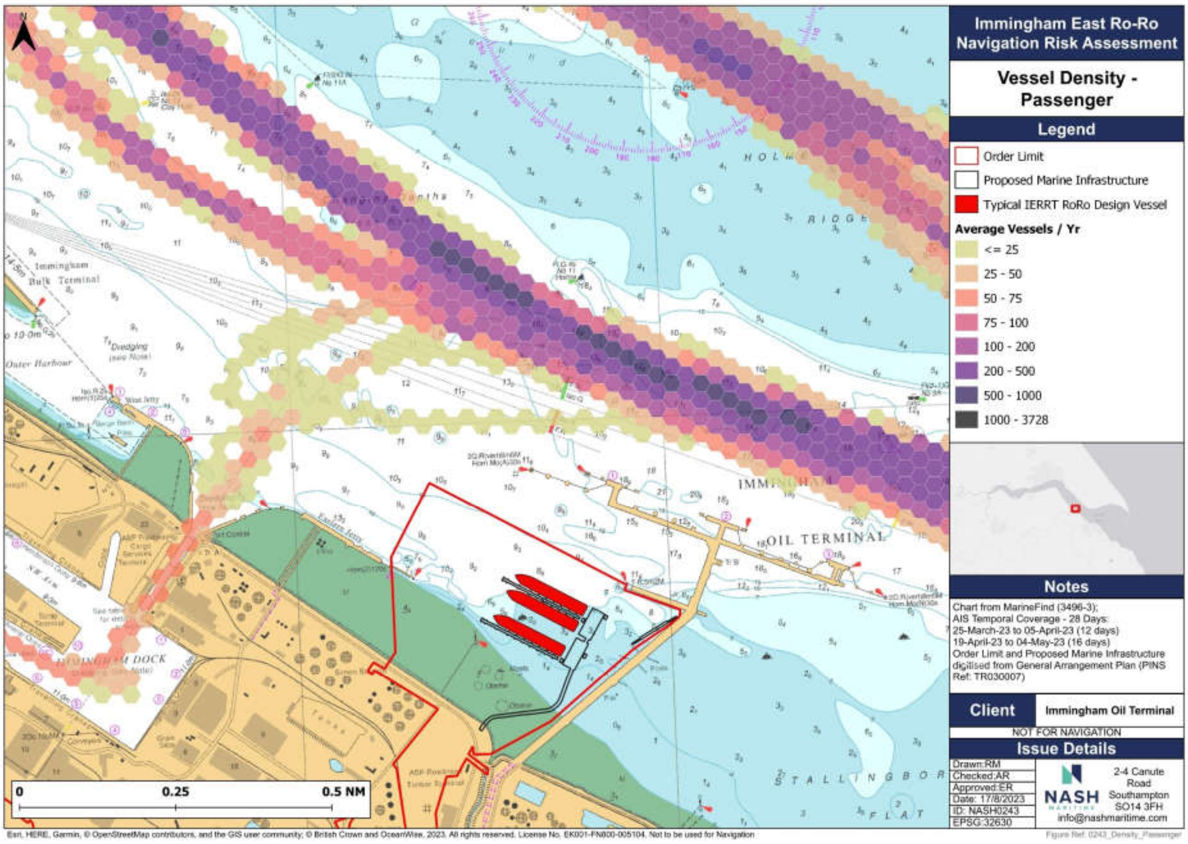


Figure 40: Passenger Density.

7.6 GATE ANALYSIS

253. Gate analysis was undertaken to develop an understanding of the lateral distribution of vessel transits across the various identified locations. Figure 41 shows the count of vessel tracks crossing between the Immingham Bulk Terminal -(IBT) and the IOT per day during May and June for each vessel type. The exact location of the gate is shown alongside the direction and weekly count of cross-gate transits in Figure 40.

254. A total of 3719 vessel tracks crossed the gate over the 2-month period, 1,912 in May and 1,807 in June, giving an average of 62 transits per day during May and 60 transits per day during June.

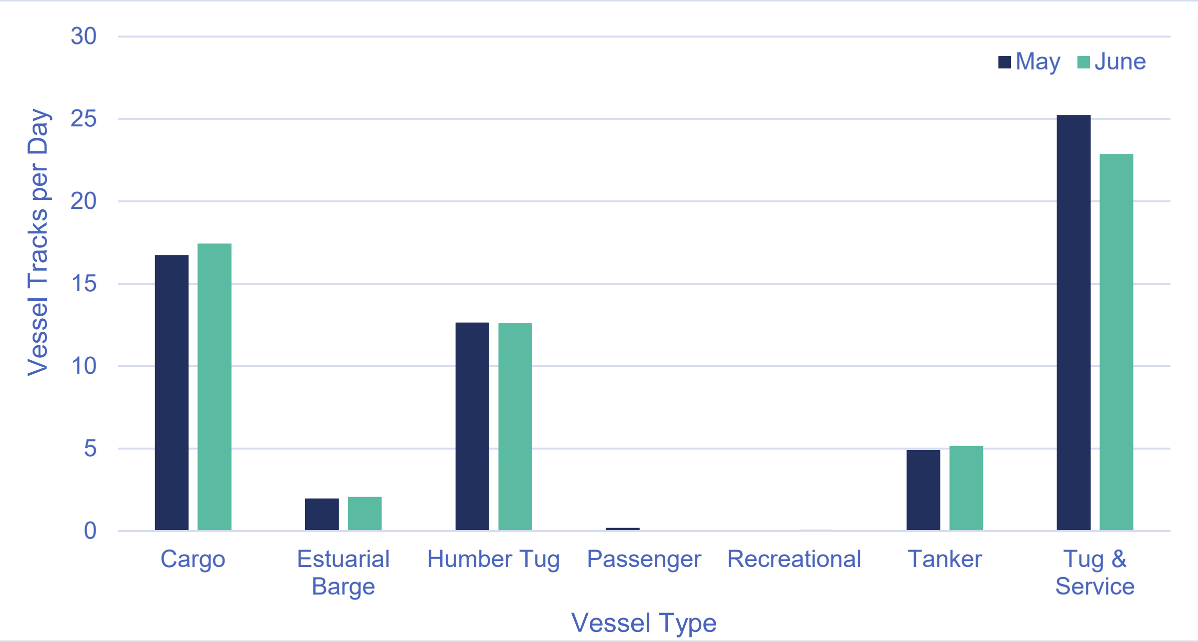


Figure 41: Count of Vessel Tracks Across Gate (may and June 2023).

Table 8: Vessel Counts by time of day.

	COUNTS BY VESSEL TYPE					
TIME OF DAY	**Cargo**	**Estuarial Barge**	**Humber Tug**	**Pax.**	**Tanker**	**Grand Total**
07:00:00 - 07:30:00	23	0	24	0	11	**58**
07:30:00 - 08:00:00	22	4	22	0	6	**54**
08:00:00 - 08:30:00	16	6	19	0	13	**54**
19:00:00 - 19:30:00	68	3	14	0	8	**93**
19:30:00 - 20:00:00	50	4	26	0	7	**87**
Grand Total	**179**	**17**	**105**	**0**	**45**	**346**

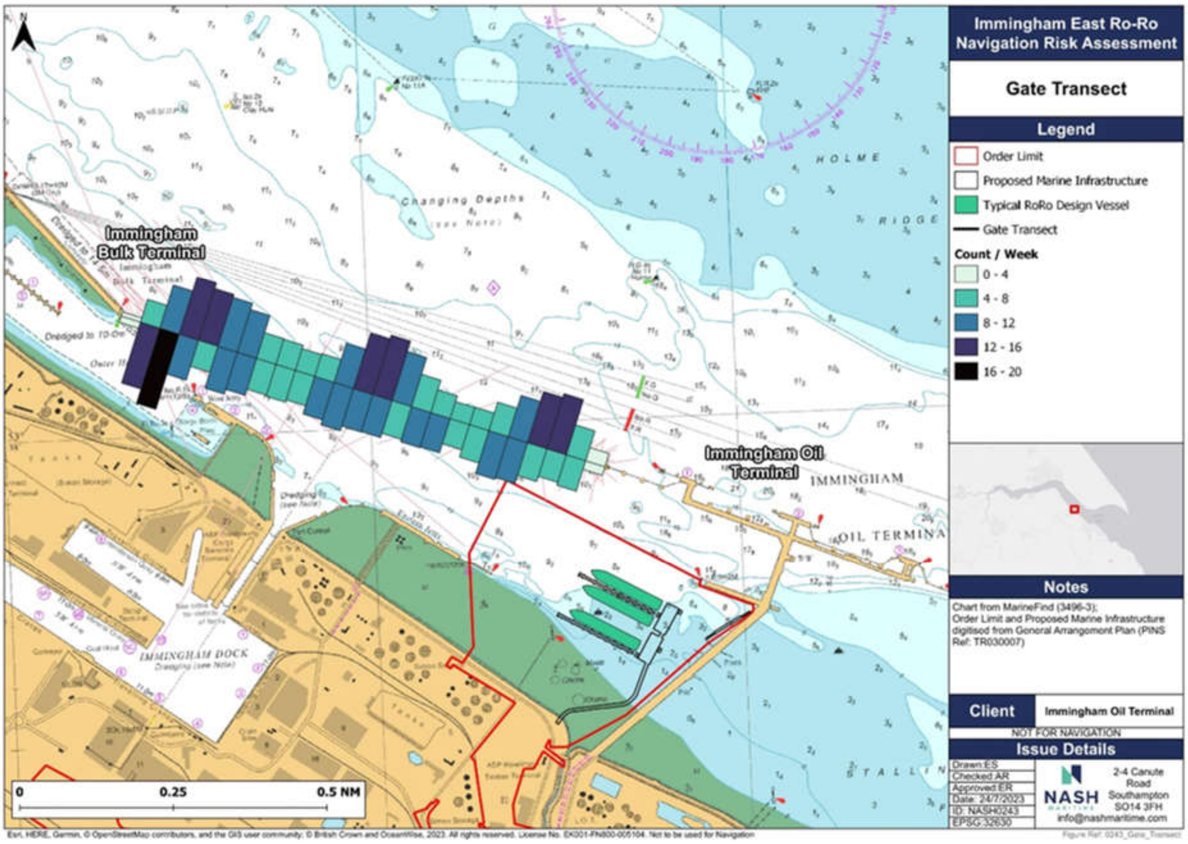


Figure 42: Gate Transect.

255. These transits were further investigated to identify how many significant vessel tracks crossed between the IBT and IOT during 1 hr time slots for the arrival and departures of Ro-Ro vessels to the proposed IERRT (from 07:00 to 08:30 and between 19:00 and 20:00), during which times the area would be closed to other vessels. The number of vessel tracks that crossed the gate between these times during May and June are provided in Table 8.

256. In total 166 significant vessel tracks crossed the gate between 07:00 and 08:30 and 180 between 19:00 and 20:00. Given that 2,249 tracks of these vessel types crossed the gate over the time of a whole day (00:00:00-23:59:59), approximately 15.4% of the usual vessel activity through this area during May and June would be unable to occur as a result of the closure during Ro-Ro arrival and departure times.

257. Most of the impacted vessels transiting in the evening are Cargo vessels heading toward Vlaardingen and Esbjerg, two main freight shipping routes. Between 19:00-20:00, the activity is heavily concentrated on the western side of the gate, nearer the IBT with fewer transits near the IOT. Those near the bulk terminal are nearly all Cargo and Humber Tug Vessels, whereas all the Barges and Tanker vessels transit within 371m of the IOT during these hours. However, the vessel activity in the morning, between 07:00 and 08:30 is more equally distributed along the gate.

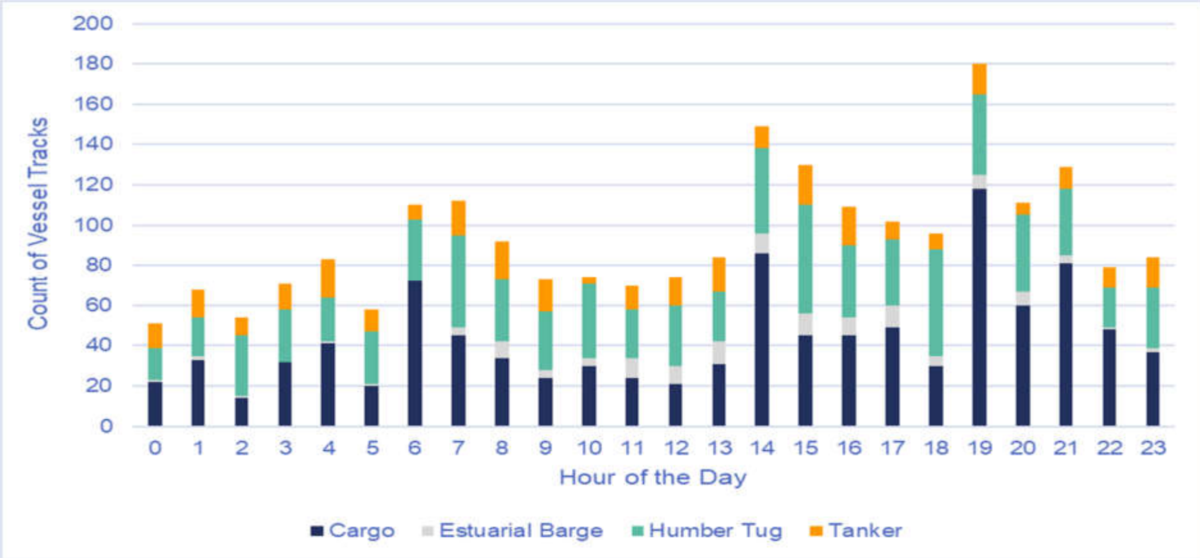


Figure 43: Count of Vessel Tracks per Hour of the Day.

258. Figure 43 shows the vessel track count per hour for each of the main vessel types during May and June. From the analysis it is evident that there were higher numbers of cargo vessel transits across the gate in the mid-morning (between 06:00-07:00) and in mid to late afternoon (14:00 and 19:00-21:00), during which times there were an average of 111 and 126 transits across the gate per hour, respectively. Otherwise, the activity is relatively consistent with an average of 73 transits per hour, across the gate.

7.7 BERTH ANALYSIS

259. Analysis of berth usage for the IOT Finger Pier was undertaken based on information provided by IOT covering March, April, May and June 2023. Analysis of the total number of vessels using the Finger Pier (see Figure 44) shows that there is little variation in vessel numbers with between 42 to 49 coastal tanker arrivals per month, and between 16 to 21 estuarial barge arrivals month.

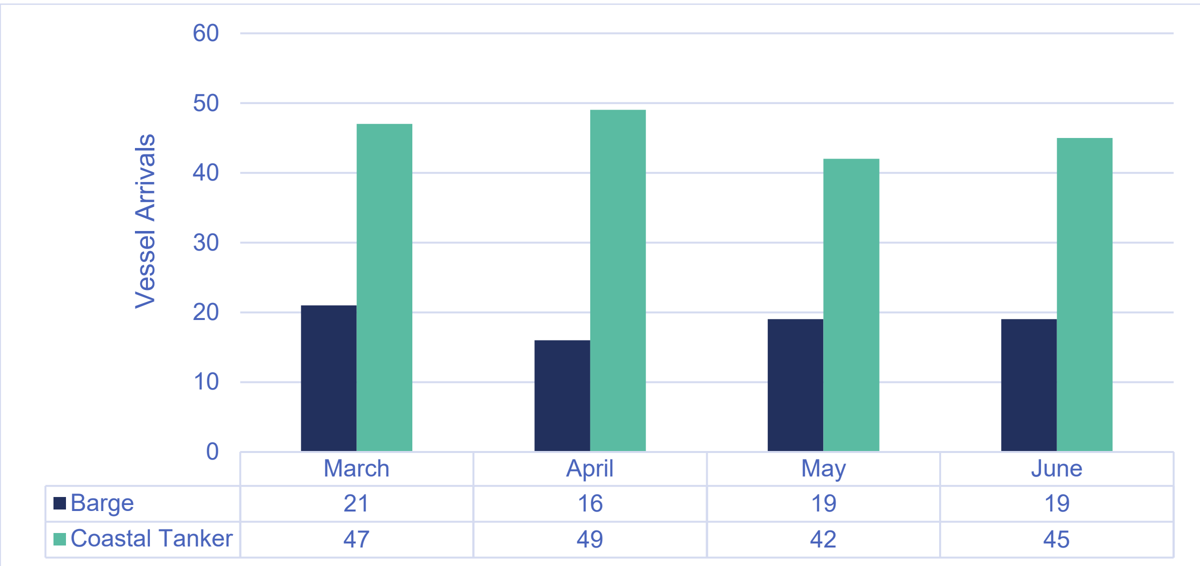


Figure 44: Total Number of vessels arrival at IOT Finger Pier (Mar 23- Jun 23).

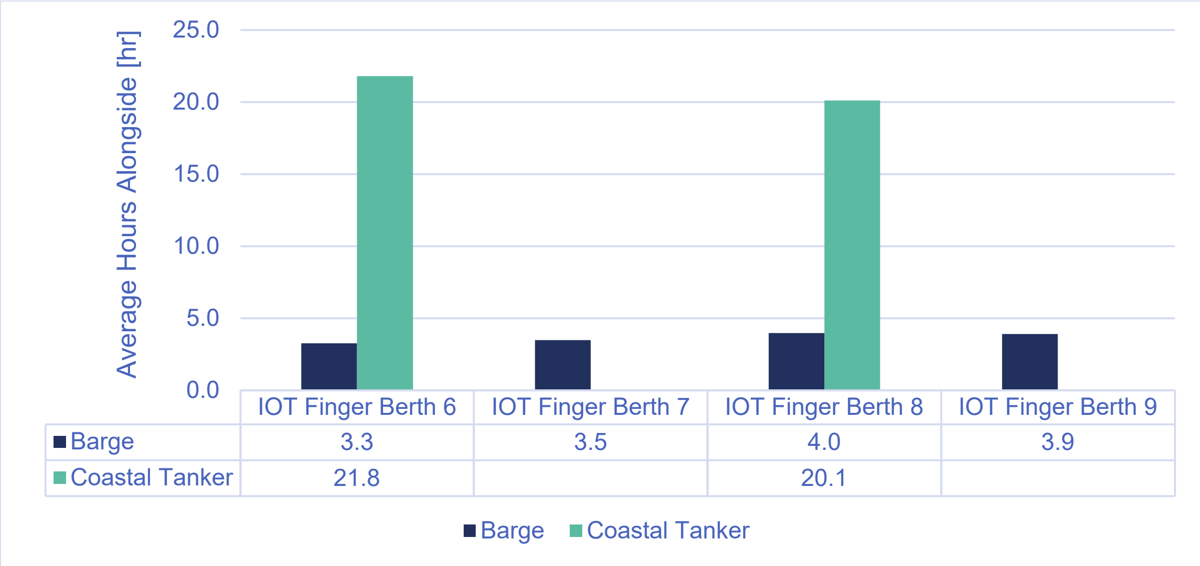


Figure 45: Average Time Spent at Berth (Mar 23- Jun 23).

260. On average Coastal Tankers remain alongside for 20 to 21 hours (see Figure 45), and estuarial barges on average remain alongside for 3.3 to 4.0 hours. As coastal tankers are limited to berthing only on flood tides, and due to the frequency of use of Finger pier berths 6 and 8, then it is evident that the berths are highly utilised (see Figure 46).

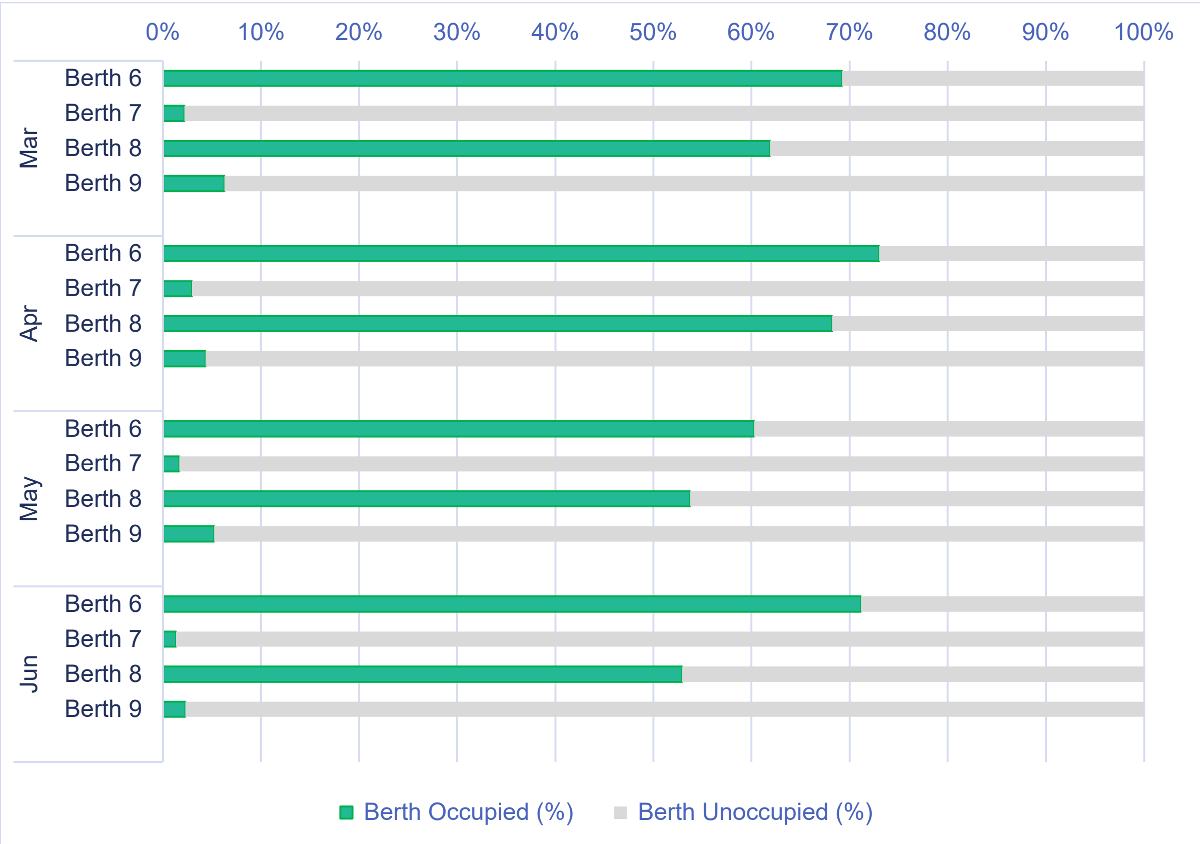


Figure 46: Percentage of Time Berths are occupied.

8. INCIDENT ANALYSIS

8.1 INTRODUCTION

261. To support the sNRA, particularly in relation to the likelihood and consequence of navigation hazard occurrence, analysis of historical incident data has been undertaken from a variety of sources which are outlined in Table 9.

Table 9: Incident data sources.

Source	Coverage	Notes
MAIB	1992-2021	Analysis of MAIB data nationally, with particular reference to incidents around Immingham and incidents involving RoRo vessels.
IMO (2008)	1994-2004	Review of IMO's FSA for RoPax Ships.
MarNIS	2011-2020	Whilst the raw data was not made available, reference is made to the analysis contained in the IERRT NRA (ABPMer, 2022).
EMSA (2018)	2011-2018	Review of report "Safety Analysis of Data Reported to EMCIP: Analysis of Marine Casualties and Incidents Involving Ro-Ro Vessels"

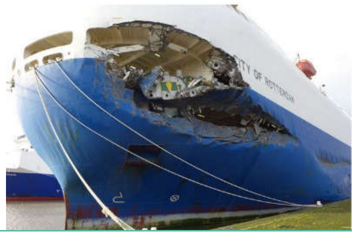
8.2 INCIDENTS OCCURRING ON HUMBER / IMMINGHAM

8.2.1 MAIB Data Analysis

262. Table 10 identifies significant incidents in the vicinity of the study area which resulted in MAIB reports. These include five collisions and three allisions. This includes three incidents whereby vessels collided with the IOT infrastructure or moored vessels. All three of these incidents involved vessels which were not bound for IOT but for other berths along the Estuary. The accident reports also emphasise the challenging navigation of the Humber and the effect of the tidal streams.

Table 10: Summary extracts of MAIB Immingham / River Humber Incidents.

Date	Type	Description
06/07/2008	Collision	General cargo vessel Fast Filip was heading down river from Goole on an ebb tide during hours of darkness, destined for Immingham Dock. ABP Pilot onboard, good visibility. Vessel commenced a turn around the stern of an inbound ferry, resulting in **colliding with a tanker berthed at IOT1**. Alongside vessel sustained a hole in the hull plating. Cause identified as **Pilot's lack of planning and situational awareness, plus poor awareness of the effect of tidal stream and speed**. Poor bridge resource management also identified.
12/12/2000	Collision	Bulk carrier Xuchanghai, inward to Immingham Dock, **collided with the moored shuttle tanker** Aberdeen, berthed at IOT3. Aberdeen sustained holes in her hull plating above the waterline. A contributing cause was **poor safety arrangements and procedures in respect of ABP for vessels proceeding to Immingham Dock and other vessels in the vicinity of Immingham Oil Terminal**. NtM09/2001 was retrospectively published in which a minimum passing distance and a location by which tugs should be secured was outlined.
19/01/2010	Allision	Fast Ann, an unmanned cargo ship, broke free from its moorings and **collided with IOT infrastructure**. Despite VTS endeavouring to identify the radar target and a tug endeavouring to secure a line to the vessel,

Date	Type	Description
		efforts were hampered by a 4-knot spring ebb tide and dense fog. Risk assessments and procedures were reviewed, particularly regarding unmanned vessels during spring tides.
03/12/2015	Collision	The car carrier City of Rotterdam collided with the ferry Primula Seaways in dense fog after the **pilot became disorientated** (due to relative motion  illusion) and failed to correct the carrier's path which had been set toward the path of inbound ferry. Both vessels were sustained major damage but made their way to Immingham without assistance. There were no serious injuries or pollution.
19/05/2016	Collision	Petunia Seaways collided with the historic motor launch Peggotty after the skipper of Peggotty became **disorientated in the dense fog** and took the motor launch into the shipping channel and the path of Petunia Seaways, which was **not sounding a regular fog signal** at the time of incident. The motor launch suffered severe structural damage and began to take on water but a local pilot launch crew were able to rescue the skipper and other person on-board so that there were no injuries or significant pollution.
02/04/2002	Allision	During hours of darkness, Ro-Ro vessel Stena Gothica **struck the eastern jetty**, during a spring ebb tide, while approaching Immingham lock. A 3-metre gash was sustained in the port side shell plating below  the waterline, leading to a large ingress of water into the lower cargo hold. Cause was identified as the **master's decision to take the con** prior to the lock, **his under estimation of the strength of the tide**.
29/08/2010	Allision	The general cargo vessel CFL Patron suffered a **controllable pitch propeller (CPP) control power failure** while manoeuvring at 1.6 knots in the lock at Immingham docks. Despite the master's attempts to recover control of the CPP system, the pitch remained at approximately 40% ahead, causing the vessel to accelerate. Although a forward spring was deployed and the tug Guardsman attempted to slow the vessel's progress by pushing, the vessel **impacted heavily with the outer lock gates at 3.7 knots**. Minor damage was sustained to vessel and tug. Significant damage was sustained to lock gates. Ship owner was encouraged to tight up pre-departure checks and preparedness for propulsion failure. Cause of failure not able to be identified.
23/01/2015	Collision	**Tanker Audacity collided** with cargo vessel Leonis in the Humber Estuary precautionary area during dense fog. Cause attributed to **Pilots on both vessels not making a full assessment of risk of collision** and **poor VTS procedures**.

263. More recently the IOT Operators are aware of two incidents involving pilot error associated with tankers departing the IOT in the last year, including:

- Coastal Tanker SELIN S near miss; and
- HEINRICH Line Parting.

8.2.2 SELIN S

264. On 28 July 2022, 'SELIN S', a 93m loaded chemical tanker was moored starboard side to the IOT finger pier, berth 6. The vessel departed the berth bound for sea and had a pilot onboard. During the vessel's daylight departure manoeuvre, which involved the vessel turning around to head out, the pilot misjudged the effect of the tide and collided with a mooring buoy located in the river. There was no apparent damage to the buoy or to the vessel, therefore the incident was latterly revised to being either a near miss or very light contact.

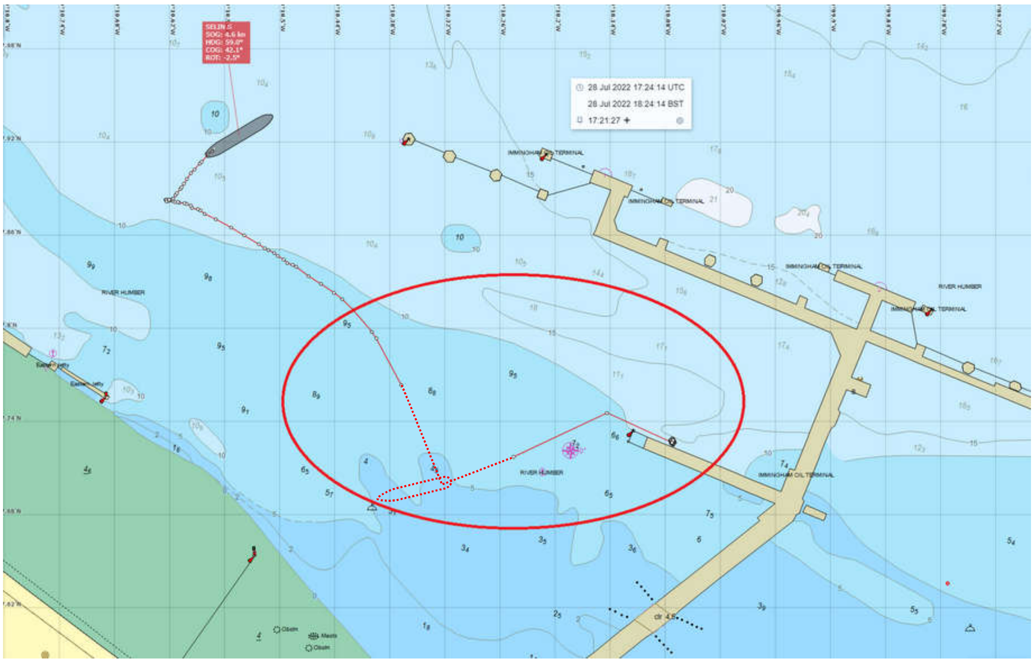


Figure 47: Commercially available AIS showing the AIS antenna position during the manoeuvre (actual track red line and vessel outline grey). Position of mooring buoy within red ellipse but not precisely shown, and indicative track of vessel and outline in dashed red.

8.2.3 HEINRICH

265. On 19 March 2023, the loaded tanker HEINRICH was making a routine departure from IOT berth 2, port side alongside. During the departure from the berth, three of the vessel's mooring lines parted, one of which snapped back close to line handlers. The subsequent internal investigation showed an inadequate Master/Pilot Information Exchange prior to departing, failure to adopt an effective unmooring sequence, misjudgement of the effect of the tide and suboptimal use of the allocated tug. The Pilot's authorisation was downgraded to smaller ships. Tide was HW minus 1.5h, wind light SW'ly, daylight conditions.

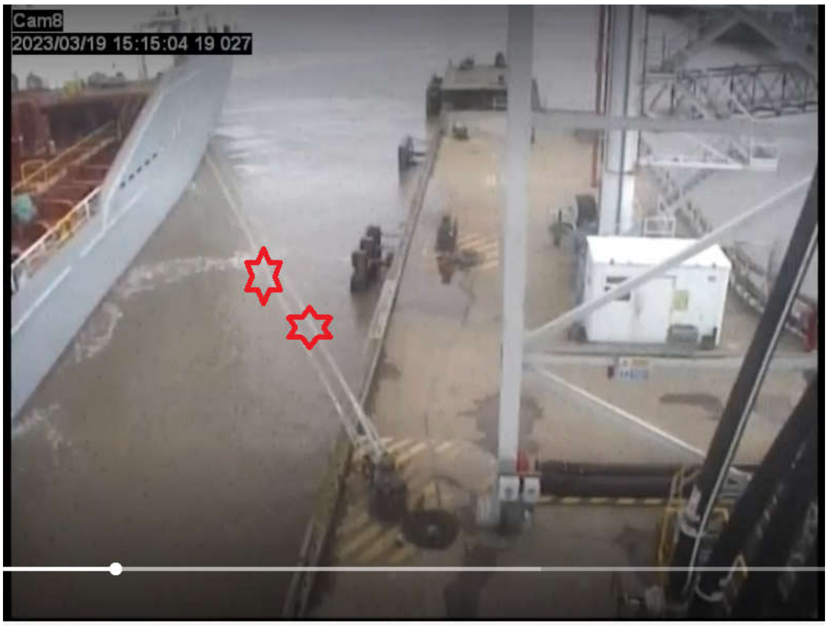


Figure 48: Extract of CCTV showing line parting of HEINRICH.

8.3 STATISTICAL INCIDENT ANALYSIS

266. The analysis contained within the IERRT NRA (ABPMer, 2022) was limited to 2011 to 2020, and has been reproduced in Figure 48. This has been extended based on a longer-term MAIB dataset to show 1992 to 2021 in Figure 50, although noting that the study area extents are not exactly aligned. It can be seen that there is a fluctuation in the total incident numbers reported to the MAIB, likely associated with changes in reporting formats. The analysis suggests that impacts with structures are the most likely incident type reported to the MAIB, followed by equipment failures.

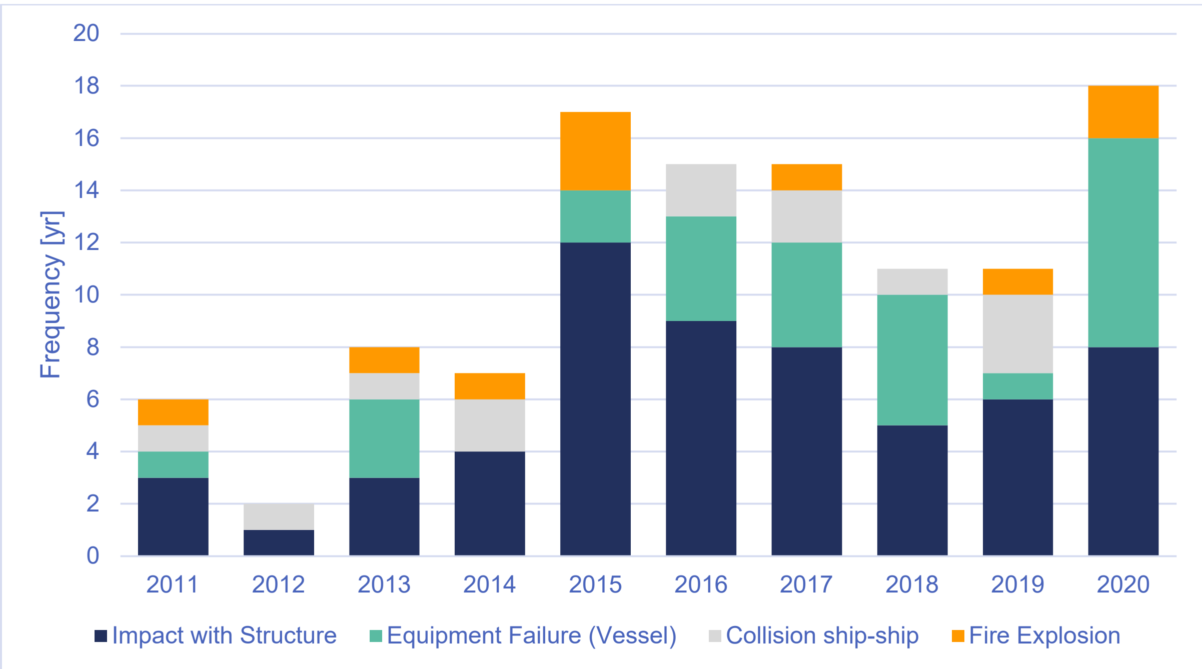


Figure 49: Chart showing ABP MAIB Accidents / Incidents per year (extracted from Table 6 ABPmer IERRT NRA).

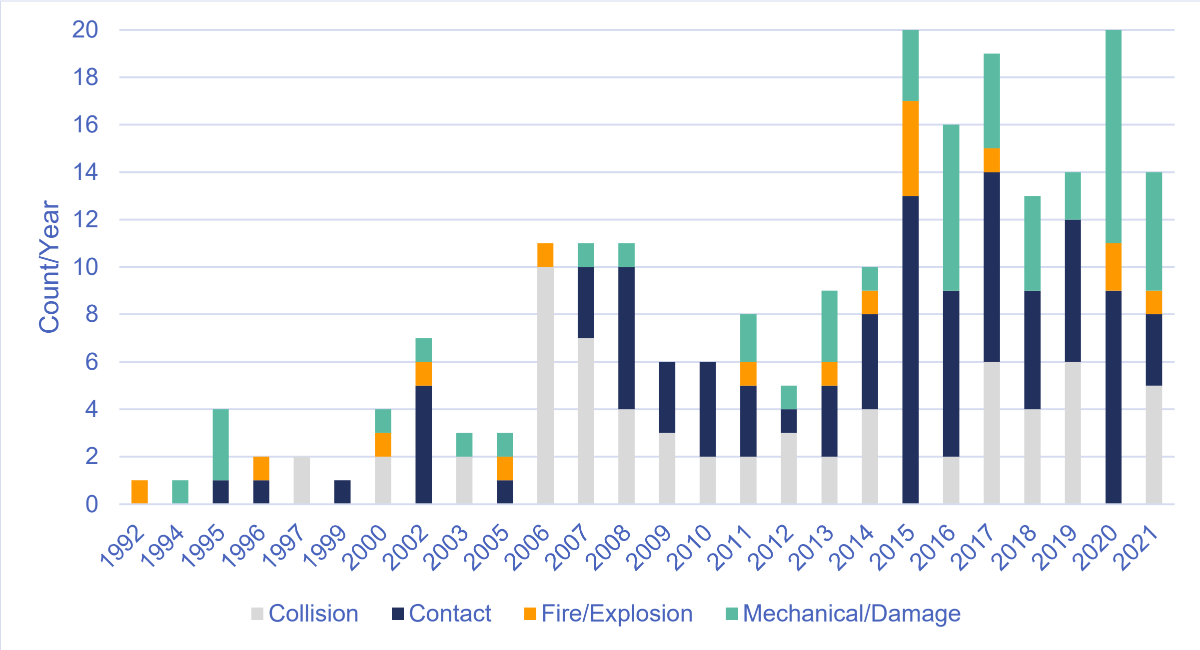


Figure 50: Extended MAIB Analysis.

8.3.1 Review of MARNIS Data

267. Whist the MARNIS data was not provided, a review has been conducted of the data presented in the IERRT NRA (see Figure 51). The IERRT NRA notes that there was on average 183.4 incidents per year in the study area. Given that the MARNIS data shows that equipment failure is the most frequent incident type, it demonstrates that the MAIB dataset analysed above underestimates these minor incidents, but which have the potential to escalate into serious incidents. Figure 52 compares the average number of incidents per year reported in the IERRT NRA between the MARNIS and MAIB datasets. It shows that approximately 13.1% of impacts and 3.6% of mechanical failures reported in the MARNIS dataset are contained within the MAIB dataset.

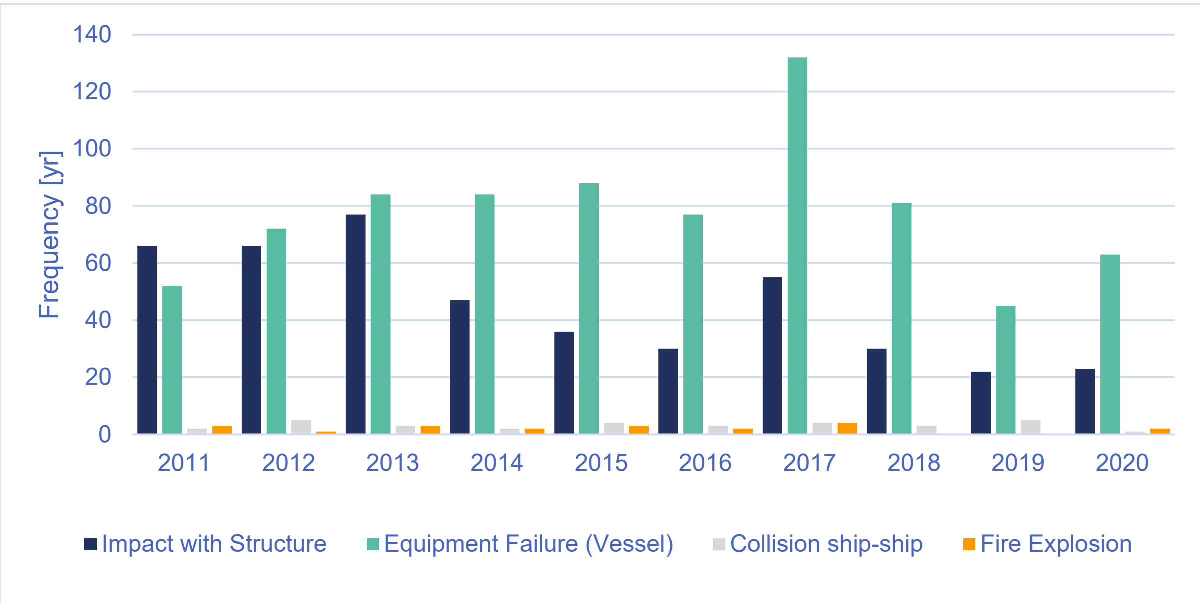


Figure 51: Chart showing ABP MARNIS Accidents / incidents per year (extracted from Table 5 ABPmer IERRT NRA).

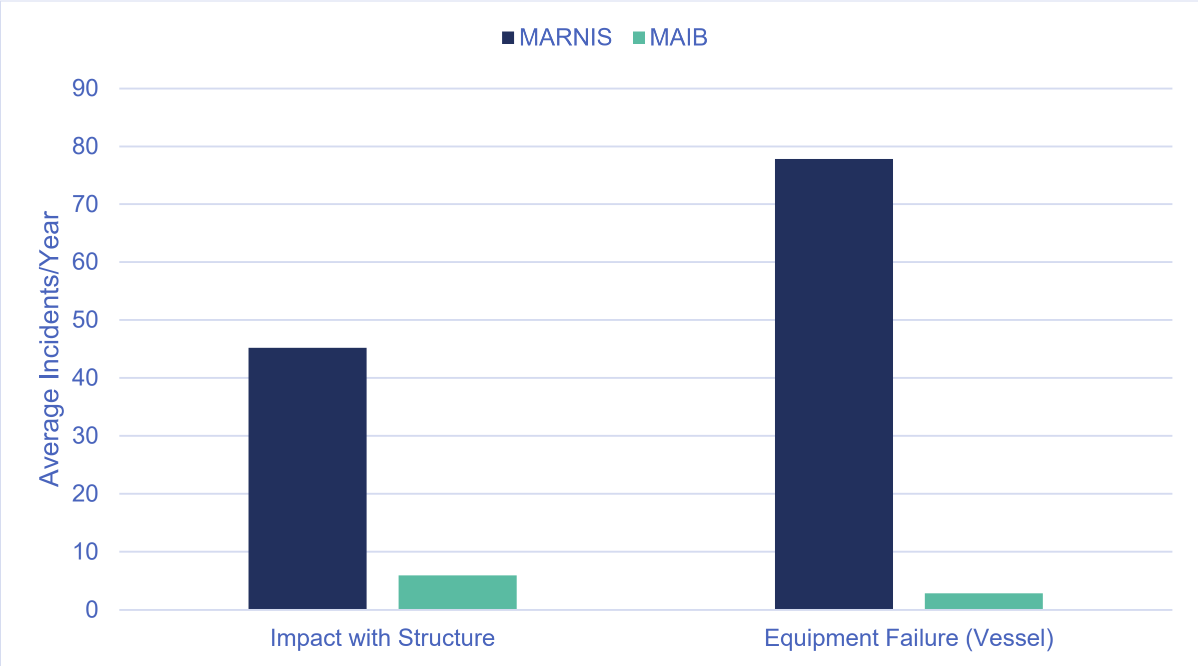


Figure 52: Comparison of MARNIS and MAIB Incident Counts in IERRT NRA.

268. Figure 53 and Figure 54 clearly demonstrate a higher number of equipment failures and impacts with structures around the existing IOT, Eastern Jetty and Killinghome Jetties as well as the proposed location of IERRT. Whilst it is not possible to analyse the frequency of occurrence without access to the underlying data, it demonstrates that the MAIB analysis conducted above is highly conservative on actual incident frequencies.

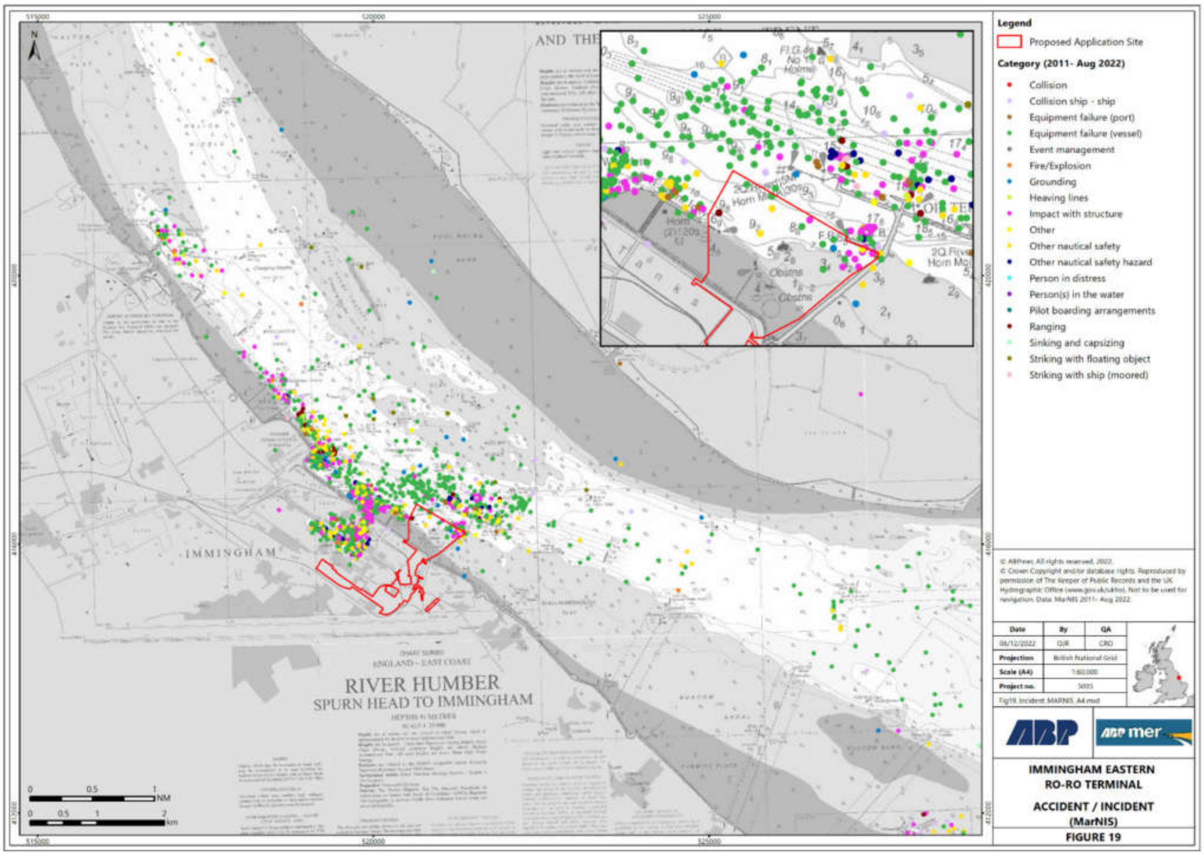


Figure 53: MARNIS accident/incident reports (Figure 19 from ABPmer IERRT NRA).

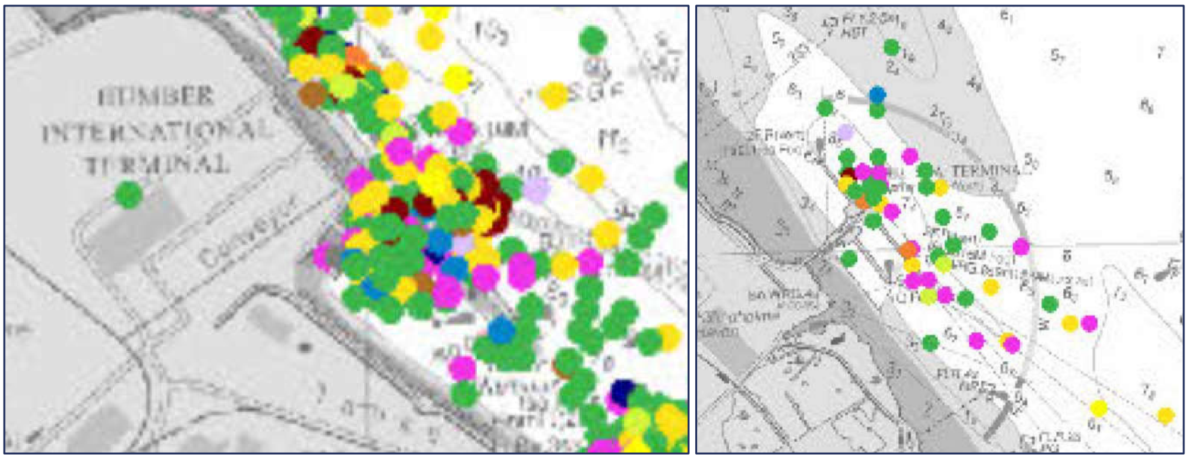


Figure 54: Extract from MARNIS accident/incident reports (Figure 19 from ABPmer IERRT NRA) Killinghome Ro-Ro Terminal and DFDS Ro-Ro terminal.

8.4 INCIDENTS OCCURRING ELSEWHERE IN THE UK

269. A summary of MAIB incident / accident reports on Ro-Ro vessels is presented in Table 11. The reports demonstrate that incidents involving Ro-Ro vessels occur and are often caused by equipment failure and human error, which are exacerbated by adverse weather. None of these incidents occurred with an oil terminal due to current locations of Ro-Ro vessel berths not being location in close proximity to such infrastructure.

Table 11: Summary of MAIB Ro-Ro Incidents.

Date	Type	Description
10/07/2023	Grounding	RoRo ferry Mazarine **lost all power** and grounded, after being adrift for 1.5 hour, adjacent to Wolf Rock lighthouse, causing significant damage to the vessel's portside keel area and bottom plating. 
25/06/2020	Grounding	Arrow grounded in thick fog, as a result of the **bridge team being under-prepared for pilotage in restricted visibility and poor Bridge Resource Management**. The ferry began to list significantly in the falling tide after the grounding and there was significant damage to the port side of the underwater hull, including holing and splitting of several water ballast tanks and damage to the port propeller and rudder, meaning the vessel was out of service for four weeks. However, there were no injuries or pollution, and the vessel was successfully re-floated 45 minutes later after grounding.
08/05/2019	Grounding	Seatruck Performance **grounded** while turning into a narrow, buoyed channel as a result of its heading being changed later than intended after entering the Greenore Channel, likely due to **nervousness and/or lack of confidence of the master and lack of bridge team support**. The ferry returned to Warrenpoint with no tug assistance and there was no damage to passengers, crew, or environment. However, it was later identified that a tank and a void space on the ferry's port side had been breached. The ferry was out of service for 3 weeks.
16/04/2018	Fire On-board	A fire broke out in the engine room of Finlandia Seaways following a catastrophic **main engine failure** that also resulted in significant structural damage to the engine. Engine failure was due to breaking of the engine's connecting rods, likely due to **poor maintenance**

Date	Type	Description
		management standards. The fire-fighting system was successfully activated but the third engineer suffered serious smoke-related lung, kidney and eye injuries and was recovered by coastguard helicopter to hospital.
25/09/2016	Allision / Grounding	As a result of **lost control of the ferry's port controllable pitch propeller following a mechanical failure**, the master was unable to prevent Hebrides from running over several mooring pontoons and briefly grounding. There were no injuries among persons on board, but the ferry was damaged and had to be repaired in dry dock.
09/11/2014	Allision	The ferry collided with the end of the breakwater while departing Dover. The **collision** was due to loss of directional control (as a result of an **unintentional change in the mode the steering control system** was operating) as the ferry turned towards the harbour's eastern entrance. The attempted corrections failed to prevent contact and the several minor injuries were suffered by passengers and crew as well as damage to the ferry's bow. There was no pollution.
29/09/2014	Fire On-board	A major fire broke out in the engine room of Pride of Canterbury while berthing. This occurred due to a series of events: unresponsive starboard pitch propeller; **master's decision to proceed with only one propeller shaft and one bow thruster;** a rupture of a pipework joint in the system, and a lack of shielding of the  joints which resulted in oil spraying onto exhaust uptakes. There were no injuries and the ferry berthed safely but the engine room was significantly damaged.
22/06/2013	Allision	**Heavy contact was made with berth** 3 at Harwich International Port, likely as a result of **inadvertent pressing of the button** which activates the back-up control system **for the starboard propulsion system** (which bypasses normal control). The error went unnoticed by bridge  team which meant it remained at 63% ahead throughout accident. Considerable damage occurred to the fore-end of the vessel and the linkspan collapsed into the water. There were no injuries or pollution.
16/02/2013	Allision	The port fin stabiliser of Finnarrow made contact with the berth during arrival into Holyhead. As a result, the hull was punctured, and the pump room subsequently flooded. The cause was concluded to be **inadequate procedures for pre-arrival checks** and a **lack of familiarity of the crew with the vessel's equipment** and emergency procedures.
22/10/2011	Allision	Heavy contact was made with the No 6 berth in Calais by the Pride of Calais as a result of **failure of the vessel's main propulsion** as the vessel approached the berth. The vessel suffered minor damage to the bow but there were no serious injuries and no pollution.

Date	Type	Description
24/05/2011	Allision	Clipper Point made heavy contact with the quay, two ro-ro ferries and another vessel while manoeuvring to berth, due to the wind increasing to 34knots during arrival into port meaning the ship was set closer to the port's South Quay than intended. The **master then made the poor decision** to attempt to turn to port as usual, with **one Un operational bow thruster,** meaning the starboard quarter of the ferry made contact with South Quay and sustained damage. The ferry's steering  compartment was also holed below the waterline. South Quay sustained damage to the upper edge and lower level and supporting structure. Scotia Seaways' port bow bulwark plating and two internal frames were damaged and Clipper Ranger's port bow sustained minor damage to port bow bulwark plating.
06/02/2010	Allision	The Isle of Arran passenger ferry hit the linkspan in Kennacraig at over 8 knots. The collision occurred due to a **mechanical failure that led to loss of control of the starboard propeller pitch** so the starboard propeller remained at full ahead during the approach to berth. There were no injuries but the vessel  and linkspan were both damaged.
13/11/2007	Collision	Ursine made contact with the passenger ferry Pride of Bruges as a result of **ineffective communication between the master and the PEC holder** and failure to clarify who would be in control of the vessel. Formal berth allocation was also absent which led to Ursine being directed toward a berth already allocated by Pride of Bruges until contact was made. Damage was caused to both vessels, including to the stern door, stern light and bracket. There were no injuries.
10/03/2006	Allision	Heavy contact was made with the linkspan at Town Quay, Southampton as a result of **miscommunication between the master, the AB and the Chief Officer**, which caused the chief officer to reduce speed on only the aft unit and not both Voith units. Hence, the vessel's speed was not sufficiently reduced and collision with the linkspan was made. 11  people were minorly injured and some vehicles on-board were damaged, as well as the vessel and linkspan.
23/01/2005	Collision	As a result of an **incorrect assumption being made by the master** of Amenity (that Tor Dania had turned onto a collision course), Amenity turned to port and hit Tor Dania close to midships on the port side at a speed of ~7 knots. Both vessels suffered significant damage but there were no injuries or pollution and both vessels were able to continue to berth un-aided before being withdrawn from service for repairs.
29/12/2004	Allision	Isle of Mull glanced off Lord of the Isles (moored alongside) and subsequently made contact with Oban Railway Pier bow on at around 4 knots. This was due to **human error, where the master forgot to start the bow thrusters at the centre control before moving to starboard wing control console**. The realisation and attempt at correction was too late so the ferry did not slow or turn sufficiently.

Date	Type	Description
		There were no passengers onboard and no injuries were sustained as a result of the impact. The bow visor and port side of the fo'c'sle were substantially damaged and the vessel was withdrawn from service for repairs.
30/07/2004	Allision	Daggri made **contact** with the Ulsta breakwater at around 3knots. This was due primarily to the **visibility becoming significantly reduced** near to Yell shore. As a result of the breakwater collision, the forward azimuth thruster blades of the propellers were distorted, and the hull was indented but not breached and there were no injuries or pollution.
18/04/2003	Allision	Pride of Provence, a ro-ro passenger ferry with 641 persons on board, made heavy contact with the end of the southern breakwater at the eastern entrance to Dover Harbour on 18 April 2003 at 1724. It was daylight, the weather was good and the visibility clear. There was a strong north-easterly wind and a southerly flowing tidal stream across the entrance. Twenty-eight passengers and crew suffered minor injuries, and two suffered major injuries in the accident, and the vessel was extensively damaged above the waterline.
14/03/2001	Grounding	Finnreel grounded after sheering to starboard out of the channel. This was as a result of the **main engine automatically shutting down following the main engine oil mist detector alarm activating**. As a result of the grounding, the vessel's fore peak, No 1 centre and No 2 port and starboard ballast tanks and the bow thruster space were all holed but there were no injuries or pollution.
27/04/2000	Allision	The master of Aquitaine put the two combinators to select astern pitch on both propellors after passing through the Calais port entrance faster than normal. However, the **port propellor failed to respond** and this was not noted by the bridge team. As a result, the master could not prevent the vessel from colliding with the berth at a speed of ~7 knots. 180 passengers and 29 crew were injured and the vessel was taken out of service and dry docked for 2 months.
22/10/1998	Grounding	The course selection that was made on-board Octogon 3 made **no allowance for the strong south-westerly winds or the tides** and, as a result, the **ship was set to starboard** until she grounded. There was no damage to the hull and no pollution or injuries.
19/09/1995	Grounding	Stena Challenger ran aground in the approach channel to Calais after the north-north-easterly gale force wind caused the vessel to drift southward and, despite more power being applied and the bow thrusters activated, fail to turn head to wind and ground on a sandy beach. A substantial amount of bottom plating was damaged in the accident but the hull was not pierced and no pollution occurred. There were no injuries. The primary cause was found to be **insufficient monitoring of the vessel's position during the approach** to Calais. 

8.5 STATISTICAL ANALYSIS OF INCIDENTS INVOLVING RO-RO VESSELS

270. The 1992-2021 MAIB incident data was analysed, extracting all Ro-Ro categorised vessels. This included 6,762 incidents, of which 416 were contacts/impacts and 949 were mechanical failures.

271. Figure 55 categorises the incidents by their reported severity using MAIB classifications. 34% of contacts are Marine Incidents (minor), whilst 36% are Less Serious and 30% are Serious. Figure 56 demonstrates that there is a 45% probability that a

contact/impact would result in material damage to the RoRo vessel, and that this is the highest of any incident category recorded. Fatalities resulting from RoRo incidents are generally rare, with none of the 416 contacts resulting in fatalities, albeit eight resulting in injuries (2%). Several of these incidents are described in Table 11.

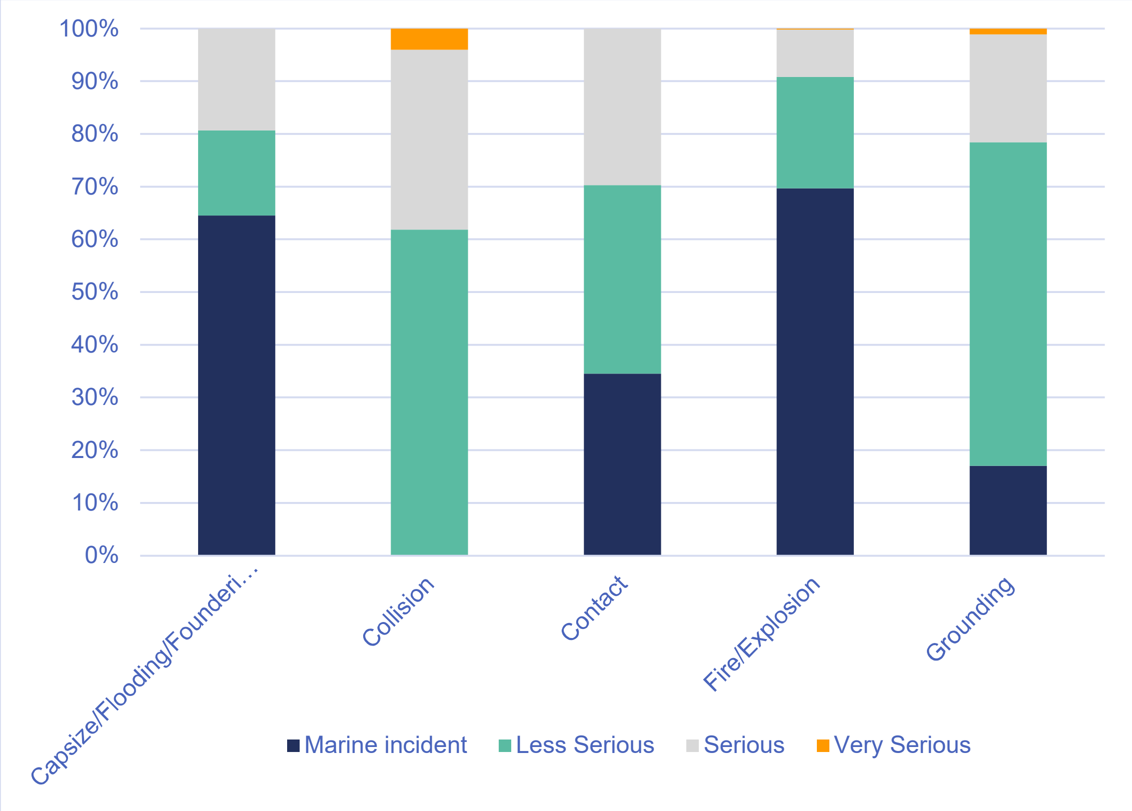


Figure 55: RoRo Incidents by Severity.

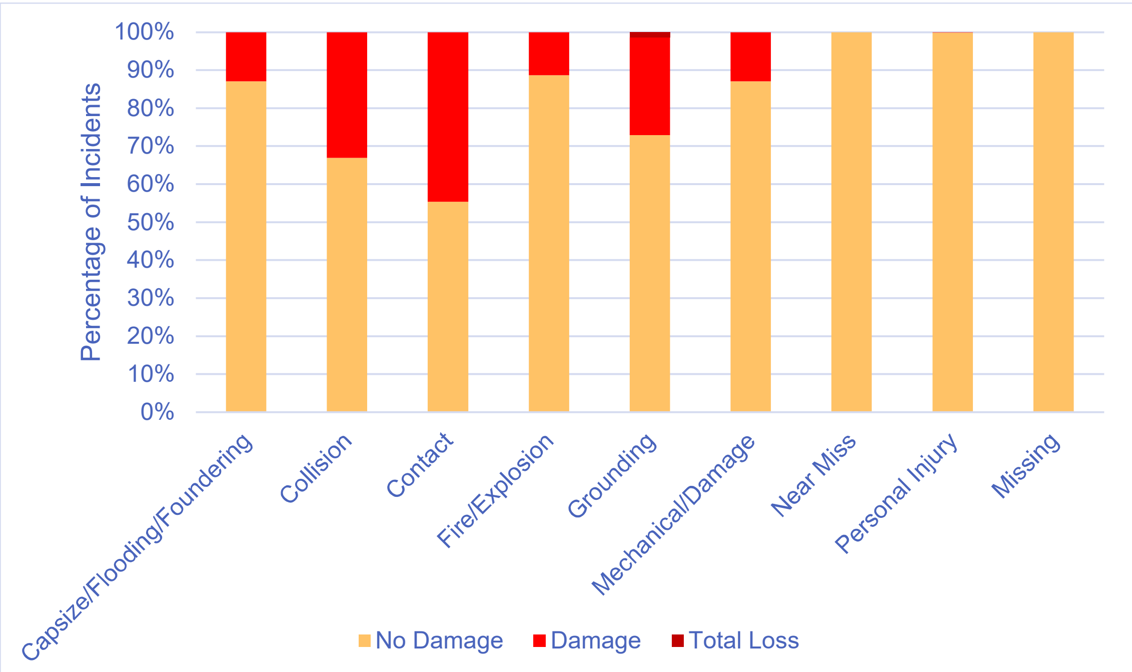


Figure 56: MAIB RoRo Incident Outcomes: Damage.

272. A study by Ciria (1999) reviewed a sample of 177 linkspans and identified that 34% had experienced significant incidents. Of these approximately 30% were the result of ship impacts.

273. A study by EMSA (2018) reviewed Ro-Ro incidents reported to EMCIP between 17/06/2011 and 26/04/2018. This included 3,236 occurrences, of which 523 were contacts, and 353 occurred on arrival and 81 on departure.

8.6 INCIDENT RATES

274. Analysis was undertaken of the MAIB Ro-Ro dataset and compared with the number of movements into different ports around the UK. This enabled determination of the incident rate per movement for use in the QRA (Section 10). Department for Transport Port and Domestic Waterborne Freight Statistics: data table PORT0601 (DfT, 2023) contains annual numbers of ship arrivals by vessel type per UK port. By extracting the number of MAIB incidents for the approximate approaches and berthing areas for each port, a rate per movement can be calculated.

275. Figure 57 shows the incident rate per movement for 11 selected RoRo ports in the UK. The average annual incident rate (for all incidents) varies between 1.4 x 10^{-3} ^{to} 3.41 x 10^{-4}, or one incident per 714 to 2,933 movements respectively. For contacts (impact / allision) incidents, this varies from between 2.85 x 10^{-4} to 4.85 x 10^{-5}, or one incident per 3,508 and 20,612 movements respectively. It is notable that Immingham/Grimsby have the highest contact incident rate (e.g. one contact per 3,508 movements), likely reflecting the challenging navigational conditions in the Estuary.

276. Much of the research into accident rates for vessels has been applied on the basis of a "ship year", which includes the full range of conditions and environments in which a ship operates and therefore cannot be directly compared to specific berthing manoeuvres in ports/harbours. Other work has provided estimated failure rates, such as a ship black out frequency of 1.14 x 10^{-5} per hour (Friis-Hansen et al. 2008), a human error rate of 4.9 x 10^{-5} (Goerlandt and Kujala, 2014) or a striking frequency per transit in a narrow waterway of 4.2 x 10^{-5} (DNV, 2013). Many of these rates are approximately an order of magnitude less likely that the Immingham contact rate of 2.85 x 10^{-4} per movement as derived above.

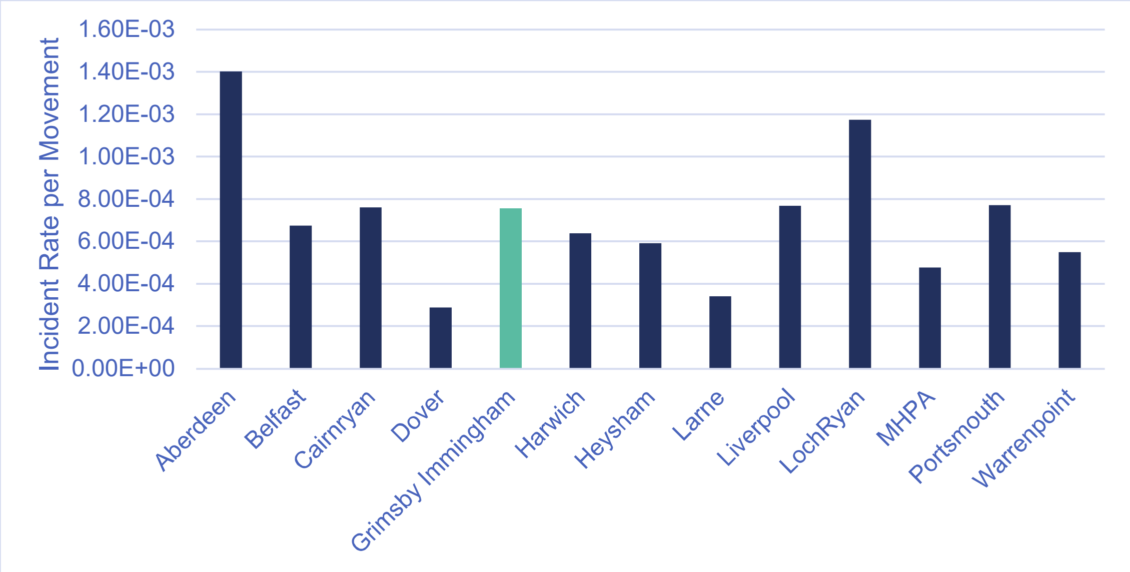
277. As has been identified above in Section 8.2, it is known that minor incidents are under-reported with approximately only 1 in 10 and 1 in 20 contacts and mechanical failures reported to the MAIB respectively. Therefore, it is likely that these figures are conservative in nature and the actual incident rate may be higher. Furthermore, given the significant difference for mechanical failures, this analysis has not been repeated for these incident types.

8.7 SUMMARY

278. Analysis of historical incidents is a very useful tool to assist in the development of NRAs. The historical analysis of MAIB incidents for the Humber Estuary show that the estuary has a high incident rate for contacts. A qualitative review of the MarNIS incidents, presented in the ABPmer IERRT NRA report, show high numbers of contact, equipment, and mooring incidents in close proximity to existing Ro-Ro berths on the river. The consequences of incidents analysed shows that contacts with linkspans and berths can have high costs and result in major injury. The consequences from historical incidents have generally been lower that would be expected at the IERRT, due to both the proximity of the IOT and also the navigational complexity of the IERRT location, which has strong

tidal velocities, frequent high winds and limited room for manoeuvring making the margin for error limited.

279. The statistical analysis of incidents enables probabilities of incident occurrence to be derived, which can be used to both inform a qualitative (see Section 9) and quantitative (see Section 10) assessment of risk.



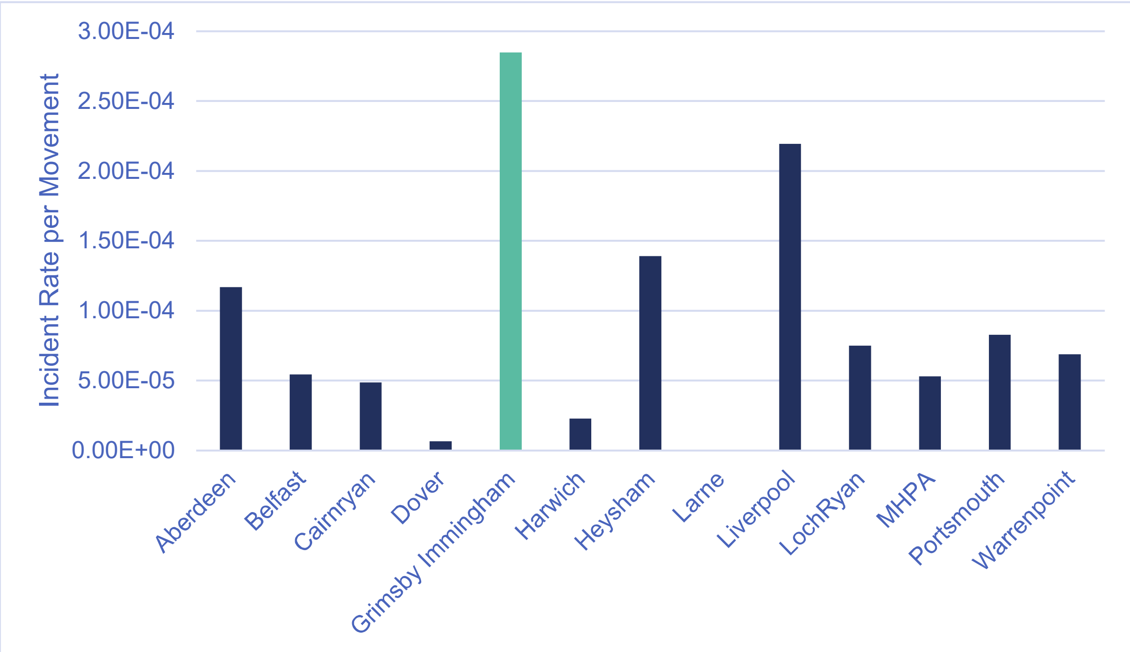


Figure 57: Incident Rates per Movement (Top: All incidents, Bottom: Contacts).

9. QUALITATIVE RISK ASSESSMENT

280. This section summarises the formal risk assessment process for the qualitative risk assessment for the operational phase only of the IERRT, including the identification of:

- Hazard types;
- Vessel types;
- Contact scenarios; and
- Identified hazards.

9.1 HAZARD IDENTIFICATION

281. The project team combined the findings of a review of the proposed IERRT NRA, with analysis presented in Sections 2, 3, 4, 5, 6, 7 and 8 of this report, to identify hazard types associated with the IERRT development, which were pertinent to IOT Operators. This resulted in three hazard types being identified which are summarised in Table 12. A commentary giving further context to the possible scenarios associated with each hazard type is included in the remainder of this section.

Table 12: Identified Hazard Types.

Hazard ID #	Hazard Types	Definition
1	**Collision**	Collision between two vessels underway (also includes striking of an anchored vessel).
2	**Contact (Allision / Impact)**	Vessel makes contact with Fixed or Floating Object (FFO) (e.g. quay, pile, shoreline, buoy, moored vessel)
3	**Breakaway**	Vessel breaks away from securely moored position may result in damage to non-vessel objects

9.1.1 Vessel Categories

282. A review of the baseline vessel traffic analysis was also undertaken to define vessel type categorisations. The following vessel categories were identified:

- **IERRT Ro-Ro vessels** – T -Class Stena ferries, (see Section 4.4)
- **Bunker Barge** – estuarial barges undertaking distribution of refined products to terminals further inland and direct delivery of bunker fuels to ships in Hull, Immingham and Grimsby, (see Section 3.2). Barges predominantly berth at IOT berths 7 and 9.
- **Tanker** – Commercial vessels larger than 100m in length carrying liquid cargo such as LPG, oil or chemicals between two ports. These vessels utilise the main river facing IOT berths and Immingham Dock.
- **Coastal Tanker** - product tankers, generally within the range 80m – 100m in length which trade predominantly to UK and near European ports distributing refined oil products and fuels. Coastal tankers berth at either IOT berths 6 or 8.

- **Cargo -** commercial vessels carrying dry cargo such as containers, bulk cargo or automobiles between two ports. Cargo vessel activity is predominantly associated with transits to and from Immingham Dock of the Outer Harbour.
- **Tug, service and other small vessels** – Tugs, workboats, port service, law enforcement and survey vessels.
- **Third Party Passenger** – Ro-Ro vessel entering Immingham Dock and transiting north of IOT.

9.1.2 Contact Scenarios

283. A number of contact (allision / impact) scenarios were identified for vessels navigating to and from the IERRT and IOT. Separate contact scenarios are considered because the severity of a contact occurrence not only depends on the vessel type(s) involved but the nature of the infrastructure contacted. For example, a contact hazard occurrence between a IERRT Ro-Ro vessel and the IERRT berth may result in significant damage to property but will likely have minimal consequences for the environment. In contrast a contact occurrence between a IERRT Ro-Ro vessel and the IOT Trunkway will not only result in significant damage to property but may also have catastrophic environmental impacts. The magnitude of risk is therefore influenced by the type of vessel and the nature of the infrastructure contacted. The contact scenarios are summarised in Table 13.

Table 13: Identified Contact Infrastructure Scenarios.

Contact Scenarios	Detail
IOT Trunkway	IOT Trunkway from shore to IOT Finger Pier and river berths
IOT Finger Pier	IOT Finger Pier including berths 6, 7, 8 and 9 and vessel moored alongside.
IOT River berths	IOT River Berths including berths 1, 2 and 3 and vessel moored alongside.
IERRT Jetty	IERRT including berths 1,2 and 3 and vessels moored alongside.

9.1.3 Identified Hazards

284. The identified hazard types, vessel types and contact scenarios were then combined to create a list of potential navigation hazards. The project team reviewed each hazard iteration to check whether the occurrence of each identified hazard was credible. Those hazards not deemed to be credible were removed from the final identified hazard list, (see Table 14).

285. The project team then reviewed each identified hazard to ascertain the relevance of the hazard to the sNRA. For example, Third party passenger vessels are not observed navigating in proximity to either the IERRT or IOT, therefore, a third party passenger vessel making contact with the IERRT or IOT was not deemed to be an appropriate hazard to consider in this sNRA. The identified hazards are therefore associated with vessels undertaking operations at either the IERRT, IOT or navigating to Immingham terminals. A commentary relating to the hazards applicable to each of the operations is outlined below.

Table 14: identified Navigation Hazards (ICW – In Collision With).

Hazard Id #:	Hazard Type	Hazard Title
1	Collision	Collision - IERRT Ro-Ro vessels (Passenger) ICW IERRT Ro-Ro vessels (Passenger)
2	Collision	Collision - IERRT Ro-Ro vessels (Passenger) ICW Coastal Tankers
3	Collision	Collision - IERRT Ro-Ro vessels (Passenger) ICW Bunker Barge
4	Collision	Collision - IERRT Ro-Ro vessels (Passenger) ICW Cargo
5	Collision	Collision - IERRT Ro-Ro vessels (Passenger) ICW Tanker
6	Collision	Collision - IERRT Ro-Ro vessels (Passenger) ICW Tug, Service and Other Small Vessel
7	Collision	Collision - IERRT Ro-Ro vessels (Passenger) ICW 3rd Party Passenger
8	Contact (Allision)	Contact (Allision) - Bunker Barge with IOT Trunkway
9	Contact (Allision)	Contact (Allision) - Coastal Tanker with IOT Trunkway
10	Contact (Allision)	Contact (Allision) - IERRT Ro-Ro vessel (Passenger) with IOT Trunkway
11	Contact (Allision)	Contact (Allision) - Bunker Barge with IOT Finger Pier
12	Contact (Allision)	Contact (Allision) - Coastal Tanker with IOT Finger Pier
13	Contact (Allision)	Contact (Allision) - IERRT Ro-Ro vessel (Passenger) with IOT Finger Pier
14	Contact (Allision)	Contact (Allision) - Tug, Service and Other Small Vessel with IOT Finger Pier
15	Contact (Allision)	Contact (Allision) - IERRT Ro-Ro vessel (Passenger) with IOT River berths
16	Contact (Allision)	Contact (Allision) - Bunker Barge with IERRT Jetty
17	Contact (Allision)	Contact (Allision) - Coastal Tanker with IERRT Jetty
18	Contact (Allision)	Contact (Allision) - IERRT Ro-Ro vessel (Passenger) with IERRT Jetty
19	Contact (Allision)	Contact (Allision) - Tug, Service and Other Small Vessel with IERRT Jetty
20	Breakaway	Breakaway - Bunker Barge at IOT Finger Pier
21	Breakaway	Breakaway - Coastal Tanker at IOT Finger Pier
22	Breakaway	Breakaway - IERRT Ro-Ro vessel (Passenger) at IERRT Jetty

9.1.3.1 IERRT Operations: Collision

286. Encounters between IERRT vessels and other vessel types will occur as they navigate to and from the IERRT berths. It is possible that these encounters could result in a collision occurrence. Collisions between IERRT vessels and other vessels could occur when

navigating past the IOT, as they swing to align with IERRT and on final approach to the berth.

287. When passing the IOT, IERRT vessels could be involved in a collision with vessels utilising the main navigable channel, tug and workboat vessels assisting tankers in berthing at the IOT river berths and tankers arriving / departing the river berths.

288. As IERRT vessels depart / join the navigable channel and manoeuvre to the IERRT they will obstruct the main channel, (see **Section 4.5**). During this manoeuvre IERRT vessels will be in a state of relative vulnerability as the ability of the master to take any avoiding action will be restricted. A collision occurrence could occur between other vessels utilising the main channel, vessels navigating to Immingham terminals and coastal tankers and bunker barges approaching the IOT Finger Pier.

9.1.3.2 IERRT Operations: Contact

289. IERRT vessels approaching / departing the IERRT will navigate in close proximity to IOT and contact incidents could occur between a IERRT vessel and:

- IOT Finger Pier (including tanker moored alongside);
- IOT Trunkway;
- IOT River Berths; and
- IERRT.

290. Contact between an IERRT vessel the IOT Finger Pier and Trunkway will be most likely to occur when approaching / departing IERRT on an ebb tide, particularly IERRT Berth 1. Berth 1 is positioned in close proximity to the IOT Finger Pier and the navigable width will be further reduced should a coastal tanker or bunker barge occupy berths 8 and 9. In addition, the ebb tide will set IERRT vessels on to IOT. Precise vessel handling will be required to manoeuvre a IERRT vessel alongside and there will be minimal margin for error, particularly in adverse conditions.

291. In addition to contact with the Finger Pier there is also the possibility that an IERRT vessel may either pass between the Finger Pier and IERRT berth 1 thus making contact with IOT Trunkway or pass through the IERRT infrastructure to make contact with the IOT Trunkway.

9.1.3.3 IERRT Operations: Breakaway

292. IERRT vessels could breakaway from their berths in adverse weather conditions or if berthing infrastructure failure e.g. parting mooring line. If an IERRT vessel does breakaway from the berth then there is the possibility that contact could be made as outlined above, the consequences of a breakaway would likely be more severe during a strong ebb tide as the tide will set the vessel back toward the IOT Finger Pier and Trunkway.

9.1.3.4 IOT Operations: Collision

293. Vessels utilising the IOT terminal include tankers utilising the IOT River Berths, Coastal tankers utilising berths 6 and 8 on the IOT Finger Pier, bunker barges utilising berths 7 and 9 on the IOT Finger Pier and, tug and workboats that assist in berthing operations.

294. Coastal tankers and bunker barges approaching the IOT Finger Pier will navigate in close proximity to IERRT vessels. Encounters between such vessels are likely and therefore there is a heightened risk of collision.

295. Tugs and workboats assisting in berthing IOT bound vessels are also likely to navigate in proximity to vessels arriving / departing IERRT berths.

9.1.3.5 IOT Operations: Contact

296. When an IERRT vessel is alongside berth 1, navigable width between IERRT berth 1 and berths 8 and 9 of the IOT Finger Pier will be significantly reduced. This will reduce the margin of error for IOT berthing manoeuvres and there is a possibility that IOT vessels could make contact with the moored IERRT vessel, IOT Finger Pier (including vessel alongside) or the Trunkway.

297. Coastal tankers, bunker barges, tugs and workboats could also make contact with the IOT Finger Pier as a result of the reduced navigable width.

9.1.3.6 Breakaway

298. IOT vessels (coastal tankers or bunker barges) moored at berth 7 and 9 could breakaway from the berth in adverse weather conditions or if there is a berthing infrastructure failure. If an IOT vessel does breakaway from the berth then there is the possibility that contact could be made with a IERRT Ro-Ro vessel moored at IERRT berth 1, the IERRT jetty or the IOT Trunkway. The consequences of a breakaway would likely be more severe during a strong ebb tide as the tide will set the IOT vessel toward the IOT Finger Pier.

9.2 HAZARD SCORING

299. Hazards scoring was based on the data and analysis contained within this report and a review of the IERRT operational phase NRA hazard likelihood and consequence scores. For the hazard consequence scoring, direct benchmarking with IERRT hazard consequence scores was undertaken. In effective hazard consequence scores for this sNRA are therefore considered to be the same or similar to those derived from the hazard workshops.

300. Due to the problems with the IERRT Frequency Descriptors (as detailed in Section 2.1.7) hazard likelihood scores were derived from analysis contained with this report at Sections 3, 4, 5, 6, 7 and 8.

9.3 BASELINE QUALITATIVE RISK ASSESSMENT

301. The results of the baseline assessment of risk (which includes the embedded risk controls) are presented in Table 15. The results of the baseline sNRA are contained in full in the "*Risk Assessment Logs*" which can be viewed in Appendix C.

302. Of the 22 identified hazards:

- Two are scored as "Intolerable":
    - Haz ID # 10 - Contact (Allision) - IERRT Ro-Ro vessel (Passenger) with IOT Trunkway; and

- Haz ID # 13 - Contact (Allision) - IERRT Ro-Ro vessel (Passenger) with IOT Finger Pier.
- 20 are scored as “Tolerable if ALARP”.

9.3.1 Intolerable Hazard Commentary

303. This section includes a short commentary expanding on the circumstances that combine to influence the relative high-risk scores attributed to those hazards classified in the baseline assessment of risk as intolerable.

9.3.1.1 Contact (Allision) - IERRT Ro-Ro vessel (Passenger) with IOT Trunkway

304. The proximity of berth 1 to the IOT Trunkway and the fact that berthing operations will take place on ebb tides combine to result in a relative high likelihood score for hazard occurrence.

305. In combination with relative high consequence scores, this results in this hazard being classified as intolerable.

306. High consequence scores are assigned on the following basis:

- People - IERRT Ro-Ro vessels are passengers vessel carrying hundreds of passengers, in a worst case scenario the IERRT Ro-Ro vessel could capsize / sink as a result of contact resulting in multiple fatalities;
- Property – a contact event between the IERRT Ro-Ro vessel and the IOT Trunkway would likely damage the Trunkway beyond repair with the IERRT Ro-Ro vessel also likely to sustain significant damage.
- Environment – should a contact occur and the Trunkway pipelines be compromised, there would be an oil / product spill resulting in catastrophic long lasting impact to the environment; and
- Business – such a contact event (involving multiple fatalities, catastrophic damage to property and the environment) would result in widespread international negative publicity and would result in significant loss of revenue to the port.

Table 15: Baseline Risk Assessment Results.

ID	Baseline Rank	Hazard Title	Baseline Risk	
			Score	Rating
10	1	Contact (Allision) - IERRT Ro-Ro Vessel with IOT Trunkway	6.0	Intolerable
13	1	Contact (Allision) - IERRT Ro-Ro Vessel with IOT Finger Pier	6.0	Intolerable
2	3	Collision - IERRT Ro-Ro Vessel ICW Coastal Tankers	5.9	Tolerable if ALARP
12	4	Contact (Allision) - Coastal Tanker with IOT Finger Pier	5.8	Tolerable if ALARP
3	5	Collision - IERRT Ro-Ro Vessel ICW Bunker Barge	5.5	Tolerable if ALARP

ID	Baseline Rank	Hazard Title	Baseline Risk	
			Score	Rating
18	6	Contact (Allision) - IERRT Ro-Ro Vessel with IERRT Jetty	5.1	Tolerable if ALARP
5	7	Collision - IERRT Ro-Ro Vessel ICW Tanker	5.0	Tolerable if ALARP
11	7	Contact (Allision) - Bunker Barge with IOT Finger Pier	5.0	Tolerable if ALARP
15	7	Contact (Allision) - IERRT Ro-Ro Vessel with IOT River berths	5.0	Tolerable if ALARP
7	10	Collision - IERRT Ro-Ro Vessel ICW 3rd Party Passenger	4.9	Tolerable if ALARP
8	10	Contact (Allision) - Bunker Barge with IOT Trunkway	4.9	Tolerable if ALARP
9	10	Contact (Allision) - Coastal Tanker with IOT Trunkway	4.9	Tolerable if ALARP
20	13	Breakaway - Bunker Barge at IOT Finger Pier	4.8	Tolerable if ALARP
21	13	Breakaway - Coastal Tanker at IOT Finger Pier	4.8	Tolerable if ALARP
16	15	Contact (Allision) - Bunker Barge with IERRT Jetty	4.6	Tolerable if ALARP
17	15	Contact (Allision) - Coastal Tanker with IERRT Jetty	4.6	Tolerable if ALARP
22	15	Breakaway - IERRT Ro-Ro Vessel at IERRT Jetty	4.6	Tolerable if ALARP
1	18	Collision - IERRT Ro-Ro Vessel ICW IERRT Ro-Ro Vessel	4.5	Tolerable if ALARP
4	19	Collision - IERRT Ro-Ro Vessel ICW Cargo	4.4	Tolerable if ALARP
14	20	Contact (Allision) - Tug, Service and Other Small Vessel with IOT Finger Pier	3.6	Tolerable if ALARP
19	20	Contact (Allision) - Tug, Service and Other Small Vessel with IERRT Jetty	3.6	Tolerable if ALARP
6	22	Collision - IERRT Ro-Ro Vessel ICW Tug, Service and Other Small Vessel	3.5	Tolerable if ALARP

9.3.1.2 Contact (Allision) - IERRT Ro-Ro vessel (Passenger) with IOT Finger Pier

307. The proximity of berth 1 to the IOT Finger Berth (and / or coastal tanker / bunker barge moored alongside) and the fact that berthing operations will take place on ebb tides combine to result in a relative high likelihood score for hazard occurrence.

308. In combination with relative high consequence scores, this results in the hazard being classified as intolerable.

309. High consequence scores are assigned on the following basis:

- People - IERRT Ro-Ro vessels are passengers vessel carrying hundreds of passengers, in a worst case scenario the IERRT Ro-Ro vessel could capsize / sink as a result of contact resulting in multiple fatalities;

- Property – a contact event between the IERRT Ro-Ro vessel and the IOT Trunkway and or vessel berthed alongside would likely damage the IOT Finger Pier beyond repair with the IERRT Ro-Ro vessel and IOT vessel also likely to sustain significant damage.
- Environment – should a contact occur and the IOT / IERRT Ro-Ro vessel be holed there would be an oil / product spill resulting in catastrophic long lasting impact to the environment; and
- Business – such a contact event (involving multiple fatalities, catastrophic damage to property and the environment) would result in widespread international negative publicity and would result in significant loss of revenue to the port.

9.4 SUMMARY

310. The hazard identification for the Qualitative Risk Assessment identified 22 unique hazards. Of these hazards two were identified as "Intolerable" in the baseline assessment of navigation risk. The remaining hazards were classified as "Tolerable if ALARP".

10. QUANTITATIVE RISK ANALYSIS

10.1 INTRODUCTION

311. Following the identification of a potentially high-risk hazard associated with an impact between an IERRT Ro-Ro and the IOT infrastructure, a detailed Quantitative Risk Assessment (QRA) has been undertaken. This consisted of modelling of incident likelihood and consequences.

10.2 LIKELIHOOD MODELLING

312. The primary methodology utilised in the QRA are event trees, whereby high-level event sequences are identified which represent the causal chain which may lead to a certain outcome. For the basis of this assessment, the causal chain of events contains the following stages:

- A vessel arrives or departs the IERRT.
- There is a mechanical or human failure aboard which results in loss of control.
- The vessel fails to rectify the issue through taking some action (e.g. dropping anchor, availability of a tug etc.).
- An impact occurs sufficient to cause significant damage.
- The impact vector results in the vessel striking the IOT Trunkway.
- The impact causes a catastrophic outcome (such as rapid capsize of the Ro-Ro or ignition of fuel).

313. For each stage in this assessment, assumptions were made that drew upon published academic literature, accident reports and the expertise of the project team. Table 16 describes the assumptions used to construct the event tree.

Table 16: QRA Likelihood Values

Node	Value	Source and Notes
Movements/ Year	2,190	ES Volume 3 Appendix 101: Navigation Risk Assessment (Document Reference 8.4.10a).
Failure Rate	True: 2.85×10^{-4} False: 9.997×10^{-1}	A review of the literature identified failure rates per movement of between 1.14 x 10-5 to 4.2 x 10-5 (see Section 8.6). However, the approximate Ro-Ro incident rate for Immingham is in the order of 2.85 x 10-4. Recognising the challenging navigation conditions, this value was applied for Ro-Ro berthing failure rates.
Probability of Intervention	True: 0.5 False: 0.5	It is reasonable that the vessel might be able to deploy contingency action to mitigate any impact. Given the relative urgency of any action this was assumed at 50%.
Impact Speed	High: 0.1 Low: 0.9	It is likely, given the location at activities the vessel is undertaking, that the vessel would be travelling at low speed when the incident occurs. However, given the potential for significant tidal flows and strong winds, coupled with the movement of the vessel, it is feasible that a higher impact speed could occur. A ratio of 0.1 to 0.9 was chosen based on the following information: To approximate the ratio of minor to serious incidents given in the IMO's FSA for RoPax Vessels of 0.86 to 0.14 (IMO, 2008).

Node	Value	Source and Notes
		The MAIB 2022 Annual Report shows ratio of Less Serious and Serious to Very Serious incidents of 221 to 13 or 0.94 to 0.06 (MAIB, 2023).
Striking Trunkway	True: 0.3 False: 0.7	It is possible that the vessel would strike another object other than the Trunkway, given the metocean and tidal conditions at the time, so striking the Trunkway is given as a 30% chance for this node.
Catastrophic Outcome	True: 0.1 False: 0.9	A catastrophic outcome likelihood was estimated as a 10% chance, given a high-speed impact of the Trunkway. This likelihood would be subject to further study to determine the potential for ignition sources following a strike of the Trunkway.

314. Figure 58 shows the event tree and associated probabilities and return period. A total probability of striking infrastructure of 3.12 x 10^{-1} or once in 3.2 years was determined. In particular, it identified four scenarios of significance:

- **Scenario 1: Low Speed Impact - moderate consequence**: 2.89 x 10^{-1} or once in 3.6 years.

  This could include impact of a tanker moored at berth 8 or 9 or impact with the Finger Pier or main jetty structure. Impact likely at speed less than 2 knots over ground, resulting from residual speed after a power failure, speed due to the effect of wind, speed due to tidal flow or any combination of these. A low speed impact could have a significant short term effect on the ability of IOT Finger pier berths to continue operating, and could potentially extend to explosion risk and pollution, including pipe rupture on the jetty, pipe use suspension pending survey and testing, ignition source during impact, breaking adrift a moored coastal tanker from berth 8 or estuarial barge from berth 9, and resultant damage to IOT Finger Pier.

- **Scenario 2: High Speed Impact (but not with Trunkway) - high consequence**: 2.19 x 10^{-2} or once in 46 years.

  This would include a substantial impact with the finger pier or the landward side of the main jetty at a speed in excess of 2 knots over ground, resulting from residual speed after a power failure, speed due to the effect of wind, speed due to ebb tidal flow or any combination of these. At worst case, speed could be up to approximately 6 knots (spring ebb tide, fluvial run down and residual momentum). Serious damage likely, resulting in IOT Finger Pier berths being out of use for an indeterminate period, potential for explosion and pollution. Coastal Tankers and estuarial barges alongside berths 8 and/or 9 could break adrift with consequent further damage.

- **Scenario 3: High Speed Impact (with Trunkway) - high consequence**: 8.43 x 10^{-3} or once in 119 years.

  Impact speed in excess of 2 knots and up to 6 knots over ground, resulting from residual speed after a power failure, speed due to the effect of wind, speed due to ebb tidal flow or any combination of these. Major damage to Trunkway pipeline infrastructure and possibly Trunkway itself resulting in temporary shutdown of IOT and consequent impact on refineries and unplanned shortage of refined products available for UK:

- **Scenario 4: High Speed Impact (with Trunkway and catastrophic outcome) - high consequence**: 9.36 x 10^{-4} or once in 1,068 years.

As above Scenario 3 but with the addition of explosion and multiple fatalities, resulting in long term shut down and IOT and consequence impact to refineries leading to shortage of refined products for the UK.

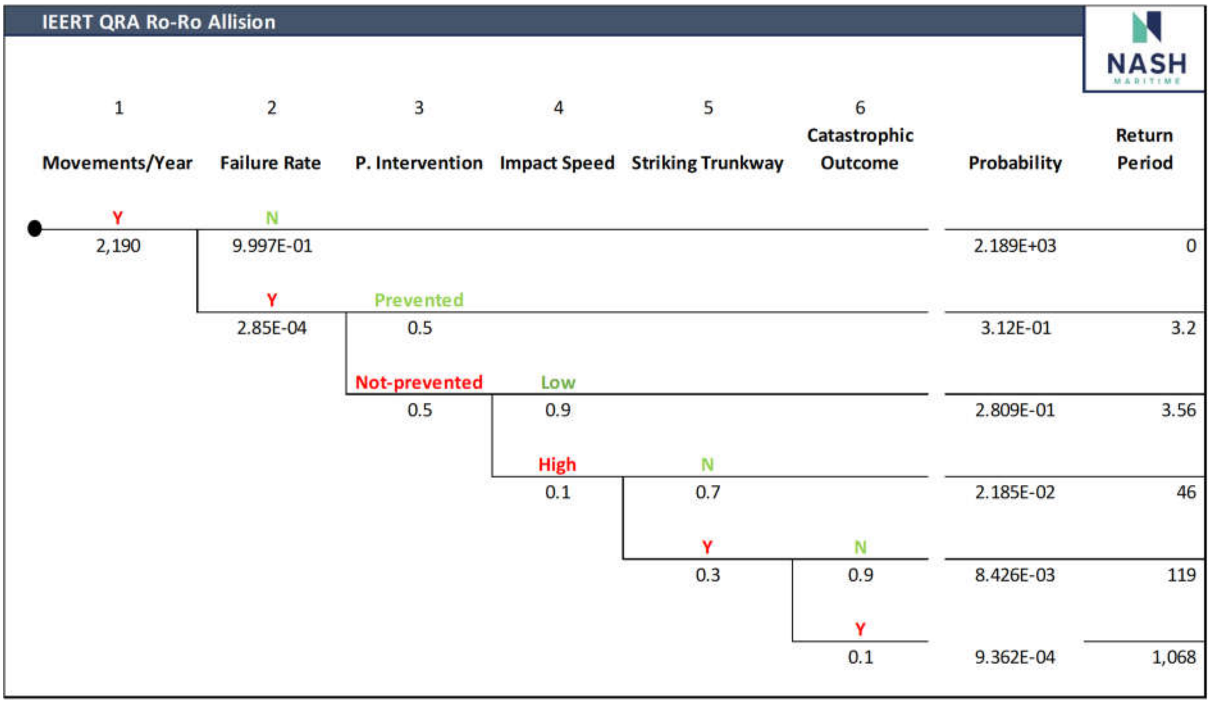


Figure 58: Event tree for Ro-Ro Allision.

10.3 CONSEQUENCE MODELLING

10.3.1 Potential Loss of Life

315. Based on the four scenarios, identified above, the potential loss of life was calculated per incident in Table 17. It has been assumed that a 300 passenger capacity vessel with 25 crew would have the following normalised distribution of persons on board of 244 (based on the assumptions set out in the IMO's 2008 FSA for RoPax Vessels):

- 25% of the time it would be full (325)
- 25% of the time it would be half full (162.5)
- 50% of the time it would be three quarters full (244).

316. For each of the four scenarios, a proportion of the persons on board who might be killed has been estimated. Previous studies have shown a range of outcomes, with, for example, the IMO's FSA for RoPax vessels ranging from 0.2% for minor slow sinking incidents (namely the Presidente Diaz Ordaz) through to 23% for incidents leading to rapid capsize in shallow water (average of European Gateway and Herald of Free Enterprise) and 87% for rapid capsize in deep water (Estonia) (IMO, 2008). For the purposes of this assessment, it has been assumed that minor incidents would cause between 0.01% and 0.1% fatalities given the modern safety standards of RoRo vessels and the immediate availability of assistance. Based on the historical analysis underpinning the IMO's work, a 25% catastrophic outcome has been utilised, however, recognising that were the vessel to become pinned or catch fire following a striking of the Trunkway, the figures of 80%/90% casualties could be possible. The determination of realistic catastrophic outcomes would be subject to further review.

Table 17: Potential Loss of Life.

Scenario	Likelihood / Year	Proportion of Fatalities	Fatalities per Incident	Potential Loss of Life/Year
1: Low Speed	2.89 x 10-1	0.01%	0.024	0.007
2: High Speed (not Trunk)	2.19 x 10-2	0.1%	0.244	0.005
3: High Speed (Trunk)	8.43 x 10-3	1%	2.24	0.021
4: High Speed (Trunk + Catast.)	9.36 x 10-4	25%	60.94	0.057
Total	3.11 x 10-1	N/A	N/A	0.09

317. Societal risk is defined in the FSA (IMO, 2018) as the "average risk, in terms of fatalities, experienced by a whole group of people (e.g. crew, port employees or society at large) exposed to an accident scenario." It is usual to express societal risk as the potential loss of life against the likelihood of occurrence on FN curves, shown with logarithmic scales.

318. It is possible to map onto the FN curves the acceptability criteria of Acceptable, ALARP and Intolerable. These have been derived from the following sources:

- HSE's (2001) Reducing Risks, Protection People states that "HSE proposes that the risk of an accident causing the death of 50 people or more in a single event should be regarded as intolerable if the frequency is estimated to be more than one in five thousand years".
- The IMO's FSA (2018) guidance shows an FN curve in Figure 1 which has an Negligible-ALARP slope running from approximately 2×10^{-4} for 1 fatality to 2×10^{-6} for 100 fatalities.
- Various academic studies (see for instance Stanley et al. 2018).

319. The resulting FN curve formed by each of the four scenarios is shown in Figure 59. As can be seen, as the severity of the scenario outcome increases, the likelihood of occurrence decreases.

    a. For Scenarios 1 and 2, the risk lies within Tolerable if ALARP, albeit close to the limits of Intolerable.

    b. For Scenarios 3 and 4, with the potential for mass casualties, the risk exceeds the limits of Tolerability and is therefore Intolerable.

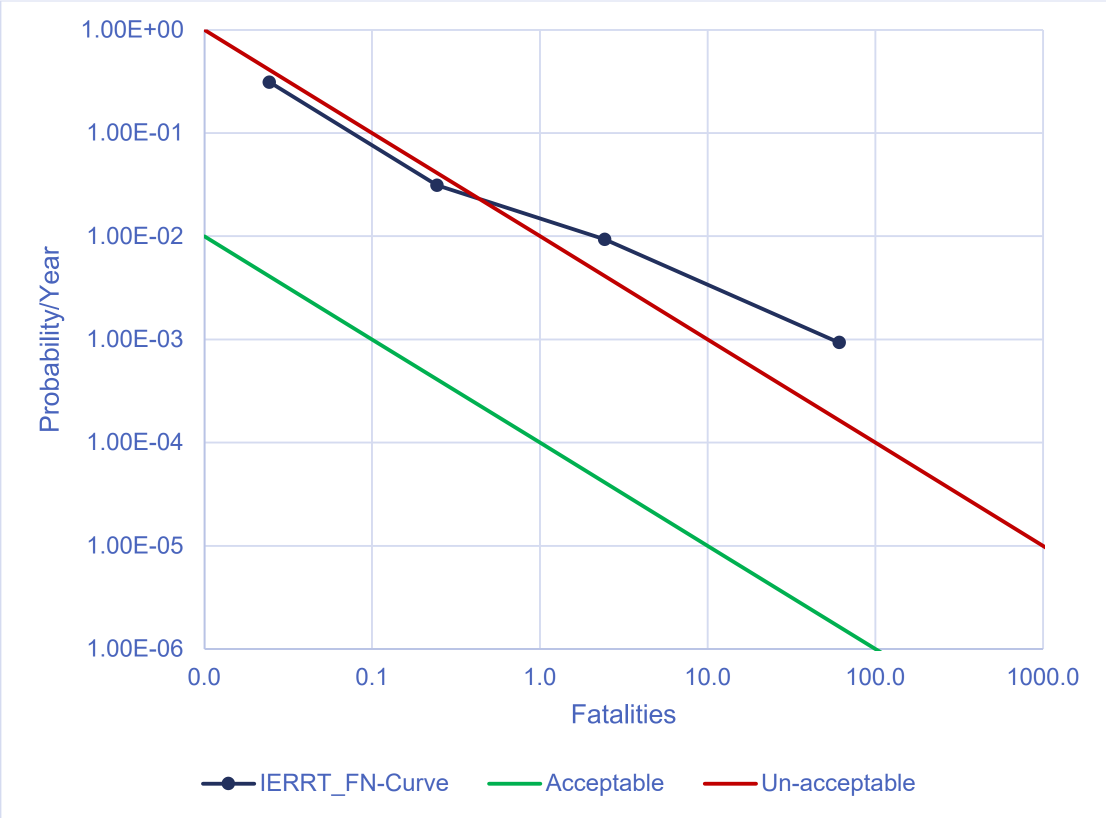


Figure 59: FN Curve.

320. In addition to the societal risk, individual risk is calculated based on the risk to any one individual aboard the ferry. This is the result of dividing the potential loss of life per year (from Table 17) by the average number of persons on board derived above (244). For all four scenarios combined, this results in a figure of 3.68 x 10^{-4}. This is greater than the maximum acceptable individual risk of 1 x 10^{-4} for members of the public given in HSE's Reducing Risks, Protecting People (HSE, 2001).

321. Finally, for comparison with other consequence types it is necessary to convert the potential loss of lives to monetary values using the principal of the Cost of Averting a Fatality/Value of a Prevented Fatality. For the purposes of this assessment a value of £2M has been utilised which is utilised by the UK Treasury (LSE, 2020). This is notably lower than has been used in other comparable studies such as GOALDS of 7.45M (Wang et al. 2020) and IMO's FSA of $3M (IMO, 2008) and is therefore considered conservative.

10.3.2 Potential Pollution

- For each of the four scenarios, the following worst credible oil outflows have been estimated:
- **Scenario 1**: 0.1 tonne of fuel spillage.
- **Scenario 2 and 3**: 500 tonnes of potential spillage. This represents approximately a 50% loss of fuel from a representative RoRo with carriage of >1000 tonnes of fuel.
- **Scenario 4**: This includes both the spillage contained in Scenario 2/3 as well as a further 1,000 tonnes of spillage from the Trunkway before it could be shut off.

322. A cost of cleanup has been derived using research by Kontovas et al. (2010) which proposes a relationship of $51,432 * $V^{0.728}$, where V is the spill size in tonnes. Whilst this figure is dated, and uses US$, it has been used as a conservative value in this assessment.

10.3.3 Potential Damage

323. The potential damage to property caused by the four scenarios are outlined below in Table 18. The asset value is representative of comparative assets and is multiplied by an impact factor for each scenario. For example, in Scenario 2 a 0.25 factor for a ferry (which costs £110M) allision would result in £27.5M damage.

Table 18: Potential Damage Criteria.

Scenario	Ferry Value	Ferry Impact	RoRo Terminal Value	RoRo Terminal Impact	IoT Terminal Value	IoT Terminal Impact	Total Cost
1: Low Speed	£110M	0.01	£90M	0.01	£100M	0	£3M
2: High Speed (not Trunk)		0.25		0.25		0.25	£75M
3: High Speed (Trunk)		0.5		0.5		0.5	£150M
4: High Speed (Trunk + Catast.)		1		1		1	£300M

10.3.4 Potential Economic Impact

324. The economic impact is a combination of loss of business to the ferry and loss of business to the IOT Terminal and shareholder refineries.

325. The loss of business to the ferry is represented by a loss of ticket sales. Assuming a ticket price of c.£500, up to 244 passengers and the ferry/berth out of action for one day (in a minor incident) or an extended period (weeks to months) across all three IERRT berths (in a major incident).

326. The analysis uses indicative figures to illustrate the range of likely economic impacts as a result of business interruption and demurrage to the refineries which might arise from a range of possible impact scenarios. The precise economic impacts will be driven by the specific nature of any impact event, associated duration of interruption in use of the IOT, associated ship demurrage and the refining margin environment at the time. The indicative figures used in this analysis provide an indication of the likely order of magnitude of the economic impacts of potential scenarios. However the impact on individual shareholder refineries are likely to differ greatly depending on scenarios so a generalised range has been used.

327. The range of impact scenarios could include.

- Minor severity collision by an IERRT vessel with the IOT Finger Pier: This would include collision of IERRT vessel with the finger pier structure or a vessel moored at berth 8 or 9. Whilst remedial actions are taken and repairs are made to the infrastructure with reduced berths operation, this could lead to short delays in servicing vessels. It is anticipated that this would have a minimal impact on refinery operations as sufficient stocks and contingency would be in place, however it could still result in losses as a result of demurrage of approximately £100K.

- Moderate severity collision by an IERRT vessel with the IOT Finger Pier: This would include a substantive impact with the finger pier or vessel alongside any of the berths, by an IERRT vessel, resulting in berths being out of use for indeterminate period whilst remedial actions are taken and repairs or alternative means of supply are made. It is estimated that the effect on refinery operations could result in a loss of at least £2 Million.
- Major consequence collision by an IERRT vessel with the IOT Trunkway. This would include major damage to the IOT Trunkway pipeline infrastructure including some or all of the pipelines, resulting in possible temporary refinery shutdown, sub optimal operation and or unplanned temporary shortage of refined products in the areas of the UK supplied by the refineries. Operations at the IOT as a whole (finger and river berths) would be shut down for a prolonged period (weeks to months). It is estimated that the effect on refinery operations could result in loss of at least £100 Million.
- Catastrophic consequence collision by an IERRT vessel with the IOT Trunkway. This would include catastrophic damage to the IOT Trunkway pipeline infrastructure including all the pipelines, resulting in sustained refinery shutdown and long-term supply interruption off refined products available within the UK supplied by the refineries. Operations at the IOT as a whole (finger and river berths) would have a prolonged shutdown (greater than several months). It is estimated that the effect on refinery operations could result in loss of at least £200 Million.

Table 19: Potential Economic Criteria.

Scenario	Ro-Ro Business	IOT Terminal Vessels	Total
1: Low Speed	£121,875	£100,000	£221.9k
2: High Speed (not Trunk)	£18.28M	£2M	£20.28M
3: High Speed (Trunk)	£18.28M	£100M	£118.28M
4: High Speed (Trunk + Catast.)	£18.28M	£200M	£218.28M

10.3.5 Summary

328. Table 20 presents the likelihood of occurrence per year multiplied by the cost per incident to show the annualised risk costs.

Table 20: Summary of Annualised Risk Costs.

Scenario	Likelihood	People	Property	Environ.	Economic	Total
1: Low Speed	2.89×10^{-1}	£13,692	£842,603	£2,702	£62,317	£921,315
2: High Speed (not Trunk)	2.19×10^{-2}	£10,650	£1,638,394	£103,619	£443,049	£2,195,712

Scenario	Likelihood	People	Property	Environ.	Economic	Total
3: High Speed (Trunk)	8.43×10^{-3}	£41,077	£1,263,904	£39,967	£996,641	£2,341,589
4: High Speed (Trunk + Catast.)	9.36×10^{-4}	£114,102	£280,868	£11,796	£204,360	£611,127
Total	3.11×10^{-1}	£179,521	£4,025,768	£158,085	£1,706,368	£6,069,742

11. ADDITIONAL RISK CONTROL MEASURES

11.1 ABPMER RISK CONTROL MEASURES

329. The ABPmer NRA for the IERRT provides three definitions of risk control measure:

- Embedded Risk Controls – existing measures in place to manage navigation safety (see ABPmer IERRT NRA Tables 24, 25 and 26)
- Further Applicable Risk Controls – possible future measures that could be put in place to manage navigation safety (see ABPmer IERRT NRA Tables 28, 29 and 30)
- Applied Risk Controls – proposed future measures that will be put in place to manage the navigation safety (see ABPmer IERRT NRA Section 9.9).

330. The Applied Risk Controls for the operational phase of the project listed in ABPmer IERRT NRA Section 9.9 and Annex C Navigation Risk Assessment: Operation are provided in Table 21 linked to individual IERRT NRA hazards.

331. The Port of Immingham and Humber Estuary Services Marine Safety Management System and baseline NRA for the area has not been supplied by ABP, even after an express request to do so, and therefore the extent and detail of Embedded risk control measures is limited to the details provided in the IERRT NRA.

332. For example, the IERRT NRA “Table 26 for Operation – Embedded Risk Controls” provides a generic list of Embedded risk control measures and only provides a title for each. It also does not include the detail of procedural controls that are in place in the area at the moment, such as the limit for flood tide only berthing of Coastal Vessels onto the IOT Finger Pier or the wind limits that IOT currently work to for vessel arrival. As such no detailed review of the current Embedded Risk Controls can be carried out.

333. For the operational phase of the IERRT project NRA the following Further Risk Controls were taken forwards by ABPmer and therefore are defined as Applied Risk Controls. This assessment therefore concludes that that they are committed to by the IERRT Developers (note that for ease of referencing a Risk Control number (RC#) has been applied to the Further Applicable Risk Controls):

- ABPmer RC1: Berthing criteria
- ABPmer RC2: Additional pilotage training/ familiarisation (Amalgamated into adaptive procedures)
- ABPmer RC3: Charted safety area, berthing procedures
- ABPmer RC5: Additional Training
- ABPmer RC7: Berth specific weather parameters
- ABPmer RC8: Marking safe water with AtoN
- ABPmer RC12: Risk assessed against relevant MSMS (HES/IMM)
- ABPmer RC13: ALARP with embedded controls

334. As noted in Section 2.1.8, IOT operators do not consider many of the IERRT developer’s Further and Applied Risk controls measures to be additional to what is already in place, or what should be included as embedded within the proposed IERRT

development – with such risk controls considered as good industry practise and therefore should be embedded within the design of the IERRT.

335. In relation to "*ABPmer RC1: Berthing criteria*", "*ABPmer RC4: Tidal limitations / weather restrictions*" and "*ABPmer RC7: Berth specific weather parameters*", then these are all considered to be nominally the same control and represent good practise as they are commonly in place across in most terminals and berths in the UK. For example, there are already berth limits in place for Coastal Tankers and Estuarial Barges berthing and departing the IOT Finger Pier. For these controls (ABPmer RC1, RC4 and RC7) then to have a level of effectiveness, over and above an Embedded risk control, and therefore be considered as Further Applicable Risk Controls or Applied Risk Controls, then they must relate to specific and conservative limits for the IERRT vessels using the IERRT berths, that must relate to actual weather or tidal state limits which are more onerous than the limits generally in place.

336. However, no limits have been specified in the IERRT NRA and therefore classification as Additional Risk Control Measures and their associated effectiveness at reducing risk is not defined. Therefore their status cannot be considered as over and above Embedded Risk Controls.

337. Further it is not clear what risk reduction is provided by the ABPmer RC12: Risk assessed against relevant MSMS (HES/IMM) and ABPmer RC13: ALARP with embedded controls – both these controls seem to suggest that conducting an assessment reduces the risk of hazard occurrence, with the formed referencing the Marine Safety Management systems of Humber Estuary Services (HES) and the Port of Immingham (IMM), neither of which are supplied.

338. For these reasons the IOT Operators have identified that a Marine and Liaison Plan should be developed which would detail specific procedural controls associated with weather and tidal limits, or training needs etc., which should be built up based on a precautionary approach.

339. Furthermore, given that IOT Operators are a significant receptor that would be seriously impacted should a hazard occur (e.g. allision with the Trunkway) then such a plan should be developed in consultation with, and agreed by, IOT operators.

11.2 IOT OPERATORS RISK CONTROL MEASURES

340. As noted at Section 1, IOT Operators have requested three specific risk controls for the IERRT project to ensure that navigation safety is maintained and safety impacts to IOT operations are mitigated to acceptable levels. The three risk controls are:

- IOT RC 1: Relocation of the IOT Finger Pier Berths;
- IOT RC 2: Installation and design of appropriate impact protection to protect the IOT Trunkway; and
- IOT RC 3: Implementation of a Marine and Liaison Plan

341. The IERRT NRA documented "IOT RC 1: Relocation of the IOT Finger Pier Berths" and "IOT RC 2: Installation and design of appropriate impact protection to protect the IOT Trunkway" as Further Applicable Risk Controls, but discounts them both on the grounds of cost benefit. As previously noted, the process / methodology utilised for the cost benefit assessment was not defined within the IERRT NRA (except for noting that meetings were held with ABP to discuss the relative cost benefit of each IOT measure proposed) and the

IOT Operators have serious concerns over the cost benefit methodology employed. Therefore, this assessment herein considers these controls in more detail.

342. IOT Operators have reviewed options for “IOT RC 1: Relocation of the IOT Finger Pier Berths” and “IOT RC 2: Installation and design of appropriate impact protection to protect the IOT Trunkway” with regard to minimising the costs associated with their implementation.

343. By relocating IOT Finger Pier berths 8 and 9 only to the inside of the IOT river berths (i.e. inside of IOT berth 1), then a total relocation of the IOT Finger Pier could likely be averted, and a smaller additional impact protection structure for IERRT vessels could be constructed adjacent to the IERRT Berth 1 and the end of the IOT Finger Pier (see Figure 60).

344. As it is not clear from the documentation provided by IERRT developers whether the IERRT itself would be able to withstand impact from an errant IERRT vessel, then impact protection is also included within this risk control measure for the IERRT infrastructure. In order to refine the Impact protection, IOT Operators commission a review by specialist marine civils engineers Beckett Rankine which is appended to this assessment at Appendix D This would be contingent on an effective and agreed “IOT RC 3: Implementation of a Marine and Liaison Plan” being in place.

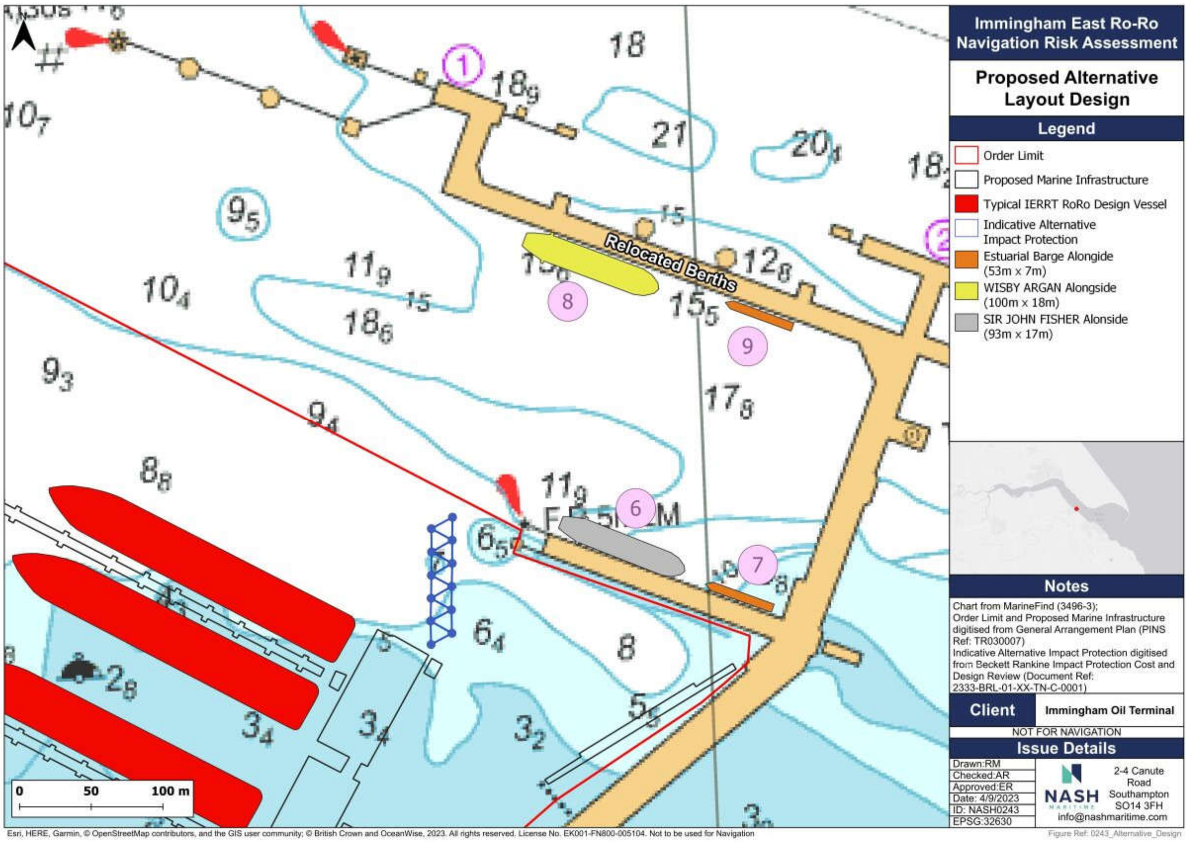


Figure 60: IOT Proposed Layout for Impact Protection and Relocation of Finger Pier.

11.2.1 Relocation of Finger Pier berths

345. “*IOT RC 1: Relocation of the IOT Finger Pier Berths*” has been defined by IOT Operators as the relocation of Finger Pier Berth 8 which is a Coastal Tanker berth and Berth 9 which is a Estuarial barge berth. By relocating these berths to a position inside

IOT River Berth 1, then construction of a replacement Finger Pier is not required, making a significant reduction to the capital cost of construction. It is generally understood that in-river works, such as piling, are considerably more expensive than pipework.

346. There may also be other cost saving measures which could be identified, such as relocation of the existing berth equipment, over procurement of new equipment / systems. The IOT Operators would require a ship manoeuvring study to confirm that the relocation of these berths does not create any unacceptable navigation safety concerns, and that operational relocation of the berths does not unacceptably impact IOT Operations.

347. A high level and indicative only cost, for the purposes of this risk assessment, to relocate the Finger Pier berths has been estimated as £25M - although further work should be undertaken to provide a more accurate costing. IOT Operators also consider that if relocation of Finger Pier berths 8 and 9 is not possible prior to completion of the IERRT, that a solution requiring the IERRT Development's outer-most berth (the northern berth of the northern pier) to remain unused until relocations have taken place have may provide the requisite mitigation / risk reduction, when combined with the other IOT identified risk control measures.

Table 21: ABPmer and IOT Risk Control applied to IERRT NRA Operation Hazards

Haz. ID	Hazard Title	ABPmer RC1: Berthing criteria	ABPmer RC2: Additional pilotage training/ familiarisation	ABPmer RC3: Charted safety area, berthing procedures	ABPmer RC4: Tidal limitations/ weather restrictions	ABPmer RC5: Additional Training	ABPmer RC6: Increased use of tugs/ Additional tug provisions	ABPmer RC7: Berth specific weather parameters	ABPmer RC8: Marking safe water with AtoN	ABPmer RC9: Increase size of dredge pocket	ABPmer RC10: Additional storm bollards	ABPmer RC11: Hooks with load monitoring	ABPmer RC12: Risk assessed against relevant MSMS (HES/IMM)	ABPmer RC13: ALARP with embedded controls	IOT RC1: Impact protection	IOT RC2: Relocation Finger Pier	IOT RC3: Marine and Liaison Plan	Notes
O1	Allision: Vessel Proceeding to/from Immingham Eastern Ro-Ro with tanker moored at IOT Finger Pier	✓	✓	✓												×	✪	
O2	Allision: Tanker manoeuvring on/off IOT Finger Pier (flood tide)		✓		×		?									✪	✪	Annex C: Table C2 doesn't include increased use of tugs / additional tug provisions
O3	Allision: Barge manoeuvring on/off IOT Finger Pier (flood tide)		✓		×											✪	✪	Annex C: Table C3 doesn't include Tidal Limitations
O4	Allision: Ro-Ro allision with IOT trunk way	✓	✓				×								×✪		✪	Annex C: Table C4 includes Additional pilotage training/ familiarisation (Amalgamated into adaptive procedures)
O5	Allision: Ro-Ro contact with IERRT infrastructure	✓				✓									✪		✪	
O6	Collision: Ro-Ro on passage to/from Immingham Eastern Ro-Ro Terminal with another vessel												✓	✓			✪	
O7	Grounding: Ro-Ro manoeuvring to south-western berth	✓							✓	×							✪	
O8	Other (Mooring): Ro-Ro vessel breaks free of moorings							✓			×✪	×✪						
O9	Allision: Ro-Ro arriving/departing Immingham Eastern Ro-Ro terminal berth 2-3 with a tanker berthed on eastern jetty	✓	✓	✓													✪	

Legend							
✓	Applied Risk Controls (post Cost Benefit Analysis)	×	Further Applicable Control (Identified but not taken forward)	✪	IOT required Risk Controls	?	Status not clear

11.2.2 Impact protection

348. Impact protection for critical infrastructure is a common mitigation measure employed for many types of infrastructure such as bridges, tunnels, riverside infrastructure, temporary works, etc. Design codes such as Eurocode 1[12] and ASHTO (2009) provide detailed design requirements for impact protection. A detailed impact assessment for the IERRT impact protection has not been provided by IERRT developers, however it is assumed that where impact protection has been identified (as a Further Applicable Control and not an Applied Risk Control) that it meets the intended purpose.

349. The impact protection provided by the IERRT structure itself has not been defined, however IOT Operators have assumed that the structure is designed to withstand impacts from IERRT vessels, e.g. IERRT vessels at 4kn. It should also be noted that the depths of water immediately behind the IERRT shelve towards the shore, and so designed in impact protection could take this into account. If this assumption is not correct, then additional impact protection located immediate behind the IERRT should be put in place.

350. The Oil and Pipeline Agency have recently constructed a new Oil Fuel Depot (oil terminal) at Thanckes in the Dockyard Port of Plymouth which has impact protection in place to protect the terminal Trunkway from naval fuel barges (of circa. 200t fuel capacity) which berth nearby on an inside berth (see Figure 60). This impact protection is similar to the design provided by IERRT developers.

Figure 61: Top: example impact protection installed 2022 at Oil Fuel Depot Thanckes, Dockyard Port Plymouth. Bottom Serco tug towing fuel barge. Source NASH Maritime.

[12] [redacted] Accessed 23-Jul-23

351. In relocating IOT Finger Pier berths 8 and 9 then the amount of impact protection for the Trunkway (subject to the IERRT infrastructure having sufficient implicit impact protection designed in) would have a smaller footprint than that identified by the IERRT.

352. The key requirement for the impact protection is to avert an IERRT Ro-Ro vessel from being able to make contact with the IOT Trunkway and pipelines. As such an impact protection island could be installed in place of a fixed longitudinal structure which would close access.

353. Impact protection structures for oil terminals and associated trunkways are not a common occurrence, as it is unusual for Ro-Ro (or other) terminals to be located close to them in a strongly tidal river. There are also few oil terminals in the UK which are individually responsible for handling such a high percentage (27%) of the UK's refined oil import/export. However, there are examples in the UK where impact protection has been put in place for the purpose of protecting oil related infrastructure. For example, the Thanckes Defence Infrastructure Organisation fuel jetty in Plymouth recently had walkway and pipeway protection installed to protect from allision by marine service craft operating in the River Tamaran oil jetty.

11.2.3 IERRT Marine Liaison Plan

354. The IOT Operators have requested that a detailed IERRT Marine and Liaison plan be developed in conjunction with IOT Operators and other applicable stakeholders to develop and manage procedural controls related to the IERRT development. It is envisaged that this control measure will bring together several procedural controls, for the operational phase of the IERRT identified during the hazard workshops as follows:

- Berth limits
  - Detailed wind limits by vessel type / specification for IERRT Berths 1, 2 and 3 should be developed. A review of limits for the relocated IOT Finger Pier Berths 8 and 9 should also be considered. It is considered by IOT Operators that limits should be conservative in nature, with the option to review and relax as operational familiarisation is gained. The limits should be related to wind direction as well as speed. To this end, wind data should be collected at the IERRT to assist with operational planning. Where limits are exceeded the use of tugs should be considered and documented (see below).
  - Detailed tidal limits should be defined by vessel type specification for IERRT Berths 1, 2 and 3 particularly strong ebb tide berthing and departures. It is envisaged that the current limit on flood tide berthing only for IOT Coastal tankers should remain. It is considered by IOT Operators that limits should be conservative in nature, with the option to review and relax as operational familiarisation is gained. Where limits are exceeded the use of tugs should be considered and documented (see below).
- Towage requirements
  - Towage requirements for IERRT vessels should be defined both for normal operations, when wind and tidal restriction are in place (see above) and if IERRT vessels have defects. Towage assets should be appropriate for the size and types of vessels (both IERRT and IOT vessels) and the geometry / layout of the IERRT berths.

    - Currently a standby tug is available to IOT vessels as prescribed in the IOT COMAH report and the also Humber Estuary Services Operational procedures. Extending this provision to IERRT vessels should be considered.

- Operational Deconfliction

    - The introduction of the IERRT significantly increases the frequency of vessel vessels navigating between the IOT and the Immingham dock, with a commensurate increase in collision and allision risk in the area. A procedural control limiting the number of vessels navigating in the same water space is therefore necessary to mitigate collision risk between IERRT vessel, IOT vessel and other 3rd party vessels as well. It is anticipated that this should be put in place by the SHAs (Port of Immingham and Humber Estuary Services) and monitored policed by the Humber Estuary Services Vessel Traffic Service / Port of Immingham Local Port Service. IOT Operators require that vessels bound for IOT have operational priority due to the limited tidal states at which they can currently berth.

355. It is envisaged the Marine and Liaison plan will also capture, document and mandate measures required for the construction phase of the IERRT, once construction methodology, timings and plant requirements have been defined.

The provision of the Marine and Liaison Plan therefore considers the following IERRT Risk controls:

- ABPmer RC1: Berthing criteria
- ABPmer RC4: Tidal limitations/ weather restrictions
- ABPmer RC7: Berth specific weather parameters
- ABPmer RC6: Increased use of tugs/ Additional tug provisions

11.3 EMERGENCY VALVES

356. Emergency cut off valves for the IOT pipework were considered by IOT Operators to mitigate the effects of catastrophic outcomes from IOT Trunkway by contact by IERRT Ro-Ro vessels. However, this control measure was discounted as:

- It was primarily only effective at mitigating the consequence of hazard occurrence to the environment (e.g. spill occurrence) but could also have a small effectiveness in damage to people due to lower amounts of volatile product being released. It did not mitigate effects associated with cost of infrastructure and business and therefore was only partially effective.
- To install such a system, IOT Operators consider it likely there would be a need to replace all IOT pipework, possibly to and from the refineries, which would make it considerably more expensive than the other IOT Operators measures, which are more effective at mitigating the likelihood and consequence of hazard occurrence.

12. RESIDUAL ASSESSMENT OF RISK

12.1 INTRODUCTION

357. Section 11 has identified several risk controls which have the potential to be effective at reducing the risk associated for the IERRT development. The following sections provide:

- An update to the qualitative assessment by rescoring the baseline hazard log (provided in Section 9) with the IOT Operators Risk Control Measures in place.
- An update to the quantitative risk assessment (provided in Section 10) by applying percentage reductions from implementation of the IOT Operators Risk Control Measures to the QRA results.
- A cost benefit assessment using the IOT Operators Risk Control Measures against the benefits of the residual QRA.

12.2 RESIDUAL QUALITATIVE NRA

358. The risk control measures identified in Section 11 were applied to the 24 identified hazards to reduce hazard risk. Table 22 shows the following information for each hazard:

- Baseline assessment hazard score and risk rank;
- Residual assessment hazard score and risk rank; and
- The risk controls applied to the hazard to reduce risk.

359. The residual assessment of navigation risk results in:

- 18 hazards scoring as “Tolerable if ALARP”; and
- 4 hazards scoring as “Broadly Acceptable”.

360. The two intolerable hazards identified in the baseline assessment of navigation risk are reduced to “Tolerable if ALARP”.

361. The risk controls have the following impacts on the navigational risk profile that combine variously to reduce hazard likelihood and consequence scores:

12.2.1 Relocation of the Finger Pier Berths

362. The relocation of berths 7 and 9 on the IOT Finger Pier reduces the likelihood of a collision occurrence between IOT vessels bound for the berths and the IERRT Ro-Ro vessels by naturally deconflicting arriving and departing vessels. The relocation of the berths also means IOT vessels will not be moored alongside berths 7 and 9, reducing the consequences of any contact occurrence as a IERRT Ro-Ro vessel would collide with the Finger Pier only, and not as well as a vessel moored alongside.

12.2.2 Impact Protection

363. The installation of impact protection (and design of the IERRT to withstand errant vessels) significantly decreases the likelihood of a IERRT Ro-Ro vessel making contact with the IOT Trunkway. The impact protection would be positioned in such a manner as to prevent a IERRT Ro-Ro vessel from being able to make contact with the IOT Trunkway. Therefore, the likelihood of such a hazard occurrence is reduced.

Table 22: Application of Risk Controls and Residual Risk Assessment

ID	Baseline Rank	Residual Rank	Hazard Title	Baseline Score	Baseline Rating	IOT RC1: Impact protection	IOT RC2: Relocation Finger Pier	IOT RC3: Marine & Liaison Plan	Residual Score	Residual Rating
15	7	1	Contact (Allision) - IERRT Ro-Ro Vessel with IOT River berths	5.0	Tolerable if ALARP				5.0	Tolerable if ALARP
22	15	1	Breakaway - IERRT Ro-Ro Vessel at IERRT Jetty	4.6	Tolerable if ALARP				5.0	Tolerable if ALARP
13	1	3	Contact (Allision) - IERRT Ro-Ro Vessel with IOT Finger Pier	6.0	Intolerable	Yes	Yes	Yes	4.0	Tolerable if ALARP
2	3	3	Collision - IERRT Ro-Ro Vessel ICW Coastal Tankers	5.9	Tolerable if ALARP		Yes	Yes	4.0	Tolerable if ALARP
12	4	3	Contact (Allision) - Coastal Tanker with IOT Finger Pier	5.8	Tolerable if ALARP	Yes	Yes		4.0	Tolerable if ALARP
3	5	3	Collision - IERRT Ro-Ro Vessel ICW Bunker Barge	5.5	Tolerable if ALARP		Yes	Yes	4.0	Tolerable if ALARP
5	7	3	Collision - IERRT Ro-Ro Vessel ICW Tanker	5.0	Tolerable if ALARP			Yes	4.0	Tolerable if ALARP
11	7	3	Contact (Allision) - Bunker Barge with IOT Finger Pier	5.0	Tolerable if ALARP	Yes	Yes		4.0	Tolerable if ALARP
20	13	3	Breakaway - Bunker Barge at IOT Finger Pier	4.8	Tolerable if ALARP		Yes		4.0	Tolerable if ALARP
21	13	3	Breakaway - Coastal Tanker at IOT Finger Pier	4.8	Tolerable if ALARP		Yes		4.0	Tolerable if ALARP
1	18	3	Collision - IERRT Ro-Ro Vessel ICW IERRT Ro-Ro Vessel	4.5	Tolerable if ALARP			Yes	4.0	Tolerable if ALARP
4	19	3	Collision - IERRT Ro-Ro Vessel ICW Cargo	4.4	Tolerable if ALARP			Yes	4.0	Tolerable if ALARP
10	1	13	Contact (Allision) - IERRT Ro-Ro Vessel with IOT Trunkway	6.0	Intolerable	Yes			3.5	Tolerable if ALARP
18	6	13	Contact (Allision) - IERRT Ro-Ro Vessel with IERRT Jetty	5.1	Tolerable if ALARP		Yes	Yes	3.5	Tolerable if ALARP
7	10	13	Collision - IERRT Ro-Ro Vessel ICW 3rd Party Passenger	4.9	Tolerable if ALARP			Yes	3.5	Tolerable if ALARP
17	15	13	Contact (Allision) - Coastal Tanker with IERRT Jetty	4.6	Tolerable if ALARP		Yes		3.5	Tolerable if ALARP
16	15	17	Contact (Allision) - Bunker Barge with IERRT Jetty	4.6	Tolerable if ALARP		Yes		3.0	Tolerable if ALARP
6	22	17	Collision - IERRT Ro-Ro Vessel ICW Tug, Service and Other Small Vessel	3.5	Tolerable if ALARP			Yes	3.0	Tolerable if ALARP
9	10	19	Contact (Allision) - Coastal Tanker with IOT Trunkway	4.9	Tolerable if ALARP	Yes	Yes		2.5	Broadly Acceptable
14	20	19	Contact (Allision) - Tug, Service and Other Small Vessel with IOT Finger Pier	3.6	Tolerable if ALARP	Yes	Yes		2.5	Broadly Acceptable
19	20	19	Contact (Allision) - Tug, Service and Other Small Vessel with IERRT Jetty	3.6	Tolerable if ALARP		Yes	Yes	2.5	Broadly Acceptable
8	10	22	Contact (Allision) - Bunker Barge with IOT Trunkway	4.9	Tolerable if ALARP	Yes	Yes		2.0	Broadly Acceptable

12.2.3 Marine and Liaison Plan

364. The introduction of a Marine and Liaison Plan ensures deconfliction between the IERRT operation and IOT operation and puts in place other procedural control measures to mitigate collision and contact risk. This decreases the likelihood of collision hazard occurrences between vessels associated with the respective operations.

365. The plan also defines appropriate operational limitations for the IERRT operation as well as minimum and additional towage requirements along with a suite of other procedural risk controls. The controls again combine to reduce the likelihood and consequences of hazard occurrence.

12.2.4 Residual Assessment Summary

366. With the implementation of the identified three additional risk control measures 22 identified hazards score as “Tolerable if ALARP” or “Broadly Acceptable” risk.

367. As such, with the implementation of the identified additional risk control measures, IERRT operations and activities, would be deemed to be Tolerable providing that all hazard risk score are reduced to ALARP.

12.3 RESIDUAL QRA

368. Based on the risk analysis performed in Section 10 and the identified additional risk controls in Section 11, the QRA was repeated accounting for risk reduction. Each of the three key measures was assessed with potential effectiveness at reducing the scenario likelihood put in place. These are shown in Table 23.

Table 23: Risk reduction effectiveness.

Measure	1: Low Speed	2: High Speed (not Trunk)	3: High Speed (Trunk)	4: High Speed (Trunk + Catast.)
Impact Protection	20%	50%	75%	95%
Relocation of Finger Pier	25%	50%	0%	0%
Marine Operations Plan	5%	10%	10%	10%

369. Impact protection is deemed to be of modest effectiveness against low speed impacts given that the potential damage from such an event is low. For high speed impacts, this measure is far more effective, estimated to reduce the risk by 50%. Notably, with impact protection in place the likelihood of striking the Trunkway reduces significantly, by up to 95%.

370. Relocation of IOT Finger Pier reduces the proximity of a hazard from the berthing RoRo and therefore would reduce the risk by 25% to 50% for low speed and high speed allisions respectively. This would have no effectiveness at reducing the risk of striking the Trunkway.

371. Marine and Liaison plans are softer procedural control measures, and would also have a limited effectiveness, so have been classified as being between 5% and 10% at reducing the likelihood of occurrence for this hazard.

Table 24: Residual likelihoods per annum / return rates per year.

Measure	1: Low Speed	2: High Speed (not Trunk)	3: High Speed (Trunk)	4: High Speed (Trunk + Catast.)
No Additional Controls	2.81×10^{-1} 1 in 3.6y	2.18×10^{-2} 1 in 45.8y	8.43×10^{-3} 1 in 118.7y	9.36×10^{-4} 1 in 1,068y
Impact Protection	2.25×10^{-1} 1 in 4.5y	1.09×10^{-2} 1 in 91.6y	2.11×10^{-3} 1 in 474.7y	4.68×10^{-5} 1 in 21,362y
Relocation of Finger Pier	2.11×10^{-1} 1 in 4.7y	1.09×10^{-2} 1 in 91.6y	8.43×10^{-3} 1 in 118.7y	9.36×10^{-4} 1 in 1,068y
Marine Operations Plan	2.67×10^{-1} 1 in 3.7y	1.97×10^{-2} 1 in 50.9y	7.58×10^{-3} 1 in 131.9y	8.43×10^{-4} 1 in 1,186y
Combined Risk Controls	1.60×10^{-1} 1 in 6.2y	4.92×10^{-2} 1 in 203.5y	1.90×10^{-3} 1 in 527.5y	4.21×10^{-4} 1 in 23,736y

372. Based on these effectiveness's, the likelihood scores derived in Section 10 were rescored and are shown in Table 24 and then remapped onto the FN curve in Figure 62. Notably, the application this reduces the Scenario 1 likelihood from one in 3.6 years to one in 6.2 years, and the Scenario 4 likelihood from one in 1,068 years to one in 23,736 years.

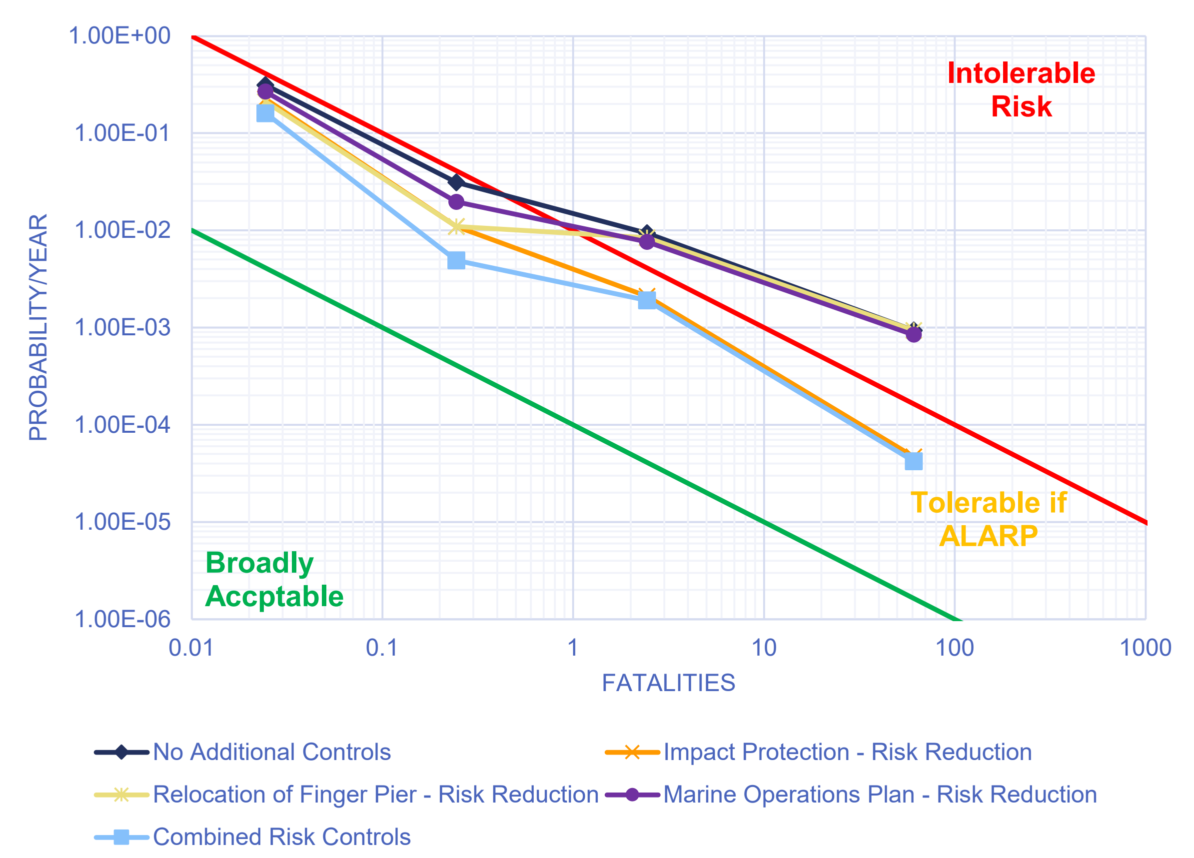


Figure 62: Residual FN Curve.

373. It is notable that the only means through which Scenario 3 and Scenario 4 fall below the Intolerable risk threshold is through implementation of Impact Protection and that the combination of other risk controls are not sufficient.

374. Furthermore, the combination of risk controls would reduce the individual risk from 3.68 x 10^{-4} to 5.04 x 10^{-5}, below the HSE's threshold of 1.0 x 10^{-4} (HSE, 2001).

12.4 COST BENEFIT ASSESSMENT

375. It has been demonstrated the three risk controls are capable of reducing the intolerable risk to Tolerable if ALARP and therefore a cost benefit assessment has been undertaken to determine if they are ALARP. For the purposes of the assessment, the three risk controls have been estimated to cost as follows to implement and maintain over a 50-year project duration:

- Impact Protection: £9M
- Relocation of IOT Finger Pier berths 8 and 9: £25M
- Marine Operations Plan: £250k

376. Table 25 shows the baseline consequence costs/year, the residual consequence costs/year with each mitigation measure in place and the ratio of the mitigation cost to the reduction in risk. A ratio greater than 1.0 indicates that the reduction in risk is greater than the cost to implement the risk control. The results demonstrate that almost all scenario-risk control combinations have greater benefits of implementation that costs.

Table 25: CBA Results.

	Risk Control	Low Energy Striking	High Speed Striking (Not Trunkway)	High Speed Striking Trunkway	High Speed Striking Trunkway w/ Catastrophic Outcome	Total Cost/Year
Baseline Consequence Cost per Year		£921,315	£2,195,712	£2,341,589	£611,127	£6,069,742
Residual Consequence per Year	Impact Protection	£737,052	£1,097,856	£585,397	£30,556	£2,450,861
	Relocation of Finger Pier	£690,986	£1,097,856	£2,341,589	£611,127	£4,741,557
	Marine Operations Plan	£875,249	£1,976,140	£2,107,430	£550,014	£5,508,833
	Total	£525,149	£494,035	£526,857	£27,501	£1,573,543
Ratio of Mitigation Cost (per Year) to Reduction in Risk	Impact Protection	1.02	6.10	9.76	3.23	**20.10**
	Relocation of Finger Pier	0.46	2.20	0.00	0.00	**2.66**
	Marine Operations Plan	9.21	43.91	46.83	12.22	**112.18**
	Total	**0.58**	**2.48**	**2.65**	**0.85**	**6.56**

377. The Impact protection has a relatively low-cost benefit ratio of 1.0 for low energy strikes given the high cost and low benefit, however, for high consequence events this is significantly more effective, with ratios in excess of 5 for Scenario 2 and Scenario 3. Therefore, the total benefit for impact protection is approximately 20 times the cost.

378. The relocation of the finger pier is more expensive and therefore is only cost effective for preventing high speed impacts with the Finger Pier. Overall, this measure has a benefit of 2.7 times the cost.

379. The marine operations plan is a low-cost risk control and therefore its modest benefits provide significant cost benefit, with a total benefit of more than 100 times the cost.

13. ASSESSMENT FINDINGS

13.1 CONCLUSIONS

380. This sNRA has been undertaken by NASH Maritime Ltd on behalf of the IOT to review the impacts of the IERRT on navigational safety.

381. The assessment has reached the following conclusions:

- The River Humber is a major estuary, with numerous ports and has in excess of 70 million tonnes of freight per year and approximately 10,000 ship arrivals per year. There is a 7-metre spring tidal range which results in significantly fast tidal flows and much of the study area is exposed to the effects of wind.
- IOT is a piece of critical national infrastructure and the Humber and Lindsey Oil Refineries account for 27% of the UK's refining capacity. They are dependent upon the continued and safe operation of the IOT river berths, finger pier and Trunkway flowing product from and to vessels. IOT is an Upper Tier COMAH site.
- Berths 8 and 9 located to the south of the Finger Pier are capable of handling vessels of 104m and 61m LOA respectively. Whilst smaller than the vessels on the main river berths (which can be in excess of 300m), they are critical to IOT operations and the flow of refined products destined for England and Scotland. Access to Berth 8 is restricted to the flood tide, requiring the ship's Master to balance the effects of wind and tide, and may require a workboat and/or tug.
- If developed, the IERRT would be a major 24-7 Ro-Ro terminal with three berths handling vessels up to 240m LOA and a beam of 35m. It is not clear what the detailed characteristics of these vessels would be, however, they will carry unaccompanied freight, accompanied freight and passengers. It is anticipated that there would be a minimum of one arrival (in the early morning) and one departure (in the early evening) per day per berth.
- The space between the IOT and IERRT infrastructure would be 95m, within which a tanker of 104m, with associated tugs or workboats, will be required to manoeuvre with strong tidal flows and cross winds. Furthermore, up to three large RoRo vessels would be required to manoeuvre in close proximity to the IOT infrastructure and or vessels. A potential risk of contact of an IOT tanker or IERRT RoRo with the IERRT jetties, IOT finger pier and IOT Trunkway has therefore been highlighted.
- A review of the IERRT developers NRA noted the following areas of concern:
  - The underlying data supporting the NRA is not well defined of suitably focused to aid / facilitate determination of navigation risk and nor were detailed characteristics of the IERRT vessels and the MARNIS incident data provided.
  - The operations and design of IERRT are not well defined including proposed tug use, berthing duration, metocean limits, and the detail of risk controls measures.
  - The standards and limits of acceptability/tolerability were not well defined and do not align with HSE/COMAH standards. As such there is a disconnect between the limits of tolerability between IOT and ABP.

  - The hazard workshops did not facilitate the input of all stakeholders and no attempt was made to reach a consensus on tolerability.
  - Additional risk controls were identified and considered effective, which were already included within the baseline (normal operations). Other risk controls were poorly defined and therefore their effectiveness cannot be determined. Several key risk controls, such as impact protection, were identified but discounted without undertaking any empirical cost benefit analysis.
  - Whilst the navigational simulations undertaken were useful to build an evidence base to contribute to the NRA, the omission of wind shielding of a berthed RoRo, gusting, unrealistic emergency scenario responses and technical issues undermined the credibility of their conclusions.
- This sNRA has been undertaken utilising the HSE approved IOT Operators COMAH methodology to qualitatively assess risk followed by quantitative risk modelling for high risk hazards based on the IMO's Formal Safety Assessment.
- Vessel traffic analysis was undertaken which provided greater detail on the existing manoeuvring patterns, swept paths and routes taken by vessels in the study area than that provided by IERRT.
- Berth analysis shows that IOT Berth 8 were occupied approximately 50-60% of the time between March and June 2023.
- A detailed analysis of historical incidents was undertaken from various data sources which highlighted several important findings:
  - There are on average six contacts and three equipment failure MAIB reportable incidents each year in the study area. This compares to an average of 45 and 78 impacts with structures and equipment failures per year recorded in the ABP MarNIS database.
  - It is notable that of eight MAIB reports in the study area, three involve impacts between navigating vessels and IOT infrastructure.
  - Several near misses were also highlighted (including in July 2022), however the detailed MarNIS data was not provided to the project team.
  - A review of national Ro-Ro incidents contained within the MAIB dataset noted that impacts with structures are defined as Less Serious in 36% of cases and 30% are Serious, with 45% resulting in Material Damage.
  - A calculation of incident rates was made by comparing the number of incidents per port within the MAIB dataset with the DfT ship arrival data. It concluded that RoRo vessels have one incident between every 714 and 2,933 movements, or a contact between 3,508 and 20,612 movements. Notably Immingham and Grimsby have the highest calculated Ro-Ro contact rate (e.g. one contact per 3,508 movements) of any sample port studied.
- Within the IOT sNRA, a total of 22 hazards were identified including collisions, contacts and breakaway incidents. Based on a review of the collated data and taking information and results from Hazard Workshops conducted by IERRT and

attended by IOT Operators, two of these were scored as Intolerable, with the remaining 20 assessed as Tolerable if ALARP. Those scored Intolerable were:

  - Contact (Allision) – IERRT Ro-Ro vessel (Passenger) with Finger Pier.
  - Contact (Allision) – IERRT Ro-Ro vessel (Passenger) with IOT Trunkway.

- A QRA was undertaken on the Intolerable hazards identified as part of the qualitative risk assessment to provide a more detailed and empirical assessment of risk The QRA included the following scenarios:
  - Scenario 1: Low Speed Impact with IOT infrastructure or vessel alongside - moderate consequence.
  - Scenario 2: High Speed Impact with IOT infrastructure or vessel alongside (but not with Trunkway) - high consequence.
  - Scenario 3: High Speed Impact with Trunkway - high consequence.
  - Scenario 4: High Speed Impact with Trunkway resulting in catastrophic outcome - high consequence.
- Based on these incident likelihoods and loss of life, an FN curve demonstrated that whilst Scenarios 1 and 2 fell within the high end of Tolerable if ALARP, the Scenarios 3 and 4 breached Intolerable levels. Furthermore, the risk to any individual would exceed the HSE's maximum allowable limit of 1 $x10^{-4}$.
- Additional risk controls were reviewed, with the three key risk controls discussed:
  - Relocation of Finger Pier berths: This would remove the potential risk of tankers striking the IERRT infrastructure and make the manoeuvre to Berth's 8 and 9 easier, significantly reducing this risk.
  - Impact protection: Whilst impact protection has not been defined within the IERRT, substantial protection would be required in order to prevent a vessel striking the Trunkway. Crucially this would significantly reduce the likelihood of a catastrophic event.
  - IERRT Marine and Liaison Plan: Definition of berth limits, towage requirements and operational deconfliction would further reduce the likelihood of conflicts between IERRT and IOT.
- A qualitative residual risk assessment was undertaken with the three key risk controls in place. The results identified that of the 22 hazards, 18 were scored as Tolerable if ALARP, whilst 4 were scored as Broadly Acceptable. All Intolerable hazards were mitigated.
- A residual QRA was also undertaken, which concluded that with all risk controls implemented:
  - Scenario 1: Low Speed Impact with IOT infrastructure or vessel alongside - moderate consequence - mitigated from once in 3.6 years to once in 6.2 year.
  - Scenario 2: High Speed Impact with IOT infrastructure or vessel alongside (but not with Trunkway) - high consequence - mitigated from once in 46 years to once in 204 years.

    - Scenario 3: High Speed Impact with Trunkway - high consequence - mitigated from in 119 years to once in 528 years.
    - Scenario 4: High Speed Impact with Trunkway resulting in catastrophic outcome - high consequence - mitigated from once in 1,068 years to once in 23,736 years.
- As a result, the QRA concluded that both the FN curve and individual risk were reduced below the Intolerable limits with the risk controls in place.
- A cost benefit assessment of these three measures was undertaken with estimated costs for each mitigation.
    - The Impact protection has a relatively low cost benefit ratio of 1.0 for low energy strikes given the high cost and low benefit, however, for high consequence events this is significantly more effective, with ratio's in excess of five for Scenario 2 and Scenario 3. Therefore, the total benefit for impact protection is approximately 20 times the cost.
    - The relocation of the finger pier is more expensive and therefore is only cost effective for preventing high speed impacts with the Finger Pier. Overall, this measure has a benefit of 2.7 times the cost.
    - The marine operations plan is a low cost risk control and therefore its modest benefits provide significant cost benefit, with a total benefit of more than 100 times the cost.

382. In summary, the sNRA concludes that the IERRT operations, in combination with the IOT operations, posed an unacceptable risk of contact and collision with existing mitigation in place. Additional risk controls are required to reduce this risk to Tolerable levels. A cost benefit assessment concluded that by implementing such measures, the risk could be deemed to be ALARP.

13.2 RECOMMENDATIONS

383. The following recommendations are made in order to manage risk properly and proportionately:

- IERRT developers to respond to clarification questions and provide requested information contained within Section 2.3 to enable finalisation of this assessment.
- Update QRA inputs (likelihood/costs/consequences) following review of requested data.
- IERRT developers to implement the IOT risk controls identified within this report, in consultation and agreement with navigation stakeholders (including IOT).
- IERRT developers to undertake a revised assessment of navigation risk for the construction and construction / operation phase of the IERRT addressing the deficiencies contained within this report in consultation and agreement with navigation stakeholder (including IOT).

384. Failure to implement the IOT risk controls identified in this report will result in an intolerable level of navigation risk arising as a result of the IERRT infrastructure and proposed marine operation.

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Appendix A
Correspondence following NRA Methodology Meeting

Edward Rogers

From: Edward Rogers
Sent: 06 July 2022 09:12
To: Timothy Aldridge
Cc: Montgomery Smedley; Nigel Bassett
Subject: RE: Minutes comments
Attachments: AC22-NASH-0243-NRA-Methodology-ABPmerMeetingMinutes-250522-R03-00.docx

Hi Tim,

I am slightly perplexed by changes to the meeting minutes proposed, as you had previously agreed the them, and my queries related to the post meeting notes. We generally feel that some of the proposed changes reflect where the project is now and not the discussion that took place in the meeting, though most changes don't materially affect the nature of the discussion so we have no objection to them.

The exception is the removal of the Action 2 - This was a request from APT, for ABP/ABPmer to consider using an approved NRA methodology, which during the meeting ABPmer had agreed to consider? I'm more than happy for you to put the action to "Closed" if you have considered this and decided to retain the current methodology.

Please find attached track changed version of the minutes. If you have any further changes please can you do them with track changes selected.

Many thanks

Ed

[redacted]

From: Timothy Aldridge <[redacted]
Sent: 30 June 2022 09:53
To: Edward Rogers [redacted]
Cc: Montgomery Smedley [redacted]
Subject: RE: Minutes comments

Good morning Ed,

Please find attached the minutes as checked and amended by Monty as well now. Nil changes to the post meeting elements captured.

We did not agree with action item 3 in the meeting and as such it stricken through for removal.
All other amendments in blue for your convenience.

Kind regards, Tim

Timothy Aldridge | Senior Maritime Consultant | ABPmer
Quayside Suite | Medina Chambers | Town Quay | Southampton | SO14 2AQ

[redacted]

From: Edward Rogers [redacted]
Sent: 29 June 2022 14:5[redacted]
To: Timothy Aldridge <[redacted]
Cc: Montgomery Smed [redacted]gel Bassett [redacted]
Subject: RE: Minutes comments

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Good afternoon Tim,

Further to my email below, can you advise if you have any proposed changes to the 'POST MEETING NOTE' section of the meeting minutes?

If not, then I'll issue as a final on Friday.

Many thanks

Ed

Dr Ed Rogers | Director
[redacted]

From: Edward Rogers
Sent: 17 June 2022 16:38
To: 'Timothy Aldridge' [redacted]
Subject: RE: Minutes co[redacted]

Hi Tim,

Please see updated meeting minutes – please can you review the 'POST MEETING NOTE' section at the end, and add in /edit what you want.

I will then issue as a final. Give me call if you wish to clarify anything?

Regards

Ed

Dr Ed Rogers | Director
[redacted]

From: Timothy Aldridge [redacted]
Sent: 13 June 2022 09:5[redacted]

To: Edward Rogers [redacted]
Subject: RE: Minute[redacted]

Hey Ed,

Sorry I missed your call on Friday I was in meetings all afternoon, which just isn't cricket for a Friday.

More than happy to discuss the finer points of the reply, I think the only thing we were unclear on was the terminology and implications around commercial implications for other stakeholders of Immingham (which falls outside the scope of the NRA in this proposal).

Kind regards, Tim

Timothy Aldridge | Senior Maritime Consultant | ABPmer
Quayside Suite | Medina Chambers | Town Quay | Southampton | SO14 2AQ
[redacted]eb: [redacted]

From: Edward Rogers [redacted]
Sent: 10 June 2022 14[redacted]
To: Timothy Aldridge
Cc: Montgomery Sme[redacted] Bassett [redacted]
Subject: RE: Minutes c

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Hi Tim,

I've just got round to reviewing your email below (apologies it's been a busy week back in the office) and updating the minutes to reflect your comments.

I think it may be simplest to have a call to discuss (just tried your land line) so I can update the minutes and issue as a final – but have put some notes against your items below.

Thanks

Ed

Dr Ed Rogers | Director
[redacted]

From: Timothy Aldridge <[redacted]>
Sent: 30 May 2022 17:24
To: Edward Rogers <[redacted]
Cc: Montgomery Smedley[redacted] Nigel Bassett [redacted]
Subject: Minutes comme[redacted]

Good afternoon Ed,

Hope you had a good weekend.

Thank you for the minutes, by in large we agree with the elements they represent however I have made a couple of comments below to clarify/address.

Firstly, in respect to point 1.1.1 of the minutes: To clarify, no assessment has been made on commercial vessel assessment from a utilisation perspective across the whole estuary, MS and TA stated this was outside the scope of the NRA for the development but that we would relay the message to the ABP Project Team. MS and TA were under the impression that this point was more around the business/financial effects to the operator. Could you please define 'commercial shipping assessment' in a port context/ further than has been done so in the brackets of point 1.1.1 so that we can be clear on this term?

I would define the scope of a "commercial shipping assessment" as identifying, quantifying and determining mitigation in relation to commercial impacts to APT/IOT (including its customers) from Construction, Operation and Decommissioning of the IERRT – e.g. this may include delays to arrivals or sailings of IOT vessels, impacts on land side access, etc.

Secondly, we are very grateful to APT for their correspondence dated 29 Apr 22 and all of the comments and concerns captured within. Within the HAZID workshop, all of APTs concerns relating to hazard identification and the risks discussed were documented within the context of the hazard log. However, comments that were outside of this scope were not documented whilst conducting the HAZID assessment. As stated above ABPmer is genuinely thankful to APT for providing a detailed list of their concerns in this correspondence to ABP.

Shall I add this into the minutes as a post meeting note?

With respect to the action items the following comments are offered:

1) Asked for clarity around terminology of a commercial shipping assessment in a port context – will update to "Closed" and include a statement saying no commercial shipping assessment has been undertaken?
2) Project team at ABP has been informed – noted – will keep as "Open".
3) Acknowledge this is under consideration – noted – will keep as "Open".
4) As related to 3 this is under consideration– noted – will keep as "Open".
5) The requested information is noted and it is ABPmer's intent to provide as much information as possible, within good time, prior to the rescheduled date of HAZID Workshop III which is yet to be determined. – noted – will keep as "Open" – unless you are agreeing to provide the information as requested in 4.1?
6) N/A – NASH action – this remains "Open" as APT/IOT are currently reviewing what can be issued.

Thank you very much for the Terminal Layout figure provided too.

All the best for the upcoming long weekend, I hope you all have something nice planned to do.

Kind regards, Tim

Timothy Aldridge | Senior Maritime Consultant | ABPmer
Quayside Suite | Medina Chambers | Town Quay | Southampton | SO14 2AQ
[redacted] **eb:** [redacted]

From: Ed [redacted]
Sent: 27 [redacted]
To: Timo [redacted]
Cc: Mont [redacted]
Dearnley [redacted]
Subject: RE: Plan for Wednesday

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Good afternoon Tim,

Many thanks to you and Monty for coming into our offices on Wednesday to discuss the Pre.NRA methodology for IERRT and APT's concerns.

Please find attached draft meeting notes for your records. You'll notice that we have included a list of pre-read material for the Hazard Workshop III that APT (have already requested from the project) which we think would be particularly useful. Can I ask you to review the meeting notes and revert with any comments or queries by 6th June 22 (in the absence of comment we'll assume it to be agreed)? We've also taken the latest IERRT drawing we have, issued on 01-03-22, and superimposed / georeferenced it onto a nautical chart (this is also attached for information) which we are happy to circulate to other attendees prior to the workshop. If you're able to provide the .dwg file we can update and improve accuracy.

Please note that I'm on leave next week, but look forward to meeting with you again at the Hazard Workshop III in Immingham on 7th June.

Regards

Ed

[redacted]

From: Timothy Ald[redacted]
Sent: 24 May 2022
To: Edward Rogers
Cc: Montgomery S
Subject: RE: Plan f

Hey Ed,

We can certainly discuss the Preliminary NRA tomorrow too. However the methodology section has been updated since the PreNRA's release in Jan - we can also discuss the updates to the methodology. I cant share them with you yet however, as it is in draft and not yet releasable sorry.

More than happy to listen the concerns and work to resolve them, we can certainly focus more on the NRA for the IERRT than in general too.

Looking forward to visiting tomorrow.

Kind regards, Tim

Timothy Aldridge | Senior Maritime Consultant | ABPmer
Quayside Suite | Medina Chambers | Town Quay | Southampton | SO14 2AQ
[redacted]

From: Edward Rogers[redacted]
Sent: 24 May 2022 13
To: Timothy Aldridge
Cc: Montgomery Sme

Anderson-Brown [redacted]
Subject: RE: Plan f [redacted]

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Hi Tim,

Thanks for the proposed agenda.

I think it would be better to focus our time on the Pre.NRA methodology (which presumably is unchanged – please can you confirm this?) and park discussion on how this is integrated into the ES. With discussion therefore focusing on the contents of the letter APT issued. We'd be happy to talk you through our concerns in more detail and hope you will be able to respond appropriately. Note our concerns also includes the data, analysis and modelling that should underpin a qualitative assessment of hazard risk and determination risk control effectiveness's.

I'd also note that our interest is more about how risk assessment is applied to infrastructure development, rather than how it is applied for day-to-day PMSC compliance in ports.

We can then talk specifically discuss the concerns APT have with the development and what has, and/or will be done to address them, including a review of the mitigation measures identified to date.

Look forward to seeing you tomorrow.

Regards

Ed

Dr Ed Rogers | Director
[redacted]

From: Timothy Aldri [redacted]
Sent: 23 May 2022 [redacted]
To: Edward Rogers [redacted]
Cc: Montgomery Sm [redacted]
Subject: Plan for We [redacted]

Good afternoon Ed,

Hope you are well. Just wanted to touch base on the plan for Wednesday at 1400 at your offices.

Monty and I will discuss how we conduct a HAZID workshop and NRA from a port/harbour perspective holistically and how we find adherence with the code in so doing as previously mentioned. This should only take around 15 minutes, 20 if we allow for some discussion too.
We can then go over the attached methodology specific to the IERRT Navigation ES chapter for 20 minutes (including discussion), this will hopefully leave us with the last 20min or so to discuss concerns raised by APT in correspondence to see if/how the planned methodology might mitigate any significant concerns.

Agenda:
1400-1420; HAZID/NRA Port/Harbour general principles
1420-1440: IERRT Methodology from draft ES Chapter (ES Methodology attached)
1440-1500: APT concern mitigation

Please let me know any concerns if you have them.

Kind regards, Tim

Timothy Aldridge | Senior Maritime Consultant | ABPmer
Quayside Suite | Medina Chambers | Town Quay | Southampton | SO14 2AQ
[redacted]

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IERRT NAVIGATION RISK ASSESSMENT

Project Title	IERRT Navigation Risk Assessment
Project Number	AC22-NASH-0243
Meeting subject / purpose	NRA Methodology Meeting
Revision	R03~~1~~-00
Date of meeting	25-May-2022
Start time	14:00 GMT
Finish time	15:30 GMT
Client	APT
Location	NASH Offices - Southampton

DOCUMENT CONTROL

Revision	Date of Issue	Description	Approved
R01-00	27-May-202~~1~~2	Issued to attendees for comment	EJR
R02-00	17-Jun-2022	Updated and re-issued	EJR
R03-00	06-Jul-2022	Updated and re-issued	EJR

ATTENDEES

Organisation	Attendee	Role	Initial
NASH Maritime	Capt. Nigel Bassett Dr Ed Rogers		NB ER
ABPmer	Monty Smedley Timothy Aldridge		MS TA

APOLOGIES

Organisation	Attendee	Role	Initial
N/A			

AGENDA

1. Introductions
2. Review of IERRT Preliminary Navigation Risk Assessment Methodology
3. Review of APT navigational concerns

NOTES OF MEETING

1	Introductions	Action
1.1	Introductions were had by all. A discussion was had on aspects not directly relevant to the Pre.NRA Methodology. This included: 1. ~~It was noted by MS that a~~ER asked if the NRA contained an assessment of commercial implications for shipping, MS commented that an assessment ~~(which should identify the non-safety impacts from~~of commercial considerations was not part of the ~~project to shipping and navigation) is not included in the NRA~~ NRA scope and thought ~~to~~it would be included in the socio-economic section of the ES. This assessment is not being undertaken by the Maritime ~~team~~Team (MS / TA) at ABPmer, but MS agreed to ~~find out who is responsible for~~pass this ~~and make contact~~enquiry to the ABP project team. 2. ~~MS~~ER asked MS if he knew whether a formal response had been ~~received from~~made to the Section 42 consultation response from APT – ~~ER~~MS responded saying he did not know. MS agreed to ~~check~~pass this enquiry to the ABP project team. 3. ER questioned the "Preliminary" nature of the Pre.NRA, and MS noted that the assessment is based on ~~currently available~~current scheme information (e.g. site layout, marine operations and construction methodology) and that the Pre.NRA would be updated based on finalised construction methodology and design / marine operations. ER noted this, which is common for DCO submissions, but noted the importance of sufficient scheme details ~~in determination of~~when determining navigation risk. ER also noted the need for engagement with APT when the NRA is updated was necessary to ensure safety of IOT infrastructure and operations. MS commented that this would be part of normal port/stakeholder engagement conducted by the Port of Immingham and Humber Estuary Services (HES). 4. ER requested details on the project schedule – MS noted that at this ~~but was~~time, further scheme details past that already published, were not ~~able to provide an update on schedule~~available. 5. ER provided an explanation of APT concerns, particularly in relation to the trunk way (a piece of critical national infrastructure) and IOT finger berth, in additional to other more generic concerns around increase in risk on the Humber Estuary, impact on IOT COMAH plan and commercial considerations.	Action number 1. 2.
2	**Pre. NRA Methodology**	
2.1	A detailed discussion was then had on the contents of APT letter dated 29 April 2022, in which ER articulated the issues and concerns raised with the Pre.NRA methodology. This included an explanation of APT concerns in relation to: • Actions from HAZID Workshop II (held on 7 April 2022) – primarily that ~~APT~~all of APT's concerns were not noted or minuted / documented as part of the Hazard Workshop. TA commented that navigational and marine safety concerns were incorporated into the RAs. • Navigation Risk Assessment Methodology	

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- Risk Assessment Matrices – it is understood that the matrix and methodology of assessing risk and determination of tolerability is propriety to ABP and limited details are available on the mechanics of the risk algorithms. ~~It was also noted~~ER commented that the risk appetite is set by ABP only, which may not align with that of the stakeholders. TA commented that the NRA is written for the Harbour Authority (ABP). ER noted that the NRA should be written for the DCO application and not the Harbour Authority. ER requested that further details are provided, or that an approved methodology is used. MS agreed to ~~consider this~~include further detail on the methodology in the next iteration of the NRA.
- Port Wide Risk Assessment – ~~it is understood~~ER asked if, a port wide risk assessment ~~for the area has been completed, but is not~~was, available, which should form the basis for the IERRT risk assessment ~~to inform current baseline~~. MS commented that both the Port of Immingham and HES has PMSC compliant, risk~~.~~ assessments and that~~.~~ ~~T~~ the IERRT NRA presents the assessment relevant to the IERRT scheme.
- Incident Data – ER asked about incident details and if further analysis would be presented in the updated NRA. MS noted that ~~,~~ additional details are available for the incident analysis, and would be provided in the updated Pre.NRA.
- Vessel Traffic Analysis – ER asked if additional vessel traffic analysis, such as swept path analysis to identify water space used by vessels bound for and departing IOT, ~~is unlikely to be provided.~~would be made available. MS/TA commented that AIS data has been used to assess other vessel movements holistically as it provides a high level view as to vessel movements which is sufficient for the covered area. The simulation report (HR Wallingford) will present swept path for vessels.
- Full Bridge Simulations – draft simulation report(s) from the HR Wallingford Ship Bridge Simulations have been provided to ABP/ ABPmer, but final reports are outstanding, hence they can not be shared. ER noted this, but felt it would be useful to have swept paths of vessel arriving / leaving the IERRT / IOT finger berth for the hazard workshop, which are factual records of the simulations undertaken and should not be subject to comment or analysis. NB noted that simulations undertaken for vessels using IOT berth 8 did not include the effect of wind shielding from vessels berthed at IERRT and were conducted using a vessel model significantly smaller than the IOT finger pier design vessel size.

4.

- Scheme Design
  - A scheme design was presented in A3 paper format by MS / TA which with last issue dated March 2022. ER requested the scheme design be supplied on a nautical chart – MS would take this back to the project team.
  - Details of construction schedule and design vessel were requested by ER and MS / ~~TO~~TA noted this.

3	Review of APT navigational concerns and proposed risk controls / mitigation
3.1	MS questioned what APT felt would be suitable mitigation for the scheme. ER noted that APT do not mandate any particular risk control measure, but are currently seeking to understand the detail of the assessment of risk and the resulting need for control measures.

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However, APT have identified that the Pre.NRA does not consider the following possible additional risk control measures:

- Operational controls
  - Relocation of the IOT Finger berth to downstream of the trunk way
  - Installation of appropriate impact protection for the trunk way

- Construction controls
  - Installation of temporary ship impact protection
  - Temporary closing of IOT Berth 8

4 Hazard Workshop III

MS / TA noted that a further hazard workshop (Hazard workshop III) had now been provisionally scheduled for 7 – 8 June 2022, due to the ~~inclusion~~possibility of ~~a third possible phase~~combined construction/operation option to the scheme – ~~a "partially constructed phase",~~ with construction occurring concurrently with operations. ER asked whether ~~a further phase~~this ~~option~~phase would be considered in the Pre.NRA and TA noted that this ~~phase~~ would ~~likely~~ be considered ~~within the current hazard tables.~~in 'construction', 'construction/operation' and 'operation'. ER considered that as a separate phase this would need to be considered separately.

TA then noted that the focus of Hazard Workshop III will be the determination of risk control effectiveness scores, which have to date been provided and scored in terms of effectiveness by ABP/ABPmer. ER noted that this aspect of the methodology is not well understood by APT and requested further details on how it works.

In preparation for the next Hazard workshop ~~II~~3, ER iterated the previous requests from APT that the following information be provided in good time (noting Jubilee celebration holidays next week) for APT to consider prior to the workshop: 5.

1. Provision of scheme design parameters for:
   a. ~~**Phase 1:**~~ **Construction** ~~**phase**~~ (outline construction methodology / plan against a schedule – assume 3 phases dredging / piling / pontoon & deck ways)
   b. ~~**Phase 2:**~~ **Construction / Operation** ~~**phase**~~
   c. ~~**Phase 3:**~~ **Operation** (Operation (specific details of maximum design vessel and frequency of operation and any embedded (designed in mitigation)

   APT identified a key requirement is the scheme design (construction sequences and scheme layout) to be provided on a nautical chart.
2. Provision of an explanation of the methodology, specifically:
   a. Risk matrix (APT propose adoption of an approved risk matrix (e.g. same as APT COMAH plan which include errant vessel collision with the IOT which is based on an HSE matrix.
   b. Determination on scheme risk appetite (to include stakeholders / societal expectations)
   c. Details on how the risk reduction calculations work.
3. Any port wide risk assessments which are appropriate for this area, which will provide context in how ABP currently manage the area and document what embedded risk control are in place~~(~~ (APT note that this is a PMSC requirement and should be shared with stakeholders anyway).
4. APT will give consideration to sharing details on the IOT infrastructure and operations, e.g. 6.

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a. Design of pipelines on the trunk way and existing impact protection in place for IOT Finger berths 6/8
b. Share non-sensitive aspects of the "errant vessel assessment" as part of APT HSE approved COMAH plan
c. Share details of the maximum design vessel for the IOT finger berths (with an expectation the same level of detail would be provided for the IERRT maximum design vessel).

5. The following underlying data analysis is requested prior to the workshop:
   a. Tidal stream detail for the area
   b. Swept path analysis (showing footprint of area/water used by vessels) on approach to IOT finger berths.
   c. Swept path analysis for IERRT scheme vessels during operational phase approaching / departing IERRT – this should be available from the simulations already undertaken by ABP.
   d. Vessel simulation reports would be very helpful.
   e. More details on historic incidents in the area.
   f. Details / specifications of the currently defined "further additional risk control measures".

MS commented that information for the workshop will be released in advance for attendees. ABP would review the APT request for further information to inform Hazard Workshop.

MEETING ACTIONS

Number	Owner	Action	Status
1	MS	~~Commercial shipping Assessment – ABPmer to sign post to where this is considered in the PEIR EIA.~~Offered to pass the question about scheme assessment of commercial implications for shipping to the ABP project team.	Open
2	MS	~~MS~~Offered to ~~check status of~~pass the question about Section 42 response from ABP to APT consultation~~.~~ to the ABP project team.	Open
~~3~~	~~MS / TA~~	~~ABPmer to consider adoption of standard risk matrix.~~	~~Open~~
4	~~MA~~MS / TA	Provision of further details on the risk assessment methodology, particularly around the risk control effectiveness calculations.	Open
5	~~MA~~MS / TA	Review the APT request for further information to inform Hazard Workshop III.	Open

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Commented [A1]: Please retain the action and put to "Closed" if it has been considered and will retain the same methodology?

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6	ER	APT to review what can be shared on IOT infrastructure and operations to inform Hazard Workshop III.	Open

POST MEETING NOTE

The following Post Meeting Note was received from ABPmer and is provided with a response by NASH Maritime.

- In respect to point 1.1.1 of the minutes: To clarify, no assessment has been made on commercial vessel assessment from a utilisation perspective across the whole estuary, MS and TA stated this was outside the scope of the NRA for the development but that we would relay the message to the ABP Project Team. MS and TA were under the impression that this point was more around the business/financial effects to the operator. Could you please define 'commercial shipping assessment' in a port context/ further than has been done so in the brackets of point 1.1.1 so that we can be clear on this term?

  NASH response: The scope of a "commercial shipping assessment" is related to identifying, quantifying and determining commercial impacts as a result the Construction, Operation and Decommissioning of the IERRT. They may occur as a result of presence of the IERRT and associated vessel activity, or as a result of implementing IERRT risk control measures.

  Commercial impacts may for example include delays to arrivals or sailings of IOT bound vessels as a result of increased vessel traffic activity from IERRT (particularly the IOT Finger ~~beths~~berths), impacts to IOT operations as a result implementing IERRT mitigation measures, etc~~..~~. APT / IOT are not clear whether these impacts have been quantified in the PIER – especially where they relate to commercial impacts which may not involve a safety component.

- Secondly, we are very grateful to APT for their correspondence dated 29 Apr 22 and all of the comments and concerns captured within. Within the HAZID workshop, all of APTs concerns relating to hazard identification and the risks discussed were documented within the context of the hazard log. However, comments that were outside of this scope were not documented whilst conducting the HAZID assessment. As stated above ABPmer is genuinely thankful to APT for providing a detailed list of their concerns in this correspondence to ABP.

- NASH Response: It is not clear where in the hazard logs provided that APT concerns have been "documented". Noted that ABPmer is genuinely thankful for the input from APT.

Appendix B
Extract from IOT COMAH Plan

[redacted]

8.3.3 Risk Ranking Evaluation

8.3.3.1 Severity (S)

(a) Impact on personnel;

S1. Potential for minor injury on-site – not a Major Hazard;

S2. Potential for serious injury/injuries on-site – borderline Major Hazard;

S3. Potential for some (one/few) fatalities/many serious injuries on-site, some potential for minor injury off-site – Major Hazard;

S4. Potential for many fatalities on-site or potential for serious injury or fatality off-site – Major Hazard.

(b) Impact on the surrounding environment;

Scenarios thought to have potential to cause a Major Accident to the Environment MATTE are not indicated in this section but risk ranking is detailed further in *Section 11* – Environmental Risk Assessment where the methodology for determining if a scenario has potential to create a MATTE is described.

8.3.3.2 Likelihood (L)

Table 8.1 Likelihood Categories

Rating	Description	Typical Frequency Range (of specific scenario being considered on the site)
L1	Very unlikely	< 1 in a million chance per year
L2	Unlikely	1 in 1,000,000 to 1 in 10,000 chance per year
L3	Reasonably likely	1 in 10,000 to 1 in 100 chance per year
L4	Likely	1 in 100 to 1 in 1 chance per year
L5	Very likely	> 1 in 1 chance per year (> 1 per plant year)

Note – the likelihood classification is assigned based on the likelihood of occurrence of the level of harm (severity) specified e.g. injury, not the likelihood of the initiating event e.g. a leak, process fault, impact, human error.

8.3.3.3 Risk Ranking

a) Impact on personnel and/ or the plant/site:

Table 8.2 Risk Matrix

Risk Ranking Classification					
Likelihood	**L5**	RP7	RP8	RP9	RP10
	L4	RP5	RP6	RP8	RP9
	L3	RP3	RP5	RP7	RP8
	L2	RP2	RP4	RP5	RP7
	L1	RP1	RP3	RP4	RP6
		S1	**S2**	**S3**	**S4**
	Severity	Personnel			

Events that do not present any risk to personnel are assigned a RP0 risk ranking.

Events can have both safety and environmental impacts and severity/risk classifications (see *Section 11* Environmental Assessment for further analysis of scenarios with a potential for environmental impacts.

The shading broadly indicates the tolerability of the risks, with the red indicating that the risk may be Intolerable, the yellow indicating the Tolerable region, where risks should be reduced so far as is reasonably practicable (ALARP) and the green area indicating where the risks are low enough to be Broadly Acceptable.

8.4 HAZID RECORD TABLE

The following tables present the records of the APT HAZID study.

9.8 REPRESENTATIVE SCENARIO RP1 - SHIP COLLISION WITH THE JETTY/BERTHS

9.8.1 APT Bowtie Diagrams

- B01 – loss of containment from jetty loading equipment;
- B02 – loss of containment from pipelines.

9.8.2 Definition

Ship collision with the jetty or berths could arise as a result of an errant vessel or gross manoeuvring error causing damage to the facilities leading to leaks from the ship(s) involved and or the jetty, pipelines/berths.

9.8.3 Hazard Assessment

An assessment of the potential for an impact from an errant vessel/tanker with the jetty/berths has been undertaken.

The historical record at APT has been compared with the generic ship collision frequency data derived from:

- Marine Incidents in Ports and Harbours in Great Britain, 1988 -1992, RG Robinson and AN Lelland, AEA/0253, AEA/CS/HSE-R1051, March 1996

- An assessment of oil tanker spills (1974 - 2000), Accidental Tanker Oil Spill Statistics, International Tanker Owners Pollution Federation Ltd, 2001. (ITOPF)

Collisions causing small spills have been ignored as these are not likely to cause major damage and are already accounted for in the berth spill frequencies i.e. bumps during mooring/manoeuvring, See Representative Scenario 2. The contribution of collision events to all events causing small releases (<7 te) is negligible (see *Table 9.1*). However, the likelihood of collisions can significantly affect the overall spill distribution for the larger leak categories, where ship collisions account for approximately ¼ of all major events.

The ship collision data derived from the ITOPF and Marine Incidents reports has been compared with historical experience at APT. The berths/jetty has experienced three serious collisions, one which caused the major spill in 1983, a more recent event, not involving an oil tanker but a passing bulk carrier, which damaged an unoccupied berth and did not lead to a spill and the most recent incident where an unmanned vessel due to be scrapped broke away from its moorings upstream of IOT before colliding with the jetty again no loss of containment was experienced during this incident. Over the 30 year period this equates to a 0.1 chance per year of a serious ship collision event. The frequency of spills for the jetty/berths area based upon the ITOPF/ Marine Incidents vessel collisions data has been estimated as:

Table 9.20 RP1 Spill Frequencies

Summary of Spill Frequencies for Representative Scenario RP1 (Spills per year)					
Description	Spill Quantity				
	0.1 - 1 te	1 - 10 te	10 - 1000 te	> 1000 te	All Spills
Impact from Docking or Errant Vessel	Low impact	Low impact	7.7×10^{-2}	2.7×10^{-2}	1.0×10^{-1}

It can be seen that the APT historical experience is in-line with the derived spill distribution for ship collisions, both indicating a 0.1 chance per year of a serious collision.

It should be noted that the spill distribution used for the berth spill scenarios RP2 already includes this ship collision contribution and as such no additional analysis is proposed here.

The consequences of such releases are also included as part of Representative Scenario RP2. In a serious collision there is a potential for some injuries to any person on the jetty/berth or on board the ship. Persons working on the berth are likely to see any approaching vessel on an impact course and escape along the berth/ jetty. The size of ships likely to be involved means that serious injury to those on board is unlikely.

9.8.4 Effects on People

The effects on people of this scenario are considered to be the same as those detailed in *Section 9.8.3.*

9.8.5 Effects on the Environment

An unignited spill would result in hydrocarbons being deposited into the estuary of the Humber. The rate of evaporation would be low as the substance is in contact with the sea.

Effects have been presented in *Section 11* – Environmental Risk Assessment, which includes oil spill modelling.

9.8.6 Escalation Potential

Should a release of hydrocarbon from any of the identified threats ignite, it has the potential to spread to the tanker. However, the tanker has fire-fighting equipment on board and there are fire fighting tugs on call to support both the berth’s and the tanker’s capabilities in suppressing a fire. The open nature of the jetty/berth areas and the nature of the liquid being handled means that a vapour cloud explosion (VCE) is not considered a credible hazard.

A spray release of sour crude oil could result in small quantities of H_2S being liberated. However the distances to DTL from such a release are less than the distance to the shoreline.

A large un-ignited hydrocarbon liquid spill could have a short-term environmental impact in the area.

9.8.7 Hazard Management Assessment

The berthing of all vessels at IOT is controlled by a well-established set of regulations, which include berthing and sailing “windows,” mooring patterns and ship to shore communications with the Berthing Masters. All movements involving ships having a summer deadweight of 40,000 tonnes or over, or having a declared draft of 11.0 metres or more are subject to the Humber Passage Plan requirements, which in essence, stipulates when these vessels can arrive or sail from the IOT. Vessels navigating within the port limits of the Humber Estuary are required to have a local pilot, unless the Master is specifically exempt from this requirement for the actual vessel under his command. The Harbour Authority issues pilot Exemption Certificates for this purpose by examining candidates for specific areas of operation. Mooring Masters are also put on board larger vessels prior to berthing to assist with the mooring operation (local knowledge). The Harbour Authorities operate a Vessel Traffic Service (VTS) control system, similar in some respects to an airport air traffic control system. The berths are also fitted with all the required navigational aids e.g. lights, foghorns, etc., which are inspected by Trinity House with fenders and breasting dolphins to cushion any impacts.

Passing distances from the berth are specified in official “Notice to Mariners.” This should ensure passing vessels do not get too close to the berths and the jetty infrastructure.

Harbour tugs are available to assist with the mooring and let go of larger vessels while a small work boat with pushing capability is used for the smaller vessels using the IOT Finger Pier. A stand-by tug is also available 24 hours a day 365 days a week should it be required in an emergency or during an abnormal situation where further tug assistance is required.

Tidal and weather restrictions are in place to ensure mooring and let-go of vessels is completed in suitable conditions.

APT has regular safety meetings with Humber Pilots and liaison meetings with the Harbour Authority giving an opportunity to share safety related information and concerns.

Charterers (the oil companies) also carry out vessel vetting procedures to ensure the vessel and its management meet acceptable requirements before they arrive.

APT has oil spill response equipment and contingency arrangements, which include shared local and national resources to deal with oil spills.

Overall, it is considered that APT have met all relevant marine standards and implemented sufficient checks and controls to reduce the risk of ship collision either due to mooring error or errant vessel, as is reasonably practicable and within their direct control.

Appendix C
Qualitative Risk Assessment Hazard Logs

ID	Baseline Haz. Rank	Residual Haz. Rank	Hazard Title	Baseline Risk											Additional Risk Control Measures			Residual Risk										
				Realistic Worst Credible Scores							Worst Credible Results				1	2	3	Realistic Worst Credible Scores							Worst Credible Results			
				People	Property	Environment	Business	Frequency	Baseline Risk Score	Baseline Risk Rating	People	Property	Environment	Business	IOT RC1: Impact protection	IOT RC2: Relocation Finger Pier	IOT RC3: Marine & Liaison Plan	People	Property	Environment	Business	Frequency	Residual Risk Score	Residual Risk Rating	People	Property	Environment	Business
1	18	3	Collision - IERRT Ro-Ro Vessel ICW IERRT Ro-Ro Vessel	4	3	2	3	2	4.5	Tolerable if ALARP	5.0	4.0	3.0	4.0			Yes	4	3	2	3	1	4.0	Tolerable if ALARP	4.0	3.0	2.0	3.0
2	3	3	Collision - IERRT Ro-Ro Vessel ICW Coastal Tankers	4	4	3	4	3	5.9	Tolerable if ALARP	6.0	6.0	5.0	6.0		Yes	Yes	4	4	3	4	1	4.0	Tolerable if ALARP	4.0	4.0	3.0	4.0
3	5	3	Collision - IERRT Ro-Ro Vessel ICW Bunker Barge	4	3	2	3	3	5.5	Tolerable if ALARP	6.0	5.0	4.0	5.0		Yes	Yes	4	3	2	3	1	4.0	Tolerable if ALARP	4.0	3.0	2.0	3.0
4	19	3	Collision - IERRT Ro-Ro Vessel ICW Cargo	4	3	1	3	2	4.4	Tolerable if ALARP	5.0	4.0	2.0	4.0			Yes	4	3	1	3	1	4.0	Tolerable if ALARP	4.0	3.0	1.0	3.0
5	7	3	Collision - IERRT Ro-Ro Vessel ICW Tanker	4	4	4	4	2	5.0	Tolerable if ALARP	5.0	5.0	5.0	5.0			Yes	4	4	4	4	1	4.0	Tolerable if ALARP	4.0	4.0	4.0	4.0
6	22	17	Collision - IERRT Ro-Ro Vessel ICW Tug, Service and Other Small Vessel	3	2	1	2	2	3.5	Tolerable if ALARP	4.0	3.0	2.0	3.0			Yes	3	2	1	2	1	3.0	Tolerable if ALARP	3.0	2.0	1.0	2.0
7	10	13	Collision - IERRT Ro-Ro Vessel ICW 3rd Party Passenger	3	4	4	4	2	4.9	Tolerable if ALARP	4.0	5.0	5.0	5.0			Yes	3	4	4	4	1	3.5	Tolerable if ALARP	3.0	4.0	4.0	4.0
8	10	22	Contact (Allision) - Bunker Barge with IOT Trunkway	3	4	4	4	2	4.9	Tolerable if ALARP	4.0	5.0	5.0	5.0	Yes	Yes		2	2	2	2	1	2.0	Broadly Acceptable	2.0	2.0	2.0	2.0
9	10	19	Contact (Allision) - Coastal Tanker with IOT Trunkway	3	4	4	4	2	4.9	Tolerable if ALARP	4.0	5.0	5.0	5.0	Yes	Yes		2	3	3	3	1	2.5	Broadly Acceptable	2.0	3.0	3.0	3.0
10	1	13	Contact (Allision) - IERRT Ro-Ro Vessel with IOT Trunkway	4	4	4	4	3	6.0	Intolerable	6.0	6.0	6.0	6.0	Yes			2	3	3	3	2	3.5	Tolerable if ALARP	3.0	4.0	4.0	4.0
11	7	3	Contact (Allision) - Bunker Barge with IOT Finger Pier	3	3	3	3	3	5.0	Tolerable if ALARP	5.0	5.0	5.0	5.0	Yes	Yes		3	2	2	2	2	4.0	Tolerable if ALARP	4.0	3.0	3.0	3.0
12	4	3	Contact (Allision) - Coastal Tanker with IOT Finger Pier	3	4	3	4	3	5.8	Tolerable if ALARP	5.0	6.0	5.0	6.0	Yes	Yes		3	3	2	3	2	4.0	Tolerable if ALARP	4.0	4.0	3.0	4.0
13	1	3	Contact (Allision) - IERRT Ro-Ro Vessel with IOT Finger Pier	4	4	4	4	3	6.0	Intolerable	6.0	6.0	6.0	6.0	Yes	Yes	Yes	3	3	2	2	2	4.0	Tolerable if ALARP	4.0	4.0	3.0	3.0
14	20	19	Contact (Allision) - Tug, Service and Other Small Vessel with IOT Finger Pier	2	3	2	2	2	3.6	Tolerable if ALARP	3.0	4.0	3.0	3.0	Yes	Yes		2	3	2	2	1	2.5	Broadly Acceptable	2.0	3.0	2.0	2.0
15	7	1	Contact (Allision) - IERRT Ro-Ro Vessel with IOT River berths	4	4	4	4	2	5.0	Tolerable if ALARP	5.0	5.0	5.0	5.0				4	4	4	4	2	5.0	Tolerable if ALARP	5.0	5.0	5.0	5.0
16	15	17	Contact (Allision) - Bunker Barge with IERRT Jetty	3	3	4	3	2	4.6	Tolerable if ALARP	4.0	4.0	5.0	4.0		Yes		3	3	3	3	1	3.0	Tolerable if ALARP	3.0	3.0	3.0	3.0
17	15	13	Contact (Allision) - Coastal Tanker with IERRT Jetty	3	4	3	3	2	4.6	Tolerable if ALARP	4.0	5.0	4.0	4.0		Yes		3	4	3	3	1	3.5	Tolerable if ALARP	3.0	4.0	3.0	3.0
18	6	13	Contact (Allision) - IERRT Ro-Ro Vessel with IERRT Jetty	1	4	1	3	3	5.1	Tolerable if ALARP	3.0	6.0	3.0	5.0		Yes	Yes	1	4	1	3	2	3.5	Tolerable if ALARP	2.0	5.0	2.0	4.0
19	20	19	Contact (Allision) - Tug, Service and Other Small Vessel with IERRT Jetty	2	3	2	2	2	3.6	Tolerable if ALARP	3.0	4.0	3.0	3.0		Yes	Yes	2	3	2	2	1	2.5	Broadly Acceptable	2.0	3.0	2.0	2.0
20	13	3	Breakaway - Bunker Barge at IOT Finger Pier	2	4	4	4	2	4.8	Tolerable if ALARP	3.0	5.0	5.0	5.0		Yes		2	3	3	4	2	4.0	Tolerable if ALARP	3.0	4.0	4.0	5.0
21	13	3	Breakaway - Coastal Tanker at IOT Finger Pier	2	4	4	4	2	4.8	Tolerable if ALARP	3.0	5.0	5.0	5.0		Yes		2	4	3	4	2	4.0	Tolerable if ALARP	3.0	5.0	4.0	5.0
22	15	1	Breakaway - IERRT Ro-Ro Vessel at IERRT Jetty	4	1	4	4	2	4.6	Tolerable if ALARP	5.0	2.0	5.0	5.0				4	4	3	4	2	5.0	Tolerable if ALARP	5.0	5.0	4.0	5.0

Appendix D
Impact Protection Engineering Note

CONTROLLED DOCUMENT STATUS

CLIENT	Nash Maritime
PROJECT TITLE	Immingham Ro-Ro Terminal Impact Protection
SUBJECT	Impact Protection
DOCUMENT TITLE	Cost and Design Review
DOCUMENT REF	2333-BRL-01-XX-TN-C-0001

REVISION RECORD

REV	STATUS	DATE	SUMMARY OF CHANGES	PREP	CHK	APP
P01	S2 – For Information	29/08/23	-	GT	TKHB	TKHB
P02	S2 – For Information	05/09/23	Changed location of protection system.	GT	TKHB	TKHB

CONTENTS

1 INTRODUCTION

1.1 Project Background

1.1.1 Associated British Ports (ABP) propose to construct three Ro-Ro berths adjacent to the existing Immingham Oil Terminal (IOT), see Figure 1.1.

1.1.2 As part of the proposed scheme, ABP have indicated that a ship impact protection system could be installed adjacent to the terminal's access jetty, which supports the pipework that connects the terminal's berths to the shore, however, it is noted that they do not consider this to be essential.

1.1.3 Beckett Rankine (BR) has been appointed by Nash Maritime to undertake a high-level costing review for a potential impact protection scheme to protect the oil terminal access jetty in case of any failures in the Ro-Ro vessels operating nearby.

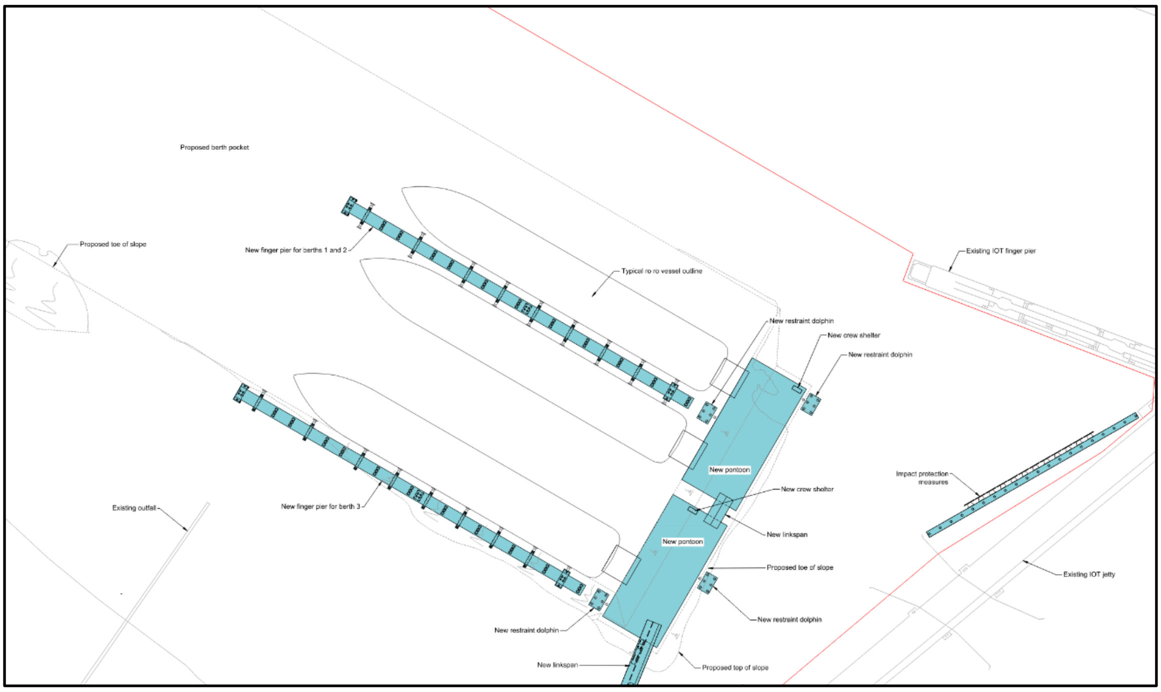

Figure 1.1: Proposed Ro-Ro berth layout

2 IMPACT PROTECTION MEASURES

2.1 Design requirements

2.1.1 BR have undertaken a high-level design review for a potential impact protection system that could be installed at IOT.

2.1.2 The *Humbria Seaways* vessel has been used as a representative vessel for the proposed Ro-Ro ships. This is noted to have a summer deadweight of approximately 17,000tonnes and a beam of 33m. The Ro-Ro vessels are proposed to reverse into the berths, and therefore are considered most likely strike the impact protection with the stern of the ship in the event of an incident.

2.1.3 The area experiences relatively strong tidal conditions, with ebb tides up to 4-knots. The impact protection system is therefore required to protect against a minimum vessel speed of 4-knots in the event of an engine failure.

2.1.4 Considering the above, we have assumed an impact force of 30MN based on the AASHTO guidance and as provided in Knott et al.[1]

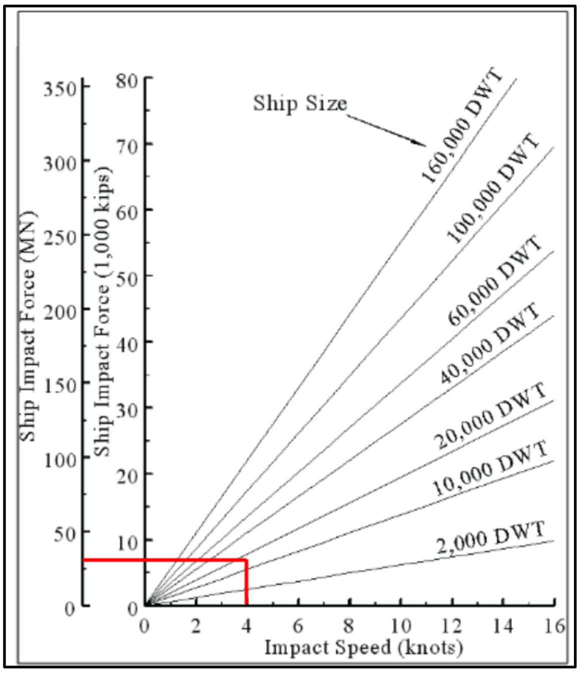

Figure 2.1: Ship impact force as per AASHTO

1. Vessel collision design – risk analysis and deep foundation issues for bridges over navigable waterways, Michael A. Knott, P.E., Moffatt & Nichol, Richmond, VA, USA

2.2 Proposed Design Review

2.2.1 ABP have proposed a potential impact protection scheme that comprises 20no. large diameter piles, approximately 1m diameter connected by a continuous capping beam and a series of fenders to absorb the vessel impact force (see Figure 2.2 and Figure 2.3).

2.2.2 BR have carried out a high-level review of this impact protection scheme and have the following concerns:

- The protection system is shown remarkably close to the existing terminal infrastructure which leaves little margin for deflection of the protection structure. Also, vessel overhangs may over-ride the protection structure with a risk of contacting the IOT pipework.
- The proposed location does not protect the finger dock for berths 6 to 9 from vessel impact.
- The system appears under designed considering the tidal conditions and the potential magnitude of the impact. Although, it should be noted, a detailed calculation check has not been undertaken and the type of fender system is not defined.

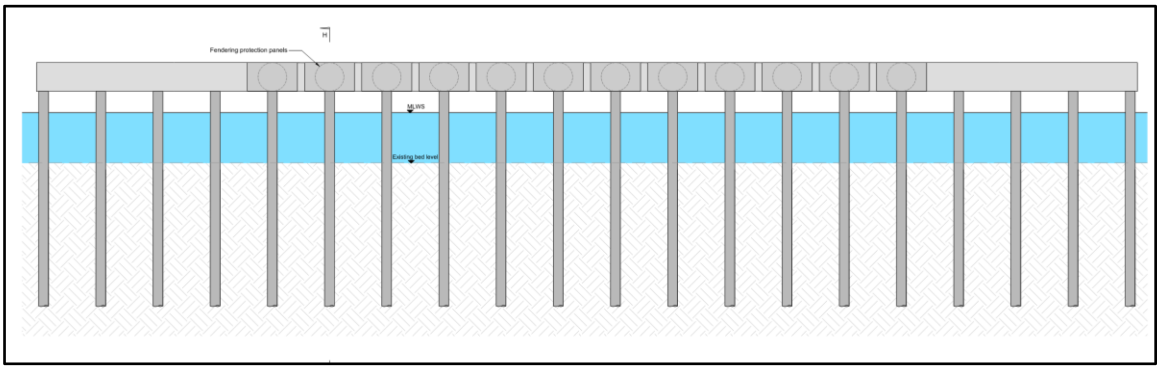

Figure 2.2: ABP's Proposed impact protection

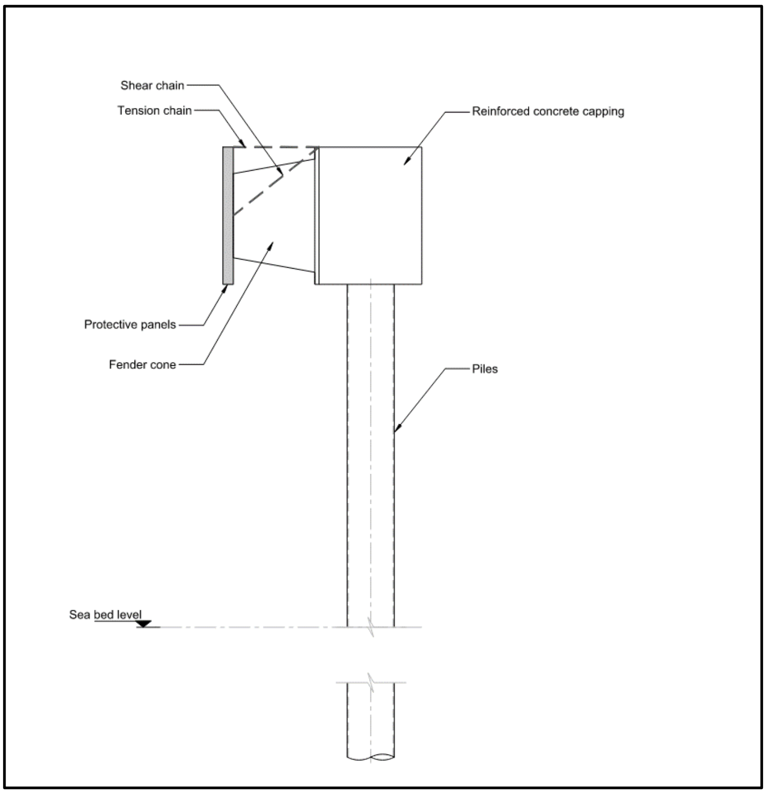

Figure 2.3: ABP's Proposed impact protection cross-section

2.3 Alternative Design Option

2.3.1 BR have developed an alternative layout that would provide a greater level of protection for the IOT infrastructure than the ABP proposal. We have not undertaken detailed design calculations; however, we have undertaken high-level estimates to justify feasibility of the scheme.

2.3.2 The layout is proposed to extend from the new berthing pontoon extending in front of the finger dock for berths 6 to 9. This will require berths 8 & 9 to be closed as vessel access will be restricted to small craft such as tugs and maintenance vessels.

2.3.3 The protection system comprises 12No. 2.8m diameter piles, spaced at 16.5m apart to restrict the Ro-Ro vessel (see Figure 2.4). The piles will be placed in two rows with a series of steel tubular cross-bracing to distribute the impact force between the piles.

2.3.4 The piles are recommended to be fitted with pile collars, and possibly also fenders, which are designed to fail during vessel impact to absorb the impact force and prevent significant damage to the piles. These proprietary items can be more readily replaced than the piles, should an impact occur.

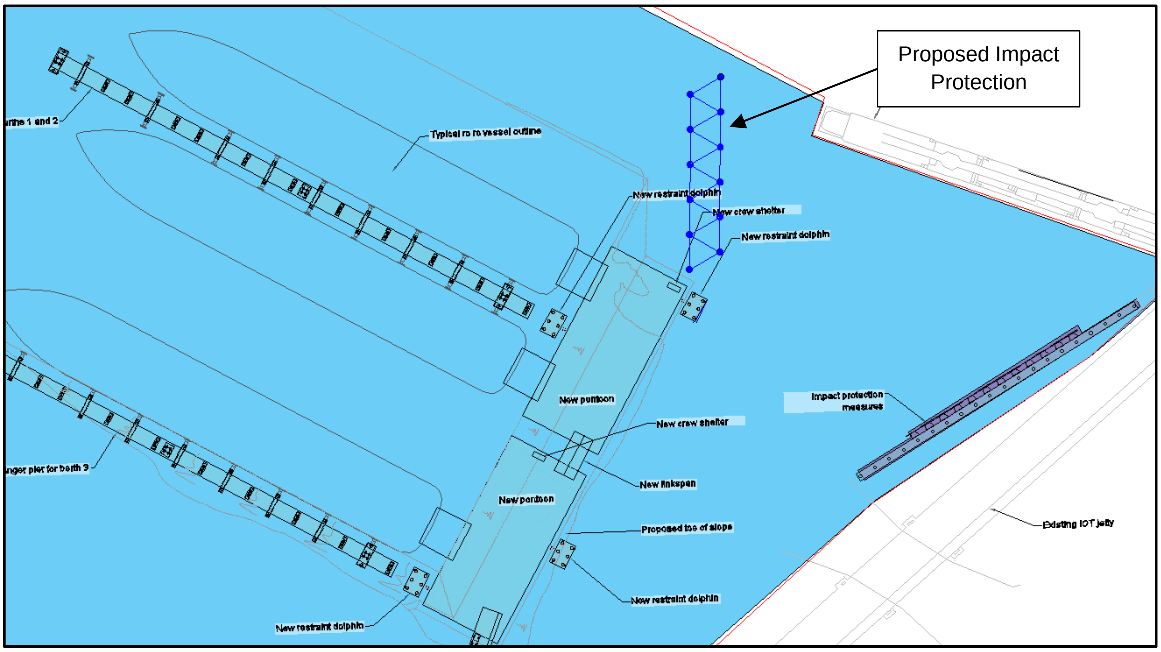

Figure 2.4: Proposed impact protection indicative layout

2.3.5 An alternative option could be to install two large diameter cellular cofferdams formed with sheet piles or combi-walls, backfilled with gravel. The cofferdams would be circa 15m diameter spaced 30m apart to restrict the vessel.

2.3.6 This option has potentially cheaper installation costs, however the maintenance of the cofferdams following a vessel impact could lead to higher costs, unless a proprietary system that could be replaced is fitted, although this would more likely a non-standard system. The cofferdams would also potentially require greater bed preparatory works and will cause a greater obstruction to the flow with potential scour issues.

2.4 Cost Estimate

2.4.1 A preliminary costing exercise has been undertaken for the 12No 2.8m diameter pile solution using prevailing rates for materials, plant and equipment based on BR project experience combined with a discussion with a specialist marine piling contractor.

2.4.2 Considering the above, the estimated construction cost is approximately £9.0M. The estimated construction period is around 6 weeks on site to install the piles.

2.4.3 The costings allow for the mobilisation of a jack-up barge, crawler crane and pile vibratory and percussive hammers for installation of the piles and the bracing system. Corrosion protection has also been considered to be required.

2.4.4 A cost saving on mobilisation could be achieved by installing the protection piles at the same time as the piles for the Ro-Ro berth.

3 RO-RO TERMINAL DESIGN REVIEW

3.1 Overall Design Review

3.1.1 BR have reviewed the proposed design drawings and reports available on the planning portal website for the proposed Ro-Ro Terminal.

3.1.2 We have not undertaken detailed design calculations; however, we have reviewed the general design principles.

3.1.3 We have the following comments on the design:

- In order to adequately protect the IOT infrastructure the Ro-Ro pontoons should be designed to resist a similar accidental impact as the ship impact protection structure, namely a Ro-Ro ship drifting at 4knots. This is to ensure that the pontoons do not break free under impact and drift down upon the IOT jetty access.
- The proposed dolphins to stabilise on the pontoon are not in the optimum positions to resist such an impact. We would expect the dolphins to be on the opposite side to the berthed vessels to restrain the pontoons against the impact forces. The dolphins on the berthing face will be inefficient to resist these forces as essentially the load will be resisted by the connections between the dolphin and pontoon only.
- The task of manoeuvring the vessels into the berths appears to be extremely challenging in the scenarios tested by HR Wallingford. The use of tugs for Ro-Ro vessel berthing is generally not favoured and how effective tug assistance could be provided for the two southern berths is unclear.

APPENDIX A ABP REFERENCE DOCUMENTS

- IERRT DCO Application – General Arrangement Plans [APP-009]
- IERRT DCO Application – Engineering Sections and Plans [AS-007]
- IERRT DCO Application – Environmental Statement Chapter 2 [APP-038]
- IERRT DCO Application - Environmental Statement Appendix 10.2 Navigation Simulation Study – Part 1 [APP-090]

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Appendix B – Alternative Navigational Risk Assessment provided by DFDS

IMMINGHAM EASTERN RO-RO TERMINAL

NAVIGATION RISK ASSESSMENT

Document Number: DFDS2023-0409

Revision: Rev 0

Date: 05 Sep 2023

Title	IMMINGHAM EASTERN RO-RO TERMINAL: NAVIGATION RISK ASSESSMENT		Number	DFDS2023-0409	
Revision	**Date**	**Description**	**Prepared**	**Checked**	**Approved**
Rev 0	05-Sep-23	Original Issue	BBP, GB	JJH	JJH

CONTENTS

ABBREVIATIONS

Abbreviation	Definition
ABP	Associated British Ports
ABPmer	ABP Marine Environment Research Ltd
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
APT	Associated Petroleum Terminals (Immingham) Ltd
CHA	Competent Harbour Authority
COLREGS	International Regulations for Preventing Collisions at Sea 1972
DCO	Development Consent Order
DfT	Department for Transport
dwt	Dead Weight Tonnage
ES	Environmental Statement
ESE	East south east
FAME	Fatty Acid Methyl Esters
FSA	Formal Safety Assessment
GtGP	Guide to Good Practice on Port Marine Operations
HAZID	Hazard Identification
HES	Humber Estuary Services
HIT	Humber International Terminal
HP	Horsepower
Hs	Significant Wave Height
HSC	High Speed Craft
HW	High Water
IERRT	Immingham Eastern Ro-Ro Terminal
IBT	Immingham Bulk Terminal
IGET	Immingham Green Energy Terminal
IGT	Immingham Gas Terminal
IMO	International Maritime Organization
IOH	Immingham Outer Harbour
IOT	Immingham Oil Terminal
LOA	Length Overall
LW	Low Water
m	Metre
MAIB	Marine Accident Investigation Board
MHWS	Mean High Water Springs
MSMS	Marine Safety Management System
NASH	NASH Maritime Ltd
NE	North east
NRA	Navigation Risk Assessment
PEC	Pilot Exemption Certificate
PEIR	Preliminary Environmental Impact Report

PMSC	Port Marine Safety Code
RIDDOR	Reporting of Injuries, Diseases and Dangerous OccurrencesRegulations
Ro-Ro	Roll-on Roll-off
Ro-Pax	Ro-Ro Passenger
SHA	Statutory Harbour Authority
SW	South west
VTS	Vessel Traffic Services
WNW	West north west

1 Introduction

1.1 Overview

Associated British Ports (ABP) has submitted a Development Consent Order (DCO) application for the development of the Immingham Eastern Ro-Ro Terminal (IERRT) (the project). As part of the DCO application ABP has submitted an Environmental Statement (ES), which includes a non-technical Shipping and Navigation Impact Assessment chapter and a technical Navigation Risk Assessment (NRA) coordinated and prepared by ABPmer (ABP's internal consulting arm), which is referred to as the ABPmer NRA in this report.

DFDS Seaways (DFDS), are shipping operators within the Port of Immingham and are therefore relevant stakeholders. DFDS have been included in various consultations on the development of the ABPmer NRA, including hazard identification workshops, ship simulations and various other written communications. It is understood that throughout the stakeholder engagement process DFDS raised concerns, particularly in relation to the navigation safety of the IERRT development and the NRA methodology employed by ABPmer. DFDS also consider the ABPmer NRA has not adequately captured and addressed these safety concerns. The DFDS concerns have been captured within a Relevant Representation submitted to the Planning Inspectorate in response to the IERRT DCO application.

Following submission of the DCO and DFDS's Relevant Representation, and as the concerns had not been addressed, DFDS decided to commission an NRA independently of the ABPmer NRA to assess the safety aspects of shipping operations of the IERRT project in accordance with the requirements of the Port Marine Safety Code (PMSC)[1] and associated PMSC guidelines, the Guide to Good Practice on Port Marine Operations (GtGP)[2].

This document is an independent NRA for the IERRT development and has been prepared by Bishop Marine Consulting Ltd, NASH Maritime Ltd, Capt. Jonathan Bush (Marine Pilot and Marine Consultant) and with supporting insight from DFDS operations personnel and captains experienced at navigating Ro-Ro vessels to and from the Port of Immingham. Collectively, this is referred to as the Risk Assessment Team within this report.

This NRA assesses the operational phase of the IERRT development and any required additional risk controls necessary. Due to time limitations, assessment of the construction of simultaneous construction + operation phases have not been assessed. Understanding the long-term risk introduced by the operation of the IERRT was deemed essential to first assess the feasibility of the proposed operations. However, it is recognised that the shorter-duration construction and simultaneous construction + operation phases would present other hazards that would need to be systematically assessed using a consistent methodology as presented herein.

1.2 Requirements for Assessment

The requirement of the DFDS NRA is to produce an independent, structured and transparent NRA using a single methodology prescribed by the PMSC and its accompanying guideline, the GtGP.

1.3 Document Structure

The structure of this report is as follows:

[1] Port Marine Safety Code, 2016 (PMSC), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/918935/port-marine-safety-code.pdf

[2] A Guide to Good Practice on Port Marine Operations (GtGP), 2018, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/854521/MCGA-Port_Marine_Guide_to_Good_Practice_NEW-links.pdf

- Section 1: Introduction – Including overview of the Port of Immingham
- Section 2: IERRT Development
- Section 3: Navigation Baseline – including current and future vessel traffic, and previous incidents
- Section 4: Vessel Traffic Analysis – including detailed analysis of AIS data
- Section 5: Risk Assessment Methodology
- Section 6: Hazard Identification
- Section 7:Inherent Risk Assessment
- Section 8: Additional risk controls
- Section 9: Residual Risk Assessment
- Section 10: Conclusions and Recommendations

1.4 Assessment Approach

The current Port of Immingham's PMSC-compliant baseline risk assessment has not been received for this NRA. Therefore, this NRA adopts a PMSC-compliant NRA approach consistent with two previous risk assessments undertaken separately for other developments within ABP port areas – these are Marchwood Port development within ABP Southampton, and Able Marine Energy Park development within ABP Humber. These are outlined below and further specific details of how each have been applied are also discussed throughout Section 5, Risk Assessment Methodology.

1. **Marchwood Port development NRA** on behalf of Solent Gateway Ltd (Solent Gateway) in development in 2021[3] (within this document referred to as the Solent Gateway NRA). The Solent Gateway NRA was undertaken on the requirements of ABP Southampton, as the local Statutory Harbour Authority (SHA). The risk assessment methodology utilised the ABP Southampton PMSC navigation risk assessment and mapped changes to risk brought about by the Marchwood Port development on this agreed baseline. The assessment utilised risk matrices, algorithms and likelihood / consequence descriptors provided by ABP Southampton from their PMSC NRA software MarNIS, which is used at all 21 ABP ports for all PMSC NRA requirements. MarNIS is also used within ABP Humber and, as such, the approach and assessment undertaken in the Solent Gateway NRA is considered to be a proven PMSC-compliant risk assessment adequate for ABP Southampton and is equally appropriate for the IERRT development within ABP Humber.
2. **Able Marine Energy Park development NRA** by Marine and Risk Consultants Ltd (Marico Marine) on behalf of Able UK in 2021[4] (within this documents referred to as the Able NRA). The Able Marine Energy Park is a development located on the Humber estuary in Killingholme, immediately upriver of the Port of Immingham, and therefore resides within ABP Humber's coverage area. The Able NRA was originally undertaken in 2011 for the DCO application of that project and was subsequently revised in 2021 following material amendments to the project. The Able NRA specifically notes in relation to the update that "the NRA methodology will additionally be reviewed and updated in accordance with current industry best practice in agreement with ABP Humber". The methodology

[3] Marchwood Port Development NRA for Solent Gateway, 2021, https://docs.planning.org.uk/20210817/52/_NEWFO_DCAPR_215019/pr5ior0rhqjgkitu.pdf

[4] Able Marine Energy Park NRA for Able UK by Marico Marine, 2021, https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR030006/TR030006-000135-TR030006-APP-6A-14-1.pdf

adopted therein is therefore considered to be compliant with ABP Humber risk assessment / safety management system processes.

The PMSC-compliant risk assessment is outlined in the GtGP, and is defined by a five-stage process, which are located within this NRA as follows:

- **Stage 1: Problem identification scoping and risk assessment design (information gathering)**
  - Section 1.6 – Port of Immingham
  - Section 2 – IERRT Development
  - Section 3 – Navigation Baseline (historical and future baseline vessel traffic)
  - Section 3.6 – Incident Analysis
  - Section 4 – Vessel Traffic Analysis
- **Stage 2: Hazard Identification**
  - Section 6 – Hazard Identification
- **Stage 3: Risk Analysis**
  - Section 5 – Risk Assessment Methodology
  - Section 7 – Inherent Risk Assessment
- **Stage 4: Assessment of existing risk control measures**
  - Section 7.1 – Embedded Risk Control Measures
  - Section 7.2 – Inherent Risk Assessment
- **Stage 5: Identification of new risk control measures**
  - Section 8 – Additional Risk Controls
  - Section 9 – Residual Risk Assessment

Although not a requirement of a PMSC style risk assessment, the Solent Gateway NRA undertook additional quantified risk modelling for collision, allision and grounding scenarios. Due to limited time available to conduct this NRA, the quantitative collision, allision and grounding modelling components have not been undertaken. Instead this NRA utilised an assessment of available historical incident data with historical, existing and future vessel movements at the Port of Immingham and developed a semi-qualitative approach with support from the practical exercise of local mariners, port operator and pilots. That is, an assessment of the number of incidents, vessel traffic and the introduction of the IERRT was used to inform qualitative judgement taking into account local insights.

1.4.1 Previous Contributing IERRT Assessments

During the preparation of the IERRT application and the ABPmer NRA, various documents and contributing assessments were produced. The contributing IERRT assessments considered in this NRA are outlined below, together with an explanation of how much of the assessment has been considered and on what basis.

1.4.1.1 ABPmer NRA

ABPmer has produced a qualitative NRA for the IERRT project[5]. DFDS, amongst various other local stakeholders and/or Interested Parties, have raised objections or criticisms of various aspects of the ABPmer NRA through their Relevant Representations[6] response to the consenting application. However, whilst these objections and criticisms form part of the reason that DFDS have undertaken this independent NRA, it is critical to note that the primary purpose of this NRA is purely to undertake an impartial, structured and transparent NRA of the IERRT using a PMSC-compliant methodology. It is not to opine on the specific objections raised by the various Interested Parties nor to specifically validate or invalidate them. As such, various objective and factual information contained within the ABPmer NRA also remain entirely relevant to supporting this NRA and these have been referenced when used. Subjective information or subjective interpretations of factual information; however, have not been carried through to allow this NRA to be undertaken on an entirely independent basis.

1.4.1.2 HAZIDs and Stakeholder Engagement

Several Hazard Identification (HAZID) workshops were undertaken during the preparation of the ABPmer NRA. These workshops are outlined in the ABPmer NRA and have been considered in preparation of this NRA (primarily for hazards identified, embedded mitigation measures and additional mitigation measures, which have subsequently been reviewed and revised or expanded upon where necessary as detailed in this report). The workshops are summarised below and further details of attendees can be found within the ABPmer NRA.

1. 29 October 2021 – Internal workshop held with internal ABP stakeholders with the primary purpose of informing the preparation of the Preliminary Environmental Impact Report (PEIR).

   Attendees: ABP stakeholders.

2. 07 April 2022 – External workshop #1 with internal ABP stakeholders and external port users and operators with the purpose reported to be extended hazard identification and risk assessment of the hazards identified from the internal workshop.

   Attendees: ABP stakeholders, Associated Petroleum Terminals (APT), NASH Maritime, Stena Line, DFDS and CLdN.

3. 16-17 August 2022 – External workshop #2 (two-day workshop) with ABP stakeholders and external port users and operators as per external workshop #1 and included an additional wider network of external stakeholders. The primary purpose for external workshop #2 was understood to be for information gathering from a wider external stakeholder group, advising changes made to adjustments in the NRA methodology (following feedback from external workshop #1), and the potential for and additional phase of operation in which operation would be possible during the construction phase.

   Attendees: ABP stakeholders, APT, NASH Maritime, Stena Line, DFDS, HR Wallingford, Exolum, Bishop Marine Consulting, Svitzer, Rix and James Fisher Everard.

The workshops were unable to fully cover the risk assessment scoring and as a result two further consultation periods were defined with email communication with the primary purpose to try and complete the risk scoring exercise (consultation period #1) and later for stakeholders to provide feedback on ABPmer's final risk assessment (consultation period #2).

[5] TR030007-000368-8.4.10(a)_IERRT ES_Vol3_Appendix 10.1_Navigation Risk Assessment.pdf
https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR030007/TR030007-000368-8.4.10(a)_IERRT%20ES_Vol3_Appendix%2010.1_Navigation%20Risk%20Assessment.pdf

[6] IERRT Interested Party Relevant Representations, https://national-infrastructure-consenting.planninginspectorate.gov.uk/projects/TR030007/representations

This report and NRA has been prepared with the awareness of the workshops and consultation periods previously undertaken but has applied a separate structured approach to hazard identification and risk scoring to allow an independent risk assessment process.

1.4.1.3 Ship Simulations

As part of the informative assessment and stakeholder involvement undertaken for the assessment of navigational safety and the preparation of the ABPmer NRA, ship simulations had been undertaken using the facilities at HR Wallingford and reports of these simulations' exercises include:

- Navigational Simulation Study, July 2022 (Part 1 [7] and Part 2 [8]).
- Navigational Simulation – Stakeholder Demonstrations [9].

There are various outstanding reservations that are shared between the external stakeholders / Interested Parties regarding the accuracy and reliability of the findings of the ship simulation exercise and as a result of this the confidence level of the findings from these ship simulations is reduced. Therefore, the findings from the ship simulations undertaken have not been used directly to inform this NRA on the ability (or inability) to navigate to and from the IERRT safely, but rather have been indirectly used to provide a higher-level objective view that the navigation to and from the IERRT berths is highly dynamic and challenging, with little room for error and limited redundancy. The Risk Assessment Team also considered that there exists a potential for deviation from the simulated exercises that could result in less favourable vessels being used at the IERRT in future. For example, the vessel used in the simulation was the DFDS Jinling Class – 238m length, 33m beam, 7m draft and are regular vessels operating within Immingham to and from the Immingham Outer Harbour (IOH). The vessel is equipped with a bow thruster, 2x controllable pitch propellors and Becker twisted flap rudders each providing a very high degree of control, response and manoeuvrability. For comparative context, the IERRT design vessels are 240m length, 35m beam and 8m draft but do not have machinery or vessel details specified. It was therefore noted by the Risk Assessment Team that vessels using the IERRT may not have the same manoeuvrability characteristics and that the design draft of the IERRT vessels was 1m deeper than the simulated vessels (being far more susceptible to strong currents or under keel clearance effects hampering manoeuvrability).

This NRA uses the objective finding that navigation and manoeuvring onto IERRT berths 1, 2 and 3 (particularly berth 3) present a significantly challenging navigational environment for arrival and departure (particularly arrival) in adverse weather which would likely result in more difficult navigational demands in real life.

1.5 Relevant Guidance

The following sections provide details on the legislation and guidance, procedures and practices required to be taken into account when conducting an NRA within a port area, such as is required for the project.

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[7] TR030007-000369-8.4.10(b)_IERRT ES_Vol3_Appendix10.2_Navigation Simulation Study - Part 1.pdf
https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR030007/TR030007-000369-8.4.10(b)_IERRT%20ES_Vol3_Appendix10.2_Navigation%20Simulation%20Study%20-%20Part%201.pdf

[8] TR030007-000370-8.4.10(b)_IERRT ES_Vol3_Appendix10.2_Navigation Simulation Study - Part 2.pdf
https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR030007/TR030007-000370-8.4.10(b)_IERRT%20ES_Vol3_Appendix10.2_Navigation%20Simulation%20Study%20-%20Part%202.pdf

[9] TR030007-000371-8.4.10(c)_IERRT ES_Vol3_Appendix 10.3 - Navigational Simulation _ Stakeholder Demonstrations.pdf,
https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR030007/TR030007-000371-8.4.10(c)_IERRT%20ES_Vol3_Appendix%2010.3%20-%20Navigational%20Simulation%20_%20Stakeholder%20Demonstrations.pdf

1.5.1 Legislation

The following list provides a summary of the relevant legislation identified as part of this NRA outline review:

- The Humber Navigation Byelaws 1990
- Harbours Docks and Piers (Clauses) Act 1847
- Harbours Act 1964
- The Pilotage Act 1987 (Amendment) Regulations 2019
- Schedule 3, Transport Act 1981
- The Docks Regulations 1988
- Marine Navigation Act 2013
- International Ship and Port Facility Security Code 2004
- British Transport Docks Act 1972
- Transport Docks Act 1964
- Associated British Ports Act 1987
- The Associated British Ports (Immingham Outer Harbour) Harbour Revision Order 2004
- The Associated British Ports (Immingham Gas Jetty) Harbour Revision Order 2007
- Immingham Dock Revision Order 1966
- Merchant Shipping Act, 1894.

1.5.2 Guidance, Procedures, Practices

The following list provides a summary of the relevant guidance, procedures and practices identified as part of this NRA outline review:

- Port Marine Safety Code (PMSC)
- Port Marine Safety Code – "Guide to Good Practice on Port Marine Operations" (GtGP)
- MGN 401 (M+F) Amendment 3 Navigation: Vessel Traffic Services (VTS) and Local Port Services (LPS) in the UK
- IALA VTS Manual 2022 [10]
- IALA G1111 Establishing Functional Performance Requirements [11]
- ABP Pilotage Directions for Ships to Be Navigated in within the Humber Pilotage area [12]
- ABP Marine Safety Plan [13]

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[10] IALA VTS Manual https://www.iala-aism.org/product/m0002/

[11] IALA G1111 Establishing Functional Performance Requirements, https://www.iala-aism.org/product/g1111/

12 ABP Pilotage Directions
https://www.humber.com/admin/content/files/Misc/The%20Humber%20Pilotage%20Directions%20Amended%202016.pdf

[13] ABP Marine Safety Plan https://www.abports.co.uk/media/hponb0o5/marine-safety-plan.pdf

- The Humber Pilot Handbook 2017
- Humber Passage Plan 2021 [14]
- Revised Guidelines for Formal Safety Assessments (FSA) for Use in The IMO Rule-Making Process, 2018 [15]
- Marine Navigation Act 2013 [16]
- The Pilotage Act 1987 (Amendment) Regulations 2019 [17]
- Immingham Docks Byelaws [18]
- General Directions for Navigation on the Humber [19]
- Humber Notices to Mariners (HNtMs) [20]

1.5.3 Port Marine Safety Code

As stated on the UK Government website, the PMSC sets out a national standard for every aspect of port marine safety. Its aim is to enhance safety for everyone who uses or works in the UK port marine environment. The PMSC is intended to be flexible enough that any size or type of harbour or marine facility will be able to apply its principles in a way that is appropriate and proportionate to local requirements.

The PMSC represents best-practice for management of port marine safety. It is applicable both to statutory harbour authorities and to other marine facilities which may not have statutory powers and duties and it is strongly recommended that organisations or facilities which are not a statutory harbour authority also seek a proportionate compliance with the PMSC.

The PMSC defines 10 keys measures of which the three listed below are recommended as the very minimum in order to comply, these are:

- 4. Duties and Powers: Comply with the duties and powers under existing legislation, as appropriate.
- 5. Risk Assessment: Ensure that marine risks are formally assessed and are eliminated or reduced to the lowest possible level, so far as is reasonably practicable, in accordance with good practice.
- 6. Marine Safety Management System: Operate an effective MSMS which has been developed after consultation, is based on formal risk assessment and refers to an appropriate approach to incident investigation.

[14] ABP Humber Passage Plan, https://www.humber.com/admin/content/files/Estuary%20Information/Humber%20%20Passage%20Plan%202021.pdf

[15] IMO FSA guidelines, https://wwwcdn.imo.org/localresources/en/OurWork/HumanElement/Documents/MSC-MEPC.2-Circ.12-Rev.2%20-%20Revised%20Guidelines%20For%20Formal%20Safety%20Assessment%20(Fsa)For%20Use%20In%20The%20Imo%20Rule-Making%20Proces...%20(Secretariat).pdf

[16] Marine Navigation Act 2013, https://www.legislation.gov.uk/ukpga/2013/23/contents

[17] Pilotage Act 1987, https://business.senedd.wales/documents/s96824/EM%20SICM527%20-%20The%20Pilotage%20Act%201987%20Amendment%20Regulations%202019.pdf

[18] Immingham Docks Byelaws, https://www.abports.co.uk/media/2trjujz5/immingham-dock-bye-laws.pdf

[19] General Directions for Navigation on the Humber, https://www.humber.com/admin/content/files/Notice%20to%20Mariners/Standing%20Notice%20to%20Mariners/SH_01_2001_NTM.pdf

[20] Humber Notices to Mariners (HNtMs), https://www.humber.com/Estuary_Information/Marine_Information/Notice_to_Mariners/

To secure marine safety, the PMSC tightly binds the use of a formal risk assessment of hazards and risks; the use of a MSMS to ensure risks are managed and controlled; and incident reporting and investigation which can feedback to enhance the ongoing update and review of hazards and risks.

The PMSC specifically states that "*an MSMS should be in place to ensure that all risks are identified and controlled – the more severe ones must either be eliminated or reduced to the lowest possible level, so far as is reasonably practicable (that is, such risks must be kept as low as reasonably practicable or "ALARP"). Organisations should consult, as appropriate, those likely to be involved in, or affected by, the MSMS they adopt. The opportunity should be taken to develop a consensus about safe navigation. The MSMS should refer to the use of formal risk assessment which should be reviewed periodically as well as part of post incident/accident investigation activity*".

The PMSC also recommends striving to maintain a consensus about safe navigation. This can be achieved through formal programmes of stakeholder engagement to review of relevant risk assessments with users of the facility or harbour.

At section 2.7 of the PMSC the formal risk assessments are required to:

- Identify hazards and analyse risks.
- Assess those risks against an appropriate standard of acceptability.
- Where appropriate consider a cost-benefit assessment of risk-reduction measures.

The GtGP (which is in conjunction with the PMSC) identifies the use of a risk matrix to compare risk levels based on its likelihood of occurrence and the consequences if it were occur. The risk matrix is then used to identify risks which are acceptable/tolerable, which are unacceptable/intolerable and those in between which can only be acceptable if the risks are reduced to "as low as reasonably practicable" (ALARP). The principle of ALARP therefore relates to risks between acceptable and unacceptable and what is "reasonably practicable" is dependent on the specific hazard, likelihood, consequence and the tolerability threshold of the impacted users. The acceptability or tolerability of risks that reside within the ALARP region therefore require further consideration and can only be considered acceptable/tolerable if the principle of ALARP is met such that no other risk controls can be adopted in order to further reduce risk.

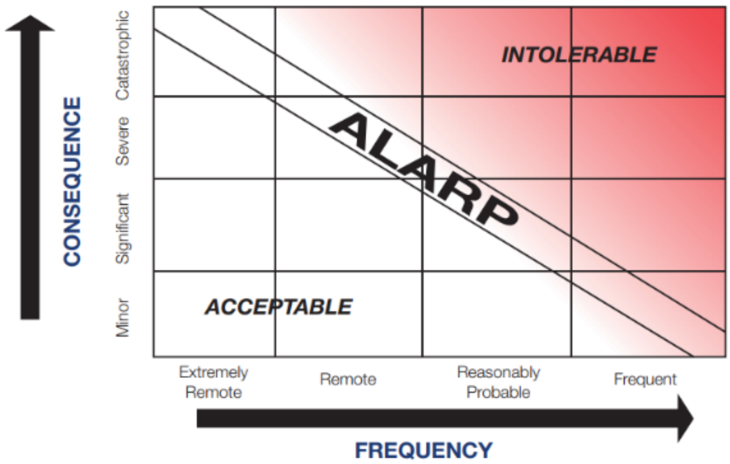

Figure 1: Example Risk Matrix used in GtGP (Source: GtGP)

1.6 Port of Immingham

1.6.1 Port Overview

The Port of Immingham is one of the largest UK ports by volume, handling more than 50 million tonnes per annum, and is the largest of the four Humber ports – Immingham, Grimsby, Hull and Goole. The Port of

Immingham is the UK's largest port by tonnage, and includes handing of products including agribulks, automotive, construction, containers, bulk energy, liquid bulks, rail freight, offshore wind, project cargo, Ro-Ro and Ro-Pax and steel.

The key Port of Immingham terminals are outline below and are shown in **Figure 2**, with a summary table of maximum ship dimensions shown in **Table 1**.

1.6.1.1 The Immingham Oil Terminal (IOT)

- The IOT is formed of two key parts: the River Berths and the Finger Pier, contacted to shore by an elevated piled jetty which carries all product piping. It is understood that product piping maintains charged pipework lines and therefore maintains oil and products with the lines when not in active use.
- The IOT River Berths are three riverside berths and handle large tankers for bulk oil / petroleum liquid cargo to serve two local oil refineries (which produce approximately 20% of the UK's petroleum products). The berths are primarily used for cargo import.
- The IOT Finger Pier are four finger pier berths (two on each side) and are used by smaller product tankers and local bunker barges for oil and chemical liquid bulk cargoes for local petroleum product distribution and Humber ship bunkering needs. The berths are primarily used for cargo export. Maximum vessel size is 104m and 8,500 dwt.
- The IOT is one of the busiest areas for vessel movements in the port, particularly on flood tides as the IOT Finger Pier has tidally restricted movements.

1.6.1.2 Immingham Eastern Jetty

- Immingham Eastern Jetty and a river berth primarily handling bulk hazardous liquid chemicals by chemical tankers with a maximum size of 213m and approximately 50,000 dwt.
- The Immingham East Jetty is a river berth primarily serviced by chemical tankers for the import of Fatty Acid Methyl Esters (FAME) and other dangerous chemicals. The imported FAME are used for the production of biodiesel.
- The Eastern Jetty is located immediately west (approximately 250m) from the proposed IERRT development.
- The eastern jetty also supports the Eastern Jetty tug barge which, being the permanent berth for the Immingham Fire Tug as the dedicated standby response tug for most of the Immingham river terminals, particularly those handling flammable cargoes. It is understood that the use of the Fire Tug has been required numerous times for machinery breakdowns, emergencies and pollution response.

1.6.1.3 Immingham Western Jetty

- The West Jetty is a river berth servicing product tankers, primarily for the import and export of hydrocarbons and dangerous chemicals such as caustic soda, dichloromethane and benzene. The maximum vessel size is the same as the Eastern Jetty of 213m and approximately 50,000 dwt.

1.6.1.4 Immingham Dock

- Immingham Dock is accessed via a lock with entry from the bellmouth entrance between the Eastern and West Jetties. It is used by a variety of ships and cargoes, including (but not limited to) containers, steel, fertiliser, bulk dry and liquid cargoes, scrap and Ro-Ro. Bunker barges also regularly enter the dock to service bunkering requirements within the dock area.

- The Immingham Container Terminal is contained within Immingham Dock and enables transhipment of deep-sea containers direct to Immingham on regular short-sea feeder vessels. The facility operates on a 24/7 basis and has three ship-to-shore cranes and four rubber-tyred gantry cranes supported by reach-stackers.
- The various berths within the dock have vessel size limits; but, in general, the limiting vessel size restricted by the lock is up to approximately 220m length, 26.8m beam and 10.36m draft with approximately 38,000 dwt.

1.6.1.5 Immingham Outer Harbour (IOH)

- The IOH is a river terminal used as a cargo handling facility for Ro-Ro freight vessels and unaccompanied freight trailers for continental freight distribution routes to European ports. It is used on dedicated freight routes operating regular daily services.
- The IOH consists of three berths with a maximum vessel size of 240m and approximately 18,500 dwt.

1.6.1.6 Immingham Bulk Terminal (IBT) / Humber International Terminal (HIT)

- These terminals serve as import facilities used for dry bulk cargoes by Panamax and Cape size bulk carriers. It is used for import of iron ore and coke for the manufacturer of steel at British Steel's Scunthorpe facility, as well as biomass pellets for Drax Power Station.
- The HIT consists of two berths with a maximum vessel size of 289m and approximately 200,000 dwt.
- The IBT consists of one berth with a maximum vessel size of 303m and approximately 200,000 dwt.

1.6.1.7 Immingham Gas Terminal (IGT)

- The IGT handles dangerous cargos including LPG up to 87,000 m^3. The terminal also handles white oil (up to 55,000 dwt) but no heavy oil products. Maximum vessel size is 280m.
- LPG carriers are considered higher risk vessels due to the carriage of dangerous substances and the potential for gas release, fire and/or explosion and fatality. These vessel will be transiting In the Immingham area.

1.6.1.8 South Killingholme Oil Jetty (SKJ) – Immediately up stream of the Port of Immingham

- The SKJ is located within South Killingholme, immediately adjacent to the IGT and handles similar cargoes – LPG and white oil. Maximum vessel size is understood to be 200m.

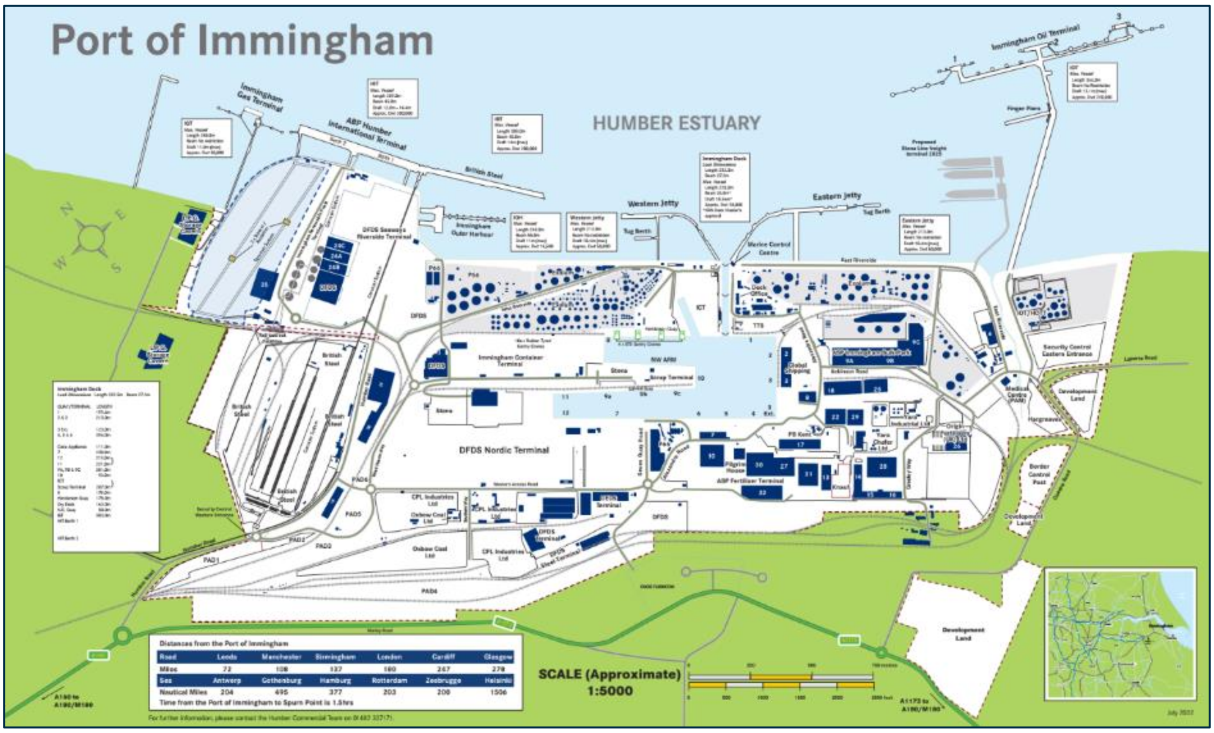

*Figure 2: Plan Overview for the Port of Immingham. Source: ABP Immingham website[21]. Note, the IERRT shown in this plan is not to scale – see IERRT Development section below (**Section 2**).*

Table 1: Maximum Vessel Dimensions for Port of Immingham Terminals. Source: ABP Immingham.

Terminal/Dock/Quay	Length (m)	Beam (m)	Draught (m)	Approx. Dwt
Immingham Dock	198.0	26.2	10.36	38,000
Immingham Dock *1	220.0	26.8 *3	10.36 *3	38,000
Eastern Jetty	213.0	No restrictions	10.4	50,000
Western Jetty	213.0	No restrictions	10.4	50,000
Immingham Oil Terminal (IOT)	366.0	No restrictions	13.1	290,000
Immingham Bulk Terminal (IBT)	303.0	45.0	14.0	200,000
Immingham Gas Terminal (IGT)	280.0	No restrictions	11.0	50,000
Humber International Terminal (HIT)	289.0	45.0	12.80-14.20 *2	200,000
Immingham Outer Harbour (IOH)	240.0	55.0	11	18,500

*1: These Immingham Dock values are from the plan overview for the Port of Immingham (**Figure 2**) and so have been included separately in the table. Other values are from the Port of Immingham website.

*2: 12.80 - 14.40 according to the plan overview for the Port of Immingham (**Figure 2**).

*3: With Dock Master's approval

[21] Port of Immingham plan, Jul 2022 (ABP Port of Immingham website), https://www.abports.co.uk/media/0yoinmtg/immingham.pdf

2 IERRT Development

2.1 IERRT Infrastructure

The proposed IERRT development consists of three river berths numbered 1 (outer), 2 (inner north) and 3 (inner south) all serving both freight and passenger movements. The berths are located between the Eastern Jetty on the west and the IOT on the east, with the IERRT berth 1 located in close proximity to the tidally restricted IOT Finger Pier. The berth arrangement and location in Immingham Port are show in Figure 3**,** whilst **Figure 4** shows the IEERT with three vessels of 240 m length and 35 m beam alongside and the proximity of the IOT Finger Pier being less than 100m.

The berths are made up of piled finger piers with berthing and mooring infrastructure with a pile supported floating pontoon offloading dock connected to a piled accessway for vehicle movements ashore. The floating pontoon is understood to not have any berthing or mooring infrastructure and is assumed not designed for berthing and mooring loads.

The current location of the Eastern Jetty tug barge is an extension off the Eastern Jetty, between the jetty and the proposed IERRT berth 3. The location of the tug barge is shown on navigation charts (see **Figure 3**), although is not shown in ship simulations (see **Figure 5** to **Figure 8**). It is therefore unclear if this tug barge will removed, relocated or is planned remain in place; however, if the latter, this may influence the navigation or assist tug usage for navigating to and from berth 3.

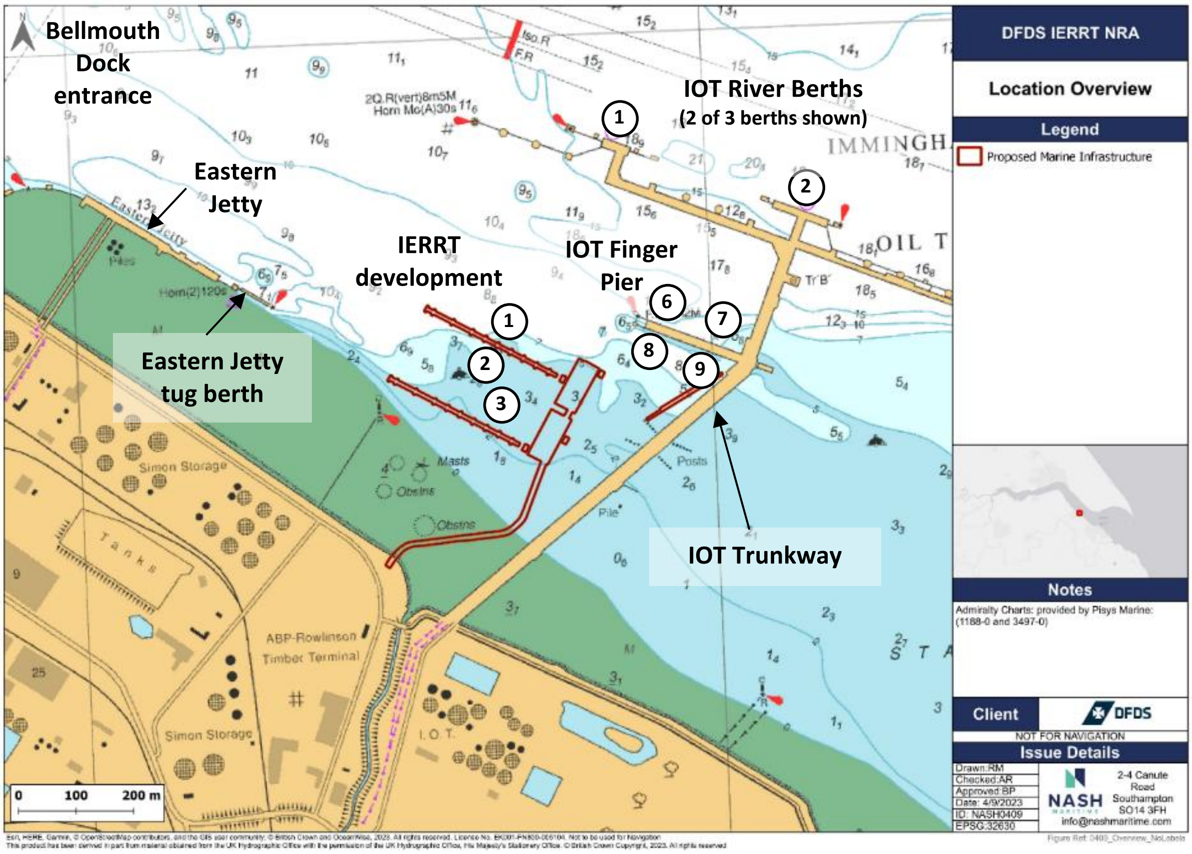

Figure 3: IERRT marine infrastructure location

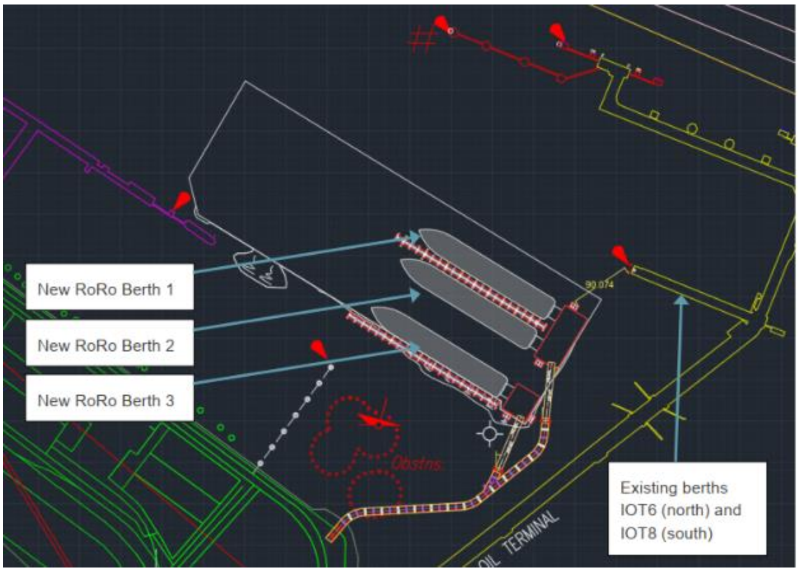

Figure 4: Layout with vessels - from IERRT Navigation Simulation report Part 1 (Note, old IERRT infrastructure design shown).

2.2 IERRT Design Vessels

The IERRT berths are capable of receiving vessels up to 240m length (overall, LOA), 35m breadth and 8m draft. However, specific details of the IERRT design vessels has not been defined including windage areas, propulsion and steering characteristics, thruster, etc. The vessels will be Ro-Ro and Ro-Pax vessels due to the intended operations and ability to handle more than 12 non-crew personnel and members of the general public – therefore these vessels would be classed as passenger vessels.

The nominated vessel size, compared to the large vessels currently operating locally is:

- IERRT project vessels (Ro-Pax, freight and more than 12 drivers / passengers): 240m x 35m x 8m
- DFDS Jinling Class (Ro-Ro, freight only, up to 12 drivers / passengers): 238m x 34m (as assessed in ship simulation with 7m draft)
- CLdN G9 Class (Ro-Ro, freight only, up to 12 drivers / passengers): 234m x 35m
- Stena T-Class (Ro-Pax, freight and more tan 12 drivers / passengers): 212m x 27m

The IERRT is intended to be operated by Stena who currently service the area through Killingholme with vessels including: Stena Transporter (212m x 26.7m x 6.3m), Stena Transit (212m x 26.7m x 6.3m), POL Maris (192m x 26m) and Hatche (192m x 26m).

2.3 IERRT Marine Throughput

The IERRT is intended to handle cargos of:

- Unaccompanied freight (trailers with no drivers). Classed as Ro-Ro cargo vessels.
- Accompanied freight (trailers with drivers). Classed as Ro-Pax cargo vessels (if more than 12 drivers).
- Passengers (car passengers, but no food passengers). Classed as Ro-Pax cargo vessels (if more than 12 drivers + passengers). It is stated in the IERRT development plans that up to 100 passengers may use the services.

The IERRT project vessels will operate every day (365 days per year) with the possible exception of Christmas day, with each berth having a regular liner service of a vessel arriving at the same time in the mornings and departing at the same times in the evening, and therefore three vessels alongside simultaneously each day. Hence, the IERRT will see six vessel movements per day (three arrivals and three departures). The terminal is intended to be operated in all conditions allowable by their future operating regulations, including adverse visibility and hours of darkness.

Within this area, the SHA for the development would be the Port of Immingham and the CHA for the development would be Humber Estuary Services (HES).

2.4 IERRT Navigation

2.4.1 Arrival

After passing the Holme Ridge No 9 buoy the tidal flow begins to change from the predominately east/west flow turning progressively more to the north to follow the shape of the estuary. Vessels at this point are reducing speed to comply with Humber Byelaws 14.3 [22] and not pass the IOT at a speed in excess of 5 knots.

As per accepted nautical navigational practice (Rule 9 The International Regulations for Preventing Collisions at Sea (COLREGs)), vessels remain to the starboard side of the channel and will pass any outbound traffic 'port to port' meaning inbound traffic remains to the north and outbound traffic to the south.

Due to the direction of the current in this area, which runs approximately 315° / 135°, mariners need to exercise caution to ensure their vessels do not set onto the Number 9A light float or No 11 Holme buoy on the flood tide or onto the IOT on the ebb tide. This tidal set is quite noticeable due to the direction of the tide in relation to the IOT, the slow speed (less than 5 knots) of vessels and is more pronounced when combined with leeway caused by strong predominately northerly or southerly winds.

Overtaking is discouraged at the IOT as per Standing Notices To Mariners SH23 Immingham Oil Terminal[23].

A 150m vessel exclusion zone exists from the jetty face of the IOT out into the navigational channel to protect vessels moored on its main deepwater berths (Standing Notices To Mariners SH34 Passing Immingham Jetties [24]).

Once past the upstream IOT mooring dolphin (A1 Dolphin) providing traffic allows the vessel then proceeds to the south.

This is achieved either reducing speed and turning the vessels head to port by around 20 degrees and allowing the ebb tide to set the vessel inside of the IOT main berth being careful not to be set onto the A1 dolphin, or by using engines, thrusters and any tug assistance (if employed) to drive the vessel around the A1 dolphin before turning back to starboard so that the vessel is stern to tide.

These two manoeuvres can be seen in Figure 5 (Ebb Tide) and Figure 6 (Flood Tide) as shown in the IERRT Ship Simulations, the applicants simulation exercises. However, it is noted that DFDS contest the direction of tide as indicated on the applicants simulations and therefore these figures are included for information only to assist explanation.

The average time taken for arrival manoeuvres from passing IOT 1 to being fast alongside is 30-45 minutes.

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[22] Humber Byelaws 14.3, https://www.humber.com/admin/content/files/Estuary%20Information/ha%20byelwas.PDF

[23] Standing Notices To Mariners SH23, https://www.humber.com/admin/content/files/Notice%20to%20Mariners/Standing%20Notice%20to%20Mariners/SH_23_2001_NTM.pdf

[24] Standing Notices To Mariners SH34, https://www.humber.com/admin/content/files/Notice%20to%20Mariners/Standing%20Notice%20to%20Mariners/SH_34_2011_NTM%20(revised).pdf

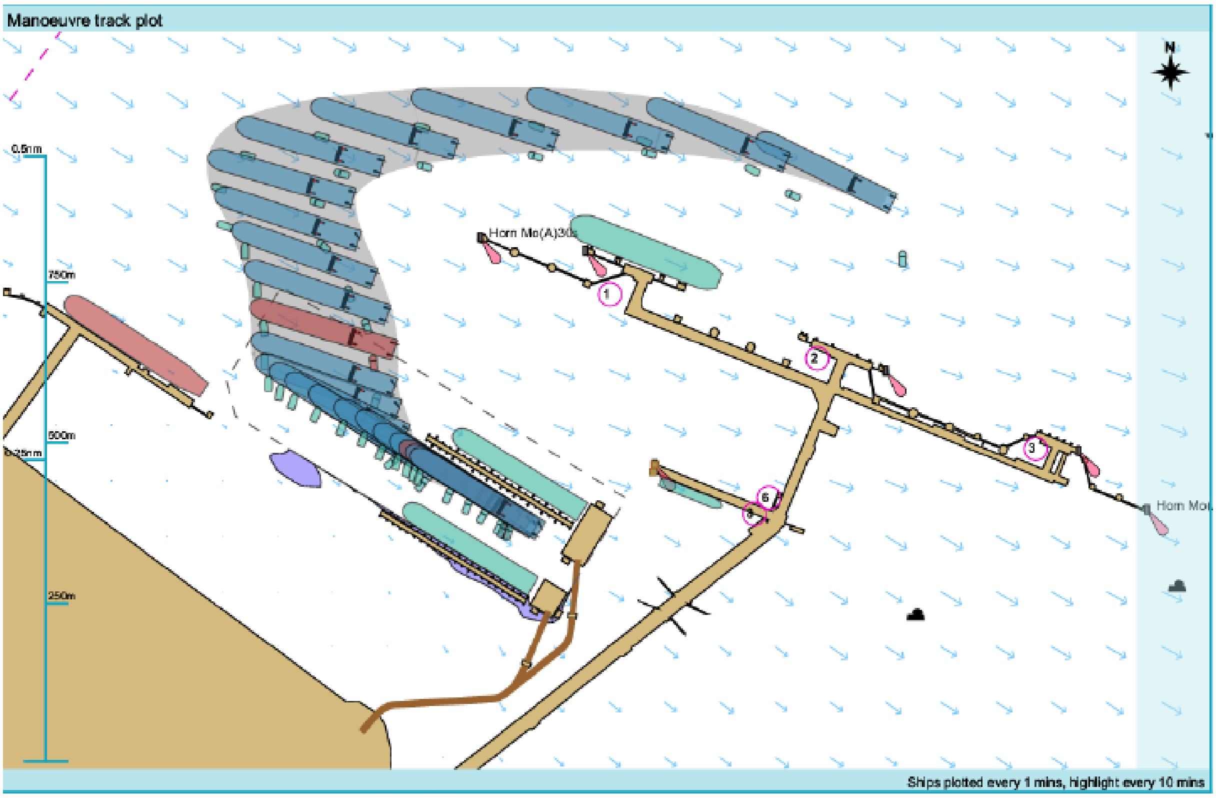

Figure 5: Ebb Tide Manoeuvre (Source: IERRT development Ship Simulations)

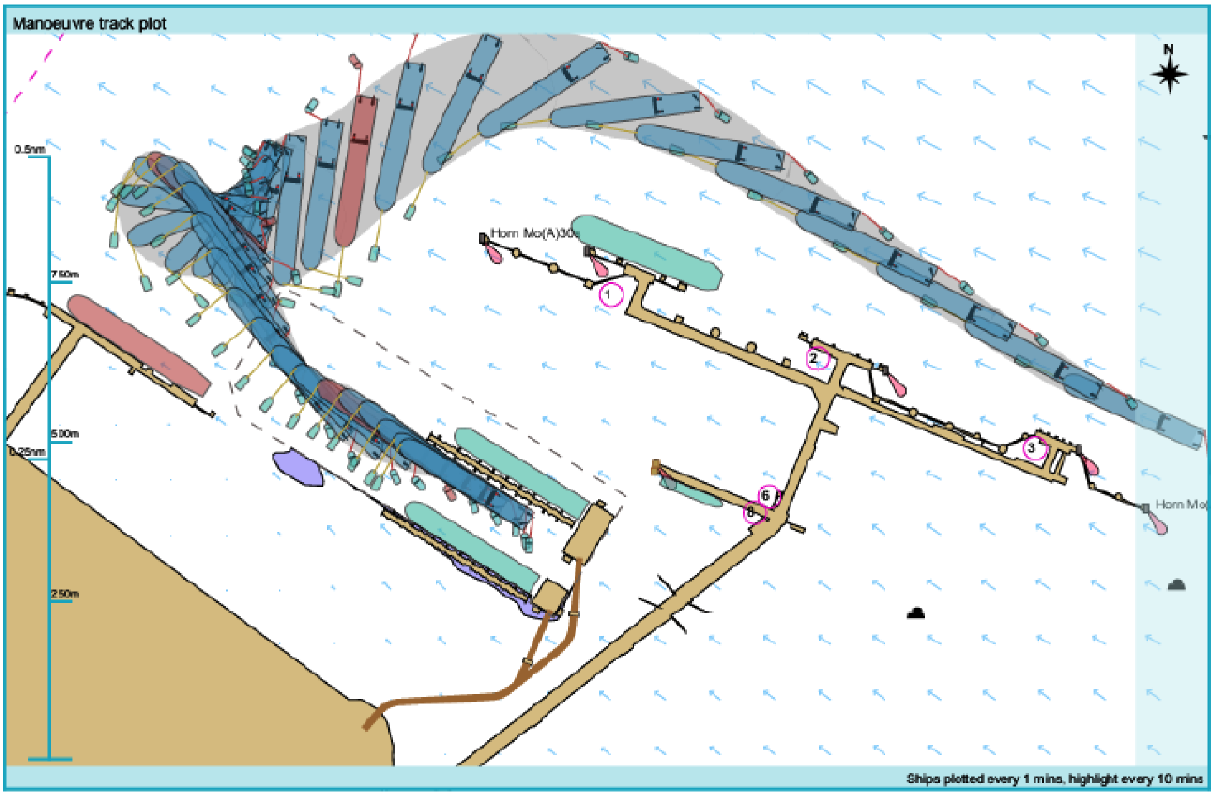

Figure 6: Flood Tide Manoeuvre (Source: IERRT development Ship Simulations)

2.4.2 Departure

Prior to 'letting go' their last mooring lines the Pilot or PEC holder must first receive traffic clearance from VTS Humber (VHF CH12) in accordance with Standing Notice To Mariners SH12 [25]. At this time they will be appraised of any nearby traffic movements and given the level of tide as indicated by the Immingham tide gauge.

Once clearance has been received a vessel lets go her remaining mooring lines and makes a whistle signal of one long blast as prescribed in Part III of the Humber Byelaws.

For a departure on the ebb tide the vessel must move the vessels head away from the pier to which she is made fast, using thrusters or tug assistance, to allow the tide to assist the vessel in moving away from the berth. Once clear of the terminal the vessel proceeds in a North Easterly direction to move well upstream of the IOT A1 dolphin before turning to starboard and proceeding outbound. Caution needs to be exercised to ensure sufficient clearance from the A1 dolphin to prevent the ebb tide setting the vessel onto here during the turn and also to ensure the vessel remains a minimum of 150m from the IOT at all times. The vessels speed when passing IOT must not exceed 5 knots as previously indicated.

Flood departures allow the vessel to turn much earlier given the tide will carry the vessel away from the IOT A1 dolphin but caution must be exercised to ensure the vessel remains close to the IOT on the starboard side of the channel to prevent any conflict with incoming vessels.

The two manoeuvres can be seen in Figure 7 and Figure 8 as shown in the IERRT Ship Simulations (stakeholder demonstration report), that details the applicant's simulation exercises. However, it is noted that DFDS contest the direction of tide as indicated on the applicant's simulations and therefore these figures are included for information only to assist explanation.

The average time taken for departures from letting go to being abeam of IOT 1 is approximately 20 minutes.

[25] Standing Notice To Mariners SH12, https://www.humber.com/admin/content/files/Notice%20to%20Mariners/Standing%20Notice%20to%20Mariners/SH_12_2009_NTM%20(revised).pdf

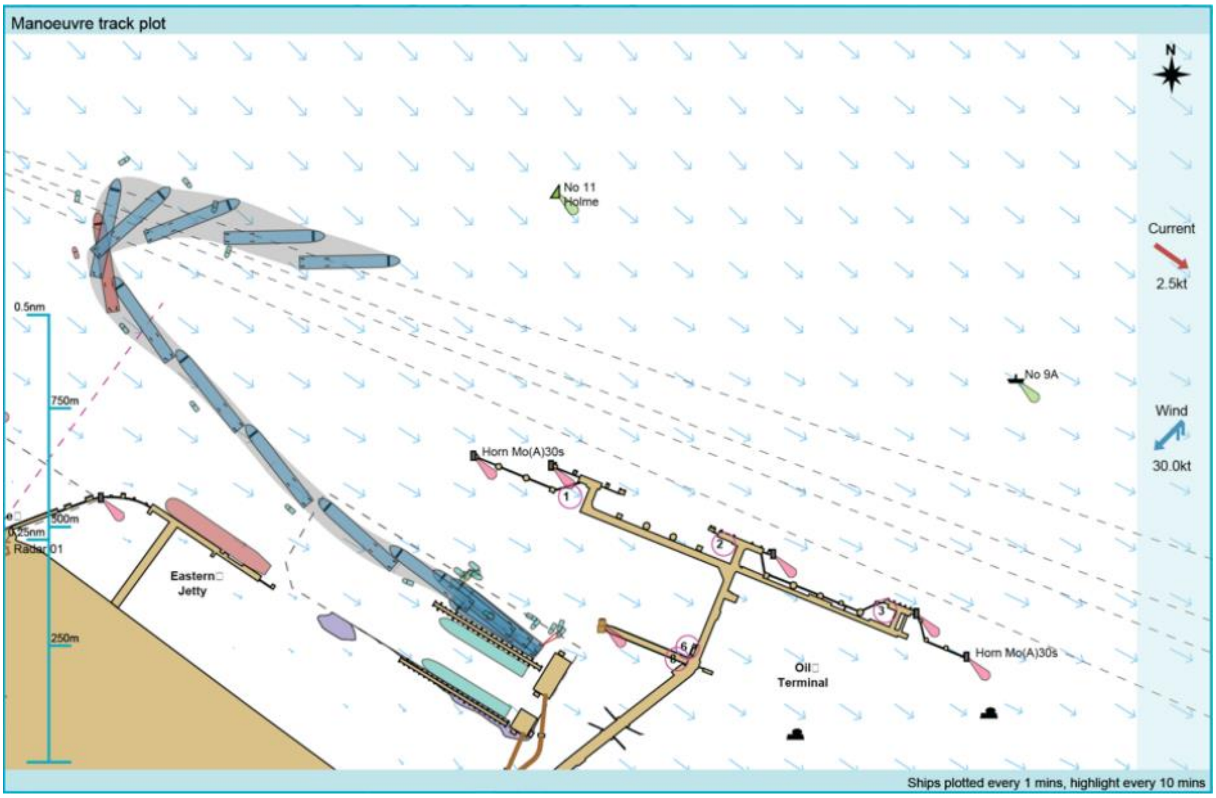

Figure 7: Departure on ebb tide (Source: IERRT development Ship Simulations)

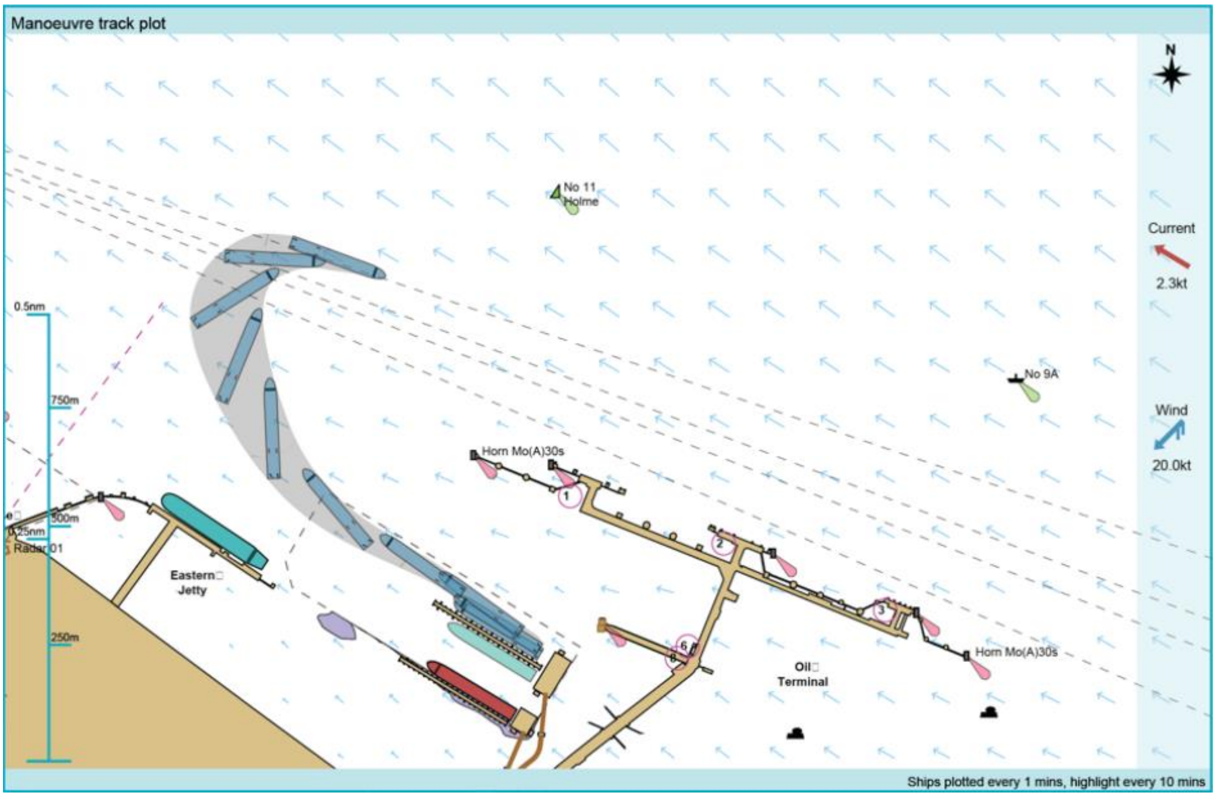

Figure 8: Departure on Flood Tide (Source: IERRT development Ship Simulations)

2.4.3 Berthing

2.4.3.1 Berth 1

This is the least complex berth to manoeuvre on and off from given the area the vessels have between the berth and southern side of the IOT. The potential issues when manoeuvring nearby this berth is with any mechanical issues or pilot/PEC error that could lead to the IERRT vessel being caught by the curt and/or wind in close proximity to the IOT Finger Pier or Trunkway

2.4.3.2 Berth 2

The manoeuvre on and off berth 2 is much more compromised due to the lack of available space to conduct the first few or final stages of the manoeuvre. This lack of available space is made even more apparent when berth 3 is occupied as it further reduces the available manoeuvring space by 35m (the beam of the proposed IERRT design vessel).

The lack of space is especially acute when employing tug assistance since the tug is most effective when positioned a reasonable distance (20-30m) away from the side of the vessel. This ultimately means that tug assisted manoeuvres would be severely hampered in this area.

The restrictive nature of the area between berths 2 and 3 also prevents the turbulent wash from the vessel or the tugs to adequately disperse which reduces the effectiveness of thrusters, propellers and tug drive units. This turbulent wash can be potentially dangerous for assisting tugs in terms of maintaining control of the tug and possible swamping (water on deck).

2.4.3.3 Berth 3

Berth 3 shares many of the difficulties and issues of berth 2 in terms of reduced manoeuvring space and presents an additional difficulty from the prevailing winds in the area being south westerly, blowing off berth 3 toward berth 2. This means the vessel will regularly be pushed by the wind off the berth and onto berth 2 (or a vessel moored thereon). Additionally the proximity of the Eastern Jetty chemical berth (and any vessel moored thereon) makes manoeuvres into the berth 2/3 berthing pocket highly challenging, particularly on the ebb tide.

The Eastern Jetty tug barge is unclear if it will remain in its current location; however, if the barge were to remain in position then it is also in a highly vulnerable position from IERRT vessels and their attending tugs, especially when manoeuvring away from the berth on the ebb tide. The Eastern Jetty tug barge and the tug/s moored alongside would be susceptible to a possible contact (allision) during IERRT vessel movements or from a breakaway incident, and possible wash effects or swamping caused by the use of engines and thrusters by the passing IERRT vessels or their attending tugs.

3 Navigation Baseline

The Humber Estuary is one the busiest trading ports in the UK and is the busiest shipping estuary, based on the UK Department for Transport's (DfT) port ship arrivals by port[26] [27]. Shipping movements are primarily made up of Tankers, Dry Bulk and Ro-Ro ship types.

The DfT data shows that every year since 2011 the Port of Immingham and Grimsby (shown combined within the DfT data), is the second busiest port for ship arrivals in the UK, following Dover. The data also shows that every year since 2019 Immingham and Grimsby has been the busiest port for tanker arrivals. Summaries of the DfT data for Immingham and Grimsby is shown within Section 3.4.

The Humber estuary is exceptionally busy and a key trading area for the UK. It is also located in a region of high tidal range and therefore experiences very high tidal currents and the varying estuary landscape creates a complex tidal flow system. Furthermore, the Port of Immingham is relatively compact with numerous terminals operating in close proximity with a high volume of vessel movements. This makes Immingham a challenging navigational area with a notably high number of reported incidents.

This section describes an overview of the baseline navigation environment including navigation management, metocean information, historical vessel traffic, future vessel traffic and historical incidents.

3.1 Management of Navigation

Vessel traffic management at the Port of Immingham and on the Humber Estuary is managed by ABP. ABP therefore acts as the:

- Statutory Harbour Authority for Port of Immingham
- Statutory Harbour Authority for the Humber Estuary
- Competent Harbour Authority for the provision of pilots on the whole of the Humber Estuary
- Vessel Traffic Services / Local Port Service
- Local Lighthouse Authority

3.1.1 Vessel Traffic Service

ABP Humber operate a 24/7 Vessel Traffic Service which is compulsory for all sea going vessels and craft when entering the Humber VTS area which is defined as:

(A straight line drawn from EASINGTON CHURCH in the county of EAST RIDING of YORKSHIRE (Latitude 53° 39'. 02 North, Longitude 000° 06'. 90 East)) in a direction 086° (T) to a position 53° 40'. 00 North 0° 30'. 00 East then a straight line in a direction 180° (T), to a position 53° 30'. 00 North, Longitude 0° 30'. 00 East. Then a straight line in a direction 262° (T), to the site of the former DONNA NOOK BEACON in the county of NORTH LINCOLNSHIRE (Latitude 53° 28'. 40 North: Longitude 000° 09'. 23 EAST). The RIVER OUSE up to SKELTON railway bridge and the river TRENT to KEADBY bridge.).

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[26] DfT port and waterborne freight statistics: UK Ports Ship arrivals, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1171863/port0602.ods

[26] DfT port and waterborne freight statistics: UK ports, ship arrivals by type and deadweight, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1171862/port0601.ods

The service provides AIS coverage throughout the VTS area and RADAR tracking within the area bounded by the Humber bridge and the seaward limits of the VTS area. The Humber approaches working VHF channel is Channel 14. Mid Humber channel 12 and upper Humber river channel 15.

3.1.2 Pilotage and Towage

As the competent Harbour Authority (CHA) for the river Humber, including river Ouse and River Trent, ABP operates a compulsory pilotage service within the meaning of the pilotage act 1987. The service is compulsory for all ships over 60m in length unless carrying a Pilotage Exemption Certificate Holder (PEC) onboard as described within the Associated British Ports Pilotage Directions for Ships to Be Navigated within the Humber Pilotage Area. Additionally, compulsory pilotage extends to vessels less than 60 m carrying a bulk cargo of dangerous substances (as defined and categorised in the Dangerous Substances in Harbour Areas Regulations (1987)) and all vessels over 100 m moving between tidal estuary berths which includes the moving of mooring lines.

Generally, all vessels inward who require a tug/s to berth at Immingham Dock, Eastern or West Jetty, IBT, HIT, IGT or South Killingholme Oil Jetty must reduce their speed and complete making tugs fast before the vessel passes berth No.3 of the Immingham Oil Terminal.

3.2 MetOcean Conditions

Metocean conditions are discussed below. The data within this section has not been independently verified and no modelling or validation exercise has been undertaken. For waves and tides, the ABPmer metocean assessment has been taken as accurate and been used in this NRA. For wind and current, the ABPmer metocean assessment has been further considered to determine the implications of inaccuracies before being used in this NRA. Where the accuracy of the data would have serious implications to the assessment of risk, only the indicative information and general trends and/or observations from the data have been used in this NRA.

A summary of potential serious risk implications of inaccuracies are:

- Current speed and, particularly, direction. Incorrect assumptions or overly simplified current direction estimates in and around the IERRT terminal, or changes to the current flows at other berths due to the IERRT terminal, the Ro-Ro / Ro-Pax vessels moored there and/or the bathymetric changes from dredging, can introduce changes to the present tidal flow which can be critical to safe, repeatable and predicable navigation.
- Wind speed and direction, including gusting. Wind speed and direction plus the variation of speed (e.g. gusting) and direction can have implications of the complexity of navigation, particularly for slow speed manoeuvring for high-sided (high windage area) vessels such as Ro-Ro / Ro-Pax vessels. Additionally, the effects of rapidly varying wind speed due to wind shielding effects from Ro-Ro / Ro-Pax vessels on other vessels can be critical for the safe, repeatable and predicable navigation.
- The effects of global warming are widely accepted to introduce more erratic and severe weather during the lifetime of the project. The effects of this would typically be to increase the historical severe weather periods including winds, tides (water levels general), waves and current. For wind and current particularly, this could present further risk implications later in the IERRT lifecycle.

3.2.1 Wind

It is understood that two sets of wind data exist for the Immingham regions: a 2.5 year dataset from the Humberside Airport, located approximately 13 km south west of the project site inland measured at a height of 10m (spanning Jan 2019 – Jun 2021); and a separate 1 year dataset from the Immingham Maritime Control Centre, located within the Port of Immingham measured at a height of 24m (spanning Aug 2020 – Aug 2021).

ABPmer has used the wind data from the Humberside Airport weather station, however, a benchmarking exercise against local wind measurements, either for average wind speeds or the gust intensity, has not been undertaken. The sampling period for the maximum speeds of the wind (such as if this is peak gusting speed or maximum hourly averaged speed) is also not clearly defined and therefore the reliability of how accurately this reflects the wind data at the site is unknown.

This NRA does not have the actual data recorded from the Port of Immingham; however, a previous 2021 ship simulation report by HR Wallingford[28] contains a breakdown of this data in the form of wind roses and summary comments. Differences were observed between the ABPmer wind assessment (using Humberside Airport data) and the HR Wallingford assessment (using Port of Immingham data), and since no comparative benchmarking exercise has been undertaken to correlate the Humberside Airport data to the local area, the Risk Assessment Team has considered the local Port of Immingham Data better representative of local conditions for the purposes of this risk assessment and would be representative of the wind experienced by a Ro-Ro / Ro-Pax vessel. The following indicative wind information and trends have been applied when considering risk in this NRA:

- Wind direction is most prevalent from the south west and, to a lesser extent, south. This is wind blowing off-berth for the IERRT and in the direction of the IOT Finger Pier.
- Highest wind speeds are from the south, south west and north.
- Winds show marginal seasonality.
- Average wind speed is predominately less than 23 knots (Force 6) with gusting predominately less than 29 knots (Force 7).
- Large variability is observed with south westerly mean wind speeds up to 29 knots (Force 7) and gusts up to knots 41 knots (Force) occurring. And northerly wind speeds up to 39 knots (Force 8) and gusts up to 47 knots (Force 9).
- Please note that wind data has not been provided and an independent assessment has not been undertaken. Values are based on limited wind rose information and wind gusting intensity and sampling duration are also not defined.

3.2.2 Waves

Wave measurements were taken by ABPmer and wave information from this has been used in this NRA. Waves show the following general information and trends:

- Wave direction is predominately from the north west and south east, being in line with the longest fetch on the waterway.
- Waves are typically less than 0.5 m significant wave height (Hs), but were recorded up to 0.84 m Hs.

[28] DJR6612-RT002-R03-00 Project Sugar – ABP Humber – Immingham East Development Navigation Simulation Study, Dec 2021 (HR Wallingford)

3.2.3 Current

Due to the high tidal range, large estuary volume, and relatively narrow constraints to the flow of water, the tidal currents within the Humber and at the Port of Immingham are very high and complex. Tidal measurements are understood to have been undertaken and used within the ABPmer NRA and a current profile has been applied in the ship simulations; however, due to the potential significance of tidal current inaccuracies it is only the indicative current information and trends that have been within the study area (particularly the manoeuvring area, IERRT terminal and IOT finger pier) that have been applied when considering risks in this NRA. The potential for inaccuracies arises due to:

- The high magnitude of the current speeds
- The differing current directions at various tide levels due to the local bathymetry (mud banks)
- The introduction of changes to this bathymetry caused by dredging
- The blockages of the tidal flow areas caused by deeper draft IERRT larger vessels and the potential for this to cause funnelling of the current
- The potential for higher than anticipated currents caused by storm surges (the tidal information provided by ABPmer also indicates the maximum tide was a result of storm surge and it is understood that negative surge can also result in tide heights lower than estimated. Surge heights are an increase or decrease in water level above the normal tidal influences. Depending on when the surge is experienced this can also result in increased current flow speeds if increase or decrease in surge aligns with the flooding or ebb tide.)

From the Admiralty Sailing Direction: North Sea (West) Pilot, the tidal streams off Immingham have an flood speed of 3.5 knots (spring) and 4.5 knots ebb. It also comments that terminal in the area can at times reach 4 knots for flood tides and 7 knots for ebb tides. Typical tidal flow of 3.5 knots flood and 4.5 knots ebb is also approximately consistent with ABP depth sounding drawings[29] and navigational charts.

- Therefore, whilst there is uncertainty in the accuracy of tidal current approximations and whilst those potential inaccuracies have the potential for significant implications on navigational risk, the general information summary statements below were considered when assessing risks in this NRA:
- The current is very strong with approximately 3.5 knots flood and 4.5 knots ebb springs, resulting in a challenging navigational environment.
- The current direction is not 180° in opposing directions between flood and ebb tides and further that the current direction may vary also between high or low water closer to the river edge.
- The current flow speeds and direction may vary due to the IERRT terminal, dredged area and other vessels alongside the IERRT, and most notably, at the IOT Finger Pier.

3.2.4 Tide

Tidal data was reviewed by ABPmer and tidal information from this review has been used in this NRA. Tides show the following general information and trends:

- Tidal range is large, with 7.3 m Mean High Water Springs (MHWS), which introduces large ebb and flood tidal currents (as noted above).

[29] Immingham Roads - Surveyed 18th April https://abpnotify.co.uk/AbpPublishedDocuments/_Immingham%20Roads%20-%20Surveyed%2018th%20April%20to%203rd%20May%202023%20(B&W).pdf

- Storm surge is possible and can combine with tides to introduce higher than predicted water levels. Maximum tide + surge record is approximately 9 m.
- Negative surge is understood to occur which can result in 0.5 m lower tide heights than predicted. Tide data is monitored by Vessel Traffic Services (VTS) from a tide gauge at Spurn.

3.3 Usage of the Navigational Area

The Immingham outer dock area (from the western end of the IOT to the eastern end of the IBT southwards) is already a busy and challenging navigational area that requires a considerable amount of traffic co-ordination in order to allow safe vessel operations. This area has vessels moving from the following key terminals:

1. IOT Finger Pier
2. Eastern Jetty
3. Immingham Dock
4. Western Jetty
5. IOH

In addition to the complexity of the area generally in relation to the traffic density is the requirement for vessels to sit within this location to await entry into the lock or their berth at IOT finger piers. These 'stemming' operations involve a vessel sitting head to tide (effectively facing into the tidal current) using minimal engine to counteract the current so they remain effectively stopped in relation to the seabed.

There are three general areas where vessels wait and stem the tide:

1. Off the Eastern Jetty – vessels for the dock sit heading WNW stemming the ebb tide awaiting their entry into Immingham Dock
2. Off the Western Jetty – vessels for the dock sit heading ESE stemming the flood tide awaiting their entry into Immingham Dock
3. Off the Eastern Jetty – vessels for the IOT Finger Pier sit heading ESE stemming the flood tide awaiting their berth becoming unoccupied on the IOT Finger Pier. An analysis of examples of vessels stemming in this area is shown in Section 4.5.2.

The use of the stemming areas improves the efficiency of the port allowing vessels to quickly enter the dock or berth once the lock/berth becomes available which in addition to time saving also reduces the labour required by combining the letting go of one vessel and the securing of the next.

The proposed terminal will sit between the IOT Finger Pier and Eastern Jetty and introduce up to six additional movements a day each expected to take up to 45 minutes on arrival and 20 minutes on departure. It is expected such movements would prevent vessels from stemming off the Eastern Jetty for either the Immingham Dock or the IOT Finger Pier thus compromising port efficiency. It is as yet unknown if the risks inherent in the physical presence of the IERRT would compromise vessel stemming off the Eastern Jetty at all times.

The coordination of traffic in this area is commonly extremely challenging for VTS Humber, this is most significant in the early evening when many of the scheduled liner services from Hull, Killingholme, IOH and Immingham Dock are scheduled to depart within a few minutes of each other. When these movements coincide with IOT Finger Pier or Immingham Eastern and/or West Jetty movements it increases complexity and pressure. Furthermore, when these movements coincide with the high water period (HW -2h to HW) there is also the added complexity of combination with large vessel movements (Passage Plan Vessels) leaving and berthing on the deep water berths (IOT, IBT, HIT).

3.4 Historical Vessel Traffic

Historical vessel traffic has been based on the DfT historical freight data and includes ship arrivals by port. Immingham and Grimsby are combined within the data but can be used to inform the study on vessel traffic volumes. Detailed vessel traffic analysis including track plots and vessel movement densities are detailed in Section 4.

Table 2 below indicates the DfT data for ship arrivals to Immingham and Grimsby since 2009. The basis on which the data was gathered was changed in 2017, making it difficult to directly compare the data from 2009 – 2017, with data from 2017 – 2022. The data for 2017 was undertaken on both bases though, and has been reproduced here as taken from the DfT source. Ship arrival numbers are vessels arriving into Immingham and Grimsby. On the basis that vessels only make only two movements per port arrival (one inbound and one outbound) and do not visit more than one terminal per arrival, the number of vessel movements is also shown. The representative average of number of arrivals and number of movements per day is also based on a calendar year. The tonnage throughput of Immingham and Grimsby can also be obtained through the DfT data which indicates that the amount of cargo moved through the ports remains relatively constant (apart from 2020 following effects of COVID). Combined with the information below that vessel numbers have reduced this shows that vessel capacity, and therefore most likely size, has been increasing.

Port arrivals for the Humber include Immingham and Grimsby, Hull, Rivers Hull and Humber, Goole, River Trent and River Ouse. This is indicative of the usage of the Humber waterway and, to an extent, of largely of the volume of traffic transiting past Immingham onto Hull, Goole and other river terminals further upstream. This has been included to provide insight into the potential for disruption in the event of a blockage or incident on the Humber. The DfT data captures commercial vessel port arrivals but does not capture the high volumes of the various small vessels, local service vessels and other vessel movements that will be operating within the study area. In essence, the data confirms that the waterway within the study area around Immingham is a very highly utilised maritime space.

Table 2: DfT Ship Arrivals Immingham/Grimsby 2009-2022

Year	Immingham and Grimsby				Humber			
	All cargo vessel arrivals *1	Average arrivals per day	Movements (in and out)	Average movements per day	All cargo vessel arrivals *1	Average arrivals per day	Movements (in and out)	Average movements per day
2009	7334	20.1	14668	40.2	12,046	33.0	24,092	66.0
2010	7923	21.7	15846	43.4	12,971	35.5	25,942	71.1
2011	8752	24.0	17504	48.0	14,108	38.7	28,216	77.3
2012	9383	25.7	18766	51.4	14,691	40.2	29,382	80.5
2013	8799	24.1	17598	48.2	13,681	37.5	27,362	75.0
2014	8572	23.5	17144	47.0	13,257	36.3	26,514	72.6
2015	8959	24.5	17918	49.1	13,688	37.5	27,376	75.0
2016	8548	23.4	17096	46.8	13,131	36.0	26,262	72.0
2017 *2	7912	21.7	15824	43.4	12,545	34.4	25,090	68.7
2017 *3	7500	20.5	15000	41.1	12,094	33.1	24,188	66.3
2018	7197	19.7	14394	39.4	12,199	33.4	24,398	66.8
2019	7126	19.5	14252	39.0	11,859	32.5	23,718	65.0
2020	6511	17.8	13022	35.7	10,333	28.3	20,666	56.6

Year	Immingham and Grimsby				Humber			
	All cargo vessel arrivals *1	Average arrivals per day	Movements (in and out)	Average movements per day	All cargo vessel arrivals *1	Average arrivals per day	Movements (in and out)	Average movements per day
2021	6636	18.2	13272	36.4	10,244	28.1	20,488	56.1
2022	6683	18.3	13366	36.6	9,930	27.2	19,860	54.4
*1 data from DfT. Includes commercial vessels for Tankers, Ro-Ro, Container and Other Dry Cargo. Excludes "Other Vessels" category and "Passenger vessels. *2 calculated on old basis (2017 and before) *3 calculated on new basis (2017 and after).								

3.5 Future Vessel Traffic

3.5.1 Baseline Vessel Traffic – Excluding IERRT

The future baseline traffic projections used by ABPmer are based on global economies a 1% increase on tonnage has applied throughput. The estimated future growth is shown in Table 3 below (and Table 12 of the ABPmer NRA). The future planned infrastructure developments other than the IERRT may also cause more pronounced jumps than the general 1% growth assumed for vessel numbers operating in and around Immingham. These potential future developments include:

- Able Marine Energy Park located in South Killingholme, immediately upstream of Immingham. Predicted vessel numbers are: 500 per annum, including offshore installation vessels, heavy support vessels and cargo ships.
- Importantly, offshore wind development projects will often involve high volume / short duration construction schedules to reduce construction time and costs. The usage profile for the Able Marine Energy Park may vary significantly year on year and in peak and non-peak construction times.
- ABP's proposed Immingham Green Energy Terminal (IGET)[30] [31] located immediately downstream of the IOT (opposite side of IOT trunkway to IERRT). Introduction of liquid green hydrogen production and necessary imports of ammonia. Predicted vessel numbers are 292 per annum, up to 250m in length (55,000 tonnes).

As discussed above, the DfT data captures commercial vessel port arrivals but does not capture the high volumes of the various small vessels, local service vessels and other vessel movements that will be operating within the study area. With more commercial vessel moment, there will also be a corresponding increase of other vessels, including port service vessels, to support this growth. These vessel movements will further contribute to the increased usage of the waterway.

When considering future baseline scenarios and risk profiles, it is important to recognise that the total number of waterway movements will increase substantially throughout a 50 year project lifespan and potentially further still for the undefined extended lifetime of the IERRT terminal beyond 50 years.

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[30] IGET website, https://immínghamget.co.uk/

[31] IGET PEIR addendum https://immínghamget.co.uk/wp-content/uploads/2023/05/IGET-Supplementary-Consultation-Report-final.pdf

Table 3: Estimated Future Growth at Immingham and Grimsby

Immingham and Grimsby				
Future year	Projected vessel arrivals	Average arrivals per day	Vessel movements (in and out)	Average movements per day
2019	7126	19.5	14252	39.0
2022	7342	20.1	14684	40.2
2030	7950	21.8	15900	43.6
2040	8782	24.1	17564	48.1
2050	9701	26.6	19402	53.2
2060	10716	29.4	21432	58.7
2070	11837	32.4	23674	64.9
2072	12075	33.1	24150	66.2

3.5.2 Baseline Vessel Traffic – Including IERRT

The IERRT development is planned to accommodate three vessels per day for every day of the year excluding Christmas. Total additional movements of Ro-Ro's / Ro-Pax's for the IERRT will increase the baseline growth estimates by up to 2,190 vessel movements per year. In 2030 this assumes a total of 18,090 vessel movements per year – a 14% increase in vessel traffic from the baseline year 2030 and reasonably comparable to the busiest year 2012 with 18,766 vessel movements. In the 50 year projection, the year 2072, this assumes a total of 26,340 vessel movements per year – a 66% increase in vessel traffic from the baseline year 2030 and a 40% increase on the busiest year in DfT data, 2012.

As discussed in Section 3.4, the additional small service vessels will also be required to support the Ro-Ro / Ro-Pax operations, such as towage, dredgers, survey vessel, etc, will also increase the amount of small vessels operating within the Port of Immingham above the projected vessel numbers.

3.6 Incident Analysis

Historical incident data has been assessed from local UK-based incident data records and international data sources or literature. These primarily include the two sources listed below:

- MAIB incident data records (1992-2021) for UK-based incidents and Immingham local incidents.
- MarNIS incident data records (2011-2020) or local Immingham incidents recorded by ABP. Incident data information from ABPmer NRA has been used to facilitate this assessment.

3.6.1 Notable Incidents in Immingham and on the Humber

A summary of major incidents that have occurred in Immingham or on the Humber are shown in Table 4 below to assesses the findings and/or circumstances that are relevant to the geographical location of the navigational waterway.

Abridged details of the incidents are included in the table; however, in summary these incidents indicate the following repeated factors:

- Strong tidal flow
- Dense fog and adverse visibility

- Navigating around or in proximity to other vessels

Table 4: Maritime Incidents at Immingham/Humber

Incident	Vessels	Incident Date	Description
Collision	Petunia Seaways and Peggotty	19/05/2016	*(MAIB)* Petunia Seaways collided with the historic motor launch Peggotty after the skipper of Peggotty became disorientated in the dense fog and took the motor launch into the shipping channel and the path of Petunia Seaways, which was not sounding a regular fog signal at the time of incident. The motor launch suffered severe structural damage and began to take on water but a local pilot launch crew were able to rescue the skipper and other person on-board so that there were no injuries or significant pollution.
Collision	City of Rotterdam and Primula Seaways	03/12/2015	*(MAIB)* The car carrier City of Rotterdam collided with the ferry Primula Seaways in dense fog after the pilot became disorientated (due to relative motion illusion) and failed to correct the carrier's path which had been set toward the path of inbound ferry. Both vessels were sustained major damage but made their way to Immingham without assistance. There were no serious injuries or pollution.
Collision	Audacity and Leonis	23/01/2015	*(MAIB)* Tanker Audacity collided with cargo vessel Leonis in the Humber Estuary precautionary area during dense fog. Cause attributed to Pilots on both vessels not making a full assessment of risk of collision and poor VTS procedures.
Contact (Allision)	CFL Patron	29/08/2010	*(MAIB)* The general cargo vessel CFL Patron suffered a controllable pitch propeller (CPP) control power failure while manoeuvring at 1.6 knots in the lock at Immingham docks. Despite the master's attempts to recover control of the CPP system, the pitch remained at approximately 40% ahead, causing the vessel to accelerate. Although a forward spring was deployed and the tug Guardsman attempted to slow the vessel's progress by pushing, the vessel impacted heavily with the outer lock gates at 3.7 knots. Minor damage was sustained to vessel and tug. Significant damage was sustained to lock gates. Ship owner was encouraged to tighten up pre-departure checks and preparedness for propulsion failure. Cause of failure not able to be identified.
Contact (Allision)	Fast Ann	19/01/2010	*(MAIB)* Fast Ann, an unmanned cargo ship, broke free from its moorings and collided with IOT infrastructure. Despite VTS endeavouring to identify the radar target and a tug endeavouring to secure a line to the vessel, efforts were hampered by a 4-knot spring ebb tide and dense fog. Risk assessments and procedures were reviewed, particularly regarding unmanned vessels during spring tides.
Collision	Fast Filip and berthed Tanker	06/07/2008	*(MAIB)* General cargo vessel Fast Filip was heading down river from Goole on an ebb tide during hours of darkness, destined for Immingham Dock. ABP Pilot onboard, good visibility. Vessel commenced a turn around the stern of an inbound ferry, resulting in colliding with a tanker berthed at IOT1. Alongside vessel sustained a hole in the hull plating. Cause identified as Pilot's lack of planning and situational awareness, plus poor awareness of the effect of tidal stream and speed. Poor bridge resource management also identified.

Incident	Vessels	Incident Date	Description
Collision	Ro-Ro vessel with multiple smaller vessels (MAIB database anonymised)	02/04/2002	*(MAIB)* A high sided RORO/LOLO vessel sailed from the berth in marginal but steady winds. When the vessel approached a critical point in the manoeuvre where the vessel entered the basin a strong squall passed through the area. Vessel was blown onto the lea berths which were occupied at this time. The port anchor was let go but was too late to prevent contact with the moored craft.
Contact (Allision)	Stena Gothica	02/04/2002	*(MAIB)* During hours of darkness, Ro-Ro vessel Stena Gothica struck the eastern jetty, during a spring ebb tide, while approaching Immingham lock. A 3-metre gash was sustained in the port side shell plating below the waterline, leading to a large ingress of water into the lower cargo hold. Cause was identified as the master's decision to take the con prior to the lock, and his under estimation of the strength of the tide.
Collision	Bulk Carrier and Oil Tanker (MAIB database anonymised)	01/12/2000	*(MAIB)* bulk carrier was inbound for Immingham Bulk Terminal. She had a pilot embarked and had secured a tug on her bow before reaching the oil terminal. In anticipation of having to turn off the entrance to the dock, the pilot reduced the vessel's speed as she approached the oil terminal. Making only 3 knots with a 20 knot wind on her port quarter and in strong flood stream she lost steerage and turned towards an oil tanker moored alongside the oil terminal. Corrective action was taken by the pilot using helm, engine and bow tug, but failed to prevent collision. Subsequent investigation highlighted that: vessel's speed was insufficient to maintain steerage in prevailing conditions.
Contact (Allision)	Bohinj	02/02/2000	(*Local Expertise*) Cargo Vessel Bohinj allided with the IOT after the vessel lost steerage on passage to Immingham Dock. This was because the pilot was unable to maintain control of the vessel in the strong tide.
Collision	Xuchanghai and Aberdeen	12/12/2000	*(MAIB)* Bulk carrier Xuchanghai, inward to Immingham Dock, collided with the moored shuttle tanker Aberdeen, berthed at IOT3. Aberdeen sustained holes in her hull plating above the waterline. A contributing cause was poor safety arrangements and procedures in respect of ABP for vessels proceeding to Immingham Dock and other vessels in the vicinity of Immingham Oil Terminal. NtM09/2001 was retrospectively published in which a minimum passing distance and a location by which tugs should be secured was outlined.

3.6.2 MAIB Incident DATA

The MAIB dataset between number of incidents for the approximate Immingham area, broken down by incident type, is shown in Table 5 below for the period 1992 to 2021.

The analysis has focussed on the incidents that provide insights to the navigation risk of the IERRT project. Incidents that unrelated to ship navigation and navigational risk have been excluded. The data indicates that contacts (allisions) are the most likely incident type reported to the MAIB with over 50% of these key incident categories for navigation, followed by mechanical failures, collisions, then fires / explosions. From this data, the 20 year average for shown there are around 9 incidents per year. The most recent 10 years average shows around 11.5 incidents per year. The most recent 5 years average shows around 13.2 incidents per year. It is not clear what the increase in yearly average in more recent years is due to; however, this is likely due to more incidents being reported, rather than more incidents occurring.

Table 5: MAIB Incidents 1992-2021

Year	Collision	Contact	Fire / Explosion	Mechanical Failure	Total per year
Proportion	**13%**	**52%**	**9%**	**26%**	**100%**
Total per type	**25**	**96**	**17**	**48**	**186**
2021	2	3	1	4	10
2020	0	9	2	8	19
2019	3	6	0	2	11
2018	1	5	0	4	10
2017	3	8	1	4	16
2016	1	7	0	7	15
2015	0	13	4	3	20
2014	2	4	1	1	8
2013	1	3	1	3	8
2012	1	1	0	1	3
2011	1	3	1	1	6
2010	1	4	0	0	5
2009	2	3	0	0	5
2008	2	6	0	1	9
2007	2	3	0-	1	6
2006	0	9	1	0	10
2005	0	1	1	1	3
2003	1	0	0	1	2
2002	0	5	1	1	7
2000	1	0	1	1	3
1999	0	1	0	0	1
1997	1	0	0	0	1
1996	0	1	1	0	2
1995	0	1	0	3	4
1994	0	0	0	1	1
1992	0	0	1	0	1

3.6.3 MarNIS Incident Data

ABP uses the MarNIS incident reporting database for the Humber and incidents recorded from 2011 – 2020 had been provided to ABPmer to undertake the ABPmer NRA. The MarNIS incident database also logs incidents that do not require reporting to the MAIB and, therefore, it can potentially provide greater clarity on the number of incidents that have occurred in the Port of Immingham study area. The MarNIS data is tabulated in Table 5 of the ABPmer NRA. From all incident categories, the incidents that are unrelated to ship navigation and navigational risk have been excluded leaving only the key incident categories of Collision, Equipment Failure (Vessel), Fire / Explosion, Grounding, Impact with Structure and Striking with Ship (Moored). These are reproduced below in Table 6.

The MarNIS data indicates that approximately 183 incidents per year occur in the area (all incidents) and approximately 134 incidents per year for those key incident categories for navigational risk. The data indicates that Equipment Failures are the most likely incident type reported in MarNIS with 58% of the reported incidents within the key incident categories for navigation risk. This is followed by Impact with Structure (contact), then to a far lesser extent Collisions, Striking with Ship (Moored), Grounding and Fires / Explosion.

From the data, the 10 years average shows around 133.8 incidents per year. The most recent 5 years average shows around 121.8 incidents per year. Compared to MAIB data, it can be seen that the MarNIS system captures a substantially larger number of reported incidents which did not require reporting to the MAIB.

It can be seen in **Figure 9** below that there is significant concentration of incidents around several key locations including:

- High concentration of equipment failure incidents (light green dots) reported near the IOT and on approaches to the Port of Immingham.
- Notable concentration of impacts with structures (magenta dots) around the IOT infrastructure.
- Notable concentration of impact with structures (magenta dots) around the other Ro-Ro terminals in Killingholme and the Immingham Bulk Terminal (DFDS)

Table 6: MarNIS Incident Data 2011-2020

Year	Collision ship - ship	Equipment failure (vessel)	Fire / Explosion	Grounding	Impact with Structure	Striking with ship (moored)	Total per year
Proportion	**2%**	**58%**	**1%**	**2%**	**34%**	**2%**	**100%**
Total per type	**32**	**778**	**20**	**28**	**452**	**28**	**1338**
2020	1	63	2	1	23	1	91
2019	5	45	0	0	22	2	74
2018	3	81	0	6	30	0	120
2017	4	132	4	4	55	4	203
2016	3	77	2	6	30	3	121
2015	4	88	3	5	36	0	136
2014	2	84	2	2	47	4	141
2013	3	84	3	1	77	5	173
2012	5	72	1	0	66	6	150
2011	2	52	3	3	66	3	129

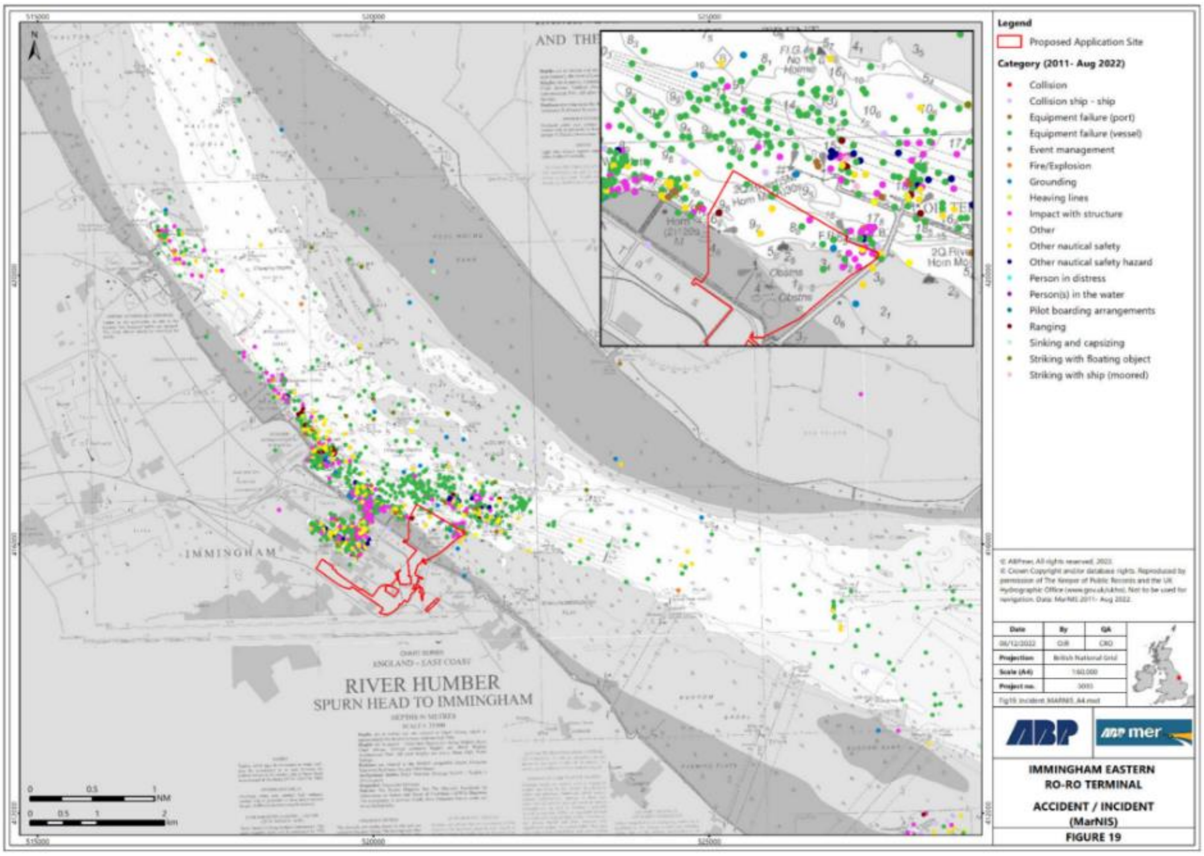

Figure 9:Accidents / Incidents recorded in MarNIS (from ABPmer NRA, Figure 19)

3.6.4 Summary

Historical incidents indicate that Contact / Impact with Structures and Mechanical / Equipment Failures are the most prevalent incident type. The cited causes of historical incidents in area regularly refer to strong currents, winds and adverse visibility being some of the dominating contributing factors.

A high level analysis of incidents and vessel movements using the most recent five years data is outlined for MAIB-reportable incidents benchmarked against DfT ship arrivals data. When considering these averages, it should be noted that the DfT data consists of arrivals for both Immingham and Grimsby, whereas the MAIB data is focussed on the Immingham area only.

Using the yearly DfT vessel data in Table 2 above, and the yearly MAIB incident data in Table 5 above, the number of vessel movements per incident has been assessed for each year. Over the most recent five years, on average there is one incident every 1,316 vessel movements. Broken down as (rounded figures):

- 1 collision every 9,370 movements
- 1 contact every 3,200 movements
- 1 fire / explosion every 13,900 movements
- 1 mechanical / damage every 4,800 movements

The MarNIS data cannot be as readily used to relate incidents and movements because these incidents are recorded across a broader range of incidents severities and would likely include a large number of incidents that occur on/by/to vessels that are not captured within the DfT commercial vessel data. Therefore, without the details of the MarNIS incident database, or the details of each incident, the indicative incident rates can not be derived.

The comparison of MAIB and MarNIS incident numbers (13.2 vs 121.8 incidents per year on average, respectively) are however, informative and indicate that the MAIB dataset considerably understates the number of incidents that have significant potential to result in serious consequences. The above incident assessment can be used to provide guidance into the potential likelihood of occurrence when considered alongside the unique factors of the proposed development, such as location, manoeuvring difficulty, manoeuvring time, proximity to structures, route or vessels, etc.

4 Vessel Traffic Analysis

To establish an indication of current traffic levels and disposition of vessel traffic activity in the vicinity of Immingham Dock, AIS data was collated from an AIS received located at the IOT. AIS data is an informational broadcast of vessel parameters including speed, heading, location (coordinates), course, etc together with vessel particulars such as vessel name, size, type, length, breadth, etc. The AIS data for the months of June and July 2023 were analysed to better understand the general / representative disposition of vessel movements in and around the study area. The data used is for the summer months and the full extent of seasonal vessel traffic variations may also fluctuate. For the purpose of this NRA the study area is as illustrated by the red boundary in **Figure 10**. However, AIS data tracks outside of this study area are also included in data visualisation plots.

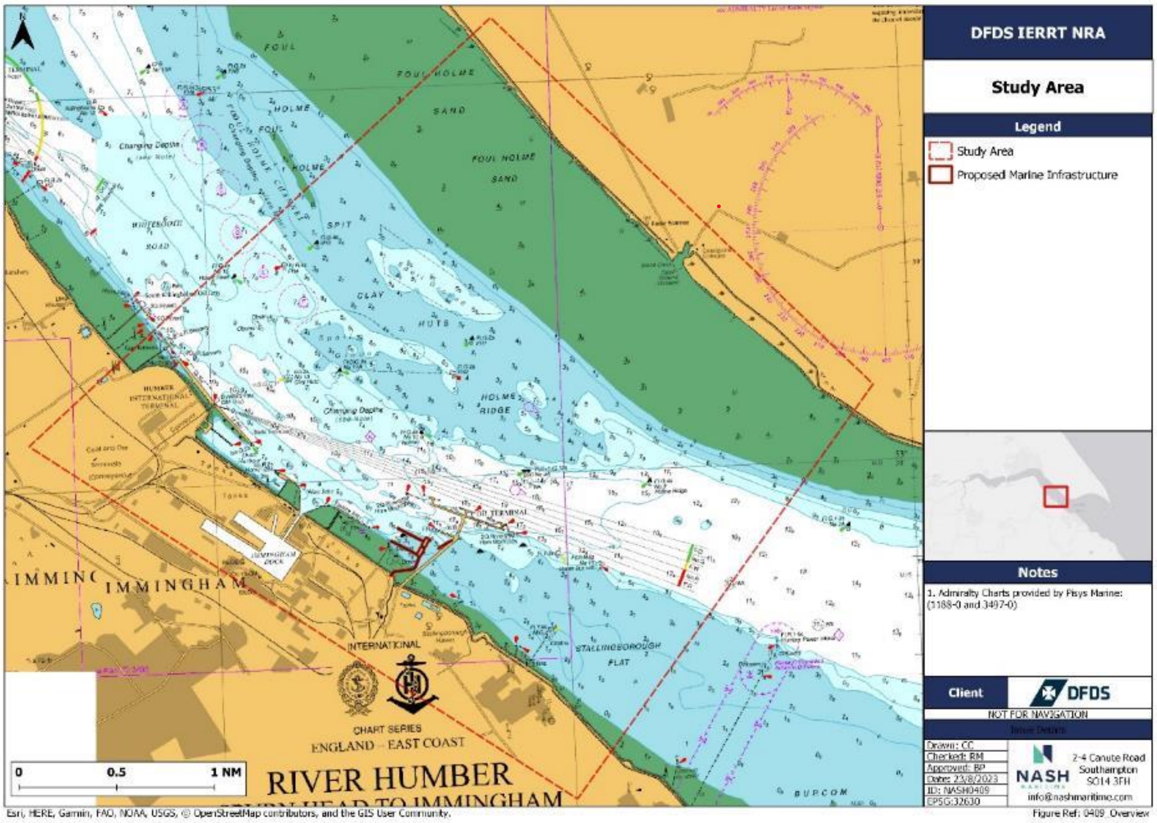

Figure 10: Study Area.

To establish an understanding of vessel movement and passage through the study area the following analysis was conducted:

- Vessel track and density analysis by vessel type (see **Section 4.1**);
- Vessel activity around individual terminals and jetties within the study area (see **Section 4.2**);
- Gate analysis (vessels passing across a defined line) across two sections within the study area (see **Section 4.3**);
- Tidal analysis of vessel movements on the ebb and flood tide, and 1 hour either side of high and low water (see **Section 4.4**); and
- Swept path analysis of tankers berthing / unberthing at IOT Finger Pier in proximity to the proposed infrastructure (see **Section 4.5**).

Together these analyses provide the evidence behind the understanding and characterisation of vessel traffic that informs the identification and assessment of navigation risk within this NRA.

4.1 Vessel Track and Density Analysis by Vessel Type

Vessel traffic analysis was undertaken on the AIS datasets based on the follow vessel type classifications:

- Cargo Vessels e.g. container ships, Ro-Ro cargo vessels;
- Tankers e.g. oil/chemical tankers, LNG/LPG tankers, estuarial barges;
- Passenger Vessels e.g. ferries;
- Tug and Service Vessels e.g. tugs, pilot vessels, dredgers, SAR, military / law enforcement vessels, port tenders, survey vessels;
- High Speed Craft (HSC);
- Recreational Vessels e.g. sailing vessels, pleasure cruisers; and
- Fishing Vessels.

4.1.1 Cargo Vessels

The River Humber has serval cargo terminals resulting in a high density of cargo vessel transits. As shown in **Figure 11,** Immingham Dock receives both container and Ro-Ro cargo vessels typically <200m whilst the DFDS terminal at Immingham Outer Harbour (IOH) receives larger Ro-Ro cargo vessels of up to 250m LOA. Over the 2 months of data collection, there were approximately 1000 cargo vessel transits (~17 per day) into Immingham Dock, and 300 cargo vessel transits (~5 per day) to IOH.

As shown in **Figure 12**, the highest cargo vessel density lies within the centre of the main navigation channels and alongside berths in Immingham Dock and IOH. Typically, larger vessels (>200m LOA) and vessels accessing Immingham Dock / IOH transit through the deeper southern channel whilst smaller cargo vessels passing through the region use the shallower / narrower northern channel.

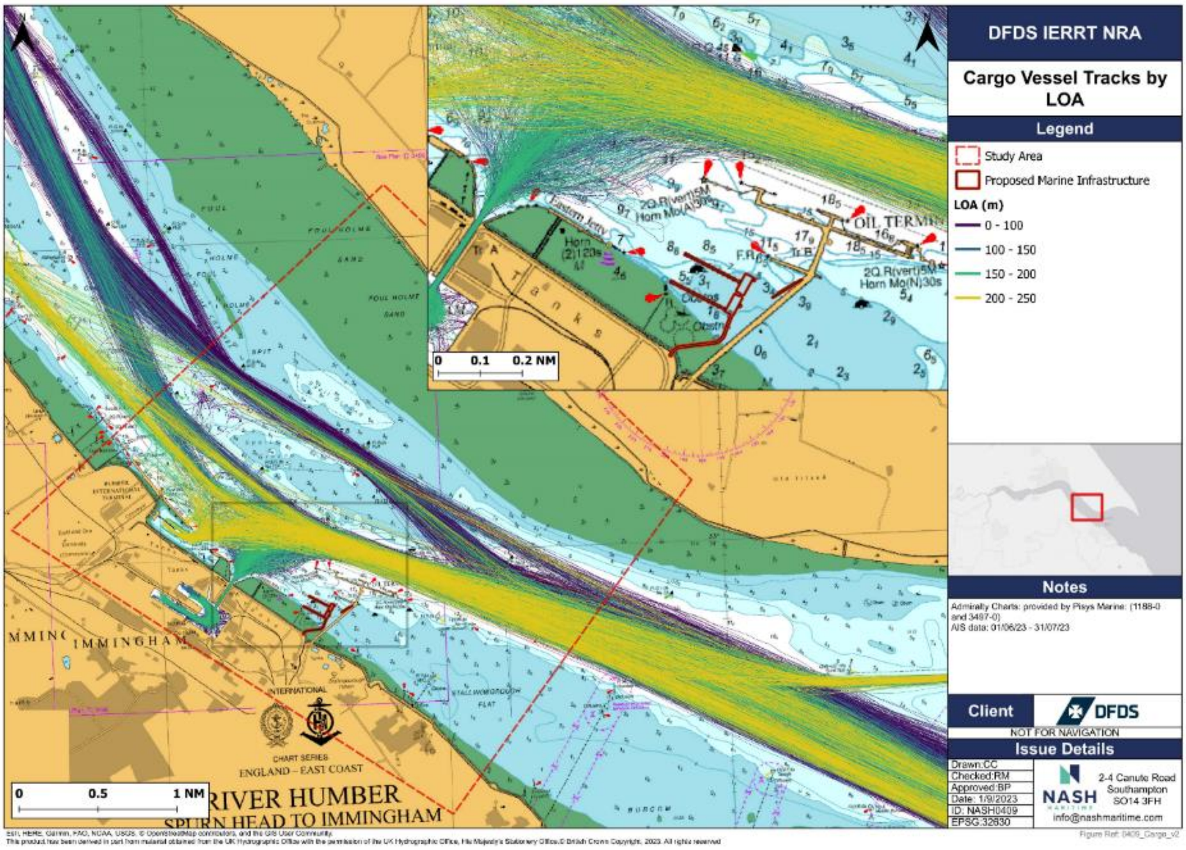

Figure 11: Cargo Vessel Tracks.

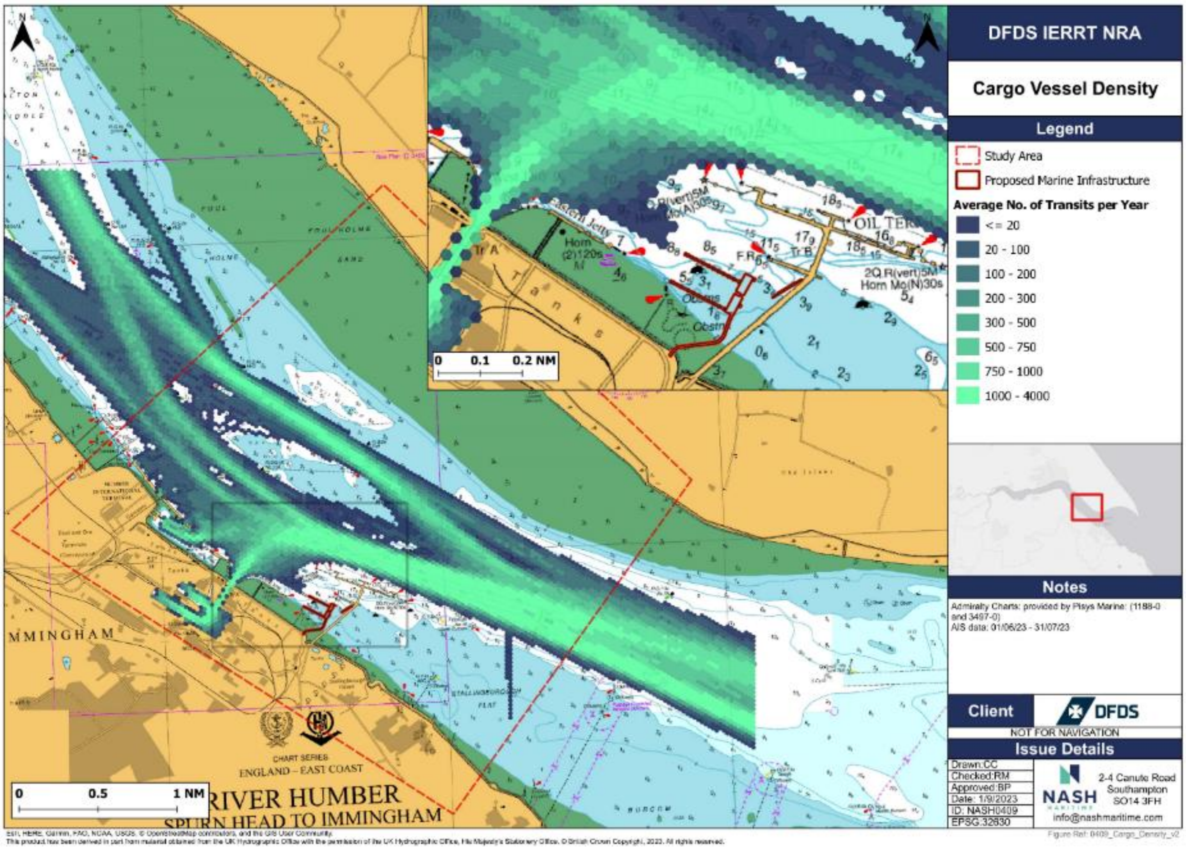

Figure 12: Cargo Vessel Transit Density.

4.1.2 Tankers

As shown in **Figure 13** and **Figure 14,** there are several oil / gas terminals in the Humber region resulting in a high density of tanker and estuarial barge activity within the study area. These include:

- Immingham Oil Terminal (IOT);
- IOT Finger Pier; and
- Immingham Gas Terminal (IGT) / South Killingholme Oil Jetty.
- IOT has 3 berths and receives tankers between 100 - 275m LOA, with approximately 4 tanker visits per day. IOT Finger Pier is positioned within 100m of the proposed infrastructure and receives over 120 tankers per month (~4 tankers per day). All tankers visiting IOT Finger Pier are exclusively <100m LOA. IGT / South Killingholme Oil Jetty are positioned to the west of the study area and are less busy than the other oil / gas terminals in the region. Over the study period, 177 tanker transits were recorded at IGT / South Killingholme Oil Jetty which is just under 3 transits per day.

There is considerable tanker activity on the Eastern Jetty and West Jetty which are situated either side of the entrance to Immingham Dock. The jetties are used as holding locations for tankers waiting to berth / depart. Over the two month period of data collection, tankers utilised the jetties on approximately 130 occasions.

- **Figure 14** shows that approximately 95% of tankers accessing terminals / jetties in the study area use the southern channel to navigate. Across the 2 month period, there are only 30 tanker transits navigating the northern channel to pass through the region, all of which are <100m LOA.

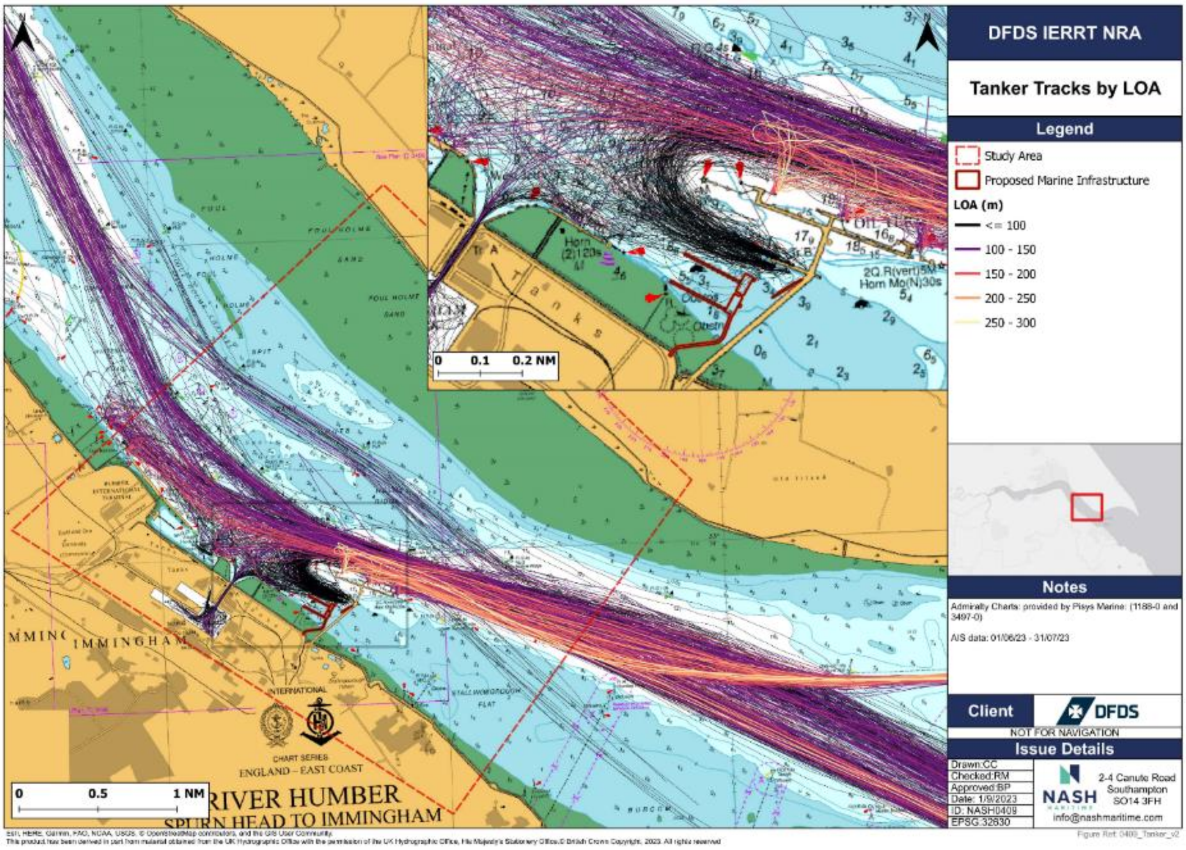

Figure 13: Tanker Tracks.

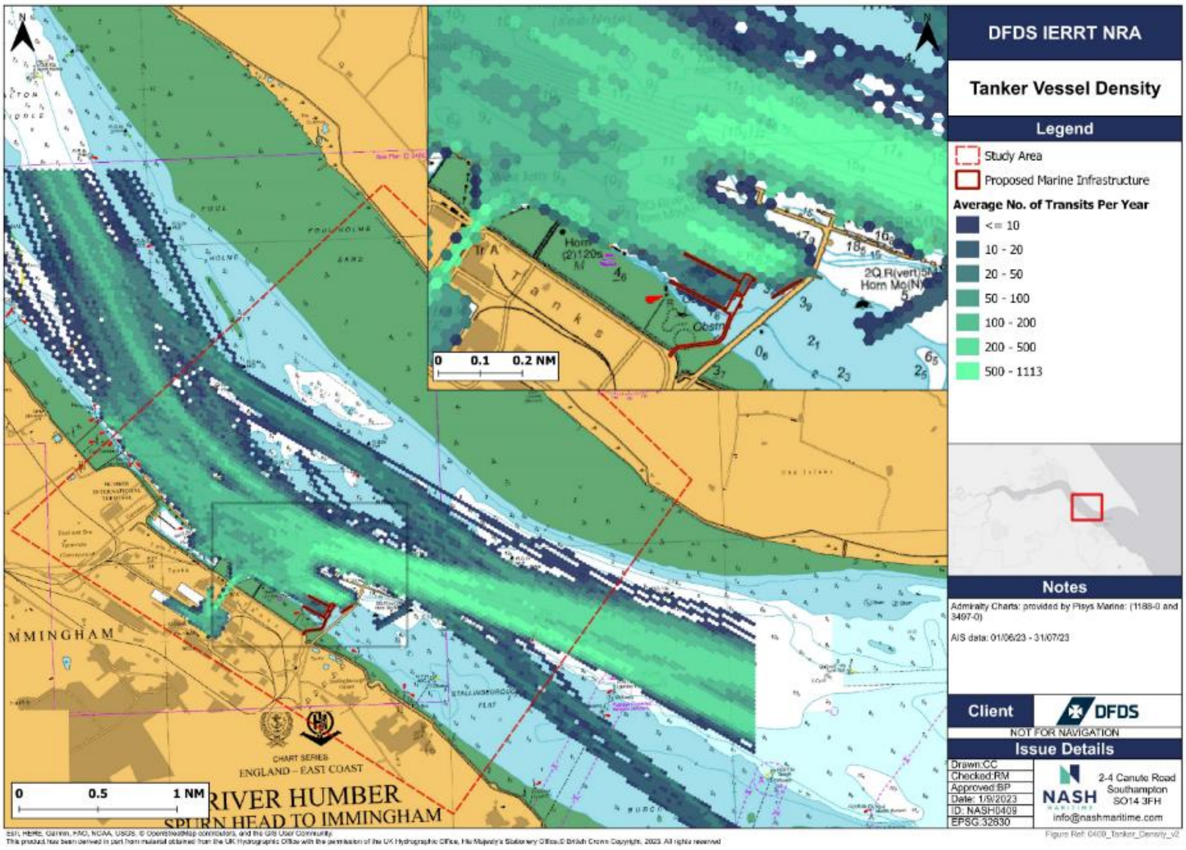

Figure 14: Tanker Transit Density.

4.1.3 Passenger Vessels

Figure 15 and **Figure 16** show that there are several ferries operated by Stena Line and P&O Ferries that transit through the study area. All P&O ferries pass through the study area as they transit to / from the terminal in Hull which is situated further upriver. All Stena Line ferries berth at the Killingholme which is located 1.4nm northwest of the study area.

Over the two month period of data collection, there were ~240 ferry transits of which 64% used the southern navigation channel and the remaining 36% used the northern channel. The ferries recorded during this period range in length from 170 – 215m.

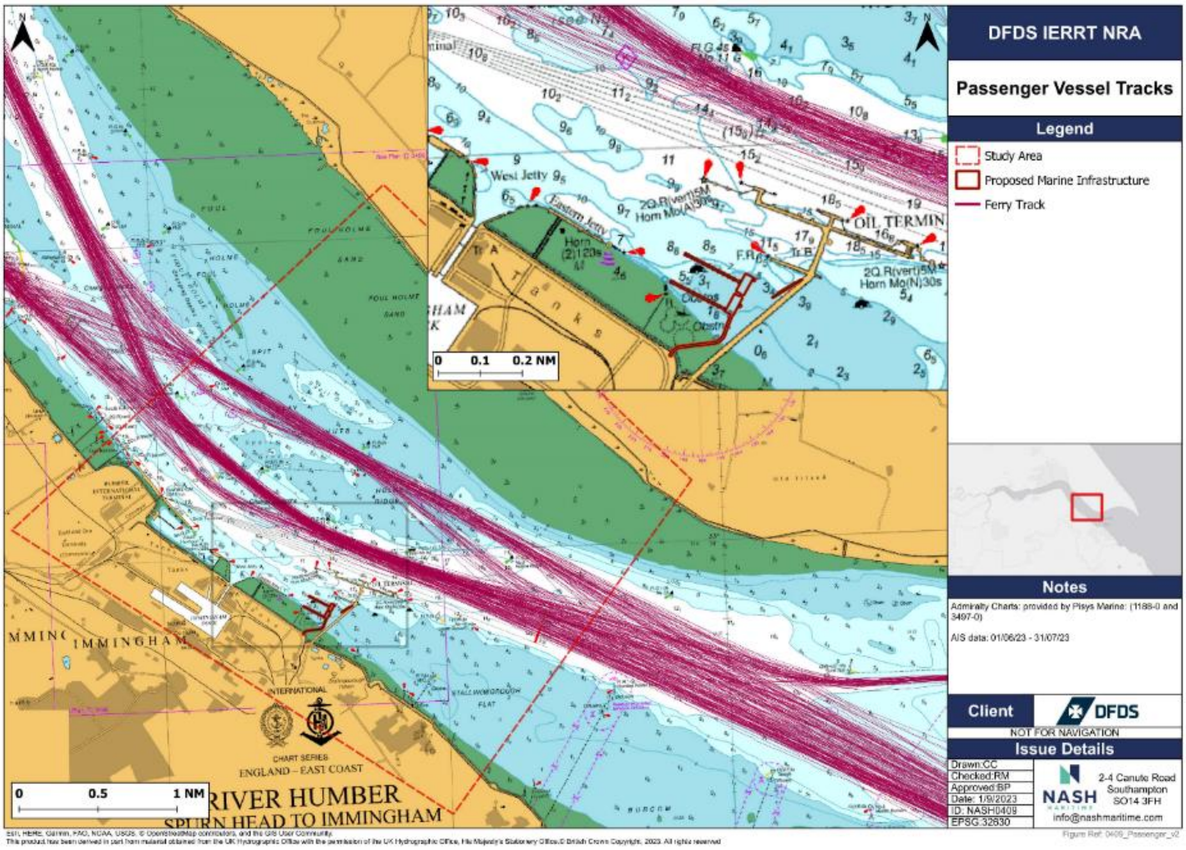

Figure 15: Passenger Vessel Tracks.

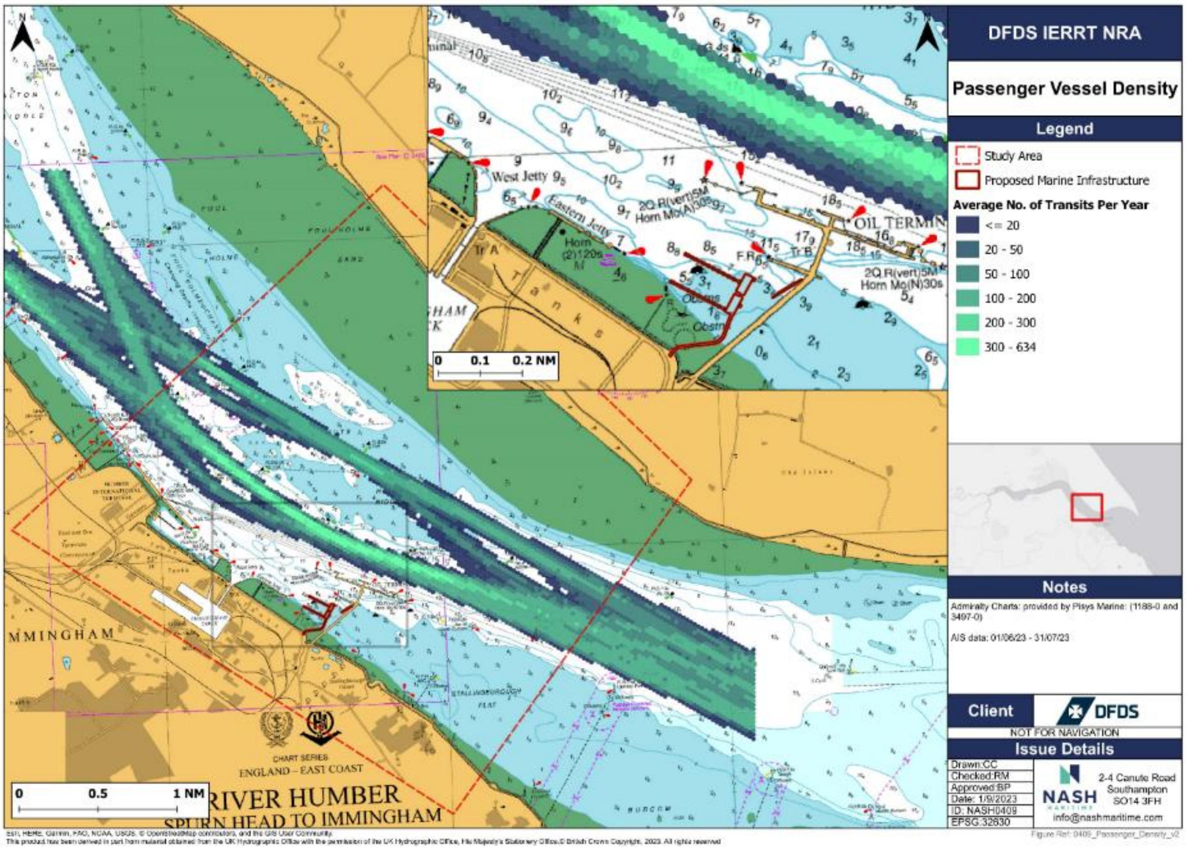

Figure 16: Passenger Vessel Transit Density.

4.1.4 Tug and Service Vessels

Figure 17 and **Figure 18** show a significant number of tug and service vessel movements within the study area due to the high level of commercial activity taking place.

On average there are ~33 tug movements within the study area per day, however, this fluctuates daily with the number of tankers / cargo vessels operating within the region on any given day. Tug activity is concentrated around the jetties and terminals as well as Immingham Dock as they assist larger vessels arriving / departing their berths.

There is limited pilot vessel, port tender, SAR and law enforcement activity within the study area. Most transits show vessels passing through the region, with only ~10 transits showing vessels operating in proximity to the port of Immingham.

Figure 17 shows that several hydrographic surveys have been conducted within the study area by the vessels *Humber Sounder* and the *Humber Surveyor.* All surveys are scheduled in advance and are periodically undertaken to confirm channel and berth depths. **Figure 19** shows that there's significant dredging activity within Immingham Dock and the IOH berths, with the spoil ground being situated on Holme Ridge within the centre of the river. There were up to 70 dredger transits within both Immingham Dock and around the IOH berths over the 2 month data collection period. Dredgers of up to 80m LOA were utilised. It is worth noting that dredging takes place over concentrated periods of time in which several trips between berth and spoil ground are made successively. As with the hydrographic surveys, dredging is scheduled ahead of time and typically coordinated around commercial cargo movements. The additional maintenance dredging requirements of the IERRT would require similar patterns of works as shown below with transits from the IERRT marine development site across the main channel to the spoil groups at and near Holme Ridge.

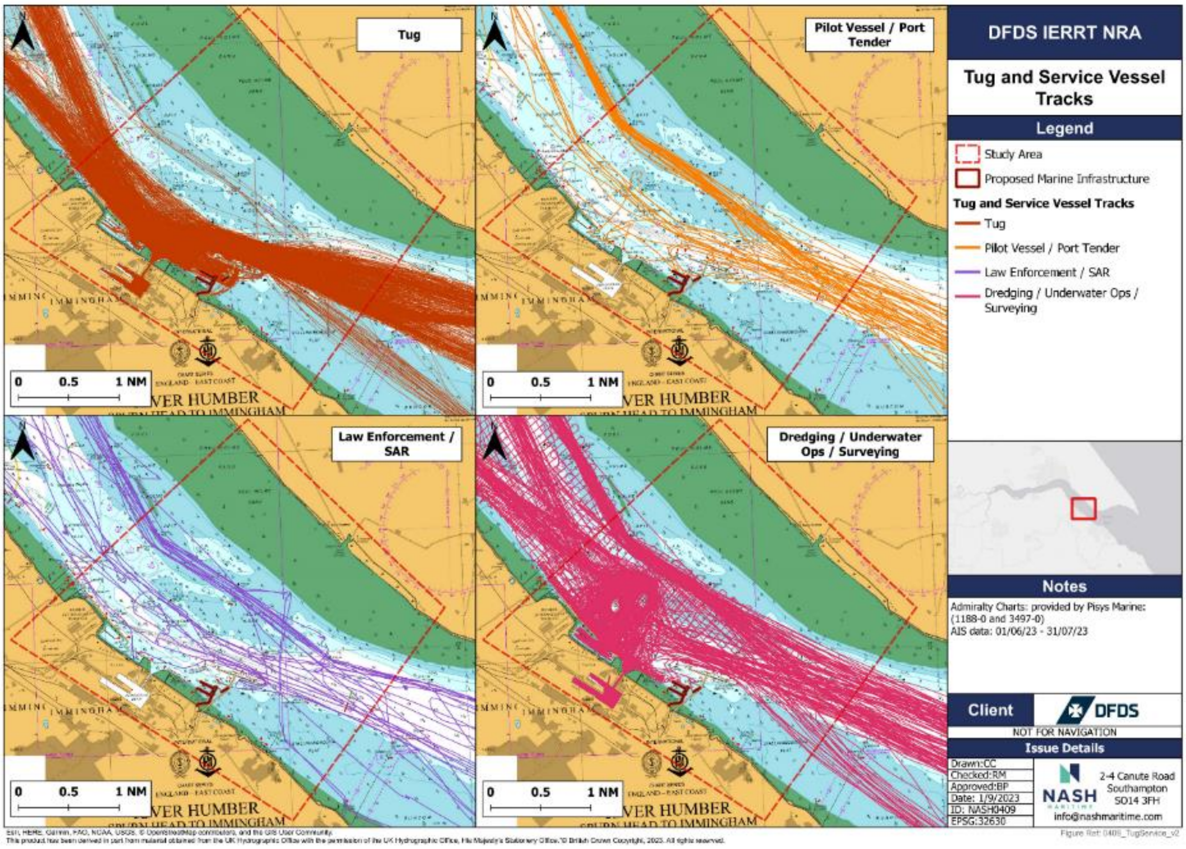

Figure 17: Tug and Service Vessel Tracks.

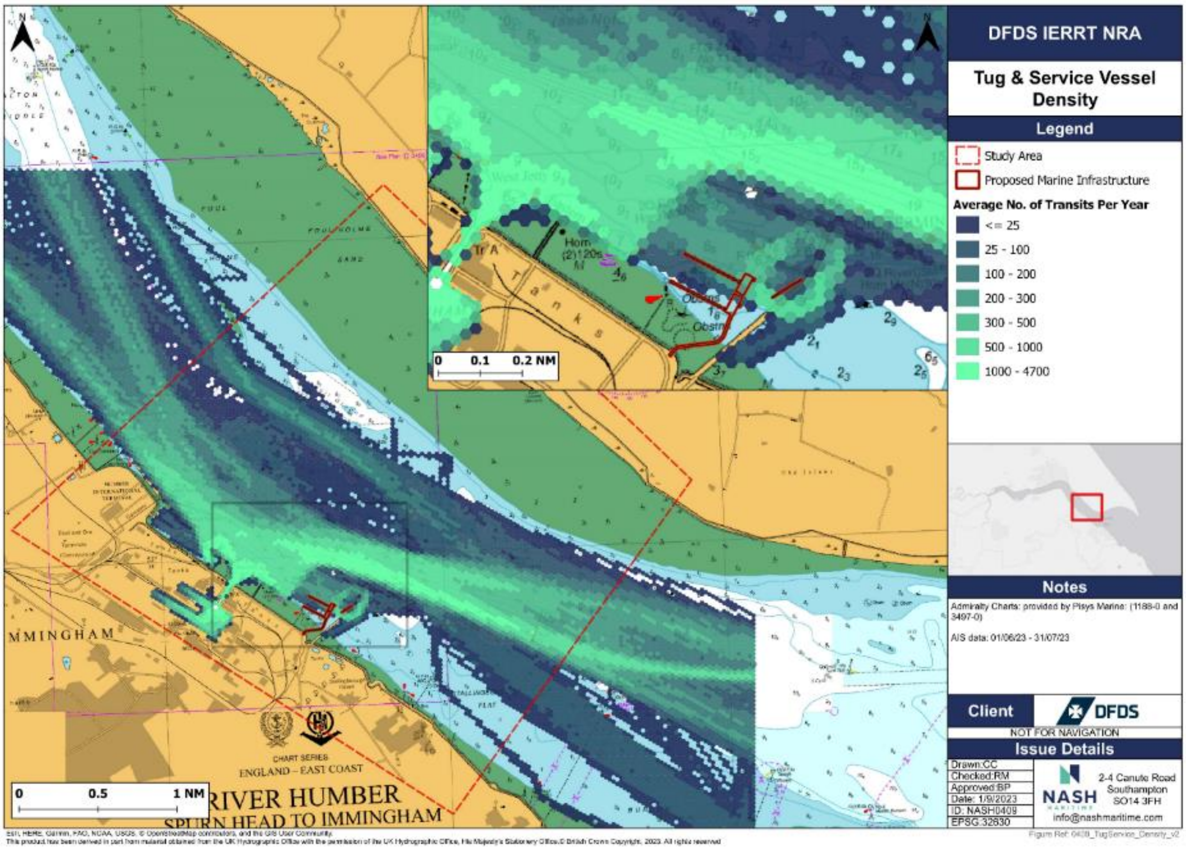

Figure 18: Tug and Service Vessel Transit Density.

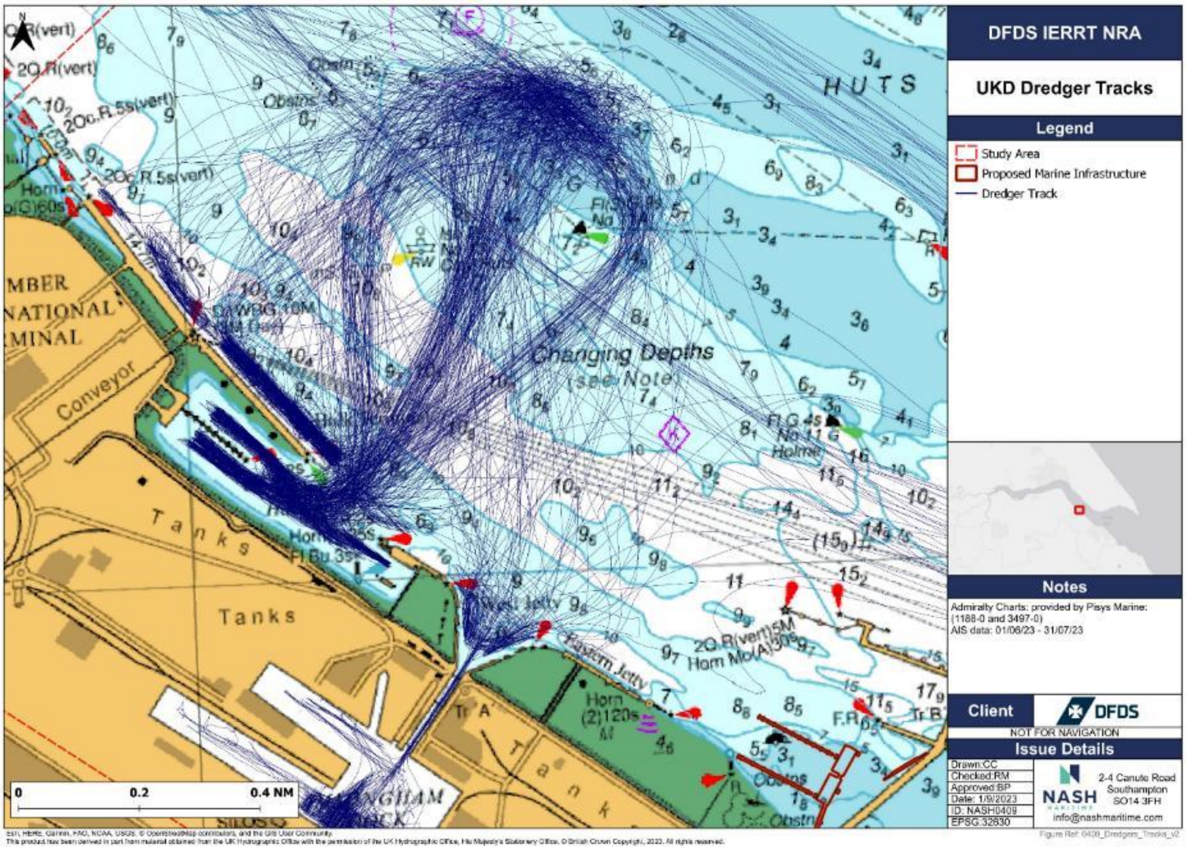

Figure 19: Dredger Tracks and Transit Density.

4.1.5 Other Vessels

Other vessel activity within the study area is very limited, as shown in **Figure 20**. All recreational, fishing and HSC transits show vessels passing through the region, the majority of which use the northern channel.

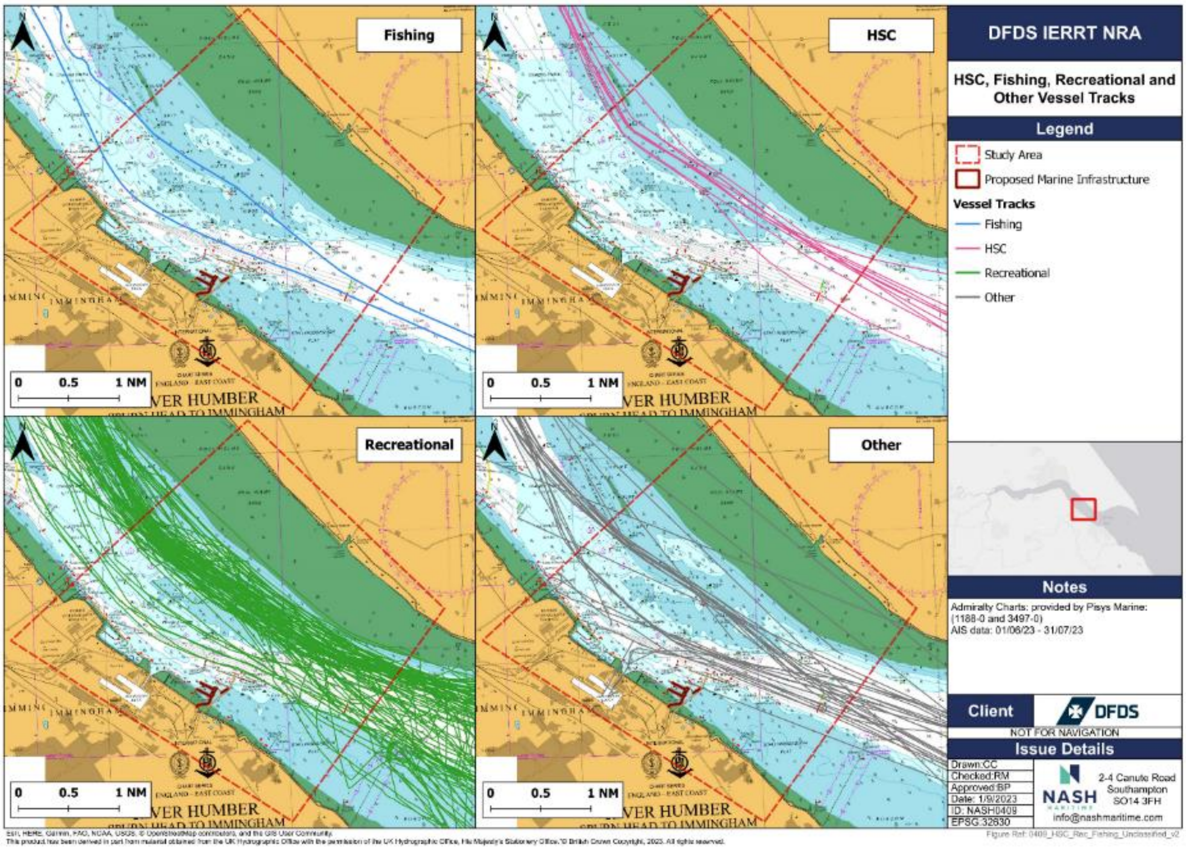

Figure 20: HSC, Recreational, Fishing and Unclassified Vessel Tracks.

4.2 Vessel Activity by Terminal

Table 7 and **Table 8** provide examples of frequent commercial callers and the largest vessels at each jetty / terminal within the study area over Jun / Jul 2023. In general, the largest vessels most commonly call at IOH, IOT, Immingham Dock and the ABP Humber International Terminal (HIT) / IBT ranging from 200 – 274m.

Cargo, tanker and tug tracks have been isolated for each jetty / terminal in order to determine how tankers and cargo vessels:

1. Typically approach / depart each terminal / jetty within the study area; and
2. Utilise different spaces to manoeuvre into position / stem the tide.

Figure 21 and **Figure 22** show that vessels arriving / departing IOT, IGT and HIT / IBT typically approach / leave the berth in a relatively direct manner using predominantly small manoeuvres. In contrast, vessels arriving / departing IOH, Eastern Jetty and West Jetty appear to swing at varying degrees in order to approach / leave the berth. This is most likely due to vessels trying to stem the tide or avoiding other large commercial vessels in transit within the immediate area. Vessels approaching / departing Immingham Dock use the region directly north of the lock to manoeuvre into place and align with the dock entrance which lies between the Eastern and West Jetties. It is understood that the Jetties are used by tugs and tankers if they are required to wait before entering Immingham Dock or departing from the port of Immingham.

All jetties / terminals have vessels approaching / departing exclusively from downriver other than Immingham Dock which is the only location that has vessels approaching / departing from upriver.

In order to approach / depart IOT Finger Pier, tankers must swing around the western extent of IOT. This takes them within close proximity of the proposed IERRT infrastructure.

Table 7: Frequent large commercial callers at each terminal within the study area during Jun / Jul 2023.

Jetty / Terminal	Vessel Type	Vessel Name	Vessel LOA (m)	MMSI Number	No. Visits
ABP Humber International Terminal / Immingham Bulk Terminal	Cargo	Golden Fortune	229	538008727	2
Eastern Jetty	Tanker	Sulphur Genesis	95	256656000	4
Immingham Dock	Cargo	Britannia Seaways	197	219825000	43
	Tanker	Christian Essberger	100	255805753	6
Immingham Gas Terminal	Tanker	Vortex	88	255805640	14
Immingham Outer Harbour	Cargo	Hollandia Seaways	238	219234000	52
Immingham Oil Terminal Finger Pier	Tanker	Shannon Fisher	85	308539000	29
Immingham Oil Terminal	Tanker	Murray Star	123	215178000	8
West Jetty	Tanker	Cobaltwater	100	246545000	5

It should be noted that the two month data collection period for this study may not capture all vessels frequently using the jetties / terminals outlined in **Table 7**. Additionally, other large (or larger) vessels than those detailed in **Table 8** may also use the jetties / terminals outside of the data period assessed. For example, the IOH regularly sees other large Ro-Ro vessels operating at the terminal including Scandia Seaways (235m), Ficaria Seaways (230m), Selandia Seaways (197m), Ark Dania (195m) and Ark Germania (195m).

Table 8: Largest commercial vessel to call at each jetty / terminal within the study area during Jun / Jul 2023.

Jetty / Terminal	Vessel Type	Vessel Name	Vessel LOA (m)	MMSI Number
ABP Humber International Terminal / Immingham Bulk Terminal	Cargo	Kaupang	180	636021568
Eastern Jetty	Tanker	CB Baltic	183	255806263
Immingham Dock	Cargo	Federal Mayumi	200	538004646
	Tanker	Dutch Emerald	118	246436000
Immingham Gas Terminal	Tanker	Silver Cindy	183	538005746
Immingham Outer Harbour	Cargo	Hollandia Seaways	238	219234000
Immingham Oil Terminal Finger Pier	Tanker	Wisby Argan	100	259746000
Immingham Oil Terminal	Tanker	Nobleway	274	564912000
West Jetty	Tanker	Alfred N	169	538006805

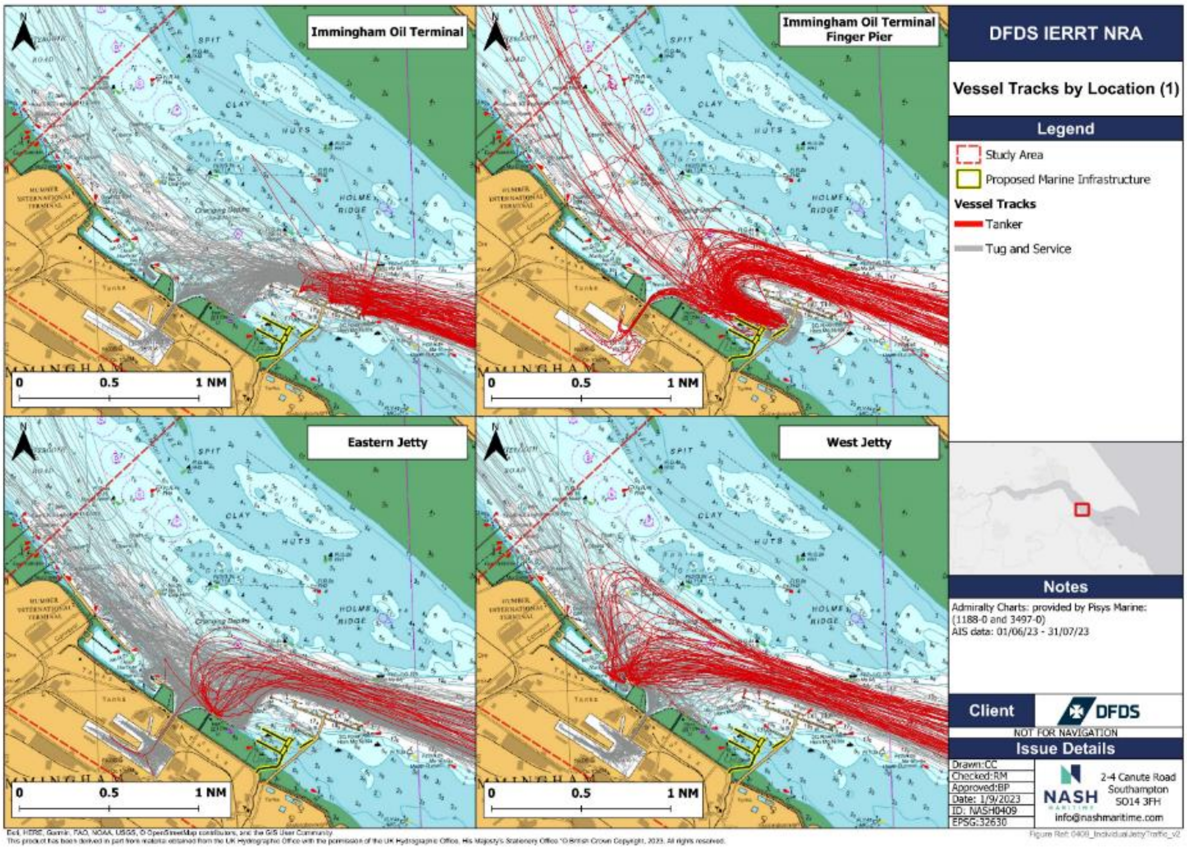

Figure 21: Tanker and Tug Tracks by location (1).

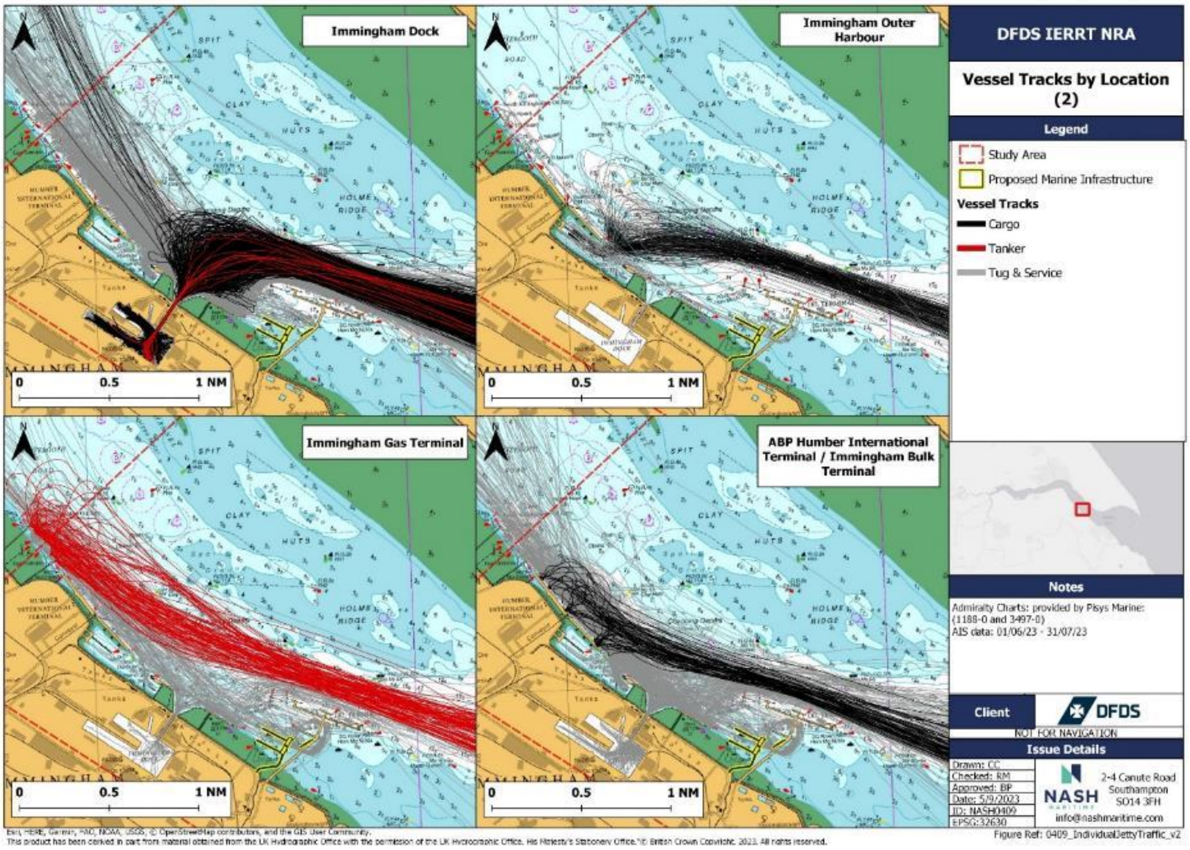

Figure 22: Tanker, Cargo and Tug Tracks by Location (2).

Figure 22 shows that Immingham Dock is significantly the busiest location within the study area with up to 24 cargo vessel transits on the busiest day recorded in Jun / Jul 2023. Even on the quietest day, Immingham Dock received 5 cargo vessels which equates to the average daily movements for several other jetties / terminals within the study area. ABP HIT / IBT, IOT and IOH also have relatively high levels of commercial activity with approximately 4-5 cargo or tanker transits per day.

It is evident that most, if not all, cargo vessel arrivals / departures at Immingham Dock are assisted by tugs, as are vessels calling at ABP HIT / IBT. Both IOT and IOT Finger Pier appear to have tugs assisting vessels on the majority of occasions, but it does not appear to occur for every movement. The Ro-Ro cargo vessels berthing at the IOH are not typically assisted by tugs.

Table 9: Total number of cargo, tanker and tug transits and daily average, minimum, and maximum for each terminal in the study area.

Jetty / Terminal	Total no. of transits over Jun / Jul 2023			Average no. of transits per day			No. of transits on busiest day			No. of transits on quietest day		
	Cargo	Tanker	Tug	Cargo	Tanker	Tug	Cargo	Tanker	Tug	Cargo	Tanker	Tug
Humber International Terminal / Immingham Bulk Terminal	267	11	287	4	0	5	15	0	6	0	0	0
Eastern Jetty	0	32	265	0	1	4	0	2	7	0	0	1
Immingham Dock	978	15	1029	16	0	17	24	0	22	5	0	7
Immingham Gas Terminal	0	131	84	0	2	1	0	8	3	0	0	0
Immingham Outer Harbour	280	0	9	5	0	0	5	0	3	2	0	0
Immingham Oil Terminal Finger Pier	0	109	83	0	2	1	0	7	0	0	0	0
Immingham Oil Terminal	0	242	117	0	4	2	0	11	5	0	0	0
West Jetty	0	92	90	0	2	1	0	7	1	0	0	0

4.3 Gate Analysis

To better understand the existing vessel traffic flows approaching / departing the port of Immingham, a gate analysis was carried out. Two gates were established as illustrated in **Figure 23** and **Figure 24** to analyse the frequency of vessel transiting through different regions of the study area.

Figure 23 shows that vessels arriving into the port of Immingham are relatively evenly spread across the gate, other than a high concentration at the entrance of IOH in which vessels must arrive and depart through the 330m gap between IBT and West Jetty. There are three relatively distinct departing routes on the western, central and eastern portion of the gate that are used by IOH and west Jetty, Immingham Dock, and IOT Finger Pier and Eastern Jetty, respectively.

Figure 24 shows that the southern channel experiences a significant amount of vessel traffic transiting both up and down river. The busiest portion of the gate for outbound vessels is just south of the centre of the channel with ~5 transits per day, and is mostly likely due to commercial vessels departing the port of Immingham. The inbound vessels are more spread over the gate with the highest portion towards the north of the gate, most likely as a result of vessels passing through the region and using the southern channel to navigate.

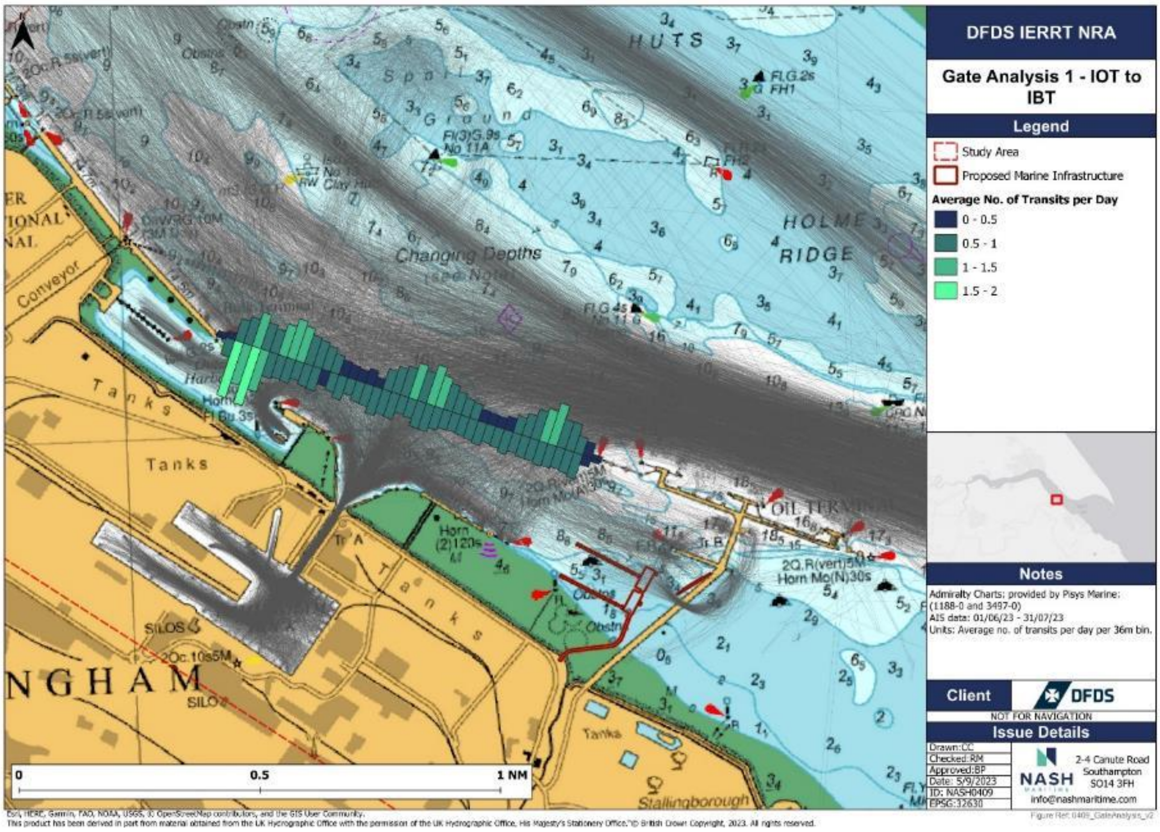

Figure 23: Gate 1: IOT - IBT Gate Analysis.

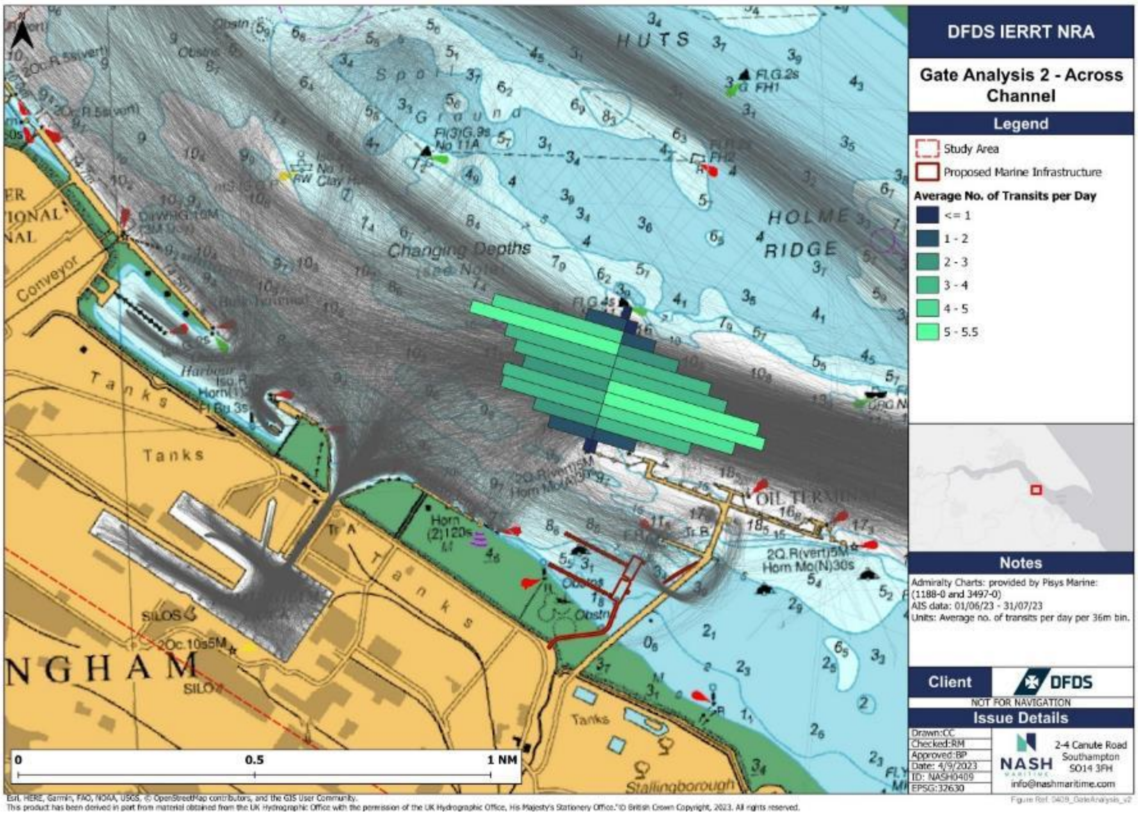

Figure 24: Gate 2: Channel Gate Analysis.

Figure 25 shows the average number of vessel transits for each day across both gates, classified by vessel type. It is evident that tug and service vessels are the most active vessel type within the port of Immingham, with over twice as many tug and service transits as cargo transits per day. In contrast, gate 2 shows that there are approximately the same number of cargo and tug and service vessel transits per day within the southern channel.

There are more tanker transits per day within the southern channel than there are within the port of Immingham mostly likely because the tanker terminals are positioned east and west of Immingham Dock and therefore tankers are not often required to pass between IOT and IBT.

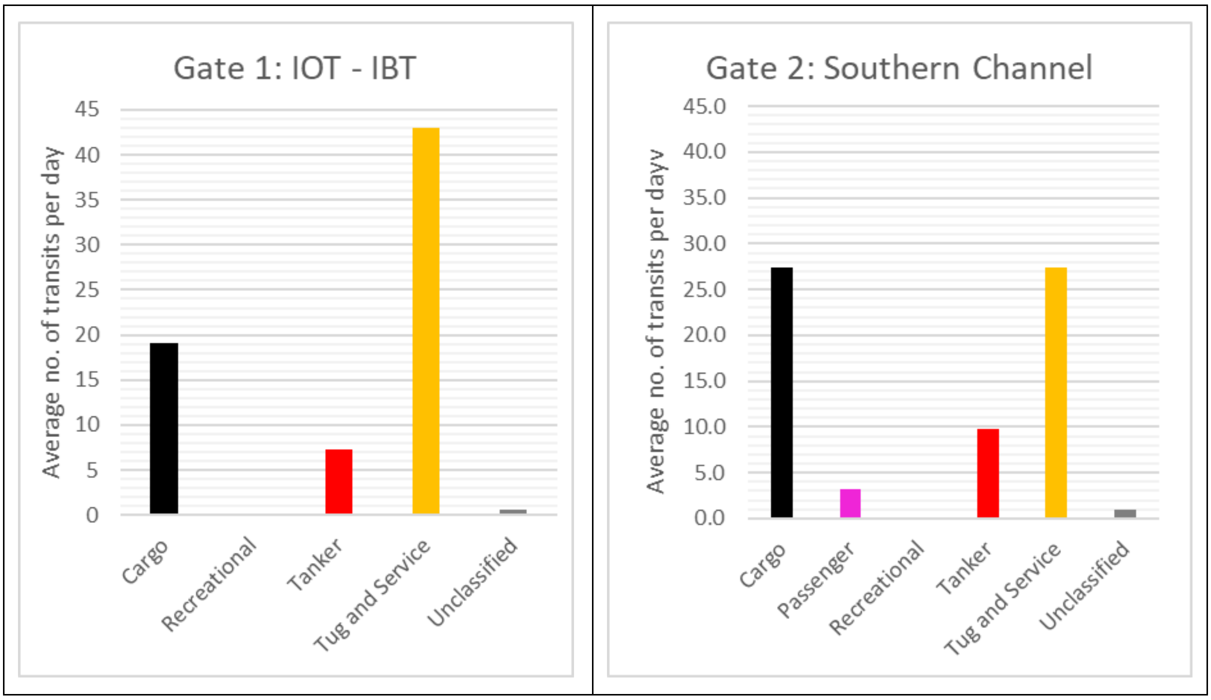

Figure 25: Gate analysis results - Average no. of transits per day

On the busiest days, **Table 10** shows that gate 1 has ~100 tug and service movements, and 47 cargo / tanker movements which is over double the average number of transits per day. Gate 2 has significantly less tug and service transits per day but on average has 23% more tanker and cargo vessels transiting through the channel on the busiest day, most likely due to commercial vessels passing through the region and using the southern channel for navigation.

Table 10: Gate analysis results – total number of vessel transits and daily averages, minimums, and maximums.

Vessel Movements - Gate 1: IOT - IBT				
Vessel Type	**Total no. of transits over Jun / Jul 23**	**Average no. of transits per day**	**Maximum no. of transits in a day**	**Minimum no. of transits in a day**
Cargo	1145	19	28	11
Recreational	9	<1	4	2
Tanker	439	7	19	2
Tug and Service	2579	43	100	16
Unclassified	35	1	5	1
Vessel Movements - Gate 2: Southern Channel				
Vessel Type	**Total no. of transits over Jun / Jul 23**	**Average no. of transits per day**	**Maximum no. of transits in a day**	**Minimum no. of transits in a day**
Cargo	1647	27	38	16
Passenger	160	3	5	1
Recreational	5	<1	2	1
Tanker	618	10	20	3
Tug and Service	1645	27	50	9
Unclassified	38	1	3	1

4.4 Tidal Analysis

Tidal analysis was conducted in order to determine how each vessel type utilises different tidal states and currents to travel inbound or outbound within the study area. **Figure 26** and **Table 11** highlight two significant trends:

1) Tankers predominantly arrive / depart on the flood tide for both Gate 1 and Gate 2; and
2) Cargo vessels utilise both the flood and ebb tide relatively equally for arriving / departing across Gate 1 and Gate 2 (as expected for liner services).

It is also worth noting that the increase in tanker movements on the flood tide results in more tug and service transits on the flood as they assist the larger tankers arriving / departing.

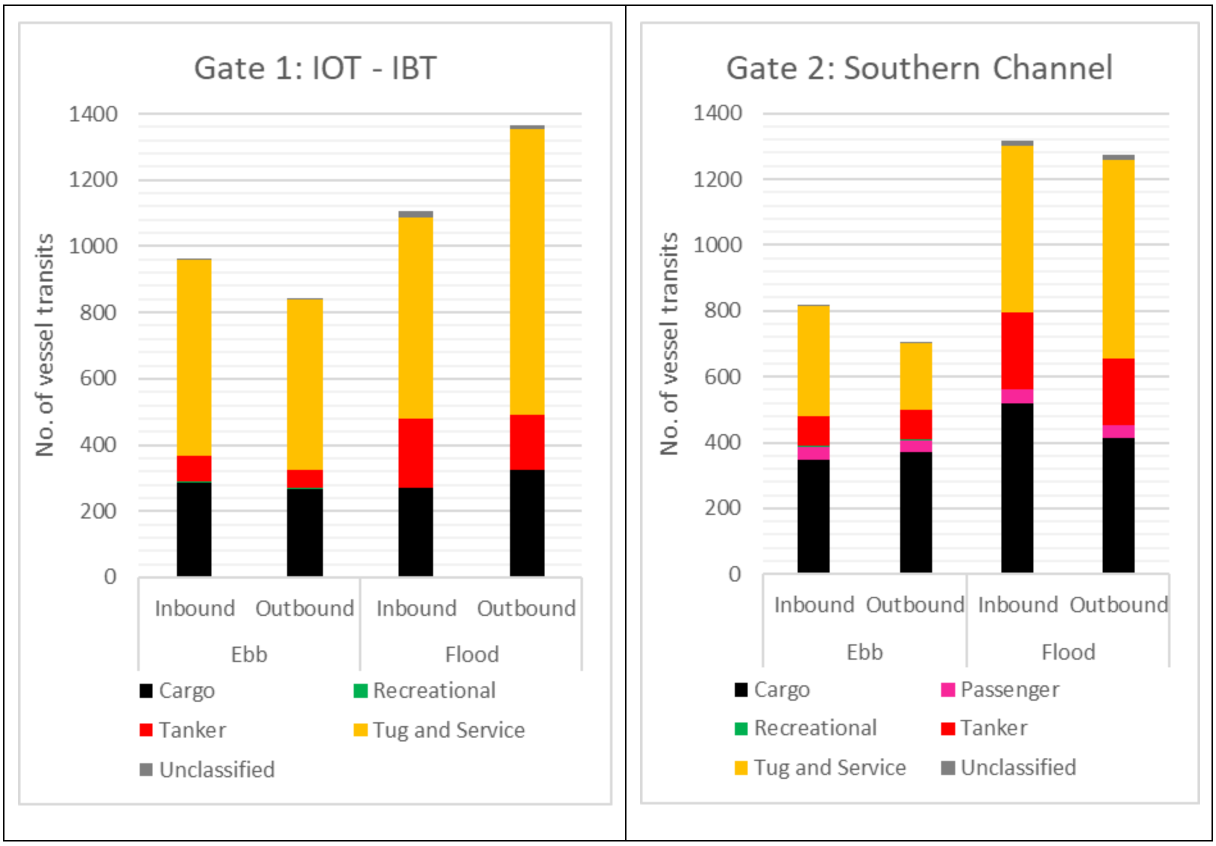

Figure 26: Total number of inbound and outbound vessel transits on the flood and ebb tide across gate 1 and gate 2.

Table 11: Average number of inbound and outbound vessel transits per day over gate 1 and gate 2 on the flood and ebb tide.

Average no. of vessel transits per day								
Vessel Type	**Gate 1: IOT - IBT**				**Gate 2: Southern Channel**			
	Ebb tide		**Flood tide**		**Ebb tide**		**Flood tide**	
	Inbound	**Outbound**	**Inbound**	**Outbound**	**Inbound**	**Outbound**	**Inbound**	**Outbound**
Cargo	5	4	4	5	6	6	9	7
Passenger	NA	NA	NA	NA	1	1	1	1
Recreational	<1	<1	<1	<1	<1	<1	<1	<1
Tanker	1	1	3	3	2	2	4	3
Tug and Service	10	9	10	14	6	3	8	10

Unclassified	<1	<1	<1	<1	<1	<1	<1	<1

Figure 27 and **Table 12** show vessel transits 1 hour either side of low water / high water and highlight 3 significant trends:

1) Tankers predominantly arrive / depart over high water across Gate 1 and Gate 2 (there were approximately double the number of tanker transits over high water than low water across both gates);
2) Cargo vessels utilise both high water and low water relatively equally for arriving / departing across Gate 1 and Gate 2; and
3) Passenger activity through Gate 2 is highest over low water for inbound and outbound transits (~97% of transits recorded across Gate 2 were over low water).

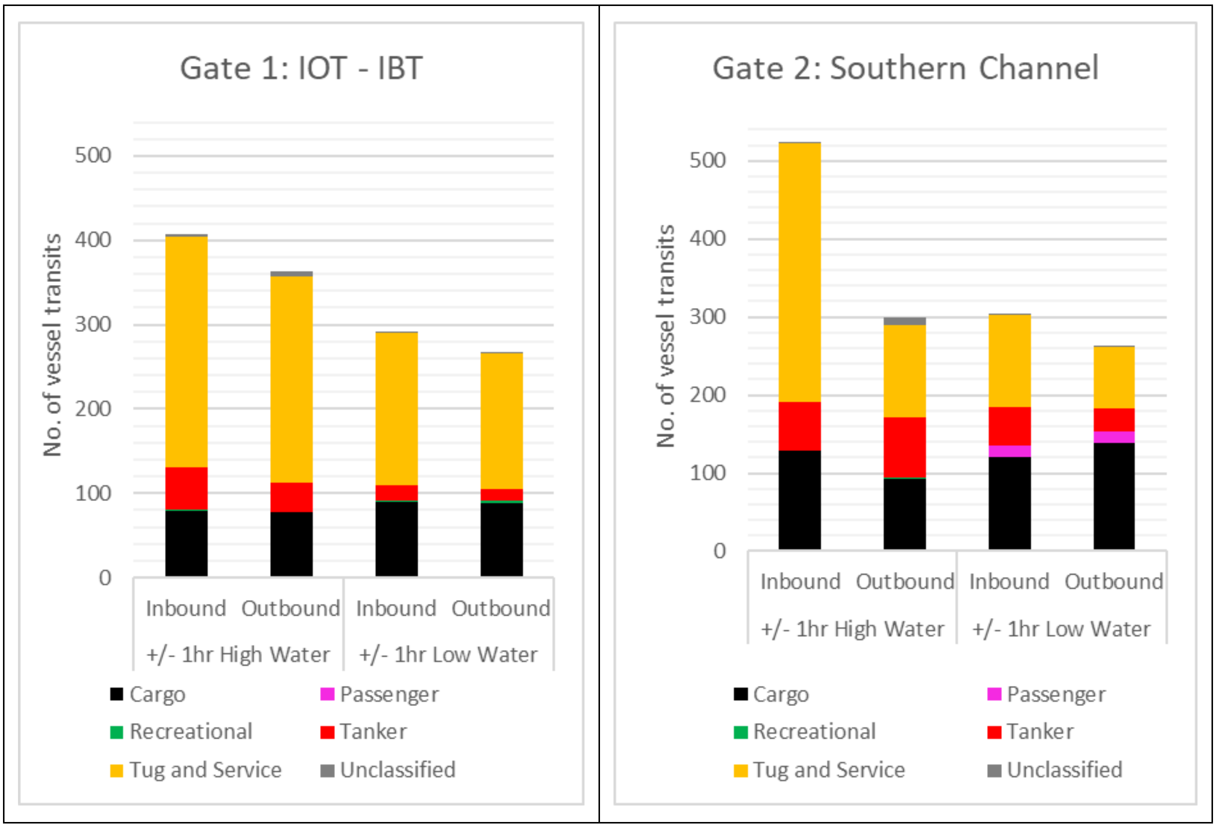

Figure 27: Total number of inbound and outbound vessel transits over high and low water across gate 1 and gate 2.

Table 12: Total number of inbound and outbound vessel transits over high and low water across gate 1 and gate 2.

Total number of vessel transits								
Vessel Type	**Gate 1: IOT - IBT**				**Gate 2: Southern Channel**			
	+/- 1hr High Water		**+/- 1hr Low Water**		**+/- 1hr High Water**		**+/- 1hr Low Water**	
	Inbound	**Outbound**	**Inbound**	**Outbound**	**Inbound**	**Outbound**	**Inbound**	**Outbound**
Cargo	79	78	90	89	128	93	121	138
Passenger	NA	NA	NA	NA	1	0	15	16
Recreational	2	0	1	2	0	1	0	0
Tanker	50	35	19	14	62	78	49	29
Tug and Service	273	244	181	161	331	117	118	78
Unclassified	3	6	1	2	1	10	1	2

4.5 Swept Path Analysis

4.5.1 IOT Finger Pier

The proposed infrastructure is positioned approximately 105m from the IOT Finger Pier making it the closest terminal to the proposed project. To illustrate how large vessels manoeuvre within the immediate region of the proposed infrastructure, swept path analysis of tankers arriving / departing the IOT Finger Pier was undertaken (excluding estuarial barges).

Figure 28 shows the swept path density exposure time of all tankers arriving / departing IOT Finger Pier over Jun / Jul 2023. The north (6 and 7) and south (8 and 9) berths of the Finger Pier have the longest exposure times of over 6 hours from vessels remaining alongside. The immediate approaches to the berths also have long exposure times of 1 – 6 hours as vessels slow down to moor alongside the berths. Further away from the Finger Pier, the passages taken by approaching / departing tankers vary between tankers taking a tight turn (within 100m) around the west end of IOT, to tankers turning up to 1km away from the IOT Finger Pier before approaching. This results in lower exposure times across the spread. Exposure times within 100m of the proposed infrastructure are over 6 hours.

This exposure is primarily only on the flood tide due to the tidal restrictions at the IOT finger Pier, hence the “available” period of operation of the IOT finger Pier is effectively halved comparted to combined flood and ebb tides. The consecutive arrivals of the IERRT vessels will be up to 45 minutes each arrival, therefore 135 minutes for three vessels or approximately 60 min each if allowing a gap for tugs and between IERRT vessels, this would be 3 hours occupied for IEERT vessels. When this aligns with the time required for IOT finger Pier operations (departure of berthed vessel, stemming of awaiting vessel and arrival and morning of awaiting vessel), the occupied time of the immediate area around the I IERRT development and the Eastern Jetty is highly constrained.

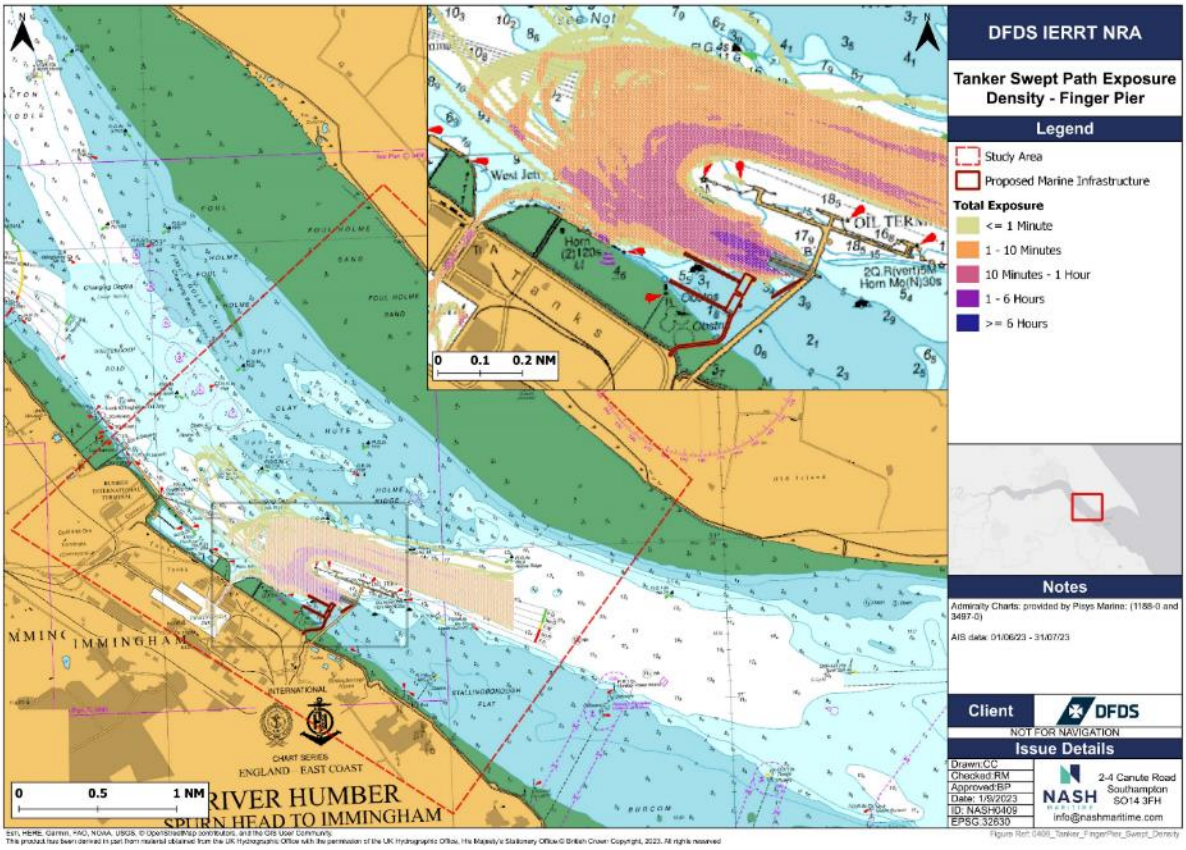

Figure 28: Tanker swept path density for Immingham Oil Terminal Finger Pier.

4.5.2 Stemming Area

Stemming areas can be observed for IOT Finger Pier vessels holding station just off the Eastern Jetty in the density plot shown above in **Figure 28.** Additionally, **Figure 29** below shows several swept paths of tankers approaching the IOT Finger Pier. All tankers shown have utilised the region in front of Immingham Dock or Eastern Jetty as a stemming area to wait before approaching their berth. Waiting periods range from 17 – 30 mins for the vessels shown. Stemming the tide is a regular occurrence and is covered under ABP Humber Standing Notice to Mariners SH22 [32].

Other than *Thun Blythe*, all the tankers shown in **Figure 29** wait between 160m (*Sarnia Liberty*) and 60m (*Solway Fisher*) in front of Eastern Jetty before approaching their berth at the IOT Finger Pier. *Thun Blythe* waits 400m in front of the entrance to Immingham Docks. It is also worth noting that the vessel *Sarnia Cherie* comes within 50m of the proposed infrastructure whilst waiting 19 minutes before approaching its berth.

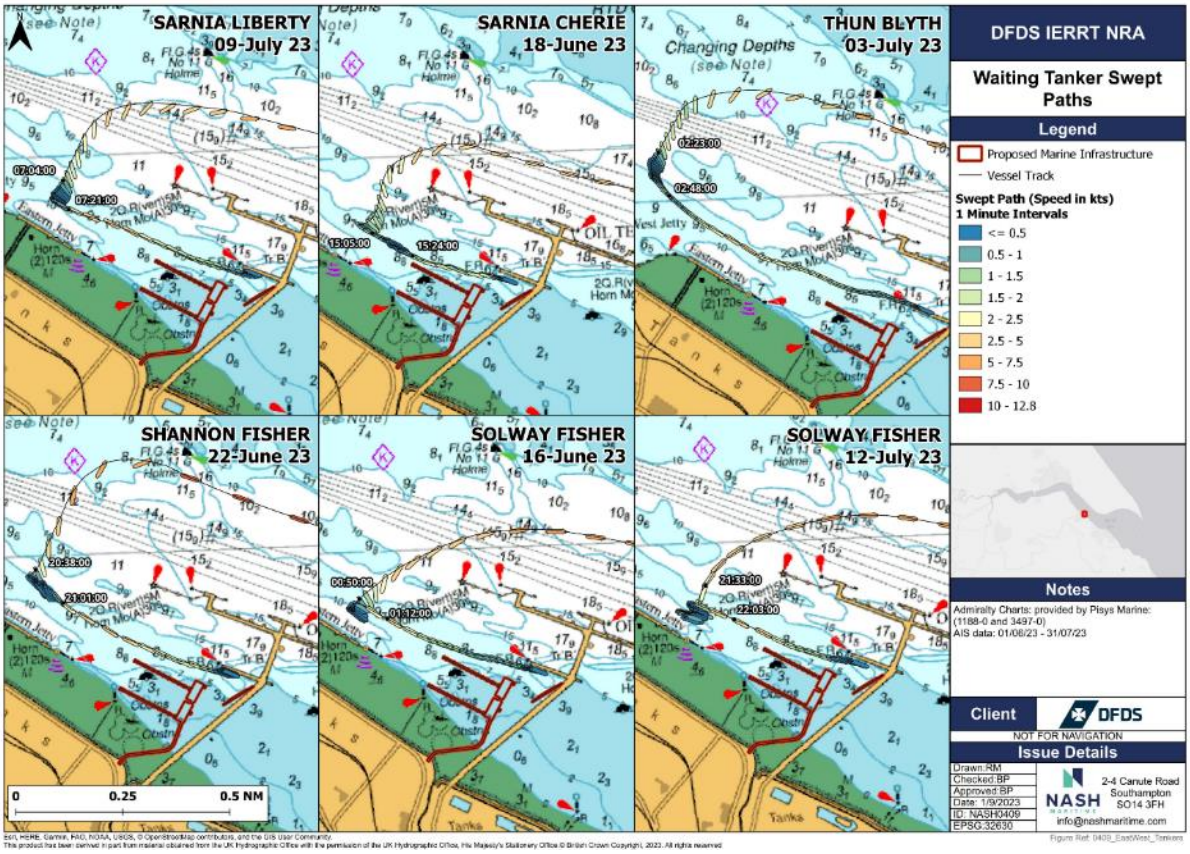

Figure 29: Examples of stemming area use from AIS data

[32] SH_22_2002_NTM (revised), https://www.humber.com/admin/content/files/Notice%20to%20Mariners/Standing%20Notice%20to%20Mariners/SH_22_2002_NTM%20(revised).pdf

5 Risk Assessment Methodology

5.1 Introduction

As discussed in Section 1.4, this NRA adopts a PMSC-compliant NRA approach consistent with two previous risk assessments undertaken separately for other developments within ABP port areas – these are Marchwood Port development within ABP Southampton, and Able Marine Energy Park development within ABP Humber.

The risk assessment methodology is based on the International Maritime Organisation (IMO) Formal Safety Assessment methodology which is presented within **Figure 30**. This includes five steps:

1. FSA Step 1 – Hazard Identification.
2. FSA Step 2 – Score Risk (that is, the Risk Assessment).
3. FSA Step 3 – Identify Risk Controls (that is, Additional Risk Controls).
4. FSA Step 4 – Cost-Benefit Analysis, undertaken if necessary.
5. FSA Step 5 – Recommendations.

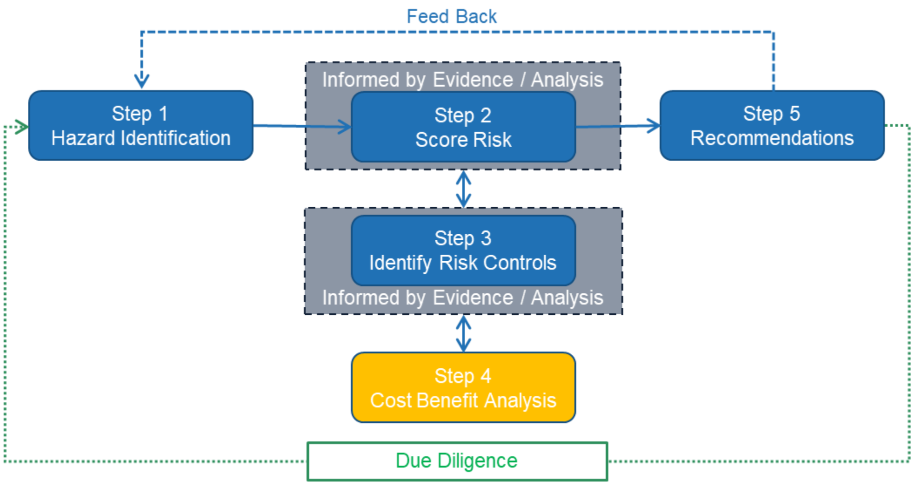

Figure 30: Formal Safety Assessment Process

Within the NRA, the following definitions apply:

- **Hazard** – an unwanted event resulting in adverse consequences.
- **Likelihood** – a determination of how likely a hazard is to occur.
- **Consequence** – the magnitude of the consequences should a hazard occur.
- **Risk** – a non-dimensional measure of hazard consequence and likelihood.
- **Embedded risk control measures** – a risk control measure that is already in place.
- **Additional risk control measures** – a risk control measure that is put in place specifically for the project scheme under consideration.
- **Baseline Assessment of Navigation Risk** – an assessment of hazard risk prior to the proposed operation being in place (this is considered to be the Port Authority's existing NRA. For ABP ports, this is captured within navigation risk assessment software, MarNIS, as was used in the Solent Gateway NRA and the Able NRA. The Port of Immingham's existing NRA has not been provided and has therefore not been used in this NRA).

- **Inherent Assessment of Navigation Risk** – an assessment of hazard risk with the proposed operation occurring including existing ("Embedded") risk control or mitigation measures.
- **Residual Assessment of Navigation Risk** – an assessment of hazard risk with the proposed operation occurring including existing ("Embedded") risk control or mitigation measures, and "additional" project / risk control or mitigation measures.

5.2 Risk Assessment Methodology

NRA's of new developments in existing ports benefit from utilising the definitions contained within the Port's current baseline NRA. This approach allows the findings of further NRAs to be easily compared to the ports existing risk profile and to allow newly identified risks to be seamlessly integrated back into the Port's NRA, where necessary. The Solent Gateway NRA was prepared in this way by using the ABP Southampton baseline NRA (as recorded in MarNIS); and, comparably, the Able NRA has been prepared in agreement with ABP Humber (although not specifically referencing ABP Humber's MarNIS system). Since ABP Humber's baseline NRA and MarNIS information are currently unavailable, this NRA has been prepared using the definitions of likelihood, consequence, risk matrix and acceptability/tolerability as previously adopted in these other NRAs. This is further explained in each subsection below.

The risk assessment methodology requires that marine hazards are identified and assessed in relation to hazard likelihood and hazard consequence to generate a hazard risk score:

$$Navigation\ Risk = likelihood\ of\ hazard\ occurrence \times consequence\ of\ hazard\ occurrence$$

5.2.1 Hazard Likelihood

In order to determine hazard likelihood, the assessment uses a likelihood classification table to allocate likelihood scores to hazards – see **Table 13**.

The likelihood categorisation used in the ABPmer NRA did not provide any quantitative upper or lower bounds to allow objective judgement for the likelihood of occurrence of a hazard. Therefore, the Able NRA, having been previously prepared with agreement by ABP Humber, has been adopted in this NRA.

Table 13: Hazard Likelihood Classifications.

Likelihood Score	Descriptor	Definition
1	Remote	An event that could be expected to occur less than once > 1, 000 years.
2	Unlikely	An event that could be expected to occur once in 1,000 years.
3	Possible	An event that could be expected to occur once in 100 years.
4	Likely	An event that could be expected to occur once in 10 years.
5	Frequent	An event that could be expected to occur yearly

5.2.2 Hazard Consequence

Hazard consequence classifications are as shown in **Table 14** and relate in board terms to hazard outcome to four categories: People, Property, Environment and Port business. These four categories align with the four categories recommended by the PMSC and its GtGP risk assessment process.

The consequence categorisation used in this NRA is the same as the MarNIS consequence categorisation provided by ABP Southampton and used in the Solent Gateway NRA. This is also the same as the consequence categorisation sued in the ABPmer NRA and is therefore assumed to be in alignment with the ABP Humber MarNIS.

Table 14: Hazard Consequence Classifications.

Consequence Score	People	Property	Environment	Port business
0 - Negligible	No injury	Negligible £0 - £10,000	None No incident - or a potential incident/near miss	None
1 - Minor	Minor injury(s)	Minor £10,000 - £750,000	No Measurable Impact An incident or event occurred, but no discernible environmental impact. Tier 1 but no pollution control measures needed.	Minor Little local publicity. Minor damage to reputation. Minor loss of revenue, £0- £750,000.
2 - Moderate	Serious injury(s) MAIB/RIDDOR reportable injury.	Moderate £750,000 - £4 million	Minor An incident that results in pollution with limited/local impact. Tier 1, Harbour Authority pollution controls measures deployed.	Moderate Negative local publicity. Moderate damage to reputation. Moderate loss of revenue, £750,000 - £4m.
3 - Serious	Single fatality	Serious £4 million - £8 million	Significant Has the potential to cause significant damage and impact. Tier 2, pollution control measures from external organisations required.	Serious Negative national publicity. Serious damage to reputation. Serious loss of revenue, £4m - £8m.
4 - Major	Multiple fatalities	Major More than £8 million	Major Has the potential to cause catastrophic and/or widespread damage. Tier 3, requires major external assistance.	Major Negative national and international publicity. Major damage to reputation. Major loss of revenue, more than £8 million.

5.2.3 Risk Matrix

A risk matrix is then used to combine the likelihood score and the consequence scores for each hazard to generate an inherent assessment of risk. Based on the evaluation of the impact of the proposed operation, each hazard is scored using the matrix as defined in **Table 15**. Hazard risk scores are assessed separately for the "*most likely*" and the "*worst credible*" outcomes of an individual hazard. In total therefore there are eight scores: 4x hazard scores for "most likely" and 4x hazard scores for "worst credible" (one each for People, Property, Environment and Port business).

Hazard risk scores for each individual hazard consequence are then brought together using a weighted averaging formula to give a single overall risk score. The averaging formula, which generates a single risk score on a scale of 1 to 10 is generated by taking the average of:

- The highest "Mostly Likely" risk score;
- Average of the "Mostly Likely" risk scores;
- The highest "Worst Credible" risk score; and
- Average of the "Worst Credible" risk scores.

The Risk Matrix used in this NRA is the same as the MarNIS risk score matrix provided by ABP Southampton and used in the Solent Gateway NRA. This is also the same as the risk score matrix used in the Able NRA in agreement with ABP Humber. The ABPmer NRA did not use a structured risk calculation and used a substantially different matrix to the MarNIS risk matrix, therefore, it has not been used in this NRA.

Table 15: MarNIS Risk Score Matrix.

Risk Matrix							
Frequency	Frequent	5	0	6	8	9	10
	Likely	4	0	3	6	7	8
	Possible	3	0	2	4	6	7
	Unlikely	2	0	2	3	5	6
	Remote	1	0	1	3	4	5
			0	1	2	3	4
			Negligible	Minor	Moderate	Serious	Major
			Consequence				

5.2.4 Acceptability / Tolerability

Hazards with risk scored at "Negligible" or "Low" would be deemed acceptable, which puts the acceptability threshold at risk scores lower than 3.0 (see **Table 16** for risk score classifications). Where hazards are scored between 3 to 5.99 (Medium) then additional control measures are necessary unless their cost is disproportionate to their benefit – e.g. following the As Low As Reasonable Practicable (ALARP) principle. Where hazard risk scores are greater than 6.0 ("Significant" or "High" risk), risk controls must be identified and allocated to hazards to reduce risk. Hazard risk scores are then recalculated using the same method as above and a residual assessment of risk determined.

The acceptability / tolerability of risk used in this NRA is the same as used in the Solent Gateway NRA provided by ABP Southampton. The Able NRA and its agreed approach with ABP Humber indicates slightly different risk scores separating the risk levels. However, the score threshold between "Medium" and "Significant" risk remains the same (being the threshold between "Intolerable" and "Tolerable if ALARP"), which is therefore assumed to remain equally appropriate between ABP Humber and ABP Southampton.

Table 16: Hazard risk score classifications.

Risk Level	Risk Score	Tolerability
Negligible	0 - 0.99	Acceptable
Low	1 - 2.99	Acceptable
Medium	3 - 5.99	Tolerable if ALARP
Significant	6 - 8.99	Intolerable

Risk Level	Risk Score	Tolerability
High	9 - 10	Intolerable

5.3 Stakeholder Consultation

Stakeholder consultation and feedback used in this NRA has been obtained from various sources, including:

- Hazard Workshop with the Risk Assessment Team and DFDS.
- Various regular meetings and discussions with the Risk Assessment Team and DFDS.
- Relevant Representations from various parties in response to the development application.
- Information from previous Hazard Workshops undertaken by ABP.

The stakeholder consultation was used to gather local feedback, contributions and obtained consensus from the key local expertise of those listed in **Table 17**. The consultation was focused on navigational safety, hazard identification, review of embedded risk controls, inherent risk assessment (scoring), additional mitigation measures and residual risk assessment (scoring).

Table 17: Summary of Consultees

Representative	Name	Occupation
Bishop Marine Consulting	Graham Bishop	Marine Expert / Port Management Expert
Jonathan Bush (Independent consultant)	Jonathan Bush	(Captain) Marine Expert / Local Pilotage Expert
DFDS	Jesper Hartvig Nielsen	(Captain) Head of Fleet Management
DFDS	Kim Carlsson	(Captain) Current DFDS Ro-Ro Captain
DFDS	Thomas Stephensen	(Captain) Current DFDS Ro-Ro Captain
NASH Maritime	Brocque Preece	Principal Consultant
NASH Maritime	Claire Conning	Maritime Consultant
NASH Maritime	Jamie Holmes	Director

As described in **Section 1.4.1**, two ABP-led Hazard Workshops and two other consultation windows were held with external stakeholders during the development of the ABPmer NRA. DFDS stakeholders engaged with for this NRA were also involved in the previous stakeholder hazard workshops and additional information gathered from these has been taken into consideration when undertaking this NRA.

6 Hazard Identification

The hazard identification approach adopted was a systematic and structured approach based on the study team and consultation to reach a consensus on appropriate hazards, and appropriate level of granularity of those hazards, to carried forward to the risk assessment.

The process involved the following stages:

- **Stage 1** – Review data gathered during the data gathering phase, including historical data, vessel traffic analysis, IERRT project definition and current and future vessel traffic scenarios.
- **Stage 2** – Identify appropriate Hazard Types that may be present due to the IERRT development, the IERRT Ro-Ro / Ro-Pax vessels or changes to the waterway operations due to the IERRT project.

- **Stage 3** – Identify appropriate Vessel Types as receptors for collision hazards to provide an appropriate level of detail within the risk assessment, such as by grouping vessels with different likelihood or consequence, in order to allow identification of key hazards and key risk areas during the risk assessment.
- **Stage 4** – Identify appropriate Contact Scenarios for berth, structure or moored vessel related contact hazards to provide an appropriate level of detail within of risk assessment, such as specific berths having different likelihood or consequences.
- **Stage 5** – Review all permutations of potential hazard types with various vessel type receptors and/or various contact scenarios and determine viability and credibility of each individual hazard scenario in consultation with local navigation experts. Viable hazards to be carried forward into risk assessment.

The sections below describe the outcomes of the structured hazard identification process.

6.1 Hazard Types

A review of historical incidents, data and project information was used to define Hazard Types. Six hazard types were identified and are summarised and defined in **Table 18.**

Table 18: Identified Hazards

Hazard Type ID #	Hazard Types	Definition
1	Collision	Collision between two vessels underway (also includes striking of an anchored vessel).
2	Contact (Allision)	Vessel makes contact with Fixed or Floating Object (FFO) (e.g. quay, pile, shoreline, buoy or moored vessel).
3	Breakaway	Vessel breaks away from securely moored position, may result in damage to non-vessel objects.
4	Grounding	Vessel makes contact with shore or river bed
5	Fire	The uncontrolled process of combustion characterised by heat or smoke or flame or any combination of these aboard a vessel when alongside IERRT.
6	Foundering / Swamping	Loss of stability, buoyancy or water tight integrity (e.g. may be caused by severe adverse weather, mechanical failure or water on deck) leading to capsize and/or sinking.

6.2 Vessel Types

A review of the Vessel Traffic Analysis was used to define Vessel Types. The following vessel categories were identified as having defined difference in likelihood or consequence and therefore providing an appropriate level of detail within the risk assessment. Seven Vessel Types were identified and are summarised and defined in **Table 19.**

Table 19: Vessel Categories

Vessel ID #	Vessel Types	Description
1	Coastal Tanker	Smaller product tankers (generally 80m – 100m in length) which trade predominantly to UK and near European ports distributing refined oil

Vessel ID #	Vessel Types	Description
		products and fuels. Typical berths: Immingham Oil Terminal (IOT) Finger Pier berths 6 or 8.
2	Bunker Barge	Estuarial barges undertaking distribution of refined products to terminals further inland and direct delivery of bunker fuels to ships in Hull, Immingham and Grimsby. Typical berths: Immingham Oil Terminal (IOT) Finger Pier berths 7 and 9.
3	Cargo	Commercial vessels carrying dry cargo such as containers, bulk cargo, automobiles or trailers between two ports, including DFDS vessels. Example typical terminals: Immingham Dock, Immingham Bulk Terminal (IBT), Humber International Terminal (HIT) and Immingham Outer Harbour (IOH).
4	Tanker	Larger commercial liquid bulk carriers generally (generally 100m in length) carrying cargo such as gas as liquid, oil or chemicals between two ports. Example typical terminals: Immingham Oil Terminal (IOT) river berths, Immingham Gas Terminal (IGT), South Killingholme Oil Jetty, Immingham Eastern Jetty.
5	Tug, Service and Other Small Vessel	Tugs, dredgers, workboats, port service, law enforcement and survey vessels.
6	Passenger	Ro-Pax vessels transiting within the main channel and to / from Immingham Dock.
7	Project Vessel (Passenger / Drivers)	Vessels navigating to and from IERRT. Ro-Pax vessels capable of carrying passengers and/or truck drivers.

6.3 Contact Scenarios

A review of the project location, manoeuvring areas and local existing infrastructure was used to define the Contact Scenarios. The following contact scenarios were identified as having defined difference in likelihood or consequence and therefore providing an appropriate level of detail within the risk assessment. Seven Vessel Types were identified and are summarised and defined in **Table 20.**

Table 20: Contact Hazards

Contact Scenarios	Detail
IOT Trunkway	IOT Trunkway from shore to finger pier and river berths
IOT Finger Pier	IOT Finger Pier including berths 6, 7, 8 and 9 and vessel moored alongside.
IOT River berths	IOT River Berths including berths 1, 2 and 3, mooring dolphins and vessel moored alongside.
IERRT Jetty	IERRT including berths 1, 2 and 3 and vessels moored alongside.
Eastern Jetty	Eastern Jetty berth, Mooring dolphins and vessels moored alongside (including Tanker or Bunker Barge alongside Tanker)

6.4 Hazards Identified

A review of the credibility of each permutation of the above Hazard Types, Vessel Types, Contact Scenarios was used to refine the final hazard list relevant to the introduction of risks or change in the level of risk, brought on by the introduction of the IERRT and associated Ro-Ro / Ro-Pax operations.

There were 27 individual hazards identified which and are summarised in **Table 21**.

Table 21: Final Hazard List

HazID	Hazard Type	Hazard Title
1	Collision	Collision - Project Vessel (Passenger / Driver) ICW Project Vessel (Passenger / Driver)
2	Collision	Collision - Project Vessel (Passenger / Driver) ICW Coastal Tanker
3	Collision	Collision - Project Vessel (Passenger / Driver) ICW Bunker Barge
4	Collision	Collision - Project Vessel (Passenger / Driver) ICW Cargo
5	Collision	Collision - Project Vessel (Passenger / Driver) ICW Tanker
6	Collision	Collision - Project Vessel (Passenger / Driver) ICW Tug, Service and Other Small Vessel
7	Collision	Collision - Project Vessel (Passenger / Driver) ICW Passenger
8	Contact (Allision)	Contact (Allision) - Coastal Tanker with IOT Trunkway
9	Contact (Allision)	Contact (Allision) - Bunker Barge with IOT Trunkway
10	Contact (Allision)	Contact (Allision) - Project Vessel (Passenger / Driver) with IOT Trunkway
11	Contact (Allision)	Contact (Allision) - Coastal Tanker with IOT Finger Pier (or moored vessel)
12	Contact (Allision)	Contact (Allision) - Bunker Barge with IOT Finger Pier (or moored vessel)
13	Contact (Allision)	Contact (Allision) - Project Vessel (Passenger / Driver) with IOT Finger Pier (or moored vessel)
14	Contact (Allision)	Contact (Allision) - Project Vessel (Passenger / Driver) with IOT River berths (or moored vessel)
15	Contact (Allision)	Contact (Allision) - Coastal Tanker with IERRT Jetty (or moored vessel)
16	Contact (Allision)	Contact (Allision) - Bunker Barge with IERRT Jetty (or moored vessel)
17	Contact (Allision)	Contact (Allision) - Tanker with IERRT Jetty (or moored vessel)
18	Contact (Allision)	Contact (Allision) - Tug, Service and Other Small Vessel with IERRT Jetty (or moored vessel)
19	Contact (Allision)	Contact (Allision) - Project Vessel (Passenger / Driver) with IERRT Jetty (or moored vessel)
20	Contact (Allision)	Contact (Allision) - Project Vessel (Passenger / Driver) with Eastern Jetty (or moored vessel)
21	Breakaway	Breakaway - Coastal Tanker at IOT Finger Pier
22	Breakaway	Breakaway - Bunker Barge at IOT Finger Pier
23	Breakaway	Breakaway - Project Vessel (Passenger / Driver) at IERRT Jetty

HazID	Hazard Type	Hazard Title
24	Breakaway	Breakaway - Tanker at Eastern Jetty
25	Grounding	Grounding - Project Vessel (Passenger / Driver)
26	Fire	Fire - Project Vessel (Passenger / Driver) at IERRT Jetty
27	Foundering / Swamping	Foundering / Swamping - Tug, Service and Other Small Vessel from Project Vessel thrust

7 Inherent Risk Assessment

Navigation hazards shown in **Table 21** above were identified following the hazard identification process described in Section 6. A total of 27 individual navigation hazards were identified and their associated risk was assessed. This section describes the:

- Embedded risk controls
- Inherent risk assessment – assumes all embedded risk controls are in place.
- Hazards identified as Significant.
- Additional risk controls identified to reduce risk where necessary
- Residual risk assessment – assumes all embedded and additional risk controls are in place.

7.1 Embedded Risk Control Measures

Embedded risk controls were discussed at the ABP-led Hazard Workshops. 28 embedded risk controls were identified in this process, as listed in the ABPmer NRA. Whilst some of these embedded mitigation measures seem duplicated (or so similar that they could be grouped), they have all been carried over for use in this NRA. In addition to this, the additional risk control of “Pilotage” was not specifically listed within the ABPmer NRA; however, this is considered to be an existing embedded risk control which has also been included in this NRA. Therefore, there are a total of 29 embedded risk controls applied here and are considered to be included in the inherent risk assessment, as shown in **Table 22**.

Table 22: Embedded Risk Control Measures.

#	Control Name	#	Control Name
1	Towage, available and appropriate	16	Accurate tidal measurements
2	Harbour Authority requirements	17	Availability of latest hydrographic information
3	Vessel Traffic Services	18	Berthing procedures
4	Towage guidelines	19	Arrival/Departure, advance notice of
5	Monitoring of met ocean conditions	20	Byelaws
6	Oil spill contingency plans	21	Communications - traffic broadcast
7	Passage planning	22	Design criteria
8	Adequate berth tendering	23	Hydrographic Survey
9	Aids to navigation, Provision and maintenance of	24	International COLREGs 1972 (as amended)

#	Control Name	#	Control Name
10	Anchors cleared and ready for use	25	Joint emergency drills with VTS and Port staff
11	Communications equipment	26	Mooring analysis
12	Local Port Service	27	Vessel simulation study
13	Port Facility Emergency Plan	28	Weather limits
14	Training of port marine/operations personnel	29	Pilotage
15	Vessel propulsion redundancies		

7.2 Inherent Risk Assessment

The inherent assessment of risk was reviewed (in terms of hazard likelihood and consequence scoring) by the Risk Assessment Team, to score hazards in relation to the IERRT development – a summary table of which is provided in **Table 23**. The results of this NRA are contained in full in the "*Risk Assessment Logs*" which are contained within **Annex A**.

Table 23 below shows the inherent risk assessment summary with hazards ranked in order from highest risk to lowest risk. The assessment identified:

- 4 "*significant*" hazards – classified as *Intolerable*.
    - 3 Contact (Allision) hazards
    - 1 Collision hazard
- 21 "*medium*" hazards – classified as *Tolerable if ALARP*.
- 2 "*low*" hazards – classified as *Acceptable*.

The significant hazards are further described in the following subsections.

Table 23: Inherent Risk per Hazard (sorted by descending inherent risk score)

Haz ID	Scenario Name	Inherent Risk	
		Risk Score	Classification
20	Contact (Allision) - Project Vessel (Passenger / Driver) with Eastern Jetty (or moored vessel)	6.7	Significant
13	Contact (Allision) - Project Vessel (Passenger / Driver) with IOT Finger Pier (or moored vessel)	6.4	Significant
10	Contact (Allision) - Project Vessel (Passenger / Driver) with IOT Trunkway	6.4	Significant
2	Collision - Project Vessel (Passenger / Driver) ICW Coastal Tanker	6.0	Significant
23	Breakaway - Project Vessel (Passenger / Driver) at IERRT Jetty	5.8	Medium
15	Contact (Allision) - Coastal Tanker with IERRT Jetty (or moored vessel)	5.7	Medium
27	Foundering / Swamping - Tug, Service and Other Small Vessel from Project Vessel thrust	5.6	Medium
3	Collision - Project Vessel (Passenger / Driver) ICW Bunker Barge	5.5	Medium
21	Breakaway - Coastal Tanker at IOT Finger Pier	5.4	Medium
22	Breakaway - Bunker Barge at IOT Finger Pier	5.4	Medium
11	Contact (Allision) - Coastal Tanker with IOT Finger Pier (or moored vessel)	5.3	Medium
12	Contact (Allision) - Bunker Barge with IOT Finger Pier (or moored vessel)	5.3	Medium

Haz ID	Scenario Name	Inherent Risk	
		Risk Score	Classification
16	Contact (Allision) - Bunker Barge with IERRT Jetty (or moored vessel)	5.3	Medium
14	Contact (Allision) - Project Vessel (Passenger / Driver) with IOT River berths (or moored vessel)	4.9	Medium
4	Collision - Project Vessel (Passenger / Driver) ICW Cargo	4.6	Medium
5	Collision - Project Vessel (Passenger / Driver) ICW Tanker	4.4	Medium
19	Contact (Allision) - Project Vessel (Passenger / Driver) with IERRT Jetty (or moored vessel)	4.1	Medium
8	Contact (Allision) - Coastal Tanker with IOT Trunkway	3.9	Medium
9	Contact (Allision) - Bunker Barge with IOT Trunkway	3.9	Medium
24	Breakaway - Tanker at Eastern Jetty	3.9	Medium
17	Contact (Allision) - Tanker with IERRT Jetty (or moored vessel)	3.8	Medium
6	Collision - Project Vessel (Passenger / Driver) ICW Tug, Service and Other Small Vessel	3.8	Medium
7	Collision - Project Vessel (Passenger / Driver) ICW Passenger	3.7	Medium
26	Fire - Project Vessel (Passenger / Driver) at IERRT Jetty	3.7	Medium
1	Collision - Project Vessel (Passenger / Driver) ICW Project Vessel (Passenger / Driver)	3.6	Medium
25	Grounding - Project Vessel (Passenger / Driver)	2.8	Low
18	Contact (Allision) - Tug, Service and Other Small Vessel with IERRT Jetty (or moored vessel)	2.5	Low

7.2.1 Significant / Intolerable hazards

The hazards assessed to be significant / intolerable are detailed in the subsections below. These have been assessed for likelihood and consequences from the Most Likely and Worst Credible scenario as agreed by consensus with the Risk Assessment Team.

When considering likelihood, the scenarios were considered with respect to the potential of IERRT project vessels movements of 2,190 movements per year during operational phase (or 730 berth per berth per year). That is:

- Up to 21,900 vessel movements over 10 years (7,300 movements per berth)
- Up to 109,500 vessel movements over the 50 year lifespan of the IERRT (36,500 movements per berth). Noting also that IERRT information also states that the lifespan of the terminal is intended to be longer than the nominal 50 years.

This was also considered against the historical incident rate for contact (allision) from MAIB records of one in every 3,200 vessel movements (one collision every 9,370 movements, one contact every 3,200 movements, one fire / explosion every 13,900 movements and one mechanical / damage incident every 4,800 movements), coupled with an understanding that actual incident rates, including near-misses, are significantly higher based on the Immingham area MarNIS incident records. The hazard scenarios were then qualitatively assessed by the Risk Assessment Team factoring in the location of the IERRT, the environmental conditions, the future vessel traffic and traffic density, and other relevant factors.

When considering consequence, the scenarios were considered with respect to the Most Likely and Worst Credible outcomes for the hazards groups of People, Property, Environment and Port business. These are outlined in the following paragraphs for each of the significant / intolerable hazards.

7.2.1.1 Contact (Allision) - Project Vessel with Eastern Jetty (or moored vessel)

Haz ID	Scenario Name	Risk Score	Classification
20	Contact (Allision) - Project Vessel (Passenger / Driver) with Eastern Jetty (or moored vessel)	6.7	Significant

This hazard considered an allision by the IERRT Ro-Ro / Ro-Pax vessel with either:

- The Eastern Jetty infrastructure.
- A tanker berthed at the Eastern Jetty.
- A bunker barge alongside a tanker berthed at the Eastern Jetty conducting bunker transfers.

The IERRT vessel approaching the IERRT inner berth 2 or 3 could make contact with a tanker moored at the Eastern Jetty. This is most likely result in minor damages to both vessels and due to the size and displacement of the IERRT vessel, combined with the force of the current, could realistically cause a breakaway of the tanker from the berth. In the worst credible scenario, the tanker could be taking on bunker fuel from a bunker barge alongside. The reduced sea room may result in heavy contact with the bunk barge (and tanker and damaging the eastern jetty), causing substantial loss of flammable cargo, loss of chemical products, loss of the barge and barge crew, and possible fire with the IERRT carrying large number of drivers or passengers.

From local expertise, an allision with the Eastern Jetty or moored tanker is understood not to have occurred in recent history and as such the potential baseline likelihood would be considered low. The location of the IERRT terminal, specifically berths 2 and 3 (inner berths) (having 1,460 movements per year) and the potential for prevailing conditions to result in challenging navigational environment, the Most Likely scenario was considered to be Likely (once in 10 years) and Worst Credible to be Unlikely (once in 1000 years).

7.2.1.2 Contact (Allision) - Project Vessel with IOT Finger Pier (or moored vessel)

Haz ID	Scenario Name	Risk Score	Classification
13	Contact (Allision) - Project Vessel (Passenger / Driver) with IOT Finger Pier (or moored vessel)	6.4	Significant

This hazard considered a allision by the IERRT Ro-Ro / Ro-Pax vessel with either:

- The IOT Finger Pier infrastructure.
- A tanker or bunker barge moored at the IOT Finger Pier.

In similar circumstances as HazID 10 above (IERRT Ro-Ro-/ Ro-Pax allision with the IOT trunkway), the size of the IERRT project vessels and the design of the finger pier not being able to withstand an impact from this size of vessel, combined with the force of the current and/or wind would realistically result in severe or catastrophic loss of the finger pier with significant loss of product in the Humber, and due to the high utilisation of these berths, the potential to cause a product tanker or bunker barge breakaway (and ensuring potential for damage to the IOT trunkway). Due to the proximity of the IOT Finger Pier and the small amount of time available to allow recovery the IERRT project vessel in the event of an incident, the potential for this hazard occurrence is higher.

Most Likely scenario was considered to be Likely (once in 10 years) and Worst Credible to be Unlikely (once in 1000 years).

7.2.1.3 Contact (Allision) - Project Vessel with IOT Trunkway

Haz ID	Scenario Name	Risk Score	Classification
10	Contact (Allision) - Project Vessel (Passenger / Driver) with IOT Trunkway	6.4	Significant

This hazard considered an allision by the IERRT Ro-Ro / Ro-Pax vessel with the IOT trunkway feeding oil and petroleum products to all river berths and finger pier berths.

The IERRT vessel approaching the IERRT outer berth 1 could lose control (from various causes), moving astern in a strong ebb current with strong winds and contacting the IOT trunkway. The consequences of this scenario are driven by the potential for significant consequences resulting from both the Most Likely and Worst Credible scenarios. Due to the size and displacement of the IERRT project vessel and the trunkway not being designed to withstand heavy impacts, combined with the force of the current and/or wind would realistically result in severe damage or catastrophic loss to the trunkway. It is understood that the pipelines on the trunkway are charged and any rupture of a pipe would result in substantial loss of oil products in the river. The strong current would result in widespread pollution and significant oil spill containment / clean up and the ensuing port or Humber operational downtime. This scenario would also likely result in heavy contact being made with the finger pier as the IERRT project vessel's bow is caught by the current.

Most Likely scenario was considered to be Possible (once in 100 years) and Worst Credible to be Unlikely (once in 1000 years).

7.2.1.4 Collision – Project Vessel in collision with Coastal Tanker

Haz ID	Scenario Name	Risk Score	Classification
2	Collision – Project Vessel (Passenger / Driver) ICW Coastal Tanker	6.0	Significant

This hazard considered a collision between the IERRT Ro-Ro / Ro-Pax vessel and a product tanker.

The IERRT vessels and product tankers using the IOT Finger Pier will use the same navigational space and general approach to access their respective berths. During times where the three regular liner service movements of the IERRT project vessels coincide with the flood and high tide, this would also coincide with the IOT Finger Pier movement restrictions for flood tide only. This is evident in the Vessel Traffic Analysis gate analysis indicating higher tanker movements at over these periods. This would ultimately then result in higher than normal demand for the navigational space during flood tides for the three IERRT berths and up to four IOT Finger Pier berths. An issue with either vessel, an abort or reattempt by either vessel or the elevated time pressures on both vessels may result in an increased potential for close encounters and/or human error. This could then result in collisions being more frequent than previously observed in MAIB incident data. A collision would most likely result in damages to both vessels; however, could result in a heavy contact causing a hull puncture of the product tanker, loss of cargo and loss of vessel with crew fatalities.

Most Likely scenario was considered to be Likely (once in 10 years) and Worst Credible to be Unlikely (once in 1000 years).

8 Additional Risk Controls

Based on the hazards which were assessed and subsequently classified as either Medium or Significant, additional risk controls (RCs) were identified – RC01 to RC06. These are further described and defined in the following subsections.

- RC01: Berthing / unberthing criteria
- RC02: Standby tug provision
- RC03: Deconfliction plan
- RC04: Mooring equipment and infrastructure

- RC05: Impact protection for IOT Trunkway
- RC06: Moving finger pier

Additional risk controls were identified in the ABPmer NRA through their previous hazard workshops and these have been carried through to this NRA where it had been deemed appropriate. It is noted that some additional risk controls identified within the ABPmer NRA were considered to be so similar to other risk controls identified that these have been combined; or they were risk controls that should already be in place during the project development and implementation that these have instead been considered as embedded risk controls.

8.1 RC01: Berthing / unberthing criteria

Detailed guidance and requirements relating to specific weather parameters, tidal limitations / weather restrictions and appropriate tug provision for each IERRT berth. This would define safe operating window for each berth for berthing, unberthing and leave berth limits.

This risk control would apply environmental condition limitations that are commensurate with the inherently higher risk of the IERRT project due to its vessel sizes and terminal location in close proximity to other sensitive infrastructure. These may include specific limits for each IERRT berth, reflecting the relative complexity of the berthing manoeuvres and specific hazards at each. These berthing / unberthing criteria may include:

- Maximum wind conditions per wind direction.
- Maximum wind speed in combination with peak current in ebb and flood.
- Maximum conditions for adverse visibility or during the hours of darkness (this risk control assumes that appropriate aids to navigation are already implemented as an expected embedded risk control).

The effectiveness of this risk control is highly dependent on the actual limitation thresholds placed on the berthing and unberthing manoeuvrers.

This risk control combines various ABPmer identified risk controls.

8.2 RC02: Standby tug provision

Provision of an additional tug stationed on immediate standby on-site to assist in the event of an emergency, mechanical failure, towline parting, breakaway from berth, manoeuvring difficulties or fire onboard the IERRT project vessels. The primary intention of this additional risk control is to reduce the potential consequences of emergency situations during IERRT project vessels and product tankers using the IOT Finger Pier.

This assumes the standby tug is over and above the defined normal tug requirements for IERRT movements which is already an embedded risk control and any other weather-related berthing / unberthing criteria covered under RC01. This risk control extends to a standby tug whilst IERRT vessels are moored in the event of adverse weather forecasts or other situations with elevated risk, such as manoeuvrers near the Eastern Jetty tankers handing dangerous cargo. It is assumed the Eastern Jetty tug barge will be removed as per the simulations undertaken which show free vessel and tug usage in the vicinity of the existing tug berth. However, if the current East Jetty tug berth is not removed then it is assumed this standby tug would remain on standby for the Eastern Jetty tankers during movements of the IERRT project vessels. A larger standby tug provision may also be extended to vessels operating to and from the IOT Finger Pier due to increased complexity of vessel berthing from reduced manoeuvring space, reduced margin for error and varying wind and tidal currents.

Due to the close proximity of the IERRT to critical infrastructure, there are practical safety limitations that may limit the effectiveness of this risk control. For example, active assistance by a standby tug may not be possible if placing the standby tug or its crew in danger (such as a crush zone or where susceptible to girting).

This risk control combines various ABPmer identified risk controls.

8.3 RC03: Deconfliction plan

A defined and regulated extension of the current Humber VTS and Port of Immingham management of vessel movements that is specific to IERRT project vessel movements. The primary intention of this additional risk control is to reduce the potential for collisions. The deconfliction plan may include:

- Greater restrictions on permitted vessel movements during IERRT project arrival and departures. Including restrictions on nearby vessel movements until the IERRT vessel is safely moored alongside (to reduce aborted minoveries causing increased collision risk).
- Restrictions to alongside bunkering operations at the Eastern Jetty during IERRT project vessel movements.
- Prioritisation to tidally restricted vessel movements at the IOT Finger Pier to ensure adequate time for manoeuvrers on and off the IOT finger Pier during flood tides.
- Allocation of additional or dedicated stemming areas for displaced third-party vessels currently using the Eastern Jetty stemming area whilst awaiting lock access or berths at the IOT Finger Pier.
- Extended duration of restrictions for third-party vessel movements during IERRT project vessel approach and departure due to potential for aborted manoeuvrers requiring longer use of the navigable waters.

8.4 RC04: Mooring equipment and infrastructure

Mooring monitoring equipment and larger capacity mooring infrastructure (including mooring hooks) to facilitate enhanced mooring capability over and above the base design, such as mooring hooks with load monitoring, additional storm bollards and pre-defined mooring plans specific to each visiting vessel. The primary intention of this additional risk control is the reduce the potential for IERRT project vessel breakaway.

The effectiveness of this risk control is limited by the effectiveness of the moored vessel mooring lines to effectively secure the moored vessel (capacity, conditions, winch brake capacity and available number of mooring points of the vessel).

This risk control combines various ABPmer identified risk controls.

8.5 RC05: Impact protection for IOT Trunkway

Substantially engineered impact protection for the IOT trunkway to mitigate consequences resulting from contact (allision). This risk control provides protection of the IOT trunkway for hazards involving the increase in risk from IERRT project vessel contacts, and situations that may result in a breakaway of product tankers at the IOT Finger Pier (including both direct contact by IERRT project vessels or thrust wash effects on vessels moored at the IOT Finger Pier).

The effectiveness of this risk control is dependent on the design of the impact protection and the speed and size of vessel this would arrest. However, this risk control assumes that the impact protection would be designed to withstand the largest IERRT project vessel at relatively high speed (noting the speed of the spring ebb tide can reach over 4 knots). This risk control assumes the impact protection is as per the indicative impact protection advised in the ABPmer NRA and within the IERRT outline documentation.

This risk control is carried over from the ABPmer identified risk controls.

8.6 RC06: Moving finger pier

The relocation of the finger pier berths from their current location in close proximity to proposed IERRT. Full relocation of the IOT Finger Pier to the other side of the IOT trunkway is assumed to not be an option due to the IGETT proposed development by ABP. The relocation of the finger pier is therefore assumed only feasible as either:

a) Relocation of the higher risk inner berths 8 and 9 of the IOT Finger Pier to a location closer to the IOT River Berths; but leaving the finger pier infrastructure and outer berths 6 and 7 in place. This assumes that the fendering infrastructure for the inner berths 8 and 9 would remain in place and maintained to allow partial protection of the finger pier infrastructure from minor impacts. However, this would increase the available manoeuvring room for IERRT project vessels, increase the room for error, and remove the key hazard of contact with a moored product tanker (or bunker barge) and its subsequent breakaway.

b) Complete relocation of the entire finger pier towards the IOT river berths. This would reduce the risk associated with impact to the finger pier (or moored vessels); however, would also expose a greater portion of the IOT trunkway which would require extended impact protection.

For the purposes of this risk assessment, this additional risk control assumes that “a) relocation of the higher risk berths 8 and 9” is elected so as to reduce the key risk associated with contact with a moored product tanker or bunker barge at these berths, which could feasibly result in a breakaway and the potential additional IOT trunkway impact risk. However, the potential for contact with the IOT Finger Pier infrastructure remains.

This risk control is carried over from the ABPmer identified risk controls and further defined (with assumptions).

9 Residual Risk Assessment

The inherent risk assessment was then re-scored with the additional risk controls in place (in terms of hazard likelihood and consequence scoring) by the Risk Assessment Team – a summary table of which is provided in **Table 24**. The results of this NRA are contained in full in the “*Risk Assessment Logs*” which are contained within **Annex B**.

Table 24 below shows the inherent risk assessment summary with hazards ranked in order from highest risk to lowest residual risk, alongside the previous scoring of inherent risk. The assessment identified:

- 0 “*significant*” hazards – classified as *Intolerable*.
- 23 “*medium*” hazards – classified as *Tolerable if ALARP*.
- 4 “*low*” hazards – classified as *Acceptable*.

The hazards previously defined as significant hazards in the inherent risk assessment are further described in the following subsections.

Table 24: Residual Risk per Hazard (sorted by descending residual risk score).

Haz ID	Scenario Name	Inherent Risk		Applicable Additional Risk Controls	Residual Risk	
		Risk Score	Classification		Risk Score	Classification
20	Contact (Allision) - Project Vessel (Passenger / Driver) with Eastern Jetty (or moored vessel)	6.7	Significant	RC01 RC02 RC03	5.6	Medium
13	Contact (Allision) - Project Vessel (Passenger / Driver) with IOT Finger Pier (or moored vessel)	6.4	Significant	RC01 RC02 RC06	5.4	Medium

Haz ID	Scenario Name	Inherent Risk		Applicable Additional Risk Controls	Residual Risk	
		Risk Score	Classification		Risk Score	Classification
14	Contact (Allision) - Project Vessel (Passenger / Driver) with IOT River berths (or moored vessel)	4.9	Medium	RC01 RC03	4.9	Medium
2	Collision - Project Vessel (Passenger / Driver) ICW Coastal Tanker	6.0	Significant	RC03 RC06	4.5	Medium
3	Collision - Project Vessel (Passenger / Driver) ICW Bunker Barge	5.5	Medium	RC03	4.5	Medium
11	Contact (Allision) - Coastal Tanker with IOT Finger Pier (or moored vessel)	5.3	Medium	RC06	4.4	Medium
12	Contact (Allision) - Bunker Barge with IOT Finger Pier (or moored vessel)	5.3	Medium	RC02 RC06	4.4	Medium
21	Breakaway - Coastal Tanker at IOT Finger Pier	5.4	Medium	RC01 RC06	3.9	Medium
22	Breakaway - Bunker Barge at IOT Finger Pier	5.4	Medium	RC01 RC06	3.9	Medium
5	Collision - Project Vessel (Passenger / Driver) ICW Tanker	4.4	Medium	RC03	3.9	Medium
24	Breakaway - Tanker at Eastern Jetty	3.9	Medium	-	3.9	Medium
15	Contact (Allision) - Coastal Tanker with IERRT Jetty (or moored vessel)	5.7	Medium	RC06	3.8	Medium
17	Contact (Allision) - Tanker with IERRT Jetty (or moored vessel)	3.8	Medium	-	3.8	Medium
6	Collision - Project Vessel (Passenger / Driver) ICW Tug, Service and Other Small Vessel	3.8	Medium	RC03	3.8	Medium
4	Collision - Project Vessel (Passenger / Driver) ICW Cargo	4.6	Medium	RC03	3.7	Medium
7	Collision - Project Vessel (Passenger / Driver) ICW Passenger	3.7	Medium	RC03	3.7	Medium
1	Collision - Project Vessel (Passenger / Driver) ICW Project Vessel (Passenger / Driver)	3.6	Medium	RC03	3.6	Medium
27	Foundering / Swamping - Tug, Service and Other Small Vessel from Project Vessel thrust	5.6	Medium	RC01 RC06	3.6	Medium
26	Fire - Project Vessel (Passenger / Driver) at IERRT Jetty	3.7	Medium	RC02	3.6	Medium
16	Contact (Allision) - Bunker Barge with IERRT Jetty (or moored vessel)	5.3	Medium	RC06	3.4	Medium
10	Contact (Allision) - Project Vessel (Passenger / Driver) with IOT Trunkway	6.4	Significant	RC01 RC02 RC05	3.3	Medium
23	Breakaway - Project Vessel (Passenger / Driver) at IERRT Jetty	5.8	Medium	RC01 RC02 RC04 RC05 RC06	3.3	Medium
19	Contact (Allision) - Project Vessel (Passenger / Driver) with IERRT Jetty (or moored vessel)	4.1	Medium	RC01 RC02	3.2	Medium
9	Contact (Allision) - Bunker Barge with IOT Trunkway	3.9	Medium	RC05 RC06	2.8	Low
8	Contact (Allision) - Coastal Tanker with IOT Trunkway	3.9	Medium	RC05 RC06	2.8	Low
25	Grounding - Project Vessel (Passenger / Driver)	2.8	Low	RC01 RC02 RC03	2.8	Low
18	Contact (Allision) - Tug, Service and Other Small Vessel with IERRT Jetty (or moored vessel)	2.5	Low	-	2.5	Low

9.1 Previous Significant / Intolerable hazards

9.1.1.1 Contact (Allision) - Project Vessel with Eastern Jetty (or moored vessel)

Haz ID	Scenario Name	Inherent Risk		RCs	Residual Risk	
		Score	Classification		Score	Classification
20	Contact (Allision) - Project Vessel (Passenger / Driver) with Eastern Jetty (or moored vessel)	6.7	Significant	RC01 RC02 RC03	5.6	Medium

This was the highest ranked hazard in the inherent risk assessment and remains the highest risk in the residual risk assessment.

Additional risk controls applicable:

- RC01 Berthing / unberthing criteria
- RC02 Standby tug provision
- RC03 Deconfliction plan

These risk controls would limit the berthing and unberthing manoeuvres to remain within safer operating windows, particularly at the IERRT inner berths 2 and 3 and the provision of a standby tug in the event of failure. This primarily results in lower likelihood which has been reduced. These could potentially result in reduced consequences; however, due to the proximity of the Eastern Jetty to the manoeuvring space for berths 2 and 3, this was not deemed sufficient to reduce the consequence scores as the effect of the risk controls may not be immediate enough to reduce or prevent the incident. The condition plan could be applied to restrictions in Eastern Jetty tanker bunkering or bunker barge being alongside which reduces the worst credible outcome, but not the consequence scores.

Most Likely scenario was reduced from Likely (once in 10 years) to Possible (once in 100 years) and Worst Credible was reduced from Unlikely (once in 1000 years) to Remove (once in more than 1000 years).

9.1.1.2 Contact (Allision) - Project Vessel with IOT Finger Pier (or moored vessel)

Haz ID	Scenario Name	Inherent Risk		RCs	Residual Risk	
		Score	Classification		Score	Classification
13	Contact (Allision) - Project Vessel (Passenger / Driver) with IOT Finger Pier (or moored vessel)	6.4	Significant	RC01 RC02 RC06	5.4	Medium

This was the equal second highest ranked hazard in the inherent risk assessment and remains the second highest risk in the residual risk assessment.

Additional risk controls applicable:

- RC01 Berthing / unberthing criteria
- RC02 Standby tug provision
- RC06 Moving finger pier

These risk controls would limit the berthing and unberthing manoeuvres to remain within safer operating windows, particularly at the IERRT outer berth 1 due to its proximity to the IOT Finger Pier inner berths (8 and 9), and the provision of a standby tug in the event of failure within the manoeuvring space. This primarily results in lower likelihood which has been reduced. The inherent consequences were previously associated with contact (allision) with the moored product tanker or bunker barge. With these IOT Finger Pier berths relocated the scenario would be altered to contact (allision) with the IOT Finger Pier infrastructure and not a moored vessel.

However, as there is now greater margin for error and greater time allowed for the standby tug to actively prevent the incident, the resulting consequences of a large IERRT project vessel contacting the IOT Finger Pier infrastructure were agreed to remain similar to the inherent risk of contact with a moored vessel.

Most Likely scenario was reduced from Likely (once in 10 years) to Possible (once in 100 years) and Worst Credible was reduced from Unlikely (once in 1000 years) to Remove (once in more than 1000 years).

9.1.1.3 Contact (Allision) - Project Vessel with IOT Trunkway

Haz ID	Scenario Name	Inherent Risk		RCs	Residual Risk	
		Score	Classification		Score	Classification
10	Contact (Allision) - Project Vessel (Passenger / Driver) with IOT Trunkway	6.4	Significant	RC01 RC02 RC05	3.3	Medium

This was the equal second highest ranked hazard in the inherent risk assessment and reduced to the 21st (of 27) highest risk in the residual risk assessment.

Additional risk controls applicable:

- RC01 Berthing / unberthing criteria
- RC05 Impact protection for IOT trunkway

Impact protection for IOT trunkway has a substantial capacity for risk reduction. As described in Section 8.5, this assumes the impact protection is appropriately deigned to withstand high energy impacts from maximum sized vessels. This risk control therefore assumes that contact with the IOT trunkway would not result in catastrophic loss of the trunkway, ruptured trunkway pipelines, etc and as a result this alters the scenarios to result in contact with the trunkway impact protection. This risk was then scored on this basis which reduced the consequences with frequency reductions from berthing / unberthing criteria.

Most Likely scenario was reduced from Possible (once in 100 years) to Unlikely (once in 1000 years) and Worst Credible was reduced from Unlikely (once in 1000 years) to Remove (once in more than 1000 years).

Consequences were heavily reduced throughout all consequence categories on both Most Likely and Worst Credible.

9.1.1.4 Collision - Project Vessel in collision with Coastal Tanker

Haz ID	Scenario Name	Inherent Risk		RCs	Residual Risk	
		Score	Classification		Score	Classification
2	Collision - Project Vessel (Passenger / Driver) ICW Coastal Tanker	6.0	Significant	RC03 RC06	4.5	Medium

This was the fourth highest ranked hazard in the inherent risk assessment and remains as the fourth highest risk in the residual risk assessment.

Additional risk controls applicable:

- RC03 Deconfliction plan
- RC06 Moving finger pier

The deconfliction plan was agreed to be effective in reducing the potential for the IERRT project vessels and product tankers visiting the IOT finger berths operating on the same tidal window with competing priorities. Additionally, moving the finger pier berths were also considered to contribute to the reduction in this risk as this would alter the movements of some of the product tankers further from the IERRT and could increase the tidal window permitted to move vessels on and off the relocated berths – therefore, marginally reducing the demand on high water or flood tide movements. It was agreed that neither risk control would result in a reduction of the consequences in the event of a collision, although both risk controls were agreed to reduce the hazard likelihood. The risk control of berthing / unberthing criteria was also considered, but could potentially restrict IERRT project vessel movements to a narrower operational window which was considered to negate potential benefits of this risk control.

Most Likely scenario was reduced from Likely (once in 10 years) to Possible (once in 100 years) and Worst Credible was reduced from Unlikely (once in 1000 years) to Remove (once in more than 1000 years).

10 Conclusions and Recommendations

10.1 Conclusions

The navigational risk introduced by the proposed Immingham Eastern Ro-Ro Terminal (IERRT) has been independently assessed following navigational safety concerns raised about the terminal and it's intended operations. This navigational risk assessment was undertaken by a core team of maritime risk assessment professionals, local expertise and port operations subject matter experts. The methodology employed by this navigational risk assessment used the Port Marine Safety Code (PMSC) requirements and it's associated Guide to Good Practice of Port Marine Operations (GtGP) recommendations which is consistent with previous risk assessments undertaken in agreement with ABP Southampton (the Solent Gateway NRA) and ABP Humber (the Able Marine Energy Park NRA)

The focus of the risk assessment was navigational safety of the operational phase of the terminal. The construction and simultaneous construction + operation of the terminal presents other specific risks not assessed here; however, by assessing the inherent operational phase risk only, an informed judgement on the through-life risk can be obtained, together with appropriate risk controls.

10.2 Navigation baseline and future baseline summary of conclusions:

The below summary outlines key findings from a review of the current port, future operations and the IERRT development.

1. The Humber estuary vessel traffic and Marine Safety Management System (MSMS) is managed by ABP though ABP Humber, Humber Estuary Services (HES) and Local Port Services (LPS) of the Port of Immingham.
2. The Port of Immingham is the UK's largest port by tonnage throughput and whilst ship arrival numbers have reduced over recent years the port's total tonnage throughput has maintained relatively steady indicating fewer but larger vessels are utilising the port.
3. The IERRT development would introduce a regular liner service with three vessels arriving regularly in the morning and departing regularly in the evening, totalling six vessel movements per day or 2,190 Ro-Ro / Ro-Pax vessels per year.
4. The proposed design vessels are of 240m length, 35m beam and 8m draft, making them some of the largest vessels operating within the Port of Immingham. These vessel types (Ro-Ro / Ro-Pax) are noted to have inherently high windage areas and are more susceptible to high wind forces.
5. The location of the IERRT is in close proximity to existing high-risk port infrastructure at the Immingham Oil Terminal (IOT) (oil and oil products) and the Immingham Eastern Jetty (chemical). Due to the liner service, they will operate consistently on all tides, including across tidal windows that other tidally restricted vessels are limited to, such as vessel currently operating at the IOT finger Pier.
6. Future baseline vessel traffic at the Port of Immingham and on the Humber has been assumed to steadily increase over the nominal service life of the IERRT of 50 years, such that by 2072 the port would experience a 66% increase in vessel traffic from a baseline year 2030 (including vessel operations of the IERRT).
7. Baseline risk profile of the navigational waters on the Humber estuary and within the Port of Immingham present challenging navigational wind and tidal current conditions. In summary:
    a. High tidal range with tidal currents up to 3.5 knots ebb and 4.5 knots flood.

b. Varying near shore current profile due to high tidal range, existing bathymetry and banks, and potential future differences due to the IERRT dredged areas and blockage effects of IERRT vessels, pontoons and infrastructure.

c. Occurrence of high winds with the predominate direction acting towards existing high-risk port infrastructure of the IOT.

8. Incident records repeatedly cite the following key causes or contributing factors. These factors are likely to remain the same or worsen in the future:

   a. High currents and effect of those currents on the vessel during slow-speed manoeuvring.

   b. Adverse visibility.

   c. Navigating around or in proximity to other vessels.

9. The navigation baseline assessment in this NRA was informed by 2 months of detailed AIS data analysis including vessel traffic analysis, traffic density analysis, gate analysis and swept path analysis. This indicated:

   a. The IOT finger pier is highly utilised and is restricted to flood tide movements. Vessel movements on and off regularly use the navigational space of the proposed IERRT terminal and berthing area.

   b. Vessel numbers are substantially higher over high water and during flood tides passing the Humber estuary and within the Port of Immingham access basin.

   c. Vessels currently hold position and stem the tide in the navigational space proposed for IERRT vessel manoeuvring whilst awaiting clear IOT finger pier berths to become free (also understood whilst awaiting Immingham Dock lock access). For IOT berths, these would be stemming on flood tide.

10.3 Navigation risk assessment summary of conclusions:

The below summary outlines the findings of the risk assessment and the additional risk controls identified.

1. A structured hazard identification process identified 27 individual hazards across 6 hazard categories brought about by the IERRT development mostly related to collision or contact (allision) scenarios.

2. The key contributing factors to risk relate to the primary aspects summarised below. Each factor can be considered in isolation but, importantly, these aspects are not mutually exclusive and could occur in combination.

   a. Challenging navigational environment with very high current flow and high winds.

   b. The close proximity to existing high-risk infrastructure of the IOT and Eastern Jetty.

   c. Low margin for error due to the immediate proximity of the IOT Finger Pier resulting in little time for recovery and limited availability for system redundancy.

   d. Catastrophic consequences resulting from an occurrence of a contact (Allision) hazard with the IOT Finger Pier (including moored vessel), IOT trunkway, and Eastern Jetty (including moored vessel).

   e. Increased risk on IERRT vessels due to up to 100 non-crew passengers as either accompanied freight drivers and/or members of the open public.

f. The potential for future vessel traffic to increase, resulting in increased pressure on marine operators, particularly on the flood tide, and larger potential for disruption in the event of incidents or delays.

g. There is an identified and credible potential for the occurrence of one incident resulting in the materialisation of multiple hazards and the resulting occurrence of multiple catastrophic consequences – for example, mechanical failure of IERRT project vessels in a strong ebb tide causing a contact with a moored tanker at the IOT Finger Pier causing a breakaway, causing the IOT tanker to contact the IOT trunkway, causing rupture of pipelines.

h. Highest collision risk times will be flood tide and high water with greater number of vessel movements and commercial pressure of tidally restricted movements at IOT finger pier berths.

3. The assessment of inherent risk resulted in:
   a. Four “significant” hazards (intolerable).
   b. 21 “medium” hazards (tolerable if ALARP).
   c. Two “low” hazards (acceptable).
4. The assessment of residual risk resulted in:
   a. Zero “significant” hazards (intolerable).
   b. 23 “medium” hazards (tolerable if ALARP).
   c. Four “low” hazards (acceptable).
5. The reduction of the four “significant” (intolerable) hazards resulted from the application of six additional identified risk controls. All identified risk controls were agreed by the Risk Assessment Team to be required in order to reduce the significant risks to ALARP. This was due to limitations in the effectiveness of each independent risk control when applied independently (as discussed in Section 8). The six identified risk controls include:
   a. Risk Control RC01: Berthing / unberthing criteria
   b. Risk Control RC02: Standby tug provision
   c. Risk Control RC03: Deconfliction plan
   d. Risk Control RC04: Mooring equipment and infrastructure
   e. Risk Control RC05: Impact protection for IOT trunkway
   f. Risk Control RC06: Moving finger pier
6. Other higher-risk hazards were already assessed to be “medium” / tolerable if ALARP and whilst a “medium” risk hazard does not automatically indicate that the risk is acceptable, the additional risk controls that had been identified also resulted in a reduction of the risk score of all other higher-scoring “medium” hazards. Therefore these have also be considered ALARP.

10.4 Additional factors for consideration

The factors below are highlighted here as they have the potential to influence the risk profile within the port due to the presence and operation of the IERRT. They therefore need to be taken into account when considering the future risk profile of the IERRT development throughout it’s through-life operations and further reinforce the need to implement robust risk controls.

1. Future vessel traffic created by the Able Marine Energy Park development would not conform to regular numbers of vessel per week, month or year, due to the intended use of this terminal as an offshore renewable energy construction or installation hub. Offshore renewable energy installation is typically undertaken in high intensity short duration installation schedules to reduce installation costs which makes future vessel traffic patterns highly variable. This is understood to be evident from the already operational Siemens Gamesa terminal at Hull and operation of both renewable energy terminals utilising the same optimum seasonal weather windows for installation could have a compounding effect on volume of traffic on the Humber passing the Port of Immingham.
2. Commercial pressures and time pressures for vessels restricted by tidal access limitations would see higher volumes of traffic accessing the tidally restricted berths of the IOT Finger Pier and transiting the channel past Immingham more frequently on flood tides and over high water. Liner services operating at the same time each day inevitably also require operation over the restricted tidal windows of other vessels – most critically the tidally restricted bunker barge and coastal tanker movements at the IOT Finger Pier. The IERRT proposed operations would introduce an additional three vessel movements each morning and each evening which could result in narrow windows of operation to achieve all berthing required at this time which would cause increased pressure giving rise to increased risk of human error. In situations where this also aligns with other causation factors highlighted in incident reports – such as high winds, dense fog, or hours of darkness during winter months – the potential for error increases further. The limited room for error, limited redundancy and exposed nature of the vulnerable risk receptors (IOT trunkway infrastructure, berth infrastructure and vessels berthed at the Eastern Jetty, IOT Finger Pier) results in the potential for human error to lead to small incidents which would ultimately result in substantial consequences.
3. Removing the ability to use eastern stemming area on ebb tide and the displacement of these vessels to other areas may result in shifting risk from one area to another or causing greater congestion within the port or channel (noting that other areas within the Port of Immingham may not be possible due to other regular running services by DFDS at the IOH terminal).
4. Global warming effects will increase the intensity and prevalence of severe weather spells which could result in either reduced operational windows (further increasing commercial or time pressure, as discussed above), or more rapid onset of severe weather resulting in operating windows outside of the defined berthing / unberthing criteria. This reinforces the need for adequate redundancy when defining an appropriate operational envelope.
5. It is stated that the IERRT is expected to serve purpose for longer than the nominated 50 year lifespan. The extension of the terminal's operational life also extends the potential exposure time for an incident to occur.
6. Details of the design vessels are not provided within the IERRT project documentation or ABPmer NRA, including displacement, windage areas and propulsion characteristic (engine power, steering and thrusters). This leads to uncertainty about the IERRT's maximum design vessel which could increase the risks, such as if the actual vessel using the terminal have less favourable manoeuvrability characteristics than the vessel's simulated.

10.5 Recommendations

10.5.1 Recommended Risk Controls

The Risk Assessment Team reached consensus and agreement that the credible potential for catastrophic consequences resulting from a single hazard involving the IOT trunkway, vessels at the IOT Finger Pier, and/or chemical tankers at the Eastern Jetty, would not be effectively mitigated by procedural Risk Controls alone. This is due to the limitations of each of the identified risk controls (as explained in Section 8). The residual risk assessment outcome resulted in the requirement for adoption of all identified risk controls. Therefore it is recommended to adopt and further define:

1. Risk Control RC01: Berthing / unberthing criteria
2. Risk Control RC02: Standby tug provision
3. Risk Control RC03: Deconfliction plan
4. Risk Control RC04: Mooring equipment and infrastructure
5. Risk Control RC05: Impact protection for IOT trunkway
6. Risk Control RC06: Moving finger pier *

* Note – this risk control assumed the inner berths 8 and 9 of the IOT Finger Pier would be moved, not the entire finger pier. It is based on the assumptions of the ability of the IOT Finger Pier to withstand a moderate impact from the IERRT project vessel (based on an uncalculated assumption that it would be a reasonable drift speed of an IERRT project vessel from a near-berthed position moving with a strong ebb current).

10.5.2 Recommended Further Assessments

It is also recommended that further assessment is undertaken on:

1. Review of the existing ABP Humber MSMS baseline risk assessment to ensure alignment of the risks identified within this risk assessment is consistent with the risks already identified by ABP Humber.
2. Incorporation of the hazard identification and risk assessment findings of this risk assessment within the ABP Humber baseline risk assessment.
3. Review of potential congestion caused by the vessel movement restrictions required for the six IERRT vessel movements per day, the displacement of vessels from the stemming area or the extended berthing manoeuvres of an aborted approach. This should be considered for nearby berths at the IOT Finger Pier and the Eastern Jetty, and should be separately assessed for congestion / capacity to safely handle all tidally restricted vessel movements during times of peak demand.
4. IERRT construction and simultaneous construction + operation phases should be undertaken using a similar structured, informed, justified and transparent risk assessment methodology.
5. Tug resourcing to ensure there is sufficient number and size of tugs to support additional vessel requirements (including demands from future developments like Able Marine Energy Park). Consideration should also be made for triggers requiring high tug resource demand, for example, adverse weather conditions resulting in additional push up tugs or exceedance of safe berthing limits across multiple terminals.
6. Related to Risk Control RC06 and *note above: Further review and confirmation, in consultation with IOT, on the impact resistance of the IOT Finger Pier and the potential for catastrophic consequences from an IERRT project vessel making contact with IOT Finger Pier infrastructure. This should be based on design impact energy of the berth structure, existing fender capability and existing fendering arrangement to ensure that the assumption applied in this NRA (of the adequacy of RC06 being limited to moving the inner berths 8 and 9 only) is appropriate. In the event that this further review would result in catastrophic consequences of the IOT Finger Pier, this may require additional impact protection.

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Annex A: Hazard Log – Inherent Risk Assessment

HAZ ID	Inherent Risk Rank	Residual Risk Rank	Hazard Name	Hazard Scenario	Inherent Risk Assessment										Inherent Risk Scores by Consequence Category								Inherent Risk Scores	
					Most Likely Scenario					Worst Credible Scenario					Most Likely Risk Score				Worst Credible Risk Score				Calculated Risk Score	Calculated Risk Classifications
					Frequency	People	Property	Environment	Port Business	Frequency	People	Property	Environment	Port Business	People	Property	Environment	Port Business	People	Property	Environment	Port Business		
1	25	17	Collision - Project Vessel (Passenger / Driver) ICW Project Vessel (Passenger / Driver)	**Most Likely:** light touch, low speed contact between two project vessels whilst underway. **Worst Credible:** heavy contact collision occurrence at relative high speed resulting in loss of a vessel.	**2**	2	2	1	1	**1**	4	3	2	3	3.0	3.0	2.0	2.0	5.0	4.0	3.0	4.0	3.63	Medium
2	4	4	Collision - Project Vessel (Passenger / Driver) ICW Coastal Tanker	**Most Likely:** light touch, low speed contact between two project vessels whilst underway. **Worst Credible:** heavy contact collision occurrence at relative high speed resulting in loss of vessel and loss of cargo.	**4**	2	2	2	2	**2**	4	4	4	4	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.00	Significant
3	7	4	Collision - Project Vessel (Passenger / Driver) ICW Bunker Barge	**Most Likely:** light touch, low speed contact between two project vessels whilst underway. **Worst Credible:** heavy contact collision occurrence at relative high speed resulting in loss of vessel and loss of cargo.	**4**	2	2	2	2	**1**	4	4	4	4	6.0	6.0	6.0	6.0	5.0	5.0	5.0	5.0	5.50	Medium
4	14	15	Collision - Project Vessel (Passenger / Driver) ICW Cargo	**Most Likely:** light touch, low speed contact between two project vessels whilst underway. **Worst Credible:** heavy contact collision occurrence at relative high speed resulting in puncture of cargo vessel hull and loss of cargo.	**3**	2	2	1	1	**2**	4	3	3	3	4.0	4.0	2.0	2.0	6.0	5.0	5.0	5.0	4.56	Medium
5	15	10	Collision - Project Vessel (Passenger / Driver) ICW Tanker	**Most Likely:** light touch, low speed contact between two project vessels whilst underway. **Worst Credible:** heavy contact collision occurrence at relative high speed resulting in puncture of tanker hull and loss of cargo.	**2**	2	2	1	1	**2**	4	4	4	4	3.0	3.0	2.0	2.0	6.0	6.0	6.0	6.0	4.38	Medium
6	21	14	Collision - Project Vessel (Passenger / Driver) ICW Tug, Service and Other Small Vessel	**Most Likely:** light touch, low speed contact between two project vessels whilst underway. **Worst Credible:** heavy contact collision occurrence at relative high speed resulting in loss of small craft.	**3**	2	1	1	1	**2**	3	2	2	2	4.0	2.0	2.0	2.0	5.0	3.0	3.0	3.0	3.75	Medium
7	23	15	Collision - Project Vessel (Passenger / Driver) ICW Passenger	**Most Likely:** light touch, low speed contact between two project vessels whilst underway. **Worst Credible:** heavy contact collision occurrence at relative high speed resulting in loss of vessel.	**2**	2	2	1	1	**1**	4	3	2	4	3.0	3.0	2.0	2.0	5.0	4.0	3.0	5.0	3.69	Medium
8	17	24	Contact (Allision) - Coastal Tanker with IOT Trunkway	**Most Likely:** light contact with IOT Trunkway resulting in superficial damage to vessel and trunkway. **Worst Credible:** high impact contact at relative high speed resulting in puncture of tanker hull and rupture of IOT Trunkway pipeline(s).	**2**	2	2	1	2	**1**	3	4	4	4	3.0	3.0	2.0	3.0	4.0	5.0	5.0	5.0	3.88	Medium

HAZ ID	Inherent Risk Rank	Residual Risk Rank	Hazard Name	Hazard Scenario	Inherent Risk Assessment										Inherent Risk Scores by Consequence Category								Inherent Risk Scores	
					Most Likely Scenario					Worst Credible Scenario					Most Likely Risk Score				Worst Credible Risk Score				Calculated Risk Score	Calculated Risk Classifications
					Frequency	People	Property	Environment	Port Business	Frequency	People	Property	Environment	Port Business	People	Property	Environment	Port Business	People	Property	Environment	Port Business		
9	17	24	Contact (Allision) - Bunker Barge with IOT Trunkway	**Most Likely:** light contact with IOT trunkway resulting in superficial damage to vessel and trunkway. **Worst Credible:** high impact contact at relative high speed resulting in puncture of Project Vessel hull and rupture of IOT Trunkway pipeline(s).	**2**	2	2	1	2	**1**	3	4	4	4	3.0	3.0	2.0	3.0	4.0	5.0	5.0	5.0	3.88	Medium
10	2	21	Contact (Allision) - Project Vessel (Passenger / Driver) with IOT Trunkway	**Most Likely:** high impact contact resulting rupture of IOT Trunkway pipeline(s). **Worst Credible:** high impact contact at relative high speed resulting in puncture of hull and rupture of IOT Trunkway pipeline(s).	**3**	3	4	4	4	**2**	4	4	4	4	6.0	7.0	7.0	7.0	6.0	6.0	6.0	6.0	6.44	Significant
11	10	6	Contact (Allision) - Coastal Tanker with IOT Finger Pier (or moored vessel)	**Most Likely:** light contact with IOT Finger Pier resulting in superficial damage vessel and Finger Pier infrastructure. **Worst Credible:** high impact contact at relative high speed resulting in puncture of tanker hull, rupture of IOT Finger Pier pipeline(s) and damage to berth infrastructure.	**3**	2	2	1	3	**2**	3	3	4	3	4.0	4.0	2.0	6.0	5.0	5.0	6.0	5.0	5.31	Medium
12	10	6	Contact (Allision) - Bunker Barge with IOT Finger Pier (or moored vessel)	**Most Likely:** light contact with IOT Finger Pier resulting in superficial damage vessel and Finger Pier infrastructure. **Worst Credible:** high impact contact at relative high speed resulting in puncture of tanker hull, rupture of IOT Finger Pier pipeline(s) and damage to berth infrastructure.	**3**	2	2	1	3	**2**	3	3	4	3	4.0	4.0	2.0	6.0	5.0	5.0	6.0	5.0	5.31	Medium
13	2	2	Contact (Allision) - Project Vessel (Passenger / Driver) with IOT Finger Pier (or moored vessel)	**Most Likely:** light contact with Coastal tanker / Bunker Barge moored alongside resulting in moderate damage to both vessels, IOT Finger Pier, breakaway of Coastal tanker / Bunker Barge and ruptured loading arm(s). **Worst Credible:** high impact contact with Coastal tanker / Bunker Barge moored alongside resulting in multiple vessel breakaway puncture of tanker / barge hull, rupture of IOT Finger Pier pipeline(s) and significant damage to IOT Finger Peir infrastructure (with extension of breakaway causing impact to IOT trunkway).	**4**	2	3	3	3	**2**	4	4	4	4	6.0	7.0	7.0	7.0	6.0	6.0	6.0	6.0	6.44	Significant
14	13	3	Contact (Allision) - Project Vessel (Passenger / Driver) with IOT River berths (or moored vessel)	**Most Likely:** light contact with tanker moored alongside resulting in moderate damage to both vessels and river berth infrastructure. **Worst Credible:** high impact contact with terminal infrastructure and Tanker moored alongside resulting in ruptured loading arms and river berth pipelines, multiple vessel breakaway and damage to vessels and berth infrastructure. Or, high direct impact contact with Tanker moored alongside resulting in puncture of tanker hull, rupture of river berth pipeline(s) and damage to vessels and berth infrastructure.	**2**	2	3	3	3	**1**	4	4	4	4	3.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.88	Medium

HAZ ID	Inherent Risk Rank	Residual Risk Rank	Hazard Name	Hazard Scenario	Inherent Risk Assessment – Most Likely Scenario: Frequency	People	Property	Environment	Port Business	Inherent Risk Assessment – Worst Credible Scenario: Frequency	People	Property	Environment	Port Business	Inherent Risk Scores by Consequence Category – Most Likely Risk Score: People	Property	Environment	Port Business	Inherent Risk Scores by Consequence Category – Worst Credible Risk Score: People	Property	Environment	Port Business	Inherent Risk Scores: Calculated Risk Score	Calculated Risk Classifications
15	6	12	Contact (Allision) - Coastal Tanker with IERRT Jetty (or moored vessel)	**Most Likely:** light contact with Project Vessel moored alongside resulting in moderate damage to both vessels. **Worst Credible:** high impact contact with Project Vessel moored alongside resulting in puncture of tanker hull and major damage to project vessel and project infrastructure.	**4**	2	2	1	2	**2**	3	4	4	3	6.0	6.0	3.0	6.0	5.0	6.0	6.0	5.0	5.69	Medium
16	10	20	Contact (Allision) - Bunker Barge with IERRT Jetty (or moored vessel)	**Most Likely:** light contact with Project Vessel moored alongside resulting in moderate damage to both vessels. **Worst Credible:** high impact contact with Project Vessel moored alongside resulting in puncture of barge hull and damage to project vessel.	**4**	2	2	1	2	**2**	3	3	3	3	6.0	6.0	3.0	6.0	5.0	5.0	5.0	5.0	5.31	Medium
17	20	12	Contact (Allision) - Tanker with IERRT Jetty (or moored vessel)	**Most Likely:** light contact with Project Vessel moored alongside resulting in moderate damage to both vessels and IERRT infrastructure. **Worst Credible:** high impact contact with Project Vessel moored alongside resulting in puncture of tanker hull and major damage to project vessel and IERRT infrastructure.	**2**	2	2	1	2	**1**	3	4	4	3	3.0	3.0	2.0	3.0	4.0	5.0	5.0	4.0	3.81	Medium
18	27	27	Contact (Allision) - Tug, Service and Other Small Vessel with IERRT Jetty (or moored vessel)	**Most Likely:** light contact with Project Vessel moored alongside resulting in minor damage to both vessels. **Worst Credible:** high impact contact with Project Vessel moored alongside resulting in moderate damage to tug / service vessel.	**3**	1	1	1	1	**2**	2	2	2	2	2.0	2.0	2.0	2.0	3.0	3.0	3.0	3.0	2.50	Low
19	16	23	Contact (Allision) - Project Vessel (Passenger / Driver) with IERRT Jetty (or moored vessel)	**Most Likely:** light contact with Project Vessel moored alongside resulting in minor damage to both vessel or IERRT infrastructure. **Worst Credible:** high impact contact with Project Vessel moored alongside resulting in major damage to both vessels and IERRT infrastructure.	**4**	1	1	1	1	**2**	2	4	2	3	3.0	3.0	3.0	3.0	3.0	6.0	3.0	5.0	4.06	Medium
20	1	1	Contact (Allision) - Project Vessel (Passenger / Driver) with Eastern Jetty (or moored vessel)	**Most Likely:** light contact with tanker moored alongside resulting in moderate damage to vessels, breakaway of tanker and ruptured loading arm. **Worst Credible:** high impact contact with tanker moored alongside (or bunkering barge alongside tanker) resulting in puncture of tanker hull or bunker barge hull, rupture of Eastern Jetty pipeline(s), loss of bunker barge moored alongside major and damage to berth infrastructure.	**4**	2	2	4	3	**2**	4	4	4	4	6.0	6.0	8.0	7.0	6.0	6.0	6.0	6.0	6.69	Significant
21	8	8	Breakaway - Coastal Tanker at IOT Finger Pier	**Most Likely:** mooring lines part from wash and current resulting in breakaway from berth, minor loss of cargo from loading arm, vessel engines restarted and vessel secured alongside. **Worst Credible:** mooring lines part from wash and current resulting in breakaway from berth, vessel engines cannot be restarted and contact is made with IOT Trunkway resulting in rupture to IOT trunkway pipeline(s).	**4**	2	2	2	2	**1**	3	4	4	4	6.0	6.0	6.0	6.0	4.0	5.0	5.0	5.0	5.44	Medium

HAZ ID	Inherent Risk Rank	Residual Risk Rank	Hazard Name	Hazard Scenario	Inherent Risk Assessment										Inherent Risk Scores by Consequence Category								Inherent Risk Scores	
					Most Likely Scenario					Worst Credible Scenario					Most Likely Risk Score				Worst Credible Risk Score					
					Frequency	People	Property	Environment	Port Business	Frequency	People	Property	Environment	Port Business	People	Property	Environment	Port Business	People	Property	Environment	Port Business	Calculated Risk Score	Calculated Risk Classifications
22	8	8	Breakaway - Bunker Barge at IOT Finger Pier	**Most Likely:** mooring lines part from wash and current resulting in breakaway from berth, minor loss of cargo from loading arm, vessel engines restarted and vessel secured alongside. **Worst Credible:** mooring lines part from wash and current resulting in breakaway from berth, vessel engines cannot be restarted and contact is made with IOT Trunkway resulting in rupture to IOT trunkway pipeline(s).	**4**	2	2	2	2	**1**	3	4	4	4	6.0	6.0	6.0	6.0	4.0	5.0	5.0	5.0	5.4	Medium
23	5	21	Breakaway - Project Vessel (Passenger / Driver) at IERRT Jetty	**Most Likely:** mooring lines part resulting in breakaway from berth, vessel engines cannot be restarted in time and contact is made with IOT Finger Pier resulting in damage to finger pier, rupture to finger pier pipelines, breakaway of vessel at finger pier. **Worst Credible:** mooring lines part resulting in breakaway from berth, vessel engines cannot be restarted and contact is made with IOT Finger Peir (as above), loss of life on finger pier and further contact with IOT Trunkway resulting in rupture to IOT Trunkway pipeline(s).	**3**	2	4	4	4	**1**	4	4	4	4	4.0	7.0	7.0	7.0	5.0	5.0	5.0	5.0	5.81	Medium
24	17	10	Breakaway - Tanker at Eastern Jetty	**Most Likely:** mooring lines part resulting in breakaway from berth, vessel engines cannot be restarted in sufficient time and light contact with IERRT vessel or IERRT infrastructure. **Worst Credible:** mooring lines part resulting in breakaway from berth, vessel engines cannot be restarted and contact is made with Project Vessel moored alongside IERRT or IERRT infrastructure, Tanker hull ruptured, IERRT vessel breakaway.	**2**	2	2	2	2	**1**	3	3	4	4	3.0	3.0	3.0	3.0	4.0	4.0	5.0	5.0	3.88	Medium
25	26	24	Grounding - Project Vessel (Passenger / Driver)	**Most Likely:** vessel makes light contact with river bed and is able to free, negligible damage. **Worst Credible:** vessel makes contact with river bed and requires assistance to navigate free**,** moderate damage to vessel.	**3**	1	1	1	1	**1**	2	2	2	3	2.0	2.0	2.0	2.0	3.0	3.0	3.0	4.0	2.81	Low
26	23	18	Fire - Project Vessel (Passenger / Driver) at IERRT Jetty	**Most Likely:** fire contained by crew resulting in moderate damage to vessel **Worst Credible:** crew are unable to contain fire resulting to serious damage to vessel and multiple loss of life.	**1**	2	2	1	2	**1**	4	3	3	3	3.0	3.0	1.0	3.0	5.0	4.0	4.0	4.0	3.69	Medium
27	21	18	Foundering / Swamping - Tug, Service and Other Small Vessel from Project Vessel thrust	**Most Likely**: Wash from vessel floods the deck of the tug. Tug has water tight doors closed and remains afloat **Worst Credible:** Wash from vessel floods the deck of the tug. Tug has not water tight doors closed, takes on water, loses stability and sinks.	**4**	1	1	1	1	**2**	3	2	3	2	3.0	3.0	3.0	3.0	5.0	3.0	5.0	3.0	3.75	Medium

Annex B: Hazard Log – Residual Risk Assessment

HAZ ID	Inherent Risk Rank	Residual Risk Rank	Hazard Name	Hazard Scenario	Additional Risk Controls Black = applicable Red = not applicable	Residual Risk Assessment										Residual Risk Scores by Consequence Category								Residual Risk Scores	
						Most Likely Scenario					Worst Credible Scenario					Most Likely Risk Score				Worst Credible Risk Score				Calculated Risk Score	Calculated Risk Classifications
						Frequency	People	Property	Environment	Port Business	Frequency	People	Property	Environment	Port Business	People	Property	Planet	Port Business	People	Property	Planet	Port Business		
1	25	17	Collision - Project Vessel (Passenger / Driver) ICW Project Vessel (Passenger / Driver)	**Most Likely:** light touch, low speed contact between two project vessels whilst underway. **Worst Credible:** heavy contact collision occurrence at relative high speed resulting in loss of a vessel.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**2**	2	2	1	1	**1**	4	3	2	3	3.0	3.0	2.0	2.0	5.0	4.0	3.0	4.0	3.63	Medium
2	4	4	Collision - Project Vessel (Passenger / Driver) ICW Coastal Tanker	**Most Likely:** light touch, low speed contact between two project vessels whilst underway. **Worst Credible:** heavy contact collision occurrence at relative high speed resulting in loss of vessel and loss of cargo.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**3**	2	2	2	2	**1**	4	4	4	4	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0	4.50	Medium
3	7	4	Collision - Project Vessel (Passenger / Driver) ICW Bunker Barge	**Most Likely:** light touch, low speed contact between two project vessels whilst underway. **Worst Credible:** heavy contact collision occurrence at relative high speed resulting in loss of vessel and loss of cargo.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**3**	2	2	2	2	**1**	4	4	4	4	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0	4.50	Medium
4	14	15	Collision - Project Vessel (Passenger / Driver) ICW Cargo	**Most Likely:** light touch, low speed contact between two project vessels whilst underway. **Worst Credible:** heavy contact collision occurrence at relative high speed resulting in puncture of cargo vessel hull and loss of cargo.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**2**	2	2	1	1	**1**	4	3	3	3	3.0	3.0	2.0	2.0	5.0	4.0	4.0	4.0	3.69	Medium
5	15	10	Collision - Project Vessel (Passenger / Driver) ICW Tanker	**Most Likely:** light touch, low speed contact between two project vessels whilst underway. **Worst Credible:** heavy contact collision occurrence at relative high speed resulting in puncture of tanker hull and loss of cargo.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**2**	2	2	1	1	**1**	4	4	4	4	3.0	3.0	2.0	2.0	5.0	5.0	5.0	5.0	3.88	Medium
6	21	14	Collision - Project Vessel (Passenger / Driver) ICW Tug, Service and Other Small Vessel	**Most Likely:** light touch, low speed contact between two project vessels whilst underway. **Worst Credible:** heavy contact collision occurrence at relative high speed resulting in loss of small craft.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**3**	2	1	1	1	**2**	3	2	2	2	4.0	2.0	2.0	2.0	5.0	3.0	3.0	3.0	3.75	Medium
7	23	15	Collision - Project Vessel (Passenger / Driver) ICW Passenger	**Most Likely:** light touch, low speed contact between two project vessels whilst underway. **Worst Credible:** heavy contact collision	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and	**2**	2	2	1	1	**1**	4	3	2	4	3.0	3.0	2.0	2.0	5.0	4.0	3.0	5.0	3.69	Medium

HAZ ID	Inherent Risk Rank	Residual Risk Rank	Hazard Name	Hazard Scenario	Additional Risk Controls Black = applicable Red = not applicable	Residual Risk Assessment										Residual Risk Scores by Consequence Category								Residual Risk Scores	
						Most Likely Scenario					Worst Credible Scenario					Most Likely Risk Score				Worst Credible Risk Score				Calculated Risk Score	Calculated Risk Classifications
						Frequency	People	Property	Environment	Port Business	Frequency	People	Property	Environment	Port Business	People	Property	Planet	Port Business	People	Property	Planet	Port Business		
				occurrence at relative high speed resulting in loss of vessel.	infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier																				
8	17	24	Contact (Allision) - Coastal Tanker with IOT Trunkway	**Most Likely:** light contact with IOT Trunkway resulting in superficial damage to vessel and trunkway. **Worst Credible:** high impact contact at relative high speed resulting in puncture of tanker hull and rupture of IOT Trunkway pipeline(s).	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**2**	2	1	1	1	**1**	2	2	2	2	3.0	2.0	2.0	2.0	3.0	3.0	3.0	3.0	2.81	Low
9	17	24	Contact (Allision) - Bunker Barge with IOT Trunkway	**Most Likely:** light contact with IOT trunkway resulting in superficial damage to vessel and trunkway. **Worst Credible:** high impact contact at relative high speed resulting in puncture of Project Vessel hull and rupture of IOT Trunkway pipeline(s).	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**2**	2	1	1	1	**1**	2	2	2	2	3.0	2.0	2.0	2.0	3.0	3.0	3.0	3.0	2.81	Low
10	2	21	Contact (Allision) - Project Vessel (Passenger / Driver) with IOT Trunkway	**Most Likely:** high impact contact resulting rupture of IOT Trunkway pipeline(s). **Worst Credible:** high impact contact at relative high speed resulting in puncture of hull and rupture of IOT Trunkway pipeline(s).	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**2**	2	2	1	2	**1**	2	3	2	3	3.0	3.0	2.0	3.0	3.0	4.0	3.0	4.0	3.31	Medium
11	10	6	Contact (Allision) - Coastal Tanker with IOT Finger Pier (or moored vessel)	**Most Likely:** light contact with IOT Finger Pier resulting in superficial damage vessel and Finger Pier infrastructure. **Worst Credible:** high impact contact at relative high speed resulting in puncture of tanker hull, rupture of IOT Finger Pier pipeline(s) and damage to berth infrastructure.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**2**	2	2	1	3	**1**	3	3	4	3	3.0	3.0	2.0	5.0	4.0	4.0	5.0	4.0	4.38	Medium
12	10	6	Contact (Allision) - Bunker Barge with IOT Finger Pier (or moored vessel)	**Most Likely:** light contact with IOT Finger Pier resulting in superficial damage vessel and Finger Pier infrastructure. **Worst Credible:** high impact contact at relative high speed resulting in puncture of tanker hull, rupture of IOT Finger Pier pipeline(s) and damage to berth infrastructure.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**2**	2	2	1	3	**1**	3	3	4	3	3.0	3.0	2.0	5.0	4.0	4.0	5.0	4.0	4.38	Medium
13	2	2	Contact (Allision) - Project Vessel (Passenger / Driver) with IOT Finger Pier (or moored vessel)	**Most Likely:** light contact with Coastal tanker / Bunker Barge moored alongside resulting in moderate damage to both vessels, IOT Finger Pier, breakaway of Coastal tanker / Bunker Barge and ruptured loading arm(s). **Worst Credible:** high impact contact with Coastal tanker / Bunker Barge moored	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**3**	2	3	3	3	**1**	4	4	4	4	4.0	6.0	6.0	6.0	5.0	5.0	5.0	5.0	5.38	Medium

HAZ ID	Inherent Risk Rank	Residual Risk Rank	Hazard Name	Hazard Scenario	Additional Risk Controls Black = applicable Red = not applicable	Residual Risk Assessment										Residual Risk Scores by Consequence Category								Residual Risk Scores	
						Most Likely Scenario					Worst Credible Scenario					Most Likely Risk Score				Worst Credible Risk Score				Calculated Risk Score	Calculated Risk Classifications
						Frequency	People	Property	Environment	Port Business	Frequency	People	Property	Environment	Port Business	People	Property	Planet	Port Business	People	Property	Planet	Port Business		
				alongside resulting in multiple vessel breakaway puncture of tanker / barge hull, rupture of IOT Finger Pier pipeline(s) and significant damage to IOT Finger Peir infrastructure (with extension of breakaway causing impact to IOT trunkway).																					
14	13	3	Contact (Allision) - Project Vessel (Passenger / Driver) with IOT River berths (or moored vessel)	**Most Likely:** light contact with tanker moored alongside resulting in moderate damage to both vessels and river berth infrastructure. **Worst Credible:** high impact contact with terminal infrastructure and Tanker moored alongside resulting in ruptured loading arms and river berth pipelines, multiple vessel breakaway and damage to vessels and berth infrastructure. Or, high direct impact contact with Tanker moored alongside resulting in puncture of tanker hull, rupture of river berth pipeline(s) and damage to vessels and berth infrastructure.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**2**	2	3	3	3	**1**	4	4	4	4	3.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.88	Medium
15	6	12	Contact (Allision) - Coastal Tanker with IERRT Jetty (or moored vessel)	**Most Likely:** light contact with Project Vessel moored alongside resulting in moderate damage to both vessels. **Worst Credible:** high impact contact with Project Vessel moored alongside resulting in puncture of tanker hull and major damage to project vessel and project infrastructure.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**2**	2	2	1	2	**1**	3	4	4	3	3.0	3.0	2.0	3.0	4.0	5.0	5.0	4.0	3.81	Medium
16	10	20	Contact (Allision) - Bunker Barge with IERRT Jetty (or moored vessel)	**Most Likely:** light contact with Project Vessel moored alongside resulting in moderate damage to both vessels. **Worst Credible:** high impact contact with Project Vessel moored alongside resulting in puncture of barge hull and damage to project vessel.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**2**	2	2	1	2	**1**	3	3	3	3	3.0	3.0	2.0	3.0	4.0	4.0	4.0	4.0	3.44	Medium
17	20	12	Contact (Allision) - Tanker with IERRT Jetty (or moored vessel)	**Most Likely:** light contact with Project Vessel moored alongside resulting in moderate damage to both vessels and IERRT infrastructure. **Worst Credible:** high impact contact with Project Vessel moored alongside resulting in puncture of tanker hull and major damage to project vessel and IERRT infrastructure.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**2**	2	2	1	2	**1**	3	4	4	3	3.0	3.0	2.0	3.0	4.0	5.0	5.0	4.0	3.81	Medium

HAZ ID	Inherent Risk Rank	Residual Risk Rank	Hazard Name	Hazard Scenario	Additional Risk Controls Black = applicable Red = not applicable	Residual Risk Assessment										Residual Risk Scores by Consequence Category								Residual Risk Scores	
						Most Likely Scenario					Worst Credible Scenario					Most Likely Risk Score				Worst Credible Risk Score				Calculated Risk Score	Calculated Risk Classifications
						Frequency	People	Property	Environment	Port Business	Frequency	People	Property	Environment	Port Business	People	Property	Planet	Port Business	People	Property	Planet	Port Business		
18	27	27	Contact (Allision) - Tug, Service and Other Small Vessel with IERRT Jetty (or moored vessel)	**Most Likely:** light contact with Project Vessel moored alongside resulting in minor damage to both vessels. **Worst Credible:** high impact contact with Project Vessel moored alongside resulting in moderate damage to tug / service vessel.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**3**	1	1	1	1	**2**	2	2	2	2	2.0	2.0	2.0	2.0	3.0	3.0	3.0	3.0	2.50	Low
19	16	23	Contact (Allision) - Project Vessel (Passenger / Driver) with IERRT Jetty (or moored vessel)	**Most Likely:** light contact with Project Vessel moored alongside resulting in minor damage to both vessel or IERRT infrastructure. **Worst Credible:** high impact contact with Project Vessel moored alongside resulting in major damage to both vessels and IERRT infrastructure.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**3**	1	1	1	1	**1**	2	4	2	3	2.0	2.0	2.0	2.0	3.0	5.0	3.0	4.0	3.19	Medium
20	1	1	Contact (Allision) - Project Vessel (Passenger / Driver) with Eastern Jetty (or moored vessel)	**Most Likely:** light contact with tanker moored alongside resulting in moderate damage to vessels, breakaway of tanker and ruptured loading arm. **Worst Credible:** high impact contact with tanker moored alongside (or bunkering barge alongside tanker) resulting in puncture of tanker hull or bunker barge hull, rupture of Eastern Jetty pipeline(s), loss of bunker barge moored alongside major and damage to berth infrastructure.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**3**	2	2	4	3	**1**	4	4	4	4	4.0	4.0	7.0	6.0	5.0	5.0	5.0	5.0	5.56	Medium
21	8	8	Breakaway - Coastal Tanker at IOT Finger Pier	**Most Likely:** mooring lines part from wash and current resulting in breakaway from berth, minor loss of cargo from loading arm, vessel engines restarted and vessel secured alongside. **Worst Credible:** mooring lines part from wash and current resulting in breakaway from berth, vessel engines cannot be restarted and contact is made with IOT Trunkway resulting in rupture to IOT trunkway pipeline(s).	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**2**	2	2	2	2	**1**	3	4	4	4	3.0	3.0	3.0	3.0	4.0	5.0	5.0	5.0	3.94	Medium
22	8	8	Breakaway - Bunker Barge at IOT Finger Pier	**Most Likely:** mooring lines part from wash and current resulting in breakaway from berth, minor loss of cargo from loading arm, vessel engines restarted and vessel secured alongside. **Worst Credible:** mooring lines part from wash and current resulting in breakaway from berth, vessel engines cannot be restarted and contact is made with IOT Trunkway resulting in rupture to IOT trunkway pipeline(s).	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**2**	2	2	2	2	**1**	3	4	4	4	3.0	3.0	3.0	3.0	4.0	5.0	5.0	5.0	3.94	Medium
23	5	21	Breakaway - Project Vessel (Passenger / Driver) at IERRT Jetty	**Most Likely:** mooring lines part resulting in breakaway from berth, vessel engines cannot be restarted in time and contact is	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan	**2**	2	2	1	2	**1**	2	3	2	3	3.0	3.0	2.0	3.0	3.0	4.0	3.0	4.0	3.31	Medium

HAZ ID	Inherent Risk Rank	Residual Risk Rank	Hazard Name	Hazard Scenario	Additional Risk Controls Black = applicable Red = not applicable	Residual Risk Assessment										Residual Risk Scores by Consequence Category								Residual Risk Scores	
						Most Likely Scenario					Worst Credible Scenario					Most Likely Risk Score				Worst Credible Risk Score					
						Frequency	People	Property	Environment	Port Business	Frequency	People	Property	Environment	Port Business	People	Property	Planet	Port Business	People	Property	Planet	Port Business	Calculated Risk Score	Calculated Risk Classifications
				made with IOT Finger Pier resulting in damage to finger pier, rupture to finger pier pipelines, breakaway of vessel at finger pier. **Worst Credible:** mooring lines part resulting in breakaway from berth, vessel engines cannot be restarted and contact is made with IOT Finger Peir (as above), loss of life on finger pier and further contact with IOT Trunkway resulting in rupture to IOT Trunkway pipeline(s).	RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier																				
24	17	10	Breakaway - Tanker at Eastern Jetty	**Most Likely:** mooring lines part resulting in breakaway from berth, vessel engines cannot be restarted in sufficient time and light contact with IERRT vessel or IERRT infrastructure. **Worst Credible:** mooring lines part resulting in breakaway from berth, vessel engines cannot be restarted and contact is made with Project Vessel moored alongside IERRT or IERRT infrastructure, Tanker hull ruptured, IERRT vessel breakaway.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**2**	2	2	2	2	**1**	3	3	4	4	3.0	3.0	3.0	3.0	4.0	4.0	5.0	5.0	3.88	Medium
25	26	24	Grounding - Project Vessel (Passenger / Driver)	**Most Likely:** vessel makes light contact with river bed and is able to free, negligible damage. **Worst Credible:** vessel makes contact with river bed and requires assistance to navigate free, moderate damage to vessel.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**2**	1	1	1	1	**1**	2	2	2	3	2.0	2.0	2.0	2.0	3.0	3.0	3.0	4.0	2.81	Low
26	23	18	Fire - Project Vessel (Passenger / Driver) at IERRT Jetty	**Most Likely:** fire contained by crew resulting in moderate damage to vessel **Worst Credible:** crew are unable to contain fire resulting to serious damage to vessel and multiple loss of life.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**1**	2	2	1	2	**1**	4	2	2	3	3.0	3.0	1.0	3.0	5.0	3.0	3.0	4.0	3.56	Medium
27	21	18	Foundering / Swamping - Tug, Service and Other Small Vessel from Project Vessel thrust	**Most Likely**: Wash from vessel floods the deck of the tug. Tug has water tight doors closed and remains afloat **Worst Credible:** Wash from vessel floods the deck of the tug. Tug has not water tight doors closed, takes on water, loses stability and sinks.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan RC04 Mooring equipment and infrastructure RC05 Impact protection for IOT Trunkway RC06 Moving finger pier	**1**	2	2	1	2	**1**	4	2	2	3	3.0	3.0	1.0	3.0	5.0	3.0	3.0	4.0	3.56	Medium

Appendix C – Applicant's Review of IOT's Navigational Risk Assessment

IMMINGHAM EASTERN RO-RO TERMINAL

Applicant's Review of IOT's
Navigational Risk Assessment

Document Reference – 10.2.56

PINS Reference – TR030007

APFP Regulations – 5(2)(q)

November 2023

Document Information

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Contents

1 Introduction

1.1.1 At Deadline 2 of the examination, both DFDS Seaways ("DFDS") and Associated Petroleum Terminals (Immingham) Ltd ("APT") as operators of the Immingham Oil Terminal ("IOT") submitted what are purported to be alternative Navigational Risk Assessments ("NRA") – alternatives to the formally prepared NRA submitted by the Applicant as part of its application for the Immingham Eastern Ro-Ro Terminal ("IERRT") Development Consent Order ("DCO").

1.1.2 Both alternative NRAs share similar traits – for reasons discussed below – but not least because the principal author of both NRAs was Nash Maritime, albeit instructed by different clients with different motives and objectives.

1.1.3 This report provides a review of and commentary on the IOT Operators alternative NRA ("the IOT NRA"). A review and commentary of the DFDS alternative NRA is provided as Document Reference 10.2.56.

1.1.4 The IOT Operators commissioned Nash Maritime to produce a document which describes itself as "Immingham Eastern Ro-Ro Terminal Navigational Risk Assessment" **[REP2-064]** ("the IOT NRA"). It is evident that it was produced sometime during August 2023 during the course of this examination as part of APT's representations in respect of the Proposed Development.

1.1.5 For reasons briefly summarised below, although the document purports to be an NRA in respect of the Proposed Development, it lacks some of the most basic requirements to be an NRA as identified below. As a consequence, it is wrong to treat it as such, and as a substitute or proxy for the NRA that has been properly produced for the Proposed Development by ABPmer in relation to the DCO Application.

1.1.6 Although there are many points of detail that could be elaborated by way of criticism of the IOT NRA in purporting to be a NRA of the Proposed Development, this review focuses on the key points which make the IOT NRA inherently unsuitable for use as an NRA and which reveal why it does not in any way undermine the Applicant's NRA that has already been produced and which presents a full and comprehensive NRA in respect of the Proposed Development.

1.1.7 The structure of this document is as follows:

- Section 1 – Introduction;
- Section 2 – NRA Methodology;
- Section 3 – Stakeholder Engagement;
- Section 4 – Decision Making and the Statutory Harbour Authority;
- Section 5 – IOT NRA; and
- Section 6 – Conclusion.

2 NRA Methodology

2.1.1 This section of the document summarises the general content and methodology that is followed when undertaking NRAs.

2.1.2 It should be noted at the outset that there is no policy or legislation in the UK that dictates the format of an NRA to support a new development. The Port Marine Safety Code ("PMSC") **[REP1-015]** sets out policy and guidance that relates to statutory harbour authorities, jetties, terminals and marinas. In so doing, however, it is not purporting to dictate the specific requirements of an NRA or risk assessment for a particular project.

2.1.3 As a consequence, over the years consultancies who provide NRA assistance to clients have constructed and refined their own templates, based on feedback from a range of clients.

2.1.4 It is unsurprising, therefore, that different consultancies may have different approaches to the format of NRAs depending upon what project is being assessed. However, individual preferences in presentation are not based upon any formal or mandated requirements. The term NRA is not a specifically defined term. Most consultancies that offer NRA services generally consider that risk assessments within NRAs are largely intended to consider the risks associated with the navigation or movement of vessels. Within that context, risk assessments within a Marine Safety Management System ("MSMS") may cover a number of navigational risks, whilst also considering other risks to which a port might be subject that concern port and/or marine safety.

2.1.5 The outcomes of NRAs produced during the consenting stage of new developments are later incorporated into MSMSs for ports where they are continually reviewed (see Section 4 below).

2.1.6 Whilst the PMSC does not dictate the specific requirements of an NRA, when considering the guidance in the PMSC and its associated Guide to Good Practice ("GtGP") **[REP1-016]**, it is clear that most NRAs contain certain core elements which are included by consultancies like ABPmer, Anatec, Marico Marine and Nash Maritime.

2.1.7 These core elements include the following:

- Introduction and Policy review;
- Data sources (Wind, Tide, AIS etc.);
- Baseline assessment (existing review of navigation, usually accompanied by review of incidents and traffic in the study area);
- Description of proposed change/development (if applicable);
- Risk assessment approach and details (tolerability/acceptability, descriptors, matrices);
- Hazard Logs (detailing risks with controls, causes, outcomes, usually produced as a result of HAZID workshops); and

- Discussion (of findings).

2.1.8 Some consultancies also consider a 'future baseline', where statistics and industry inference are taken into account to describe a potential future that may occur at the port. For example, on a macro scale across the UK, there is a common trend that the total freight by tonnage is increasing whilst the number of vessel movements is either constant or reducing as a result of the use of larger vessels and consequential reduction in the number of ships being used.

2.1.9 It is important to note, however, that there is no agreed standard on any of the core elements of information listed above, nor any policy or regulatory requirements as to what has to be included by way of a 'navigation baseline' in an NRA.

2.1.10 By way of example, there is reference in the PMSC GtGP, in paragraph 4.3.10 - "*Taking stock covers a review of: the adequacy and completeness of any established incident database or similar records;"* that historic incidents should be considered but there is no guidance or advice provided as to how this could or should be satisfied, for example by means of an incident-by-incident approach or by consideration of spatial data plots. These are matters of choice for the author of the relevant NRA, with the ultimate arbiter as to whether the NRA provides sufficient information being solely a matter for the Statutory Harbour Authority (see Section 4).

2.1.11 It is wrong in principle to suggest that a particular approach to presentation of data or information is correct or incorrect. This misunderstands the process that is applied to NRA and the exercise of judgment by relevant authors which is ultimately overseen by the decision of the Statutory Harbour Authority.

2.1.12 With a view to enhancing marine safety within a port and harbour approaches, a positive analytical approach is required, including the consideration of past events and accidents, examining potential dangers and the means of avoiding them. The process of assessment is continuous, so that new hazards and changed risks are properly identified and addressed in the MSMS (see Section 4). The aim of risk assessment is to define risks so that they can be managed.

2.1.13 Assessing risks to help to determine precautions can be qualitative or quantitative. Quantified risk assessment is not a requirement and may not be practicable. Risk assessments should be undertaken by competent people, especially when choosing appropriate quantitative risk assessment techniques and interpreting results.

2.1.14 Risk assessment techniques are fundamentally the same for large and small ports, but the execution and detail will differ considerably. A risk assessment will typically involve five broad stages, which are described in turn below:

- Problem identification, scoping and risk assessment design (data gathering)
- Hazard Identification ("HAZID")

- Risk Analysis
- Assessment of Existing Risk Control Measures
- Identification of Additional or Future Risk Control Measures

2.1.15 **Problem identification, scoping and risk assessment design (data gathering)** – Anybody undertaking a risk assessment has to start by taking account of the organisation, its culture, policies, procedures, and priorities together with an assessment of the existing safety management structure.

2.1.16 Key to this part of the process is to engage with those working in and using the port. Port users affected by a particular risk should be informed and involved. It is likely to involve a structured process.

2.1.17 Taking account of the existing situation covers a review of the adequacy and completeness of any established incident database or similar records, as well as considering the current management procedures, including; pilotage, navigation management (LPS/VTS), hydrography, conservancy, and marine operations. Additionally, this will typically involve reviewing Marine Accident Investigation Branch (MAIB) reports and other investigative reports which make recommendations about incidents which have taken place in a harbour.

2.1.18 **HAZID** – This stage should involve the identification of hazards (something with the potential to cause harm, loss, or injury) that arise from the proposed project in the context of the existing navigational environment. Any list of hazards will include those already known to the port, including identification of the causes of previous incidents if known.

2.1.19 Within the process of hazard identification and risk assessment, ports should have due regard of the link between the port authority and terminal/vessel operators. Structured meetings or workshops need to be held during this process involving relevant marine practitioners. Port users, including groups such as Pilotage Exemption Certificate (PEC) holders, commercial operators, and tug operators is required (PMSC GtGP; **[REP1-016]**).

2.1.20 This stage should also identify the potential outcomes if the identified events were to happen (scenarios). One useful approach is to consider both the most likely and the worst credible outcomes (set against likely frequency of the event happening in each case). This approach provides a more realistic and thorough assessment of risk, which reflects reality, in that relatively very few incidents result in the worst credible outcome. On a standard 5x5 risk matrix used by many ports, these incidents score highly for outcome, but this is tempered by a low score on the frequency axis.

2.1.21 **Risk analysis** – The hazardous scenarios identified then need to be prioritised. A method which combines an assessment of the likelihood of a hazardous scenario and its potential consequences should be used. This will be a matter of judgement crucially informed by the relevant marine practitioners and likely to be best appraised by those with professional responsibility for managing the harbour, namely the harbourmaster and dockmaster.

2.1.22 The frequency of incidents can be established in part using historical data identified in the first stage of the work. It can be determined using a qualitative scale or on a "per-shipping' movement basis, or a combination of the two. The likelihood of a hazardous incident and its potential consequences can often be determined with reference to historical data. However, it should be borne in mind that following an incident the risk of it reoccurring should have been reduced by management action. It therefore follows that any assessment of frequency and consequence is likely to rely to a certain extent upon the judgement of the assessors or others capable of making such a qualified estimate. Historical data alone will not provide a true assessment of the risk of the current operations, nor will it necessarily reveal an extremely remote event.

2.1.23 Risks and the impact of identified outcomes should normally be assessed against four criteria; the consequence to:

- Life (public safety);
- The environment;
- Port and port user operations (business, reputation etc); and
- Port and shipping infrastructure (damage).

2.1.24 **Assessment of Existing Risk Control Measures** – Risk assessment necessarily includes a review of existing hazards and their associated risk control measures (embedded controls). As a result, new risk control measures (or changes/improvements to existing risk control measures) may be identified for consideration, both where there are gaps in existing procedures and where risk controls need to be enhanced. Some control measures might also be relaxed so that resources can be re-designated to meet a new priority. Care should be taken to ensure that any new hazards created as a result are themselves identified and managed. The overall risk exposure of the port organisation itself will be identified during this stage and will allow recommendations to be made to enhance safety.

2.1.25 **Identification of Risk Control Measures** – The aim of assessing and managing marine operations in harbours is to reduce risk as low as reasonably practicable ('ALARP'). Judgement of risk should be undertaken on an objective basis and should not be influenced by the financial position of the authority. The degree of tolerable risk in a particular activity or environment can be balanced against the time, trouble, cost, and physical difficulty of taking measures that avoid the risk. If these are so disproportionate to the risk that it would be unreasonable for the people concerned to incur them, they are not obliged to do so. The greater the risk, the more likely it is that it is reasonable to go to very substantial expense, trouble, and invention to reduce it. Conversely, if the consequences and the extent of a risk are small, insistence on great expense would not be considered reasonable.

2.1.26 Risks may be identified which are intolerable. The decision as to whether risks are tolerable or intolerable sits with the appropriate authority, namely in the case of the Applicant, the Duty Holder through the Harbour Authority and Safety Board rather than the authors of the NRA (see Section 4 for further detail). Measures must be taken to eliminate identified risks so far as is practicable. This generally requires whatever is technically possible in the light of current knowledge, which the person concerned had or ought to have had at the time. The cost, time and trouble involved are not to be taken into account in deciding what measures are possible to eliminate intolerable risk.

2.1.27 Where (as for the Proposed Development) none of the risks are considered intolerable with the (to be) applied controls, there is no requirement to eliminate activity or apply additional overly onerous (i.e., not reasonably practicable) controls to meet the tolerability thresholds set by the appropriate authority, the Harbour Authority and Safety Board.

3 Stakeholder Engagement

3.1.1 This section explains the importance of stakeholder engagement in the NRA process.

3.1.2 As identified in considering the methodology above, whilst there is no specific style or format that has to be adopted for a NRA, any proper NRA will necessarily involve stakeholder engagement in the risk assessment process.

3.1.3 That engagement concerns both the identification of relevant hazard scenarios, their frequency and consequence, and how such hazards are to be addressed.

3.1.4 That does not mean that all stakeholders will necessarily agree, or have to agree, with the approach adopted in a NRA, or with the judgments that are reached. Whilst one should strive for consensus, it is in fact commonplace for there to a range of different views by affected stakeholders, depending upon the nature of their interest.

3.1.5 Any proper NRA, however, will be based upon stakeholder engagement where that includes not only taking account of other users of the marine environment, but also critically (and as an essential component) engagement with the relevant harbourmaster and dockmaster responsible for that marine environment.

3.1.6 This basic requirement is fully addressed in the Applicant's NRA. A critical part of that process was the holding of HAZID workshops to support the NRA produced for the DCO at which the considerations of all users was taken into account. It is essential to involve those working in and using the port and others in the risk assessment process and in subsequent reviews, as risks affect both port users and the harbour authority alike. It is equally essential, however, to realise that the input from users through this process does not dictate, nor should it be permitted to dictate the objective assessment of risk by the SHA.

3.1.7 SHAs are required to identify potential hazards in light of (amongst other things) input from users, but they are also required to develop and refine procedures and defences to mitigate those risks to a level which is acceptable to the SHA bearing in mind the aspirations of users and what will often be competing aspirations and demands of those users. It is good practice to establish channels of engagement which can be used for this purpose (such as the HAZID workshops). It is simply wrong in principle, however, to suggest that feedback from users through this process can be treated as determinative or that it should be allowed to dictate the outcome of how the SHA manages the safety of the port to what it considers to be acceptable levels.

3.1.8 As set out below in Section 5, and in direct contrast to the Applicant's NRA, the IOT NRA is fundamentally flawed in this respect as it has not involved essential stakeholders including the harbourmaster and dockmaster.

4 Decision Making and the Statutory Harbour Authority

4.1.1 This section explains the key aspects in managing navigational risk and the role of the Statutory Harbour Authority in controlling navigational risks within its statutory area. It is important to understand this in the wider context of the various roles and responsibilities for navigational risk on the River Humber. To assist with this, the Applicant submitted a note on the management, control, and regulation of the Port of Immingham and the River Humber to the Examination **[REP1-014]**. Within that note, the roles of the Applicant, Statutory Harbour Authority for the Port of Immingham, the Statutory Harbour Authority for the Humber Estuary, and ABP's Governance is explained.

4.2 Existing Controls, Operations and Standards

4.2.1 As set out above, any proper NRA will necessarily need to consider all potential controls and a port's established operations and relevant standards of acceptability in reaching any conclusions about proposed changes. A failure to understand the current operating environment and standards that are applicable to it will necessarily undermine the validity of any purported NRA. Again, as set out further below, the IOT NRA is also fundamentally flawed in this respect as it pays no proper regard to the existing safe operations at the Port of Immingham.

4.3 Marine Safety Management System

4.3.1 The PMSC relies upon the principle that relevant organisations will base their policies, and procedures relating to marine operations on a formal assessment of hazards and risks to their marine operations overall. They should maintain a marine safety management system (MSMS) developed from such risk assessments.

4.3.2 Any subsequent risk assessments deemed necessary as time goes on (either to update an existing situation or to address changes in the port's environment) are then reflected in subsequent updates to the MSMS which itself develops and evolves over time as a result of changes in (for example) trade, and port usage or physical developments. In this context. The outcomes of the NRA produced for the Proposed Development will be incorporated within the MSMS if the DCO application is approved.

4.3.3 Under the PMSC and consequential MSMS that is put in place, there is a critical appraisal of all routine and non-routine activities in any risk assessment work. Those involved should not just include employees, but others including stakeholders who use the port including contractors and terminal operators.

4.4 Statutory Harbour Authority

4.4.1 It is only the relevant Statutory Harbour Authority ("SHA") that is the relevant decision maker for the control of navigational risks within their statutory area. It is the SHA that is responsible for assessing navigational risks and therefore how they are to be assessed and managed within their area. It is therefore fundamental that it is the SHA that has to be satisfied that an appropriate NRA has been conducted for its needs. There is no power and certainly no principled basis for a third party to direct a SHA, or to seek to dictate a SHA, to as to how the SHA should discharge its own duties and responsibilities. The SHA has the overall responsibility and competency to deal with navigational safety in the ordinary running of its area.

4.4.2 It is evident from the very recent production of the IOT NRA (like the DFDS NRA) which the IOT Operators now claim to be their own "NRA" that the function of a NRA, the essential role of the SHA and the exclusive duty and responsibility of the SHA in decision-making is being misrepresented or misunderstood by the IOT Operators/APT and DFDS.

4.4.3 The NRA is an assessment that has to be considered by the SHA to assess navigational risks in the environment for which it is responsible for regulating safely. It therefore necessarily requires the SHA to make the necessary judgments about those risks, the myriad ways in which those risks can be mitigated (where considered necessary), the tolerability of risks and whether they have been reduced to ALARP as judgments for SHA after any such mitigation.

4.4.4 In so doing, the Statutory Harbour Authority is not only fulfilling the essential functions that are imposed on it (and no other body) by statute, but it is also fulfilling its obligation to ensure the safe operation of the port in light of the risks identified having regard to the interests of all users.

4.4.5 The River Humber is subject to navigation by a wide range of users from small leisure craft to very large commercial vessels, some transporting petro-chemicals in tankers. This of itself creates a notional risk between the interaction of such craft navigating in the same area. The SHA will need to consider the needs and aspirations of all such users in assessing risks and managing them to what it regards to be acceptable levels in practice. The fact that users of large commercial vessels might ideally wish to see leisure craft prevented from using the spaces that it wishes to use to reduce the risks and leisure craft might seek the same in reverse does not dictate the outcome of the Statutory Harbour Authority's NRA of such interactions.

4.4.6 By the same token, the River Humber is already subject to navigation by Ro-Ro vessels operating on a daily basis and seeking access to ports like Immingham in proximity to an oil facility such as that at IOT. Again, the fact that such interactions will inevitably involve residual risks, with competing commercial aspirations of users such as Ro-Ro operators and the operators of an oil terminal does not dictate the outcome of the NRA by the SHA as to how to manage those risks to what it considers to be tolerable levels. It is the Statutory Harbour Authority that decides what is tolerable and ALARP in all circumstances.

4.4.7 In each of the simple examples above, there will not only be identification of relevant risks and controls and mitigation measures, but a subsequent judgment to be made what is tolerable and ALARP, but with the integrated step of assessment of the risk and means of mitigating it to a tolerable and ALARP level, having regard to the needs and aspirations of different users. Thus, taking the second example above, there is a myriad of ways of managing interaction between such marine traffic to reduce risks to what the SHA consider to be acceptable. These may include controlling or restricting use by leisure craft in areas or operations (e.g., not operating under sail, or not exceeding certain limits or not operating in certain areas when ships manoeuvring etc), or controlling or restricting use or operations by commercial traffic (e.g., not operating at certain times of tide or in certain wind conditions, requirements for use of a pilot, requirements for use of tug or tugs etc) or a combination of any that takes account of the interests of both users, rather than simply restricting one user in preference to another.

4.4.8 The SHA is the decision maker on what activities can occur within its respective harbour authority area. The SHA needs to be satisfied that a risk assessment conducted for those purposes is appropriate. If the SHA does not believe that a risk assessment has been conducted to a sufficient standard, it is bound to discount it. Similarly, for an external body to attempt to direct an SHA to act in a certain way would be an unacceptable interference with and impinge upon the Statutory Harbour Authority's powers and duties.

4.4.9 As explained below, the IOT NRA falls into the fundamental error of seeking to impose its own expressed judgments (without any actual and genuine stakeholder engagement with key bodies like the Harbour Master Humber or dockmaster and without any understanding of existing port operational standards and measures) as if it represented judgments on tolerability or ALARP which could be substituted for the views of the SHA. That is simply not the case.

5 IOT NRA

5.1 Introduction

5.1.1 This section provides a review of the "Immingham Eastern Ro-Ro Terminal Navigational Risk Assessment" **[REP2-064]** that was undertaken by Nash Maritime on behalf of the IOT Operators (i.e., the IOT NRA).

5.1.2 As already noted, much of the document that has now been produced as the IOT NRA contains material to which it is unnecessary to provide any direct response to as it simply reflects the presentation of data (albeit in a different format or style to that in the Applicant's NRA). It is not material which either advances the position or undermines the Applicant's NRA.

5.1.3 This section, therefore, concentrates on the key part of the IOT NRA as purporting to represent a different assessment of risk to that which was presented in the Applicant's NRA (the latter which has already been considered and endorsed by the SHA and the "Duty Holder").

5.1.4 The review of IOT NRA has been undertaken in the context of the fundamental principles outlined in the preceding sections of this document. This is structured as follows:

- Stakeholder engagement;
- Assessment of tolerability;
- Selective use of methodology;
- Inappropriate use of descriptors;
- Use of risk controls; and
- Risk scoring.

5.2 Stakeholder Engagement

5.2.1 As identified above, one of the most basic requirements of any NRA is appropriate stakeholder engagement in the NRA process. The PMSC GtGP states in paragraph 4.2.6 that - '*It is essential to Involve those working in and using the port and others in the risk assessment process and subsequent reviews and development, utilising their specialist knowledge and skills*'.

5.2.2 This does not mean that every stakeholder has to agree, or that there is a requirement for consensus. Many stakeholders will often disagree and inevitably have different priorities and objectives and consider their operations to be more important than others or wish to prioritise their operations over others or seek to obtain the most favourable operating conditions for their own commercial operations. It is important, however, that genuine engagement actually takes place including with those responsible, and most experienced, for the safe operation of the marine environment including the Harbour Master Humber and the Dock Master.

5.2.3 The NRA produced for the IOT operators fails to meet this fundamental criterion and does not follow the principles of the PMSC in terms of striving for consensus. On the contrary, it fails to undertake any form of stakeholder engagement. At its most basic such engagement would be expected with the Applicant, as the port operator, but also the Harbour Master Humber, Dock Master and the various persons involved in operations such as the pilots, tug operators, VTS and, of course Stena, the proposed operator of the Proposed Development. Stena's own Masters would be responsible for navigating the particular vessels in this location for this development, even when operating under a compulsory pilotage direction, pilotage by HES pilot or under an act of self-pilotage with a pilot exemption certificate (PEC).

5.2.4 In place of this, the IOT NRA makes assumptions and presents an inherently biased perspective about such operations, with no evidence that any port stakeholder confirmed or validated their internally held opinions on risks on basic matters such as consequences or frequency. This is a fundamental flaw in the IOT NRA which renders it incapable of having any weight as an

NRA. As a consequence, the SHA is simply not in a position to take the findings of the IOT NRA into account and it would be an abrogation of its statutory obligations to do otherwise.

5.2.5 In an attempt to mitigate this obvious flaw, the IOT NRA at Page 55, Section 6.1.1 references the consultation undertaken by the Applicant as part of its own NRA exercise. This is both misconceived and unacceptable. Whilst clearly an acknowledgement of the defect in its adopted NRA methodology, it cannot effectively "plug" the omission by leaning on the Applicant's NRA which involved engaging with the relevant stakeholders to understand attitudes towards risks which then formed part of that NRA. The reality is that no such engagement or consultation was undertaken by Nash Maritime to inform the IOT NRA. As a consequence, the approach it has adopted and the various judgments it has made on central issues in relation to hazard frequency, likelihood etc. are not founded in consensus nor indeed a complete understanding of the Port of Immingham.

5.2.6 It is clearly not acceptable to rely on attendance as a representative at a third party's (i.e., the Applicant's) HAZID and for the authors to reference that as "engagement" for the IOT NRA. There has been no input by the SHA or wider port stakeholders (pilots, tug masters, etc) to inform the basic judgments that the authors of the IOT NRA have purported to make which renders such judgments meaningless.

5.3 Assessment of tolerability

Overall approach

5.3.1 Fundamentally the IOT NRA fails to take into account the appropriate standard of acceptability of risk (i.e., tolerability) as set by the ABP Harbour Authority and Safety Board (HASB). Their approach is therefore not in accordance with the PMSC GtGP.

5.3.2 The PMSC states in section 4.3, page 33, that - '*A safety management system should be informed by and based upon a formal risk assessment of the port's marine activities (routine and non-routine), a documented, structured and systematic process comprising; the identification and analysis of risks; an assessment of these risks against an appropriate standard of acceptability…*'. The HASB has determined this appropriate standard of acceptability, which has been published in the Applicants NRA.

5.3.3 Instead, the IOT NRA assumes or supposes a standard of acceptability for the Harbour Authority. Neither Nash Maritime nor the IOT Operators are in a position nor do they have the authority to make such an assumption. Further, neither Nash maritime nor DFDS sought to discuss or agree levels of tolerability with the SHA. The approach adopted in the IOT NRA is both inappropriate and unacceptable as it trespasses on the SHA's statutory powers, duties and obligations. To allow one operator to set its own standards of acceptability (with all of the flaws already identified) would seriously compromise, to a fundamental degree, the SHA's ability to discharge its duties and responsibilities to determine how best to manage safety within an area for which it is statutorily responsible.

5.3.4 In direct contrast the Applicant's NRA **[APP-089]** has evaluated risks in accordance with the thresholds set by the HASB and as such is in full alignment with the requirements of the PMSC GtGP.

5.3.5 More fundamentally, judgments about tolerability within the port are a matter for the SHA. It is the SHA which carries the consequences and liability of the risk, as empowered by schedule 3 of the Transport Act, 1981– Duties and Powers of ABP. A terminal operator or their consultants cannot simply state what it, subjectively, believes the tolerability of the port should be. If that were the case, then it effectively acts as an invitation for port/ terminal operators to operate in violation of what the SHA considers acceptable (i.e., tolerable).

Incorrect judgment of applied tolerability

5.3.6 In addition to the fact that the IOT NRA fails to take into account the appropriate standard of acceptability of risk (i.e., tolerability), there are further criticisms of their attempts to define tolerability. The IOT NRA claims that any outcome that is scored at 6 or above (on a 1 to 10 scale) has been considered as intolerable. This is an arbitrary and simplistic view of tolerability and does not apply the concept of tolerability in an appropriate way.

5.3.7 The guidance in using numbers for risk scoring and defining 'quantitative unacceptable limits' is to do so very carefully as they can create false confidences or uncertainties. Specifically, the MCA quote the HSE and state that: '*The HSE is careful to note that any quantitative 'unacceptable' limits must be used with great caution. The concepts used in establishing them are complex, and the quantitative predictions that might be compared against them are fraught with uncertainty. It may not be helpful to attempt to define quantitative limits, and developers should consider whether there are other ways to define what is unacceptable"*. The HSE guidance document Reducing Risks Protecting People (R2P2) notes that what is unacceptable "…*is often spelled out or implied in legislation, ACOPs, guidance, etc or reflected in what constitutes good practice*" such that there is no need to set an explicit quantitative boundary. Developers should therefore carefully justify any unacceptable limits they propose' (MGN 654, Annex 1, Annex C4).

5.3.8 It is considered that the score of 6 is an arbitrary figure based on different consequence and frequency descriptors and it underlines the need to avoid over-reliance on the representation of a risk outcome as a number to determine whether or not a risk is tolerable. The conclusion of the IOT NRA is that two risks are intolerable, (IOT NRA, Page 165, Annex C), specifically ID 10 (Contact (Allision) - IERRT Ro-Ro Vessel with IOT Trunkway) and ID 13 (Contact (Allision) - IERRT Ro-Ro Vessel with IOT Finger Pier).

5.3.9 The defect in this conclusion, however, is that the IOT NRA has not fully considered the operation of existing vessels into, and out of the Port of Immingham's lock in supporting their own rationale. They claim that the Proposed Development has risks that they define as intolerable. Yet the COMAH Assessment conducted in 2019 by IOT (see IOT NRA, Page 49, third line) states that *"major accident hazard as a result of a collision can be calculated as 1.7E-02/yr, or about one in every 60 years*". This is a relatively high frequency for a major accident. If one were to apply the intolerability criteria (IOT NRA, Page 59, Table 7) in the IOT NRA to such existing operations, their own conclusions drawn in the NRA would be that this risk would also be intolerable.

5.3.10 Explicitly, within the IOT NRA it is considered that a catastrophic consequence/ worst credible risk occurring up to every 10,000 years is intolerable. The authors of the IOT NRA, however, did not the consult the SHA to determine if it also would consider this to be intolerable. It is suggested that if ports were held to a standard where they were not able to operate if there was a '*potential for many fatalities on site or potential for serious injury or fatality off site'* to occur up to every 10,000 years, then shipping trade would have to cease internationally.

5.4 Selective use of methodology

5.4.1 Within the IOT NRA, Nash Maritime seek to suggest that they are the arbiter of what elements should or should not be present within an NRA. This is despite there being no such prescriptive requirements for the contents of NRAs within the PMSC or elsewhere.

5.4.2 The fact that both DFDS **[REP2-043]** and IOT **[REP2-064]** NRAs are very different, and yet were written by the same consultancy provides further evidence to support the fact that there is no policy or legislation in the UK that dictates the format of an NRA. This is further exemplified in another NRA, also written by Nash Maritime and cited by DFDS in their NRA, the 'Solent Gateway NRA' which again uses a different format and methodology. It also confirms that the guidance in the PMSC and GtGP is not prescriptive as to how NRAs are to be undertaken.

Use of COMAH methodology

5.4.3 Notwithstanding the concerns noted above, the IOT NRA is also flawed by the inclusion of Control of Major Accident Hazard (COMAH) as part of its approach. Despite the lack of applicability, the IOT NRA is presented as an assessment using HSE (COMAH) methodology and settings for tolerability as defined by the HSE (Page 51, Section 5.2.4).

5.4.4 The Applicant is concerned that the IOT NRA is effectively mixing two fundamentally different policy areas and thereby confusing its adopted methodology. In simple terms, considerations concerning COMAH and the HSE's approach to assessing COMAH risks are not part of navigational risk, nor any NRA. COMAH relates to a port's terrestrial infrastructure. This is explained further below.

5.4.5 Within the context of the UK planning and marine licencing framework, navigation risk assessment as part of the Environmental Impact Assessment (EIA) should seek to identify, assess and if necessary, propose mitigation to ensure that the planned development does not have a significant impact on shipping and navigation receptors. It should not include societal risk use for land use planning (LUP) nor should it be used to identify COMAH hazards. That said, it can inform the societal risk assessment and inform COMAH risk and how the COMAH site operator can control and mitigate the risks, if relevant. The NRA alone, however, cannot provide this, and it is not intended or designed to do so.

5.4.6 The HSE does not regulate the maritime, marine, or navigational functions of a port or its terminals. COMAH and the use of HSE societal risk applies to landside infrastructure. The use of an NRA to make decisions on COMAH and public safety hazard identification and control is, therefore, inappropriate and potentially dangerous.

5.4.7 It is not, therefore, considered appropriate to apply HSE/COMAH tolerances or assessment matrices for navigational assessments. Further, even terminals which themselves will be COMAH sites, should not reference the COMAH regime in their NRAs. As an example, the ‘Solent Gateway NRA’, cited by DFDS in their NRA **[REP2-043]** and also written by Nash Maritime, does not mention the COMAH Regulations, does not apply COMAH assessment criteria, and does not use COMAH based tolerances to define if risk is acceptable or not. This is despite the fact that the Solent Gateway port is itself a COMAH site. This does seem to demonstrate a conflict in the methodology adopted by the authors of the IOT NRA.

5.4.8 By referencing the COMAH Regulations, the IOT’s NRA is simply attempting to introduce the Regulations as the appropriate standard of acceptability instead of the Port’s own ‘tolerability’ thresholds. This is simply not correct.

Inconsistent use of data

5.4.9 The IOT NRA attempts to apply various data sources to determine both frequencies of incidents and their consequences as baseline inputs for their quantitative risk assessments. However, the application of the data used is both subjective and inconsistent. This is important as it forms the basis for determining risk levels against the COMAH tolerability threshold set by Nash Maritime (which, as noted above, is flawed in itself). This issue is compounded by the fact that it is difficult to use rigorous data in NRAs as there is a significant lack of it across the maritime industry as a whole.

5.4.10 An example of this in the IOT NRA is the use of the percentage of fatalities during a capsize as a proxy for the percentage of deaths if a Ro-Ro were to have an allision. Specifically, in paragraph 316, it is assumed that 25% of the Ro-Ro Persons on Board (i.e., an average of 60.94 persons) would be fatalities (based on 23% fatality for rapid capsize events). The use of this figure as a justification for calculating worst credible scenario consequences is fundamentally flawed. It would need significantly more relevant supporting evidence in lieu of appropriate justification, which has not been provided. It is unclear from the IOT NRA whether the predicted 60.94 fatalities are due to vessel capsize, or due to a fire associated with product release from the trunkway (and perhaps some fuel from the Ro-Ro). In other words, there is no evidence to support this assumption whatsoever, and it leads to a greatly conflated outcome for the assessment.

5.4.11 Another example of this includes discounting incident (failure) levels for roll-on/roll-off passenger (RoPax) vessels from literature when setting the ratio of Major to Minor RoPax incidents. Nash Maritime use an incomplete assessment of MARNIS data to establish RoPax failure rates within the study area, despite taking considerable effort to review 20 years of MAIB incident data on the Humber to identify only 8 serious incidents covering several vessel types over the 20 year period.

5.5 **Inappropriate use of descriptors**

Frequency descriptors

5.5.1 The IOT NRA attempts to present perspective-based information as fact in several areas when it is not fact but a combination of statistics and assumptions.

5.5.2 An example of this is where Nash Maritime has translated the likelihood descriptors used (and applied by stakeholders) within the Applicant's NRA to inform their respective risk analysis. For example, Nash Maritime, in the absence of consultation has translated frequency year bands where 'rare' has been determined to be a 1 in a million-year chance (page 56, Table 4). In doing so, the IOT NRA has invalidated data that could be transposed from the Applicant's HAZID workshops by changing the definitions of the descriptors. Nash Maritime have essentially guessed that stakeholders had a 1 in 1-million-year event in mind when they selected the associated word picture for 'rare' within the Applicants HAZID workshops. This is one example and can be applied to the other likelihood descriptors throughout (page 56, Table 4).

5.5.3 Moreover, the likelihood and consequence banding is not comprehensible outside rigorous statistical analysis. For example, the IOT NRA (page 56, Table 4) uses 'very unlikely' to describe 1 in 1,000,000, and 'unlikely' to describe the next band down as 1 in 10,000 to 1 in 1,000,000. These category bands are far too wide and very difficult to comprehend, and they cannot be substantiated based on available data.

5.5.4 As an example, the IOT NRA purports to identify two risks as intolerable at the baseline (embedded) stage. These risks are:

- ID 10, Contact (Allision) - IERRT Ro-Ro Vessel with IOT Trunkway; and
- ID 13, Contact (Allision) - IERRT Ro-Ro Vessel with IOT Finger Pier.

5.5.5 For these risks, it is asserted that the worst credible scenarios would occur with a frequency of between 1 in 100 instances to 1 in 10,000 instances. This is a meaningless scale for provision of frequency with a substantial lack of granularity immediately evident. This band of probability is far too large, meaning that a high proportion of risks will fall into this band rather than being spread out to enable more informed analysis.

5.5.6 This is particularly concerning as the IOT NRA concludes that the appropriate 'description' for a risk that can occur up to 1 in 10,000 is 'Reasonably Likely'. This is a statistically meaningless description of such an event. It results in a misleading categorisation of the risk in plain terms in that a reader might see a high consequence risk that is 'reasonably likely' and think that there is considerable risk whereas this could be a 1 in 10,000 likelihood event, which is in fact not "reasonably likely".

Consequence descriptors

5.5.7 It is noted that the consequence descriptors are different to those used (and applied by stakeholders) within the Applicants NRA for assessing risk (IOT NRA, Page 57, Table 5). This makes comparison of risk outcomes between NRAs impossible without introducing a degree of uncertainty through interpolation. If the assessment criteria are not the same, the SHA will not be able to apply its tolerability thresholds consistently to the NRA descriptor bands and assessment outcomes by reason of the difference in terminology.

5.6 Use of risk controls

5.6.1 As identified above, the proper and correct consideration of the use of controls when assessing risk is essential for any NRA and the subsequent and consequential judgments made by the relevant SHA. Despite this, the authors of the IOT NRA have only identified three potential controls (see Appendix C of **[REP2-064]**). This is considered to be a deeply flawed and inadequate assessment and ignores the range of controls that are available, as identified by a wide range of port stakeholders recorded in the Applicant's NRA.

5.6.2 As to the three controls identified, the Applicant agrees with the principle of the inclusion of a Marine Liaison Plan control (as already identified within the Applicant's NRA **[APP-089]**). The Applicant has also addressed provision of impact protection to be implemented, at a later date, if it were to be considered necessary.

5.6.3 The Applicant does not agree with the imposition of the control that would require the relocation of the IOT finger pier. Although such a "control" would clearly eliminate a risk of an allision with the IOT finger pier – due to its absence – the SHA considers the control to be neither necessary nor a reasonably practicable control to implement. Fundamentally it has been identified through the Applicant's NRA as not being required to reduce risk to an ALARP and tolerable state (see paragraph 9.9.21 of **APP-089**).

5.6.4 The IOT NRA in this respect pays little regard to the existing situation and reality. Vessels daily enter and exit the Immingham Dock's bell mouth, with no tidal restrictions imposed on such movements even though there remains a risk of an allision with the IOT trunkway or IOT finger pier if such vessels were to lose power under similar conditions being suggested by Nash Maritime (e.g., on an ebb tide).

5.6.5 Within the IOT NRA, it is considered that this risk, or the risk of an allision with IOT infrastructure, as a 1 in 60-year event, which is actually deemed acceptable by IOT within their COMAH Assessment (2019) as the operator of the infrastructure (Section 5.2.2 IOT COMAH Safety Report: Ship Impact paragraph 179).

5.6.6 Moreover, the IOT NRA takes an unrealistic and artificially limited view of the possible controls that could be implemented to reduce the risk of an allision occurring between a Ro-Ro vessel and the IOT Finger pier or the IOT trunkway.

5.6.7 As outlined above, the IOT NRA only identifies three controls that could be implemented at the port to improve safety in the context of the construction and operation of the IERRT project. The Applicant's NRA considered 29 further controls that were suggested by a wide range of stakeholders at the HAZID workshops. The Applicant then identified a further seven controls that could be applied during a provisional cost benefit analysis meeting.

5.6.8 This highlights what is considered to be an inappropriate approach to understanding the risks and potential control measures available to the IERRT project within the IOT NRA. By failing to sufficiently identify control measures, the authors have failed to identify ways in which risks can be made tolerable and ALARP and as a consequence, have over-inflated the assessment of residual risk. This has resulted in recommendations for control measures (such as the movement of the finger pier and impact protection) that are disproportionate to the scale of risk identified even if one were (inappropriately) to impose the DFDS judgments about tolerability and ALARP for those of the SHA (something which would be an abrogation of the SHA's functions). In practice there are in fact many controls (as identified through the wider port stakeholders' engagement and identified in the Applicant's NRA) that could be applied to ensure all risks are tolerable and ALARP (as judged by the Harbour Authorities) without the need for such drastic and disproportionate solutions.

5.6.9 This also further emphasises the basic problem with the lack of stakeholder engagement with wider port stakeholders. No consultation with or consideration of the SHAs judgement on tolerability and ALARP means that any conclusion drawn has to be viewed as flawed as it is based upon the opinion of an Interested Party objecting in isolation. This is in direct contravention to the PMSC which states that stakeholder engagement is essential.

5.7 Risk scoring

5.7.1 Risk outcomes within the IOT NRA are scored and then averaged to reach an overall score as a single number which is then used in order for the authors to describe whether the risk is acceptable by reference to their own choice of scoring. This approach is oversimplistic and does not take into consideration the fact that risks can affect more than one receptor (such as people, property, planet (environment), port (business)), but also the scale of effect on these receptors can be very different.

5.7.2 Within the Applicant's NRA **[APP-089]** the review of risks has been undertaken against criteria of tolerance/acceptability across each of the receptor types. This prevents a risk that scores highly for one receptor being hidden by lower risk outcomes for other receptors by reducing the average. For example, using the approach adopted by Nash Maritime, a risk that could be considered to be intolerable to people could be masked if it scored lower for property, planet, and port.

5.7.3 Furthermore, the approach taken within the Applicant's NRA is consistent with the approach taken to risk assessment across Associated British Ports, which considers all four receptor types individually when evaluating port operations.

5.8 Comparison of outcomes for risks considered intolerable by IOT

5.8.1 This section directly compares the differences in outcomes between the Applicant's NRA and the IOT NRA. Overall, despite the many differences in approach outlined in the preceding sections, the differences in outcomes of both risk assessments are limited. The fundamental and important difference is what is considered tolerable by the IOT Operators and what is considered tolerable by the SHA. This is explained in further detail below for each of the intolerable risks identified in the DFDS and IOT NRA. A detailed comparison of each of these risks is provided in Appendix A.

5.8.2 It is important to note that the tables at Appendix A compare intolerable risks identified by DFDS and IOT Operators at the baseline/embedded stage. All three NRAs subsequently identify further controls which suitably mitigate the risks to a 'tolerable if ALARP' or 'tolerable and ALARP' state. Supplementary to this, the most significant elements to observe are; the source of the assessed risk outcomes (i.e., level of stakeholder engagement), the similarity of risk outcomes across the three assessments and, the authority/entity which has determined if the risk is tolerable (and whether they have the authority to do so).

Collision – Ro-Ro on passage to/from Immingham Eastern Ro-Ro Terminal with another vessel

5.8.3 This risk was considered 'Tolerable if ALARP' at both the Baseline and Residual risk stages (Embedded and Future) within the IOT Operators NRA. Therefore, no comparison of intolerable risk is required against the outcomes presented in the Applicant's NRA. However, it serves to highlight that, despite Nash Maritime being the author of the DFDS and IOT NRAs, a different conclusion is reached, in that the DFDS NRA considers this risk intolerable at the Baseline (Embedded) risk control stage.

Allision with Eastern Jetty

5.8.4 This risk was not assessed within the IOT Operators NRA. Again, this highlights the difference even between the DFDS and IOT NRAs despite be written by the same authors.

Allision with Finger Pier

5.8.5 This risk has been considered across each of the three NRAs. Within the context of this risk, one element that all three NRAs agree on is that the risk can be mitigated to tolerable if/and ALARP. In this regard, the only suggested further control with which the SHA fundamentally does not agree is 'moving the finger pier' as identified by NASH Maritime within the DFDS and IOT Operators NRAs. This is because the SHA already considers this risk to be tolerable based on the full range of alternative controls that can be applied to mitigate the risk. Moving the finger pier is far too onerous for it to be considered a control that fits within the definition of ALARP.

5.8.6 The other further controls identified are broadly consistent with those considered by the Applicant. The Applicant has also indicated the need for berthing/unberthing criteria to be defined along with the implementation of a marine liaison plan both during construction and operation which can be implemented through a combination of VTS and other port and construction management practises.

Allision with Trunk Way

5.8.7 This risk has been considered in all three NRAs. All three NRAs believe that this risk can be mitigated to a tolerable and/if ALARP state if further controls are put in place. Specifically, 'impact protection' measures are identified by the IOT Operators. In this regard, however, although the Applicant broadly agrees with the IOT NRA assessment, as is set out in paragraph 9.9.24 and Table C4 of its NRA **[APP-089],** as the ExA is aware, the Applicant does not consider the provision of impact protection measures to be necessary and such measures will only be provided as part of the project specific adaptive controls if required.

6 Conclusion

6.1.1 As outlined throughout this Review, the Applicant is satisfied and confident that it has been provided with an independent and robust NRA as part of the IERRT DCO application. The Applicant's NRA considers all relevant elements concerned with navigational risk, especially those raised by port stakeholders during HAZID workshop and thus has given comprehensive consideration to the risk against a wide range of subject matter expertise and stakeholder opinion.

6.1.2 The NRA conducted for the Applicant's DCO submission considers the views of stakeholders and seeks to reduce risk by increasing safety and considering a wide range of potential controls. This was achieved by identifying which hazard scenarios exist, what might cause them to happen, and how one might control or limit these causes. Following this, the Applicant's NRA analysed the risks, which involved attributing risk outcomes (consequence and likelihood/frequency) in consultation with a diverse range of stakeholders and port users. This is known as Hazard Identification and Risk Analysis and must be included in any risk assessment if it is to comply with the PMSC's GtGP (**[REP1-016]**).

6.1.3 Further, the Applicant's NRA considered the identified risks against the appropriate standard of acceptability for the SHAs, the Harbour Authority and HASB set 'tolerability' threshold. The controls identified for a hazardous scenario were then considered, in consultation with the Humber Harbour Master and the Immingham Dock Master (amongst others), against the concepts of ALARP and 'tolerability'. This stage is known as Risk Assessment and in this instance was accompanied by a preliminary cost-benefit analysis assessment. This then enabled the NRA produced for the Applicant to demonstrate to their Duty Holders, Designated Person, and SHAs that considerable effort and thought had been put into safely managing the risks identified by the stakeholders.

6.1.4 The SHAs have fully considered the Applicant's NRA and has determined that the identified risks are capable of being properly mitigated to the point where safe operations can continue to occur at the port. This is in relation both to existing operations and for the construction and operation phases of the IERRT project.

6.1.5 In contrast, the fundamental issues identified above make the IOT NRA **[REP2-064]** impossible for the SHA to accept as a whole because the engagement with wider port stakeholders is non-existent and as a result the potential controls considered are so limited that it artificially forces the document to consider that controls far too drastic are required to mitigate the identified risks. No consultation with or consideration for the SHAs tolerability means that any conclusion drawn is false as it is based upon the opinion of an Interested Party objecting in isolation.

6.1.6 In summary, the IOT NRA has been completed with:

- A narrow perspective with a failure to consider either the IERRT project or the Port of Immingham as a whole;
- A lack of stakeholder engagement with other port users and fundamentally the Statutory Harbour Authority;
- An inappropriate application of COMAH regulations;
- Over-reliance on statistical assumptions of outcomes, rather than actual experience;
- Inappropriate definitions and application of frequency;
- No consideration of levels of tolerability set by the SHA; and
- Insufficient integration of risk controls into the risk assessment process resulting in a disproportionate assessment of residual risk and unjustified recommendations for further control measures.

6.1.7 The table below provides a summary of how each aspect of the Applicant's NRA and the IOT NRA has been met, highlighting the differences and the fundamental shortcomings of the alternative NRA provided by the IOT Operators. Ultimately, the fundamental point is that it is for the SHA to assess navigational risk, assess tolerability and to be accountable for its decisions. It is neither appropriate, nor usual, for third parties to make their own assessments independent of all other stakeholders, nor is there any mechanism for third parties to be held accountable for the outcomes of their opinions.

Table 1. Summary of approach taken in each NRA

Aspect of NRA	Applicant NRA	IOT Alternative NRA
Stakeholder engagement	Comprehensive stakeholder engagement undertaken to inform risk assessment	No engagement undertaken relying on output of Applicant's NRA – biased perspective about operations with no evidence that any port stakeholder confirmed or validated internally held opinions on risks
Hazard identification	Based on formal HAZID process involving all key stakeholders as part of the NRA	Relied on Applicant's process and their own data - no new hazards identified
Existing risk controls	Fully considered existing controls used to manage risk within the Port, identified at HAZID	No consideration of existing controls used to manage risk within the Port
Additional risk controls	29 additional risk controls identified at HAZID and another seven controls identified with the SHA	Three additional risk controls identified in the NRA
Assessment of frequency	Based on known local and extensive data, using agreed definitions of probability already accepted by Duty Holder, clearly explained to stakeholders. Aligned with SHA guidance and process.	Attempts to use COMAH for navigational matters. Inappropriate, not aligned with SHA accepted frequencies.
Methodology	Most Likely/Worst Credible principle (industry standard and appropriate) Transparent approach to risk scoring	Worst Credible Outcomes consider only. Inappropriate mixing of COMAH and HSE methodology in marine environment. Inflates risks and receptors. Inappropriate risk scoring.
Outcomes	No intolerable risks identified with suggested risk controls **agreed by SHA**	Two intolerable risks and application of risks controls not considered reasonably practicable – **in contrast to position of SHA**

Appendix A

Collision – Ro-Ro on passage to/from Immingham Eastern Ro-Ro Terminal with another vessel

Party	Risk and worst credible/most likely scenarios	Causes identified	Embedded Controls identified	Embedded Worst Credible Consequence/ Likeihood Outcomes	Embedded Most Likely Consequence/ Likeihood Outcomes	Further controls identified	Future Worst Credible Consequence/ Likeihood Outcomes	Future Most Likely Consequence/ Likeihood Outcomes	Tolerance and ALARP outcome
Applicant	Collision; Scenario: Ro-Ro on passage to/from Immingham Eastern Ro-Ro Terminal with another vessel Worst Credible: Manoeuvring speed collision with no avoiding action leading to multiple fatalities, hull breach, serious impact to property, significant consequence to the environment including a tier 2 pollution event, and serious consequence to the port business and reputation. Most Likely: Low speed glancing collision with bridge crew taking avoiding action, minor injuries, minor impact to property, no appreciable consequence to the environment or to the port's business/reputation.	Failure to comply with Towage guidelines High traffic density COLREGs failure to comply Restricted visibility Failure to follow passage plan Vessel breakdown or malfunction AIS failure/ lack of AIS Excessive vessel speed Incorrect assessment of tidal flow Excessive vessel speed Poor situational awareness Human error/fatigue - Pilot/ Vessel Personnel Inadequate bridge resource management Inadequate procedures in place onboard vessel Manoeuvre misjudged Ship/Tug/Launch failure Communication failure - Personnel Adverse weather conditions	Towage, available and appropriate Communications - traffic broadcast International COLREGs 1972 (as amended) Passage planning Vessel propulsion redundancies Vessel Traffic Services Accurate tidal measurements Byelaws Aids to navigation, Provision and maintenance of Harbour Authority requirements Joint emergency drills with VTS and Port staff Local Port Service Availability of latest hydrographic information Arrival/Departure, advance notice of Oil spill contingency plans	The worst credible outcome for this risk (at the embedded/baseline stage) **was considered by the attendees at the HAZID workshop** to result in: People - Multiple Fatalities; Property - Serious (£4M - £8M); Planet - Significant (Has the potential to cause significant damage and impact - Tier 2, pollution control measures from external organisations required); Port - Serious (Negative national publicity. Serious damage to reputation. Serious loss of revenue, £4M - £8M) It was also considered that the risk is: Unlikely - The impact of the hazard might occur but is unlikely (within the lifetime of the entity)	The most likely outcome for this risk (at the embedded/baseline stage) was **considered by the attendees at the HAZID workshop** to result in: People - Minor injury(s); Property - Minor (£10,000 - £750,000); Planet - None (No incident - or a potential incident/near miss); Port - None It was also considered that the risk is: Possible - The impact of the hazard could very well occur, but it also may not (within the lifetime of the entity)	Nil further controls identified at HAZID Workshop and post-workshop consultation; Risk considered against existing risks within the MSMS in place and considered ALARP and tolerable with existing controls by the SHA	No Change	No Change	Deemed tolerable and ALARP **by the SHA with the controls agreed**
DFDS	Collision - Project Vessel (Passenger / Driver) ICW Coastal Tanker Most Likely: light touch, low speed contact between two project vessels whilst underway. Worst Credible: heavy contact collision occurrence at relative high speed resulting in loss of vessel and loss of cargo.	The DFDS NRA does not present a table or list of causes	Towage, available and appropriate Accurate tidal measurements Harbour Authority requirements Availability of latest hydrographic information Vessel Traffic Services Berthing procedures Towage guidelines Arrival/Departure, advance notice of Monitoring of met ocean conditions Byelaws Oil spill contingency plans Communications - traffic broadcast Passage planning Design criteria Adequate berth tendering Hydrographic Survey Aids to navigation, Provision and maintenance of International COLREGs 1972 (as amended) Anchors cleared and ready for use Joint emergency drills with VTS and Port staff Communications equipment Mooring analysis Local Port Service Vessel simulation study Port Facility Emergency Plan Weather limits Training of port marine/operations personnel Pilotage Vessel propulsion redundancies	The worst credible outcome for this risk (at the embedded/baseline stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Multiple fatalities; Property - Major, More than £8 m -illion; Planet - Major, Has the potential to cause catastrophic and/or widespread damage. Tier 3, requires major external assistance; Port Major, Negative national and international publicity. Major damage to reputation. Major loss of revenue, more than £8 million. It was also considered that this risk scenario could occur in: An event that could be expected to occur once in 1,000 years.	The most likely outcome for this risk (at the embedded/baseline stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Serious injury(s) MAIB/RIDDOR reportable injury; Property - Moderate £750,000 - £4 million; Planet - Minor, An incident that results in pollution with limited/local impact. Tier 1, Harbour Authority pollution controls measures deployed; Port - Moderate, Negative local publicity. Moderate damage to reputation. Moderate loss of revenue, £750,000 - £4m. It was also considered that this risk scenario could occur in: An event that could be expected to occur once in 10 years.	RC03 Deconfliction plan	The worst credible outcome for this risk (at the potential/future/residual stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Multiple fatalities; Property - Major, More than £8 million; Planet - Major, Has the potential to cause catastrophic and/or widespread damage. Tier 3, requires major external assistance; Port - Major, Negative national and international publicity. Major damage to reputation. Major loss of revenue, more than £8 million. It was also considered that this risk scenario could occur in: An event that could be expected to occur less than once > 1, 000 years.	The most likely outcome for this risk (at the potential/future/residual stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Serious injury(s) MAIB/RIDDOR reportable injury; Property - Moderate £750,000 - £4 million; Planet - Minor, An incident that results in pollution with limited/local impact. Tier 1, Harbour Authority pollution controls measures deployed; Port - Moderate, Negative local publicity. Moderate damage to reputation. Moderate loss of revenue, £750,000 - £4m. It was also considered that this risk scenario could occur in: An event that could be expected to occur once in 100 years.	Deemed 'Tolerable if ALARP' **by authors of the DFDS NRA (NASH Maritime) against tolerance suggested by DFDS,** which differs from that of the IOT Operators and the SHA.
IOT Operators	This risk was considered 'Tolerable if ALARP' at both the Baseline and Residual risk stages (Embedded and Future) within the IOT Operators NRA. Therefore no comparision of intolerable risk is required in this context.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Deemed 'Tolerable if ALARP' **by authors of the IOT Operators NRA (NASH Maritime) against tolerance suggested by IOT Operators,** which differs from that of DFDS and the SHA

Allision with Eastern Jetty

Party	Risk and worst credible/most likely scenarios	Causes identified	Embedded Controls identified	Embedded Worst Credible Consequence/ Likelihood Outcomes	Embedded Most Likely Consequence/ Likeihood Outcomes	Further controls identified	Future Worst Credible Consequence/ Likelihood Outcomes	Future Most Likely Consequence/ Likeihood Outcomes	Tolerance and ALARP outcome
Applicant	Allision; Scenario: Ro-Ro arriving/departing Immingham Eastern Ro-Ro terminal berth 2-3 with a tanker berthed on eastern jetty Worst Credible: Ro-Ro makes contact with berthed tanker resulting in a significant allision that punctures the tanker's double hull leading to a tier 3 pollution event with release of toxic chemical. Causing major risk to life and environment both short and long term. Incident results in multiple fatalities, sever damages to both vessels and berth infrastructure for an amount greater than £8M. Negative international news that significantly affects the ports reputation and port operations. An approaching Ro-Ro loses control and makes slow contact with berthed tanker resulting in an allision that damages cargo pipes, leading to a tier 3 pollution event with release of toxic chemical. Moderate damage to port infrastructure and vessel, serious injuries to personnel, and negative national port reputational damage.	Adverse weather conditions Incorrect assessment of tidal flow Navigation equipment failure Excessive vessel speed Inadequate number/type tugs Manoeuvre misjudged High traffic density Communication failure - Personnel Vessel breakdown or malfunction Limited area for manoeuvring Failure of berth mooring systems Human error/fatigue - Pilot/ Vessel / Marine Personnel	Monitoring of met ocean conditions Passage planning Towage guidelines Towage, available and appropriate Harbour Authority requirements Vessel Traffic Services Port Facility Emergency Plan Oil spill contingency plans	The worst credible outcome for this risk (at the embedded/baseline stage) was **considered by the attendees at the HAZID workshop** to result in: People - Multiple Fatalities; Property - Major (> £8M); Planet - Major (Potential to cause catastrophic and/or widespread damage - Tier 3, requires major external assistance); Port - Major (Negative national and international publicity. Major damage to reputation. Major loss of revenue, > £8 M) It was also considered that the risk is: Unlikely - The impact of the hazard might occur but is unlikely (within the lifetime of the entity)	The most likely outcome for this risk (at the embedded/baseline stage) was **considered by the attendees at the HAZID workshop** to result in: People - Serious injury(s) (MAIB/RIDDOR reportable injury); Property - Moderate (£750,000 - £4M); Planet - Major (Potential to cause catastrophic and/or widespread damage - Tier 3, requires major external assistance); Port - Serious (Negative national publicity. Serious damage to reputation. Serious loss of revenue, £4M - £8M) It was also considered that the risk is: Possible - The impact of the hazard could very well occur, but it also may not (within the lifetime of the entity)	Berthing criteria Charted safety area, berthing procedures Additional pilotage training/ familiarisation (Controls later confirmed by SHA to be put in place)	The worst credible outcome for this risk (at the potential/future/residual stage, in contemplation of further controls) was **considered by representatives of the SHA, in consideration of the comments made by attendees at the HAZID workshop**, to result in: People - Multiple Fatalities; Property - Major (> £8M); Planet - Major (Potential to cause catastrophic and/or widespread damage - Tier 3, requires major external assistance); Port - Major (Negative national and international publicity. Major damage to reputation. Major loss of revenue, > £8 M) It was also considered that the risk is: Rare - The impact of the hazard is realised but should very rarely occur (within the lifetime of the entity)	The most likely scenario for this risk (at the potential/future/residual stage, in contemplation of further controls) **was considered by representative of the SHA attendees at the HAZID workshop** to result in: People - Serious injury(s) (MAIB/RIDDOR reportable injury); Property - Moderate (£750,000 - £4M); Planet - Major (Potential to cause catastrophic and/or widespread damage - Tier 3, requires major external assistance); Port - Serious (Negative national publicity. Serious damage to reputation. Serious loss of revenue, £4M - £8M) It was also considered that the risk is: Unlikely - The impact of the hazard might occur but is unlikely (within the lifetime of the entity)	Deemed tolerable and ALARP **by the SHA with the controls agreed**
DFDS	Contact (Allision) - Project Vessel (Passenger /Driver) with Eastern Jetty (or moored vessel) Most Likely: light contact with tanker moored alongside resulting in moderate damage to vessels, breakaway of tanker and ruptured loading arm. Worst Credible: high impact contact with tanker moored alongside (or bunkering barge alongside tanker) resulting in puncture of tanker hull or bunker barge hull, rupture of Eastern Jetty pipeline(s), loss of bunker barge moored alongside major and damage to berth infrastructure.	The DFDS NRA does not present a table or list of causes	Accurate tidal measurements Harbour Authority requirements Availability of latest hydrographic information Vessel Traffic Services Berthing procedures Towage guidelines Arrival/Departure, advance notice of Monitoring of met ocean conditions Byelaws Oil spill contingency plans Communications - traffic broadcast Passage planning Design criteria Adequate berth tendering Hydrographic Survey Aids to navigation, Provision and maintenance of International COLREGs 1972 (as amended) Anchors cleared and ready for use Joint emergency drills with VTS and Port staff Communications equipment Mooring analysis Local Port Service Vessel simulation study Port Facility Emergency Plan Weather limits Training of port marine/operations personnel Pilotage Vessel propulsion redundancies	The worst credible outcome for this risk (at the embedded/baseline stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Multiple fatalities; Property - Major, More than £8 million; Planet - Major, Has the potential to cause catastrophic and/or widespread damage. Tier 3, requires major external assistance; Port - Major, Negative national and international publicity. Major damage to reputation. Major loss of revenue, more than £8 million. It was also considered that the risk could occur in: An event that could be expected to occur once in 1,000 years.	The most likely outcome for this risk (at the embedded/baseline stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Serious injury(s) MAIB/RIDDOR reportable injury.; Property - Moderate £750,000 - £4 million; Planet - Major, Has the potential to cause catastrophic and/or widespread damage. Tier 3, requires major external assistance; Port - Serious, Negative national publicity. Serious damage to reputation. Serious loss of revenue, £4m - £8m. It was also considered that this risk scenario could occur in: An event that could be expected to occur once in 10 years.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan	The worst credible outcome for this risk (at the potential/future/residual stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Multiple fatalities; Property - Major, More than £8 million; Planet - Major, Has the potential to cause catastrophic and/or widespread damage. Tier 3, requires major external assistance; Port: Major, Negative national and international publicity. Major damage to reputation. Major loss of revenue, more than £8 million. It was also considered that this risk scenario could occur in: An event that could be expected to occur less than once > 1, 000 years.	The most likely outcome for this risk (at the potential/future/residual stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Serious injury(s) MAIB/RIDDOR reportable injury; Property - Moderate £750,000 - £4 million; Planet - Major, Has the potential to cause catastrophic and/or widespread damage. Tier 3, requires major external assistance; Port: Serious, Negative national publicity. Serious damage to reputation. Serious loss of revenue, £4m - £8m. It was also considered that this risk scenario could occur in: An event that could be expected to occur once in 100 years.	Deemed 'Tolerable if ALARP' **by authors of the IOT Operators NRA (NASH Maritime) against tolerance suggested by IOT Operators,** which differs from that of DFDS and the SHA
IOT Operators	Risk not assessed by the IOT Operators NRA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Allision with Finger Pier

Party	Risk and worst credible/most likely scenarios	Causes identified	Embedded Controls identified	Embedded Worst Credible Consequence/ Likelihood Outcomes	Embedded Most Likely Consequence/ Likeihood Outcomes	Further controls identified	Future Worst Credible Consequence/ Likeihood Outcomes	Future Most Likely Consequence/ Likeihood Outcomes	Tolerance and ALARP outcome
Applicant	Allision; Scenario: Vessel proceeding to/from Immingham Eastern Ro-Ro with tanker moored at IOT Finger Pier Worst Credible: Ro-Ro makes contact with berthed tanker resulting in a significant allision that punctures the tanker's double hull leading to a tier 3 pollution event with possible ignition of the petrochemical. That could cause a fire which significantly damages the vessel and/or infrastructure. Incident results in multiple fatalities, and negative international news that significantly affects the ports reputation and port operations. Most Likely: An approaching Ro-Ro misses its berth and continues to the IOT Finger Pier which results in a low speed glancing collision, dislodging a tanker from its berth causing a tier 3 pollution event. Major damage to port infrastructure and vessel, serious injuries to personnel, and negative national port reputational damage.	Adverse weather conditions Incorrect assessment of tidal flow Restricted visibility Inadequate bridge resource management Failure to follow passage plan Inadequate procedures in place onboard vessel Manoeuvre misjudged Vessel breakdown or malfunction Ship/Tug/Launch failure Failure to comply with Towage guidelines Inadequate number/type tugs Interaction with passing vessel Poor situational awareness Communication failure - Personnel Excessive vessel speed Human error/fatigue - Vessel Personnel	Monitoring of met ocean conditions Passage planning Port Facility Emergency Plan Towage guidelines Towage, available and appropriate Vessel Traffic Services Harbour Authority requirements Oil spill contingency plans	The worst credible outcome for this risk (at the embedded/baseline stage) was **considered by the attendees at the HAZID workshop** to result in: People - Multiple Fatalities; Property - Major (> £8M); Planet - Major (Potential to cause catastrophic and/or widespread damage - Tier 3, requires major external assistance); Port - Major (Negative national and international publicity. Major damage to reputation. Major loss of revenue, > £8 M) It was also considered that the risk is: Unlikely - The impact of the hazard might occur but is unlikely (within the lifetime of the entity)	The most likely outcome for this risk (at the embedded/baseline stage) was **considered by the attendees at the HAZID workshop** to result in: People - Serious injury(s) (MAIB/RIDDOR reportable injury); Property - Serious (£4M - £8M); Planet - Major (Potential to cause catastrophic and/or widespread damage - Tier 3, requires major external assistance); Port - Serious (Negative national publicity. Serious damage to reputation. Serious loss of revenue, £4M - £8M) It was also considered that the risk is: Possible - The impact of the hazard could very well occur, but it also may not (within the lifetime of the entity)	Charted safety area, berthing procedures Additional pilotage training/ familiarisation Berthing criteria *Move finger pier to east side of trunk way* Moving finger pier deemed too onerous by the SHA, other controls taken forward and amended as: Project specific adaptive procedures Charted safety area, berthing procedures Specific berthing criteria for each of the three berths	The worst credible outcome for this risk (at the potential/future/residual stage, in contemplation of further controls) was **considered by representatives of the SHA, in review of the comments made by attendees at the HAZID workshop**, to result in: People - Serious injury(s) (MAIB/RIDDOR reportable injury); Property - Serious (£4M - £8M); Planet - Minor (Incident results in pollution with limited/local impact - Tier 1, Harbour Authority pollution control measures deployed); Port - Moderate (Negative local publicity. Moderate damage to reputation. Moderate loss of revenue, £750,000 - £4M) It was also considered that (in contemplation of further controls) the risk is: Rare - The impact of the hazard is realised but should very rarely occur (within the lifetime of the entity)	The most likely scenario for this risk (at the potential/future/residual stage, in contemplation of further controls) was **considered by representative of the SHA attendees at the HAZID workshop** to result in: People - Minor Injury(s); Property - Moderate (£750,000 - £4M); Planet - Significant (Has the potential to cause significant damage and impact - Tier 2, pollution control measures from external organisations required); Port - Minor (Little local publicity. Minor damage to reputation. Minor loss of revenue, £0 - £750,000) It was also considered that (in contemplation of further controls) the risk is: Unlikely - The impact of the hazard might occur but is unlikely (within the lifetime of the entity)	Deemed tolerable and ALARP **by the SHA with the controls agreed**
DFDS	Contact (Allision) - Project Vessel (Passenger /Driver) with IOT Finger Pier (or moored vessel) Most Likely: light contact with Coastal tanker / Bunker Barge moored alongside resulting in moderate damage to both vessels, IOT Finger Pier, breakaway of Coastal tanker / Bunker Barge and ruptured loading arm(s). Worst Credible: high impact contact with Coastal tanker / Bunker Barge moored alongside resulting in multiple vessel breakaway puncture of tanker / barge hull, rupture of IOT Finger Pier pipeline(s) and significant damage to IOT Finger Peir infrastructure (with extension of breakaway causing impact to IOT trunkway).	The DFDS NRA does not present a table or list of causes	[illegible] Accurate tidal measurements Harbour Authority requirements Availability of latest hydrographic information Vessel Traffic Services Berthing procedures Towage guidelines Arrival/Departure, advance notice of Monitoring of met ocean conditions Byelaws Oil spill contingency plans Communications - traffic broadcast Passage planning Design criteria Adequate berth tendering Hydrographic Survey Aids to navigation, Provision and maintenance of International COLREGs 1972 (as amended) Anchors cleared and ready for use Joint emergency drills with VTS and Port staff Communications equipment Mooring analysis Local Port Service Vessel simulation study Port Facility Emergency Plan Weather limits Training of port marine/operations personnel Pilotage Vessel propulsion redundancies	The worst credible outcome for this risk (at the embedded/baseline stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Multiple fatalities; Property - Major, More than £8 million; Planet - Major, Has the potential to cause catastrophic and/or widespread damage. Tier 3, requires major external assistance; Port - Major, Negative national and international publicity. Major damage to reputation. Major loss of revenue, more than £8 million. It was also considered that this risk scenario could occur in: An event that could be expected to occur once in 1,000 years.	The most likely outcome for this risk (at the embedded/baseline stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Serious injury(s) MAIB/RIDDOR reportable injury; Property - Serious, £4 million - £8 million; Planet - Significant, Has the potential to cause significant damage and impact. Tier 2, pollution controlm easures from external organisations required; Port - Serious, Negative national publicity. Serious damage to reputation. Serious loss of revenue, £4m - £8m. It was also considered that this risk scenario could occur in: An event that could be expected to occur once in 10 years.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC06 Moving finger pier	The worst credible outcome for this risk (at the potential/future/residual stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Multiple fatalities; Property - Major, More than £8 million; Planet - Major, Has the potential to cause catastrophic and/or widespread damage. Tier 3, requires major external assistance; Port - Major, Negative national and international publicity. Major damage to reputation. Major loss of revenue, more than £8 million. It was also considered that this risk scenario could occur in: An event that could be expected to occur less than once > 1, 000 years. *It is not explained how the outcomes about allison are reached in circumstances where the controls that are being assessed include moving the finger pier.*	The most likely outcome for this risk (at the potential/future/residual stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Serious injury(s) MAIB/RIDDOR reportable injury; Property - Serious, £4 million - £8 million; Planet - Significant, Has the potential to cause significant damage and impact. Tier 2, pollution control measures from external organisations required; Port - Serious, Negative national publicity. Serious damage to reputation. Serious loss of revenue, £4m - £8m. It was also considered that this risk scenario could occur in: An event that could be expected to occur once in 100 years. *It is not explained how the outcomes about allison are reached in circumstances where the controls that are being assessed include moving the finger pier.*	Deemed 'Tolerable if ALARP' **by authors of the DFDS NRA (NASH Maritime) against tolerance suggested by DFDS,** which differs from that of the IOT Operators and the SHA.
IOT Operators	Contact (Allision) - IERRT Ro-Ro Vessel with IOT Finger Pier	The IOT Operators NRA does not present a table or list of causes	The IOT Operators NRA does not present a table or list of embedded controls	The worst credible outcome for this risk (at the embedded/baseline stage) was **considered by NASH Maritime** to result in: People - Potential for many fatalities on site or potential for serious injury or fatality off site; Property - >£10million; Planet - DETR criteria – the highest levels of harm to the receptor (long term/permanent/widespread damage); Port - International negative publicity, serious disruption to operations to port / ship register >£10million International publicity. It was also considered that the risk could occur with a: 1 in 10,000 to 1 in 100 chance per year	The IOT Oerators NRA does not consider the 'Most Likely' scenario	IOT RC1: Impact protection IOT RC2: Relocation Finger Pier IOT RC3: Marine & Liaison Plan	The worst credible outcome for this risk (at the potential/future/residual stage) was **considered by NASH Maritime** to result in: People - Potential for some (one/few) fatalities / many serious injuries on site, some potential for minor injury off site; Property - £1million - £10million; Planet - Department of the Environment, Transport and the Regions (DETR) criteria – the lowest level of harm that can be considered a MATTE; Port - Widespread negative publicity, temporary suspension of activities at port / ship register £100,000 Local publicity - £1million It was also considered that the risk could occur with a: 1 in 1,000,000 to 1 in 10,000 chance per year *It is not explained how the outcomes about allison are reached in circumstances where the controls that are being assessed include moving the finger pier.*	The IOT Oerators NRA does not consider the 'Most Likely' scenario	Deemed 'Tolerable if ALARP' **by authors of the IOT Operators NRA (NASH Maritime) against tolerance suggested by IOT Operators,** which differs from that of DFDS and the SHA

Allision with Trunk Way

Party	Risk and worst credible/most likely scenarios	Causes identified	Embedded Controls identified	Embedded Worst Credible Consequence/ Likelihood Outcomes	Embedded Most Likely Consequence/ Likeihood Outcomes	Further controls identified	Future Worst Credible Consequence/ Likelihood Outcomes	Future Most Likely Consequence/ Likeihood Outcomes	Tolerance and ALARP outcome
Applicant	Allision; Scenario: Ro-Ro allision with IOT trunk way Worst Credible: Ro-Ro vessel collides with IOT trunk way, severing the charged pipeline causing a tier 3 pollution incident. Possibility of ignition and fire when the motor spirit pipeline is burst due to its flammability. Two refineries must be closed for a considerable time in order to repair the pipeline. This causes significant impacts for multiple weeks and has national affect to petroleum production. Multiple fatalities, negative international publicity for port and greater than £8 million of damage to port infrastructure. Most Likely: Ro-Ro has a slow speed impact with IOT trunk way leading to minor damage to vessel and distortion of pipe line on trunk way. Single fatality to personnel on the trunk way and tier 3 pollution, negative international publicity and greater than £8 million of damages to the port.	Anchors not cleared Inadequate number/type tugs Failure to comply with Towage guidelines Adverse weather conditions Restricted visibility Incorrect assessment of tidal flow Vessel breakdown or malfunction Human error/fatigue - Pilot/ Vessel Personnel Poor situational awareness Excessive vessel speed Inadequate bridge resource management Inadequate procedures in place onboard vessel Communication failure - Personnel Ship/Tug/Launch failure	Anchors cleared and ready for use Towage, available and appropriate Towage guidelines Weather limits Vessel propulsion redundancies Harbour Authority requirements Vessel Traffic Services Local Port Service Port Facility Emergency Plan Oil spill contingency plans Communications equipment Training of port marine/operations personnel	The worst credible outcome for this risk (at the embedded/baseline stage) was **considered by the attendees at the HAZID workshop** to result in: People - Multiple Fatalities; Property - Major (> £8M); Planet - Major (Potential to cause catastrophic and/or widespread damage - Tier 3, requires major external assistance); Port - Major (Negative national and international publicity. Major damage to reputation. Major loss of revenue, > £8 M) It was also considered that (at the embedded/existing stage) the risk is: Possible - The impact of the hazard could very well occur, but it also may not (within the lifetime of the entity)	The most likely outcome for this risk (at the embedded/baseline stage) was **considered by the attendees at the HAZID workshop** to result in: People - Single Fatality; Property - Major (> £8M); Planet - Major (Potential to cause catastrophic and/or widespread damage - Tier 3, requires major external assistance); Port - Major (Negative national and international publicity. Major damage to reputation. Major loss of revenue, > £8 M) It was also considered that (at the embedded/existing stage) the risk is: Possible - The impact of the hazard could very well occur, but it also may not (within the lifetime of the entity)	Impact protection Berthing criteria Additional tug provisions Controls taken forward and amended as: Project specific adaptive procedures Specific berthing criteria for each of the three berths	The worst credible outcome for this risk (at the potential/future/residual stage, in contemplation of further controls) was **considered by the attendees at the HAZID workshop** to result in: People - Multiple Fatalities; Property - Major (> £8M); Planet - Major (Potential to cause catastrophic and/or widespread damage - Tier 3, requires major external assistance); Port - Major (Negative national and international publicity. Major damage to reputation. Major loss of revenue, > £8 M) It was also considered that (in contemplation of further controls) the risk is: Unlikely - The impact of the hazard might occur but is unlikely (within the lifetime of the entity)	The most likely outcome for this risk (at the potential/future/residual stage, in contemplation of further controls) was **considered by the attendees at the HAZID workshop** to result in: People - Single Fatality; Property - Major (> £8M); Planet - Major (Potential to cause catastrophic and/or widespread damage - Tier 3, requires major external assistance); Port - Major (Negative national and international publicity. Major damage to reputation. Major loss of revenue, > £8 M) It was also considered that (in contemplation of further controls) the risk is: Unlikely - The impact of the hazard might occur but is unlikely (within the lifetime of the entity)	Deemed tolerable and ALARP **by the SHA with the controls agreed**
DFDS	Contact (Allision) - Project Vessel (Passenger /Driver) with IOT Trunkway Most Likely: high impact contact resulting rupture of IOT Trunkway pipeline(s). Worst Credible: high impact contact at relative high speed resulting in puncture of hull and rupture of IOT Trunkway pipeline(s).	The DFDS NRA does not present a table or list of causes	Towage, available and appropriate Accurate tidal measurements Harbour Authority requirements Availability of latest hydrographic information Vessel Traffic Services Berthing procedures Towage guidelines Arrival/Departure, advance notice of Monitoring of met ocean conditions Byelaws Oil spill contingency plans Communications - traffic broadcast Passage planning Design criteria Adequate berth tendering Hydrographic Survey Aids to navigation, Provision and maintenance of International COLREGs 1972 (as amended) Anchors cleared and ready for use Joint emergency drills with VTS and Port staff Communications equipment Mooring analysis Local Port Service Vessel simulation study Port Facility Emergency Plan Weather limits Training of port marine/operations personnel Pilotage Vessel propulsion redundancies	The worst credible outcome for this risk (at the embedded/baseline stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Multiple fatalities; Property - Major, More than £8 million; Planet - Major, Has the potential to cause catastrophic and/or widespread damage. Tier 3, requires major external assistance; Port - Major, Negative national and international publicity. Major damage to reputation. Major loss of revenue, more than £8 million. It was also considered that (at the embedded/existing stage) the risk could occur with a: An event that could be expected to occur once in 1,000 years.	The most likely outcome for this risk (at the embedded/baseline stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Single fatality; Property - Major, More than £8 million; Planet - Major, Has the potential to cause catastrophic and/or widespread damage. Tier 3, requires major external assistance; Port - Major, Negative national and international publicity. Major damage to reputation. Major loss of revenue, more than £8 million. It was also considered that this risk scenario could occur in: An event that could be expected to occur once in 100 years.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC05 Impact protection for IOT Trunkway	The worst credible outcome for this risk (at the potential/future/residual stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Serious injury(s) MAIB/RIDDOR reportable injury; Property - Serious, £4 million - £8 million; Planet - Minor, An incident that results in pollution with limited/local impact. Tier 1, Harbour Authority pollution controls measures deployed.; Port - Serious, Negative national publicity. Serious damage to reputation. Serious loss of revenue, £4m - £8m. It was also considered that this risk scenario could occur in: An event that could be expected to occur less than once > 1, 000 years.	The most likely outcome for this risk (at the potential/future/residual stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Serious injury(s) MAIB/RIDDOR reportable injury; Property - Moderate, £750,000 - £4 million; Planet - No Measurable Impact. An incident or event occurred, but no discernible environmental impact.Tier 1 but no pollution control measures needed.; Port - Moderate Negative local publicity. Moderate damage to reputation. Moderate loss of revenue, £750,000 - £4m. It was also considered that this risk scenario could occur in: An event that could be expected to occur once in 1,000 years.	Deemed 'Tolerable if ALARP' **by authors of the DFDS NRA (NASH Maritime) against tolerance suggested by DFDS,** which differs from that of the IOT Operators and the SHA.
IOT Operators	Contact (Allision) - IERRT Ro-Ro Vessel with IOT Trunkway	The IOT Operators NRA does not present a table or list of causes	The IOT Operators NRA does not present a table or list of embedded controls	The worst credible outcome for this risk (at the embedded/baseline stage) was **considered by NASH Maritime** to result in: People - Potential for many fatalities on site or potential for serious injury or fatality off site; Property - >£10M; Planet - DETR criteria – the highest levels of harm to the receptor (long term/permanent/widespread damage); Port - International negative publicity, serious disruption to operations to port / ship register >£10million International publicity. It was also considered that (at the embedded/existing stage) the risk could occur with a: 1 in 10,000 to 1 in 100 chance per year	The IOT Oerators NRA does not consider the 'Most Likely' scenario	IOT RC1: Impact protection	The worst credible outcome for this risk (at the potential/future/residual stage) was **considered by NASH Maritime** to result in: People - Potential for serious injury / injuries on site.; Property - £1million - £10million; Planet - Catastrophic environmental impact on 2 or more MATTE categories over the designated threshold and for greater than 1 year (widespread, requires long term additional resources considered a MATTE on 2 or more environmental receptors; Port - National negative publicity, prolonged closure or restrictions to port / ship register £1million National publicity -£10million. It was also considered that the risk could occur with a: 1 in 1,000,000 to 1 in 10,000 chance per year	The IOT Oerators NRA does not consider the 'Most Likely' scenario	Deemed 'Tolerable if ALARP' **by authors of the IOT Operators NRA (NASH Maritime) against tolerance suggested by IOT Operators,** which differs from that of DFDS and the SHA

Appendix D – Applicant's Review of DFDS' Navigational Risk Assessment

IMMINGHAM EASTERN RO-RO TERMINAL

Applicant's Review of DFDS' Navigational Risk Assessment

Document Reference – 10.2.54

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Contents

1 Introduction

1.1.1 At Deadline 2 of the examination, both DFDS Seaways ("DFDS") and Associated Petroleum Terminals (Immingham) Ltd ("APT") as operators of the Immingham Oil Terminal ("IOT") submitted what are purported to be alternative Navigational Risk Assessments ("NRA") – alternatives to the formally prepared NRA submitted by the Applicant as part of its application for the Immingham Eastern Ro-Ro Terminal ("IERRT") Development Consent Order ("DCO").

1.1.2 Both alternative NRAs share similar traits – for reasons discussed below – but not least because the principal author of both NRAs was Nash Maritime, albeit instructed by different clients with different motives and objectives.

1.1.3 This report provides a review of and commentary on the DFDS alternative NRA ("the DFDS NRA"). A review and commentary of the IOT Operators' alternative NRA is provided as Document Reference 10.2.57.

1.1.4 DFDS commissioned Nash Maritime to produce a document which describes itself as "Immingham Eastern Ro-Ro Terminal Navigational Risk Assessment" **[REP2-043]** ("the DFDS NRA"). It is evident that it was produced sometime during August 2023 during the course of this examination as part of DFDS's representations in respect of the Proposed Development.

1.1.5 For reasons briefly summarised below, although the document purports to be an NRA in respect of the Proposed Development, it lacks some of the most basic requirements to be an NRA as identified below. As a consequence, it is wrong to treat it as such and as a substitute or proxy for the NRA that has been properly produced for the Proposed Development by ABPmer in relation to the DCO Application.

1.1.6 Although there are many points of detail that could be elaborated by way of criticism of the DFDS NRA in purporting to be an NRA of the Proposed Development, this review focuses on the key points which make the DFDS NRA inherently unsuitable for use as an NRA and which reveal why it does not in any way undermine the Applicant's NRA that has already been produced and which presents a full and comprehensive NRA in respect of the Proposed Development.

1.1.7 The structure of this document is as follows:

- Section 1 – Introduction;
- Section 2 – NRA Methodology;
- Section 3 – Stakeholder Engagement;
- Section 4 – Decision Making and the Statutory Harbour Authority;
- Section 5 – DFDS NRA;
- Section 6 – Conclusion.

2 NRA Methodology

2.1.1 This section of the document summarises the methodology that is followed when undertaking NRAs.

2.1.2 It should be noted at the outset that there is no policy or legislation in the UK that dictates the format of an NRA to support a new development. The Port Marine Safety Code ("PMSC") **[REP1-015]** sets out policy and guidance that relates to statutory harbour authorities, jetties, terminals and marinas. In so doing, however, it is not purporting to dictate the specific requirements of an NRA or risk assessment for a particular project.

2.1.3 As a consequence, over the years, consultancies who provide NRA assistance to clients have constructed and refined their own templates, based on feedback from a range of clients.

2.1.4 It is unsurprising, therefore, that different consultancies may have different approaches to the format of NRAs depending upon what project is being assessed. However, individual preferences in presentation are not based upon any formal or mandated requirements. The term NRA is not a specifically defined term. Most consultancies that offer NRA services generally consider that risk assessments within NRAs are largely intended to consider the risks associated with the navigation or movement of vessels. Within that context, risk assessments within a Marine Safety Management System ("MSMS") may cover a number of navigational risks, whilst also considering other risks to which a port might be subject that concern port and/or marine safety.

2.1.5 The outcomes of NRAs produced during the consenting stage of new developments are later incorporated into MSMSs for ports where they are continually reviewed (see Section 4 below).

2.1.6 Whilst the PMSC does not dictate the specific requirements of an NRA, when considering the guidance in the PMSC and its associated Guide to Good Practice ("GtGP") **[REP1-016]**, it is clear that most NRAs contain certain core elements which are included by consultancies like ABPmer, Anatec, Marico Marine and Nash Maritime.

2.1.7 These core elements include the following:

- Introduction and Policy review;
- Data sources (Wind, Tide, AIS etc.);
- Baseline assessment (existing review of navigation, usually accompanied by review of incidents and traffic in the study area);
- Description of proposed change/development (if applicable);
- Risk assessment approach and details (tolerability/acceptability, descriptors, matrices);
- Hazard Logs (detailing risks with controls, causes, outcomes, usually produced as a result of HAZID workshops); and

- Discussion (of findings).

2.1.8 Some consultancies also consider a ‘future baseline’, where statistics and industry inference are taken into account to describe a potential future that may occur at the port. For example, on a macro scale across the UK, there is a common trend that the total freight by tonnage is increasing whilst the number of vessel movements is either constant or reducing as a result of the use of larger vessels and a consequential reduction in the number of ships being used.

2.1.9 It is important to note, however, that there is no agreed standard on any of the core elements of information listed above, nor any policy or regulatory requirements as to what has to be included by way of a ‘navigation baseline’ in an NRA.

2.1.10 By way of example, there is reference in the GtGP, in paragraph 4.3.10 - “*Taking stock covers a review of: the adequacy and completeness of any established incident database or similar records;”* that historic incidents should be considered but there is no guidance or advice provided as to how this could or should be satisfied, for example by means of an incident-by-incident approach or by consideration of spatial data plots. These are matters of choice for the author of the relevant NRA, with the ultimate arbiter as to whether the NRA provides sufficient information being solely a matter for the Statutory Harbour Authority (see Section 4).

2.1.11 It is wrong in principle to suggest that a particular approach to presentation of data or information is correct or incorrect. This misunderstands the process that is applied to NRA and the exercise of judgment by relevant authors which is ultimately overseen by the decision of the Statutory Harbour Authority.

2.1.12 With a view to enhancing marine safety within a port and harbour approaches, a positive analytical approach is required, including the consideration of past events and accidents, examining potential dangers and the means of avoiding them. The process of assessment is continuous, so that new hazards and changed risks are properly identified and addressed in the MSMS (see Section 4). The aim of risk assessment is to define risks so that they can be managed.

2.1.13 Assessing risks to help to determine precautions can be qualitative or quantitative. Quantified risk assessment is not a requirement and may not be practicable. Risk assessments should be undertaken by competent people, especially when choosing appropriate quantitative risk assessment techniques and interpreting results.

2.1.14 Risk assessment techniques are fundamentally the same for large and small ports, but the execution and detail will differ considerably. A risk assessment will typically involve five broad stages, which are described in turn below:

- Problem identification, scoping and risk assessment design (data gathering)
- Hazard Identification (“HAZID”)

- Risk Analysis
- Assessment of Existing Risk Control Measures
- Identification of Additional or Future Risk Control Measures

2.1.15 **Problem identification, scoping and risk assessment design (data gathering)** – Anybody undertaking a risk assessment has to start by taking account of the organisation, its culture, policies, procedures and priorities together with an assessment of the existing safety management structure.

2.1.16 Key to this part of the process is to engage with those working in and using the port. Port users affected by a particular risk should be informed and involved. It is likely to involve a structured process.

2.1.17 Taking account of the existing situation covers a review of the adequacy and completeness of any established incident database or similar records, as well as considering the current management procedures, including; pilotage, navigation management (LPS/VTS), hydrography, conservancy, and marine operations. Additionally, this will typically involve reviewing Marine Accident Investigation Branch (MAIB) reports and other investigative reports which make recommendations about incidents which have taken place in a harbour.

2.1.18 **HAZID** – This stage should involve the identification of hazards (something with the potential to cause harm, loss, or injury) that arise from the proposed project in the context of the existing navigational environment. Any list of hazards will include those already known to the port, including identification of the causes of previous incidents if known.

2.1.19 Within the process of hazard identification and risk assessment, ports should have due regard of the link between the port authority and terminal/vessel operators. Structured meetings or workshops need to be held during this process involving relevant marine practitioners. Port users, including groups such as Pilotage Exemption Certificate (PEC) holders, commercial operators, and tug operators is required (PMSC GtGP; **[REP1-016]**).

2.1.20 This stage should also identify the potential outcomes if the identified events were to happen (scenarios). One useful approach is to consider both the most likely and the worst credible outcomes (set against likely frequency of the event happening in each case). This approach provides a more realistic and thorough assessment of risk, which reflects reality, in that relatively very few incidents result in the worst credible outcome. On a standard 5x5 risk matrix used by many ports, these incidents score highly for outcome, but this is tempered by a low score on the frequency axis.

2.1.21 **Risk analysis** – The hazardous scenarios identified then need to be prioritised. A method which combines an assessment of the likelihood of a hazardous scenario and its potential consequences should be used. This will be a matter of judgement crucially informed by the relevant marine practitioners and likely to be best appraised by those with professional responsibility for managing the harbour, namely the harbourmaster and dockmaster.

2.1.22 The frequency of incidents can be established in part using historical data identified in the first stage of the work. It can be determined using a qualitative scale or on a “per-shipping’ movement basis, or a combination of the two. The likelihood of a hazardous incident and its potential consequences can often be determined with reference to historical data. However, it should be borne in mind that following an incident the risk of it reoccurring should have been reduced by management action. It therefore follows that any assessment of frequency and consequence is likely to rely to a certain extent upon the judgement of the assessors or others capable of making such a qualified estimate. Historical data alone will not provide a true assessment of the risk of the current operations, nor will it necessarily reveal an extremely remote event.

2.1.23 Risks and the impact of identified outcomes should normally be assessed against four criteria; the consequence to:

- Life (public safety);
- The environment;
- Port and port user operations (business, reputation etc); and
- Port and shipping infrastructure (damage).

2.1.24 **Assessment of Existing Risk Control Measures** – Risk assessment necessarily includes a review of existing hazards and their associated risk control measures (embedded controls). As a result, new risk control measures (or changes/improvements to existing risk control measures) may be identified for consideration, both where there are gaps in existing procedures and where risk controls need to be enhanced. Some control measures might also be relaxed so that resources can be re-designated to meet a new priority. Care should be taken to ensure that any new hazards created as a result are themselves identified and managed. The overall risk exposure of the port organisation itself will be identified during this stage and will allow recommendations to be made to enhance safety.

2.1.25 **Identification of Risk Control Measures** – The aim of assessing and managing marine operations in harbours is to reduce risk as low as reasonably practicable (‘ALARP’). Judgement of risk should be undertaken on an objective basis and should not be influenced by the financial position of the authority. The degree of tolerable risk in a particular activity or environment can be balanced against the time, trouble, cost, and physical difficulty of taking measures that avoid the risk. If these are so disproportionate to the risk that it would be unreasonable for the people concerned to incur them, they are not obliged to do so. The greater the risk, the more likely it is that it is reasonable to go to very substantial expense, trouble, and invention to reduce it. Conversely, if the consequences and the extent of a risk are small, insistence on great expense would not be considered reasonable.

2.1.26 Risks may be identified which are intolerable. The decision as to whether risks are tolerable or intolerable sits with the appropriate authority, namely in the case of the Applicant, the Duty Holder through the Harbour Authority and Safety Board rather than the authors of the NRA (see Section 4 for further detail). Measures must be taken to eliminate identified risks so far as is practicable. This generally requires whatever is technically possible in the light of current knowledge, which the person concerned had or ought to have had at the time. The cost, time and trouble involved are not to be taken into account in deciding what measures are possible to eliminate intolerable risk.

2.1.27 Where (as for the Proposed Development) none of the risks are considered intolerable with the (to be) applied controls, there is no requirement to eliminate activity or apply additional overly onerous (i.e., not reasonably practicable) controls to meet the tolerability thresholds set by the appropriate authority, the Harbour Authority and Safety Board.

3 Stakeholder Engagement

3.1.1 This section explains the importance of stakeholder engagement in the NRA process.

3.1.2 As identified in considering the methodology above, whilst there is no specific style or format that has to be adopted for a NRA, any proper NRA will necessarily involve stakeholder engagement in the risk assessment process.

3.1.3 That engagement concerns both the identification of relevant hazard scenarios, their frequency and consequence, and how such hazards are to be addressed.

3.1.4 That does not mean that all stakeholders will necessarily agree, or have to agree, with the approach adopted in a NRA, or with the judgments that are reached. Whilst one should strive for consensus, it is in fact commonplace for there to a range of different views by affected stakeholders, depending upon the nature of their interest.

3.1.5 Any proper NRA will, however, be based upon stakeholder engagement where that includes not only taking account of other users of the marine environment, but also critically (and as an essential component) engagement with the relevant harbourmaster and dockmaster responsible for that marine environment.

3.1.6 This basic requirement is fully addressed in the Applicant's NRA. A critical part of that process was the holding of HAZID workshops to support the NRA produced for the DCO at which the considerations of all users was taken into account. It is essential to involve those working in and using the port and others in the risk assessment process and in subsequent reviews, as risks affect both port users and the harbour authority alike. It is equally essential, however, to realise that the input from users through this process does not dictate, nor should it be permitted to dictate, the objective assessment of risk by the SHA.

3.1.7 SHAs are required to identify potential hazards in light of (amongst other things) input from users, but they are also required to develop and refine procedures and defences to mitigate those risks to a level which is acceptable to the SHA bearing in mind the aspirations of users and what will often be competing aspirations and demands of those users. It is good practice to establish channels of engagement which can be used for this purpose (such as the HAZID workshops). It is simply wrong in principle, however, to suggest that feedback from users through this process can be treated as determinative or that it should be allowed to dictate the outcome of how the SHA manages the safety of the port to what it considers to be acceptable levels.

3.1.8 As set out below in Section 5, and in direct contrast to the Applicant's NRA, the DFDS NRA is fundamentally flawed in this respect as it has not involved essential stakeholders including the harbourmaster and dockmaster.

4 Decision Making and the Statutory Harbour Authority

4.1.1 This section explains the key aspects in managing navigational risk and the role of the Statutory Harbour Authority in controlling navigational risks within its statutory area. It is important to understand this in the wider context of the various roles and responsibilities for navigational risk on the River Humber. To assist with this, the Applicant submitted a note on the management, control, and regulation of the Port of Immingham and the River Humber to the Examination **[REP1-014]**. Within that note, the roles of the Applicant, Statutory Harbour Authority for the Port of Immingham, the Statutory Harbour Authority for the Humber Estuary, and ABP's Governance is explained.

4.2 Existing Controls, Operations and Standards

4.2.1 As set out above, any proper NRA will necessarily need to consider all potential controls and a port's established operations and relevant standards of acceptability in reaching any conclusions about proposed changes. A failure to understand the current operating environment and standards that are applicable to it will necessarily undermine the validity of any purported NRA. Again, as set out further below, the DFDS NRA is also fundamentally flawed in this respect as it pays no proper regard to the existing safe operations at the Port of Immingham.

4.3 Marine Safety Management System

4.3.1 The PMSC relies upon the principle that relevant organisations will base their policies, and procedures relating to marine operations on a formal assessment of hazards and risks to their marine operations overall. They should maintain a marine safety management system (MSMS) developed from such risk assessments.

4.3.2 Any subsequent risk assessments deemed necessary as time goes on (either to update an existing situation or to address changes in the port's environment) are then reflected in subsequent updates to the MSMS which itself develops and evolves over time as a result of changes in (for example) trade, and port usage or physical developments. In this context. The outcomes of the NRA produced for the Proposed Development will be incorporated within the MSMS if the DCO application is approved.

4.3.3 Under the PMSC and consequential MSMS that is put in place, there is a critical appraisal of all routine and non-routine activities in any risk assessment work. Those involved should not just include employees, but others including stakeholders who use the port including contractors and terminal operators.

4.4 **Statutory Harbour Authority**

4.4.1 It is only the relevant Statutory Harbour Authority ("SHA") that is the relevant decision maker for the control of navigational risks within their statutory area. It is the SHA that is responsible for assessing navigational risks and therefore how they are to be assessed and managed within their area. It is therefore fundamental that it is the SHA that has to be satisfied that an appropriate NRA has been conducted for its needs. There is no power and certainly no principled basis for a third party to direct a SHA, or to seek to dictate a SHA, to as to how the SHA should discharge its own duties and responsibilities. The SHA has the overall responsibility and competency to deal with navigational safety in the ordinary running of its area.

4.4.2 It is evident from the very recent production of the DFDS NRA (like the IOT NRA) which DFDS now claim to be their own "NRA" that the function of an NRA, the essential role of the SHA and the exclusive duty and responsibility of the SHA in decision-making is being misrepresented or misunderstood by the IOT Operators and DFDS.

4.4.3 The NRA is an assessment that has to be considered by the SHA to assess navigational risks in the environment for which it is responsible for regulating safely. It therefore necessarily requires the SHA to make the necessary judgments about those risks, the myriad ways in which those risks can be mitigated (where considered necessary), the tolerability of risks and whether they have been reduced to ALARP as judgments for SHA after any such mitigation.

4.4.4 In so doing, the Statutory Harbour Authority is not only fulfilling the essential functions that are imposed on it (and no other body) by statute, but it is also fulfilling its obligation to ensure the safe operation of the port in light of the risks identified having regard to the interests of all users.

4.4.5 The River Humber is subject to navigation by a wide range of users from small leisure craft to very large commercial vessels, some transporting petro-chemicals in tankers. This of itself creates a notional risk between the interaction of such craft navigating in the same area. The SHA has to consider the needs and aspirations of all such users in assessing risks and managing them to what it regards to be acceptable levels in practice. The fact that users of large commercial vessels might ideally wish to see leisure craft prevented from using the spaces that it wishes to use to reduce the risks and leisure craft might seek the same in reverse does not dictate the outcome of the Statutory Harbour Authority's NRA of such interactions.

4.4.6 By the same token, the River Humber is already subject to navigation by Ro-Ro vessels operating on a daily basis and seeking access to ports like Immingham in proximity to an oil facility such as that at IOT. Again, the fact that such interactions will inevitably involve residual risks, with competing commercial aspirations of users such as Ro-Ro operators and the operators of an oil terminal does not dictate the outcome of the NRA by the SHA as to how to manage those risks to what it considers to be tolerable levels. It is the Statutory Harbour Authority that decides what is tolerable and ALARP in all the circumstances.

4.4.7 In each of the simple examples above, there will not only be identification of relevant risks and controls and mitigation measures, but a subsequent judgment to be made what is tolerable and ALARP, but with the integrated step of assessment of the risk and means of mitigating it to a tolerable and ALARP level, having regard to the needs and aspirations of different users. Thus, taking the second example above, there are a number of ways of managing interaction between such marine traffic to reduce risks to what the SHA consider to be acceptable. These may include controlling or restricting use by leisure craft in areas or operations (e.g., not operating under sail, or not exceeding certain limits or not operating in certain areas when ships manoeuvring etc), or controlling or restricting use or operations by commercial traffic (e.g., not operating at certain times of tide or in certain wind conditions, requirements for use of a pilot, requirements for use of tug or tugs etc) or a combination of any that takes account of the interests of both users, rather than simply restricting one user in preference to another.

4.4.8 The SHA is the decision maker on what activities can occur within its respective harbour authority area. The SHA needs to be satisfied that a risk assessment conducted for those purposes is appropriate. If the SHA does not believe that a risk assessment has been conducted to a sufficient standard, it is bound to discount it. Similarly, for an external body to attempt to direct an SHA to act in a certain way would be an unacceptable interference with and impinge upon the SHA's powers and duties.

4.4.9 As explained below, the DFDS NRA falls into the fundamental error of seeking to impose its own expressed judgments (without any actual and genuine stakeholder engagement with key bodies like the Harbour Master or Dock Master Humber and without any understanding of existing port operational standards and measures) as if it represented judgments on tolerability or ALARP which could be substituted for the views of the SHA. That is simply not the case.

5 DFDS NRA

5.1 Introduction

5.1.1 This section provides a review of the "Immingham Eastern Ro-Ro Terminal Navigational Risk Assessment" **[REP2-043]** that was undertaken by Nash Maritime on behalf of DFDS (i.e., the DFDS NRA).

5.1.2 As already noted, much of the document that has now been produced as the DFDS NRA contains material to which it is unnecessary to provide any direct response in that it simply reflects the presentation of data (albeit in a different format or style to that in the Applicant's NRA). It is not material which either advances the position or undermines the Applicant's NRA.

5.1.3 This section, therefore, concentrates on the key parts of the DFDS NRA as purporting to represent a different assessment of risk to that which was presented in the Applicant's NRA (the latter which has already been considered and endorsed by the SHA and the "Duty Holder").

5.1.4 The review of the DFDS NRA has been undertaken in the context of the fundamental principles outlined in the preceding sections of this document and is structured as follows:

- Stakeholder engagement;
- Risk scoring;
- Assessment of tolerability; and
- Use of risk controls.

5.2 Stakeholder Engagement

5.2.1 As identified above, one of the most basic requirements of any NRA is appropriate stakeholder engagement throughout the NRA process. The PMSC GtGP states in paragraph 4.2.6 that - '*It is essential to involve those working in and using the port and others in the risk assessment process and subsequent reviews and development, utilising their specialist knowledge and skills*'.

5.2.2 This does not mean that every stakeholder has to agree, or that there is a requirement for consensus. Many stakeholders will often disagree and inevitably have different priorities and objectives and consider their operations to be more important than others or wish to prioritise their operations over others or seek to obtain the most favourable operating conditions for their own commercial operations. It is important, however, that genuine engagement actually takes place including with those responsible, and most experienced, for the safe operation of the marine environment including the Harbour Master and Dock Master.

5.2.3 It is evident that the DFDS NRA has failed to conduct an appropriate level of stakeholder engagement. At its most basic such engagement would be expected with the Applicant, as the port operator, but also the Harbour Master, Dock Master and the various persons involved in operations such as the pilots, tug operators, VTS and, of course Stena, the proposed operator of the Proposed Development. Stena's own Masters would be responsible for navigating the particular vessels in this location for this development, even when operating under a compulsory pilotage direction, pilotage by HES pilot or under an act of self-pilotage with a pilot exemption certificate (PEC). The DFDS NRA has only considered DFDS's own view as a port user.

5.2.4 As a result, the frequency and consequence of risks along with potential control measures, does not take into consideration the expertise of those personnel that are most familiar with and currently or will operate within the Port of Immingham.

5.2.5 This is in direct contrast to the NRA produced by ABPmer for the Applicant's DCO submission **[APP-089]**, as part of which full stakeholder engagement was undertaken.

5.3 Risk scoring

5.3.1 Risk outcomes within the DFDS NRA are scored and then averaged to reach an overall score as a single number which is then used in order for the authors to describe whether the risk is acceptable by reference to their own choice of scoring. This approach is oversimplistic and does not take into consideration the fact that risks can not only affect more than one receptor (such as people, property, planet (environment), port (business)), but that the scale of effect on these receptors can be very different.

5.3.2 Within the Applicant's NRA, the review of risks has been undertaken against criteria of tolerance/acceptability across each of the receptor types. This prevents a risk that scores highly for one receptor from being hidden by lower risk outcomes for other receptors by reducing the average. For example, using the approach adopted in the DFDS NRA, a risk that could be considered to be intolerable to people could be masked if it scored lower for property, planet, and port.

5.3.3 Furthermore, the approach taken within the Applicant's NRA is consistent with the approach taken to risk assessment across the ABP Group which considers all four receptor types individually when evaluating port operations.

5.4 Assessment of tolerability

5.4.1 Fundamentally, the DFDS NRA fails to take into account the appropriate standard of acceptability of risk (i.e., tolerability) as set by the ABP Harbour Authority and Safety Board (HASB). The approach is therefore not in accordance with the PMSC GtGP.

5.4.2 The PMSC GtGP states that '*A safety management system should be informed by and based upon a formal risk assessment of the port's marine activities (routine and non-routine), a documented, structured and systematic process comprising; the identification and analysis of risks; an assessment of these risks against an appropriate standard of acceptability…*' (Section 4.3, page 33). The HASB has determined this appropriate standard of acceptability (i.e., tolerability), which has been published in the Applicant's NRA.

5.4.3 Instead, the DFDS NRA assumes or supposes a standard of acceptability for the Harbour Authority. Neither Nash Maritime nor DFDS is in a position, nor do they have the authority, to make such an assumption. Further, neither Nash Maritime nor DFDS sought to seek to discuss or agree levels of tolerability with the SHA. This approach is both inappropriate and unacceptable as it trespasses on the SHA's statutory powers, duties and obligations. To allow one operator to set its own standards of acceptability (with all of the flaws already identified) would seriously compromise, to a fundamental degree, the SHA's ability to discharge its duties and responsibilities to determine how best to manage safety within an area for which it is statutorily responsible.

5.4.4 In direct contrast, the Applicant's NRA has evaluated risks in accordance with the tolerability thresholds set by the HASB, and as such is in full alignment with the requirements of the PMSC GtGP.

5.5 Use of controls

5.5.1 As identified above, proper consideration of the use of controls in considering any risk is essential for any NRA and the subsequent judgments made by the Harbour Authorities. Despite this, the authors of the DFDS NRA only contemplate the use of six additional controls to help manage navigational risk during the construction and operational phases of the IERRT Project when there is quite clearly a much greater range of controls that require consideration.

5.5.2 In contrast, the Applicant's NRA initially considered 29 additional controls that were suggested by a wide range of stakeholders at the HAZID workshops. Representatives of the SHA and Applicant then identified a further seven controls that could be applied during a provisional cost benefit analysis meeting.

5.5.3 This highlights the inappropriate approach to understanding the risks and potential control measures available to the IERRT Project within the DFDS NRA. By failing to sufficiently identify control measures, the authors have failed to identify ways in which risks can be made tolerable and ALARP and, as a consequence, have over-inflated the assessment of residual risk. This has resulted in recommendations for control measures (such as the movement of the finger pier and impact protection) that are disproportionate to the scale of risk identified even if one were (inappropriately) to impose the DFDS judgments about tolerability and ALARP for those of the SHA (something which would be an abrogation of the Harbour Authorities' functions). In practice there are in fact many controls (as identified through the wider port stakeholders' engagement and identified in the Applicant's NRA) that could be applied to ensure all risks are tolerable and ALARP (as judged by the SHAs) without the need for such drastic and disproportionate solutions.

5.5.4 This also further emphasises the basic problem with the lack of stakeholder engagement with wider port stakeholders and partly explains why the number of controls identified in the DFDS NRA is so limited. In addition, it follows that no consultation with or consideration of the SHA's judgment on tolerability and ALARP means that any conclusion drawn has to be viewed as false as it is based upon the opinion of an Interested Party objecting in isolation.

5.5.5 In addition to the above there are various failings of logic that exacerbate the problems with the risk outcomes tabulated in Annexes A and B of the DFDS NRA.

5.5.6 These are covered in more detail in the section below and in Appendix 1, but by way of illustration, Risk 13 in the DFDS NRA proposes 'moving the finger pier' as a control. Despite this, having imposed such a control, the frequency of a Ro-Ro vessel making contact with a moored tanker in this location is still rated '3' – 'Possible'. This is illogical. Given that DFDS describe the control 'Moving the Finger Pier' to mean either complete relocation or relocation of the southern berths this control should logically eliminate the risk or not permit the risk to be scored at 3 – which was a position with which DFDS agreed during the third HAZID workshop held by the Applicant, represented in Risk ID O1 (Appendix C, Table C1) **[APP-089]**.

5.5.7 In addition, DFDS identify Risk 20 (within Annex A and B of their NRA **[REP2-043]**), being a Ro-Ro making contact (allision) with the Eastern Jetty. The DFDS NRA identifies that the risk can be made tolerable by having controls that include: 'berthing/unberthing criteria', 'standby tug provision', and a 'deconfliction plan'. In essence, DFDS identify that these three controls are sufficient to assist the controlled berthing of a Ro-Ro. As a matter of principle, given that such measures can constitute management of the risk to ALARP with respect to the Eastern Jetty, it is illogical to suggest that Ro-Ro cannot be positively controlled with the three aforementioned controls in relation to the IOT Finger Pier, such that the identification of moving/removing the finger pier for other risks considered within their assessment is not justified.

5.5.8 Additionally, DFDS acknowledge in Risk 2 [REP2-043] that a deconfliction plan and moving the Finger Pier would reduce the risk of collision between a tanker and a Ro-Ro to what they regard as a tolerable level. The Applicant agrees that deconfliction plans are an important control however, it is unclear to the Applicant how 'Moving the Finger Pier', as suggested by DFDS, will reduce the risk of collision between vessels in the Immingham SHA. This risk already exists within the port and is well managed with the Finger Pier in its current location.

5.6 Comparison of outcomes for risks considered intolerable by DFDS

5.6.1 This section directly compares the differences in outcomes between the Applicant's NRA and the DFDS NRA. Overall, despite the many differences in approach outlined in the preceding sections, the differences in outcomes of both risk assessments are limited. The fundamental and important difference is what is considered tolerable by DFDS and by the SHA. This is explained in further detail below for each of the four intolerable risks identified in the DFDS NRA. A detailed comparison of each of these risks is provided in Appendix A.

5.6.2 It is important to note that the tables provided at Appendix A compare intolerable risks identified by DFDS and IOT Operators at the baseline/embedded stage. All three NRAs subsequently identify further controls which suitably mitigate the risks to a 'tolerable if ALARP' or 'tolerable and ALARP' state. Supplementary to this, the most significant elements to observe are; the source of the assessed risk outcomes (i.e., level of stakeholder engagement), the similarity of risk outcomes across the three assessments, and the authority/entity which has determined if the risk is tolerable (and whether they have the authority to do so).

Collision

5.6.3 The Applicant's NRA and the DFDS alternative NRA (as well as the IOT alternative NRA) each include the assessment of a collision of a Coastal Tanker with a Ro-Ro vessel. Ultimately the Applicant's NRA supported by the diverse range of stakeholder opinion (including that of DFDS) considers that this risk currently exists and is tolerable as the area within the SHA boundary is already used by Ro-Ro vessels and Coastal Tankers. The SHA has indicated that they are aware of the implications of this risk, and they deem it tolerable and ALARP.

5.6.4 Further, this risk was considered 'Tolerable if ALARP' at both the Baseline and Residual risk stages (Embedded and Future) within the IOT Operators' NRA. The DFDS NRA, although produced by the same consultancy (NASH Maritime) states that this risk is tolerable when a 'deconfliction plan' is established as a further control. As the ExA is aware, however, the Applicant does already have controls in place, such as VTS, which fulfils this function. In addition, the provisions of a 'deconfliction plan' are already in place or actionable by the Harbour Master Humber and/or the Immingham Dock Master. It follows that there is actually agreement between the three NRAs and that this risk can be suitably mitigated.

Allision with Eastern Jetty

5.6.5 This risk has only been considered within the DFDS and Applicant's NRAs. Of particular note is the high degree of alignment between the perceived consequences of this risk if it were to occur. Although a direct comparison cannot be made between the two likelihood/frequency scales, due to the use of alternative methodology, the two organisations broadly consider these risks quite similarly with both considering the risk tolerable if/and ALARP with mitigations put in place.

5.6.6 Both the Applicant and DFDS have identified and agree that a further control should include berthing criteria. These criteria will be specifically informed from ongoing simulation studies and/or berthing trials, before becoming part of the MSMS in effect.

Allision with Finger Pier

5.6.7 This risk has been considered across each of the three NRAs. Within the context of this risk, one element that all three NRAs agree on is that the risk can be mitigated to tolerable if/and ALARP. In this regard, the only suggested further control with which the SHA fundamentally does not agree is 'moving the finger pier' as identified by NASH Maritime within the DFDS and IOT Operators NRAs. This is because the SHA already considers this risk to be tolerable based on the full range of alternative controls that can be applied to mitigate the risk. Moving the finger pier is far too onerous for it to be considered a control that fits within the definition of ALARP.

5.6.8 The other further controls identified are broadly consistent with those considered by the Applicant. The Applicant has also indicated the need for berthing/unberthing criteria to be defined along with the implementation of a marine liaison plan both during construction and operation.

Allision with Trunk Way

5.6.9 This risk has been considered in all three NRAs. Furthermore, all three NRAs believe that this risk can be suitably mitigated to a tolerable and/if ALARP state if further controls are put in place. Specifically, 'impact protection', 'berthing/unberthing criteria', and 'provision of a standby tug' is identified by DFDS. In this regard, however, although the Applicant broadly agrees with the DFDS NRA assessment, as is set out in paragraph 9.9.24 and Table C4 of its NRA [APP-089], as the ExA is aware, the Applicant does not consider the provision of impact protection measures to be necessary and such measures will only be provided as part of the project specific adaptive controls if required.

6 Conclusion

6.1.1 As explained throughout this review, the Applicant is satisfied and confident that it has been provided with an independent and robust NRA as part of the IERRT DCO application. The Applicant's NRA considers all relevant elements concerned with navigational risk, especially those raised by port stakeholders during HAZID workshop and thus has given comprehensive consideration to the risk against a wide range of subject matter expertise and stakeholder opinion.

6.1.2 The NRA conducted for the Applicant's DCO submission considers the views of stakeholders and seeks to reduce risk by increasing safety and considering a wide range of potential controls. This was achieved by identifying which hazard scenarios exist, what might cause them to happen, and how one might control or limit these causes. Following this, the Applicant's NRA analysed the risks, which involved attributing risk outcomes (consequence and likelihood/frequency) in consultation with a diverse range of stakeholders and port users. This is known as Hazard Identification and Risk Analysis and must be included in any risk assessment if it is to comply with the PMSC's GtGP (**[REP1-016]**).

6.1.3 Further, the Applicant's NRA considered the identified risks against the appropriate standard of acceptability for the SHAs, the Harbour Authority and HASB set 'tolerability' threshold. The controls identified for a hazardous scenario were then considered, in consultation with the Humber Harbour Master and the Immingham Dock Master (amongst others), against the concepts of ALARP and 'tolerability'. This stage is known as Risk Assessment and in this instance was accompanied by a preliminary cost-benefit analysis assessment. This then enabled the NRA produced for the Applicant to demonstrate to the Duty Holder, Designated Person, and SHAs that considerable effort and thought had been put into safely managing the risks identified by the stakeholders.

6.1.4 The SHAs have fully considered the Applicant's NRA and have determined that the identified risks are able to be mitigated to the point where safe operations can continue to occur at their port. This is in relation both to existing operations and for the construction and operation phases of the IERRT project.

6.1.5 In contrast, the evidence and assessments within the DFDS NRA are considered to be flawed. Although attempts at a qualitative risk assessment have been made, the risk outcomes have ultimately been determined subjectively and without consultation.

6.1.6 In summary, the DFDS NRA has been completed with:

- A narrow perspective with a failure to consider either the IERRT project or the Port of Immingham as a whole;
- A lack of stakeholder engagement with other port users and fundamentally the Statutory Harbour Authority.;
- No consideration of levels of tolerability set by the SHA; and
- Insufficient integration of risk controls into the risk assessment process resulting in a disproportionate assessment of residual risk and unjustified recommendations for further control measures.

6.1.7 The table below provides a summary of how each element of the Applicant's NRA and the DFDS NRA has been met, highlighting the differences and the fundamental shortcomings of the alternative NRA provided by DFDS. Ultimately, the fundamental point is that it is for the SHA to assess navigational risk, assess tolerability and to be accountable for its decisions. It is neither appropriate, nor usual, for third parties to make their own assessments independent of all other stakeholders, nor is there any mechanism for third parties to be held accountable for the outcomes of their opinions.

Table 1. Summary of approach taken in each NRA

Aspect of NRA	Applicant NRA	DFDS Alternative NRA
Stakeholder engagement	Comprehensive stakeholder engagement undertaken to inform risk assessment	No engagement undertaken relying on output of Applicant's NRA – biased perspective about operations with no evidence that any port stakeholder confirmed or validated internally held opinions on risks
Hazard identification	Based on formal HAZID process involving all key stakeholders as part of the NRA	HAZID with DFDS, Nash Maritime and an additional two consultants
Existing risk controls	Fully considered existing controls used to manage risk within the Port, identified at HAZID	Fully considered existing controls used to manage risk within the Port albeit based on Applicant's NRA
Additional risk controls	29 additional risk controls identified during HAZID and another seven controls identified with the SHA	Six additional risk controls identified in the NRA

Aspect of NRA	Applicant NRA	DFDS Alternative NRA
Assessment of frequency	Based on known local and extensive data, using agreed definitions of probability already accepted by Duty Holder, clearly explained to stakeholders. Aligned with SHA guidance and process.	Mixing of frequencies from one NRA with scoring matrix from another NRA. Inappropriate, not aligned with SHA accepted frequencies.
Methodology	Most Likely/Worst Credible principle (industry standard and appropriate) Transparent approach to risk scoring	Mixing of various methodologies used in previous NRAs. Method not agreed or used by the SHA.
Outcomes	No intolerable risks identified with suggested risk controls **agreed by SHA**	Four intolerable risks and application of risks controls not considered reasonably practicable – **in contrast to position of SHA**

Appendix A

Collision – Ro-Ro on passage to/from Immingham Eastern Ro-Ro Terminal with another vessel

Party	Risk and worst credible/most likely scenarios	Causes identified	Embedded Controls identified	Embedded Worst Credible Consequence/ Likeihood Outcomes	Embedded Most Likely Consequence/ Likeihood Outcomes	Further controls identified	Future Worst Credible Consequence/ Likeihood Outcomes	Future Most Likely Consequence/ Likeihood Outcomes	Tolerance and ALARP outcome
Applicant	Collision; Scenario: Ro-Ro on passage to/from Immingham Eastern Ro-Ro Terminal with another vessel Worst Credible: Manoeuvring speed collision with no avoiding action leading to multiple fatalities, hull breach, serious impact to property, significant consequence to the environment including a tier 2 pollution event, and serious consequence to the port business and reputation. Most Likely: Low speed glancing collision with bridge crew taking avoiding action, minor injuries, minor impact to property, no appreciable consequence to the environment or to the port's business/reputation.	Failure to comply with Towage guidelines High traffic density COLREGs failure to comply Restricted visibility Failure to follow passage plan Vessel breakdown or malfunction AIS failure/ lack of AIS Excessive vessel speed Incorrect assessment of tidal flow Excessive vessel speed Poor situational awareness Human error/fatigue - Pilot/ Vessel Personnel Inadequate bridge resource management Inadequate procedures in place onboard vessel Manoeuvre misjudged Ship/Tug/Launch failure Communication failure - Personnel Adverse weather conditions	Towage, available and appropriate Communications - traffic broadcast International COLREGs 1972 (as amended) Passage planning Vessel propulsion redundancies Vessel Traffic Services Accurate tidal measurements Byelaws Aids to navigation, Provision and maintenance of Harbour Authority requirements Joint emergency drills with VTS and Port staff Local Port Service Availability of latest hydrographic information Arrival/Departure, advance notice of Oil spill contingency plans	The worst credible outcome for this risk (at the embedded/baseline stage) **was considered by the attendees at the HAZID workshop** to result in: People - Multiple Fatalities; Property - Serious (£4M - £8M); Planet - Significant (Has the potential to cause significant damage and impact - Tier 2, pollution control measures from external organisations required); Port - Serious (Negative national publicity. Serious damage to reputation. Serious loss of revenue, £4M - £8M) It was also considered that the risk is: Unlikely - The impact of the hazard might occur but is unlikely (within the lifetime of the entity)	The most likely outcome for this risk (at the embedded/baseline stage) was **considered by the attendees at the HAZID workshop** to result in: People - Minor injury(s); Property - Minor (£10,000 - £750,000); Planet - None (No incident - or a potential incident/near miss); Port - None It was also considered that the risk is: Possible - The impact of the hazard could very well occur, but it also may not (within the lifetime of the entity)	Nil further controls identified at HAZID Workshop and post-workshop consultation; Risk considered against existing risks within the MSMS in place and considered ALARP and tolerable with existing controls by the SHA	No Change	No Change	Deemed tolerable and ALARP **by the SHA with the controls agreed**
DFDS	Collision - Project Vessel (Passenger / Driver) ICW Coastal Tanker Most Likely: light touch, low speed contact between two project vessels whilst underway. Worst Credible: heavy contact collision occurrence at relative high speed resulting in loss of vessel and loss of cargo.	The DFDS NRA does not present a table or list of causes	Towage, available and appropriate Accurate tidal measurements Harbour Authority requirements Availability of latest hydrographic information Vessel Traffic Services Berthing procedures Towage guidelines Arrival/Departure, advance notice of Monitoring of met ocean conditions Byelaws Oil spill contingency plans Communications - traffic broadcast Passage planning Design criteria Adequate berth tendering Hydrographic Survey Aids to navigation, Provision and maintenance of International COLREGs 1972 (as amended) Anchors cleared and ready for use Joint emergency drills with VTS and Port staff Communications equipment Mooring analysis Local Port Service Vessel simulation study Port Facility Emergency Plan Weather limits Training of port marine/operations personnel Pilotage Vessel propulsion redundancies	The worst credible outcome for this risk (at the embedded/baseline stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Multiple fatalities; Property - Major, More than £8 m -illion; Planet - Major, Has the potential to cause catastrophic and/or widespread damage. Tier 3, requires major external assistance; Port Major, Negative national and international publicity. Major damage to reputation. Major loss of revenue, more than £8 million. It was also considered that this risk scenario could occur in: An event that could be expected to occur once in 1,000 years.	The most likely outcome for this risk (at the embedded/baseline stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Serious injury(s) MAIB/RIDDOR reportable injury; Property - Moderate £750,000 - £4 million; Planet - Minor, An incident that results in pollution with limited/local impact. Tier 1, Harbour Authority pollution controls measures deployed; Port - Moderate, Negative local publicity. Moderate damage to reputation. Moderate loss of revenue, £750,000 - £4m. It was also considered that this risk scenario could occur in: An event that could be expected to occur once in 10 years.	RC03 Deconfliction plan	The worst credible outcome for this risk (at the potential/future/residual stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Multiple fatalities; Property - Major, More than £8 million; Planet - Major, Has the potential to cause catastrophic and/or widespread damage. Tier 3, requires major external assistance; Port - Major, Negative national and international publicity. Major damage to reputation. Major loss of revenue, more than £8 million. It was also considered that this risk scenario could occur in: An event that could be expected to occur less than once > 1, 000 years.	The most likely outcome for this risk (at the potential/future/residual stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Serious injury(s) MAIB/RIDDOR reportable injury; Property - Moderate £750,000 - £4 million; Planet - Minor, An incident that results in pollution with limited/local impact. Tier 1, Harbour Authority pollution controls measures deployed; Port - Moderate, Negative local publicity. Moderate damage to reputation. Moderate loss of revenue, £750,000 - £4m. It was also considered that this risk scenario could occur in: An event that could be expected to occur once in 100 years.	Deemed 'Tolerable if ALARP' **by authors of the DFDS NRA (NASH Maritime) against tolerance suggested by DFDS,** which differs from that of the IOT Operators and the SHA.
IOT Operators	This risk was considered 'Tolerable if ALARP' at both the Baseline and Residual risk stages (Embedded and Future) within the IOT Operators NRA. Therefore no comparision of intolerable risk is required in this context.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Deemed 'Tolerable if ALARP' **by authors of the IOT Operators NRA (NASH Maritime) against tolerance suggested by IOT Operators,** which differs from that of DFDS and the SHA

Allision with Eastern Jetty

Party	Risk and worst credible/most likely scenarios	Causes identified	Embedded Controls identified	Embedded Worst Credible Consequence/ Likelihood Outcomes	Embedded Most Likely Consequence/ Likeihood Outcomes	Further controls identified	Future Worst Credible Consequence/ Likelihood Outcomes	Future Most Likely Consequence/ Likeihood Outcomes	Tolerance and ALARP outcome
Applicant	Allision; Scenario: Ro-Ro arriving/departing Immingham Eastern Ro-Ro terminal berth 2-3 with a tanker berthed on eastern jetty Worst Credible: Ro-Ro makes contact with berthed tanker resulting in a significant allision that punctures the tanker's double hull leading to a tier 3 pollution event with release of toxic chemical. Causing major risk to life and environment both short and long term. Incident results in multiple fatalities, sever damages to both vessels and berth infrastructure for an amount greater than £8M. Negative international news that significantly affects the ports reputation and port operations. An approaching Ro-Ro loses control and makes slow contact with berthed tanker resulting in an allision that damages cargo pipes, leading to a tier 3 pollution event with release of toxic chemical. Moderate damage to port infrastructure and vessel, serious injuries to personnel, and negative national port reputational damage.	Adverse weather conditions Incorrect assessment of tidal flow Navigation equipment failure Excessive vessel speed Inadequate number/type tugs Manoeuvre misjudged High traffic density Communication failure - Personnel Vessel breakdown or malfunction Limited area for manoeuvring Failure of berth mooring systems Human error/fatigue - Pilot/ Vessel / Marine Personnel	Monitoring of met ocean conditions Passage planning Towage guidelines Towage, available and appropriate Harbour Authority requirements Vessel Traffic Services Port Facility Emergency Plan Oil spill contingency plans	The worst credible outcome for this risk (at the embedded/baseline stage) was **considered by the attendees at the HAZID workshop** to result in: People - Multiple Fatalities; Property - Major (> £8M); Planet - Major (Potential to cause catastrophic and/or widespread damage - Tier 3, requires major external assistance); Port - Major (Negative national and international publicity. Major damage to reputation. Major loss of revenue, > £8 M) It was also considered that the risk is: Unlikely - The impact of the hazard might occur but is unlikely (within the lifetime of the entity)	The most likely outcome for this risk (at the embedded/baseline stage) was **considered by the attendees at the HAZID workshop** to result in: People - Serious injury(s) (MAIB/RIDDOR reportable injury); Property - Moderate (£750,000 - £4M); Planet - Major (Potential to cause catastrophic and/or widespread damage - Tier 3, requires major external assistance); Port - Serious (Negative national publicity. Serious damage to reputation. Serious loss of revenue, £4M - £8M) It was also considered that the risk is: Possible - The impact of the hazard could very well occur, but it also may not (within the lifetime of the entity)	Berthing criteria Charted safety area, berthing procedures Additional pilotage training/ familiarisation (Controls later confirmed by SHA to be put in place)	The worst credible outcome for this risk (at the potential/future/residual stage, in contemplation of further controls) was **considered by representatives of the SHA, in consideration of the comments made by attendees at the HAZID workshop**, to result in: People - Multiple Fatalities; Property - Major (> £8M); Planet - Major (Potential to cause catastrophic and/or widespread damage - Tier 3, requires major external assistance); Port - Major (Negative national and international publicity. Major damage to reputation. Major loss of revenue, > £8 M) It was also considered that the risk is: Rare - The impact of the hazard is realised but should very rarely occur (within the lifetime of the entity)	The most likely scenario for this risk (at the potential/future/residual stage, in contemplation of further controls) **was considered by representative of the SHA attendees at the HAZID workshop** to result in: People - Serious injury(s) (MAIB/RIDDOR reportable injury); Property - Moderate (£750,000 - £4M); Planet - Major (Potential to cause catastrophic and/or widespread damage - Tier 3, requires major external assistance); Port - Serious (Negative national publicity. Serious damage to reputation. Serious loss of revenue, £4M - £8M) It was also considered that the risk is: Unlikely - The impact of the hazard might occur but is unlikely (within the lifetime of the entity)	Deemed tolerable and ALARP **by the SHA with the controls agreed**
DFDS	Contact (Allision) - Project Vessel (Passenger /Driver) with Eastern Jetty (or moored vessel) Most Likely: light contact with tanker moored alongside resulting in moderate damage to vessels, breakaway of tanker and ruptured loading arm. Worst Credible: high impact contact with tanker moored alongside (or bunkering barge alongside tanker) resulting in puncture of tanker hull or bunker barge hull, rupture of Eastern Jetty pipeline(s), loss of bunker barge moored alongside major and damage to berth infrastructure.	The DFDS NRA does not present a table or list of causes	Accurate tidal measurements Harbour Authority requirements Availability of latest hydrographic information Vessel Traffic Services Berthing procedures Towage guidelines Arrival/Departure, advance notice of Monitoring of met ocean conditions Byelaws Oil spill contingency plans Communications - traffic broadcast Passage planning Design criteria Adequate berth tendering Hydrographic Survey Aids to navigation, Provision and maintenance of International COLREGs 1972 (as amended) Anchors cleared and ready for use Joint emergency drills with VTS and Port staff Communications equipment Mooring analysis Local Port Service Vessel simulation study Port Facility Emergency Plan Weather limits Training of port marine/operations personnel Pilotage Vessel propulsion redundancies	The worst credible outcome for this risk (at the embedded/baseline stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Multiple fatalities; Property - Major, More than £8 million; Planet - Major, Has the potential to cause catastrophic and/or widespread damage. Tier 3, requires major external assistance; Port - Major, Negative national and international publicity. Major damage to reputation. Major loss of revenue, more than £8 million. It was also considered that the risk could occur in: An event that could be expected to occur once in 1,000 years.	The most likely outcome for this risk (at the embedded/baseline stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Serious injury(s) MAIB/RIDDOR reportable injury.; Property - Moderate £750,000 - £4 million; Planet - Major, Has the potential to cause catastrophic and/or widespread damage. Tier 3, requires major external assistance; Port - Serious, Negative national publicity. Serious damage to reputation. Serious loss of revenue, £4m - £8m. It was also considered that this risk scenario could occur in: An event that could be expected to occur once in 10 years.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC03 Deconfliction plan	The worst credible outcome for this risk (at the potential/future/residual stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Multiple fatalities; Property - Major, More than £8 million; Planet - Major, Has the potential to cause catastrophic and/or widespread damage. Tier 3, requires major external assistance; Port: Major, Negative national and international publicity. Major damage to reputation. Major loss of revenue, more than £8 million. It was also considered that this risk scenario could occur in: An event that could be expected to occur less than once > 1, 000 years.	The most likely outcome for this risk (at the potential/future/residual stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Serious injury(s) MAIB/RIDDOR reportable injury; Property - Moderate £750,000 - £4 million; Planet - Major, Has the potential to cause catastrophic and/or widespread damage. Tier 3, requires major external assistance; Port: Serious, Negative national publicity. Serious damage to reputation. Serious loss of revenue, £4m - £8m. It was also considered that this risk scenario could occur in: An event that could be expected to occur once in 100 years.	Deemed 'Tolerable if ALARP' **by authors of the IOT Operators NRA (NASH Maritime) against tolerance suggested by IOT Operators,** which differs from that of DFDS and the SHA
IOT Operators	Risk not assessed by the IOT Operators NRA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Allision with Finger Pier

Party	Risk and worst credible/most likely scenarios	Causes identified	Embedded Controls identified	Embedded Worst Credible Consequence/ Likelihood Outcomes	Embedded Most Likely Consequence/ Likeihood Outcomes	Further controls identified	Future Worst Credible Consequence/ Likeihood Outcomes	Future Most Likely Consequence/ Likeihood Outcomes	Tolerance and ALARP outcome
Applicant	Allision; Scenario: Vessel proceeding to/from Immingham Eastern Ro-Ro with tanker moored at IOT Finger Pier Worst Credible: Ro-Ro makes contact with berthed tanker resulting in a significant allision that punctures the tanker's double hull leading to a tier 3 pollution event with possible ignition of the petrochemical. That could cause a fire which significantly damages the vessel and/or infrastructure. Incident results in multiple fatalities, and negative international news that significantly affects the ports reputation and port operations. Most Likely: An approaching Ro-Ro misses its berth and continues to the IOT Finger Pier which results in a low speed glancing collision, dislodging a tanker from its berth causing a tier 3 pollution event. Major damage to port infrastructure and vessel, serious injuries to personnel, and negative national port reputational damage.	Adverse weather conditions Incorrect assessment of tidal flow Restricted visibility Inadequate bridge resource management Failure to follow passage plan Inadequate procedures in place onboard vessel Manoeuvre misjudged Vessel breakdown or malfunction Ship/Tug/Launch failure Failure to comply with Towage guidelines Inadequate number/type tugs Interaction with passing vessel Poor situational awareness Communication failure - Personnel Excessive vessel speed Human error/fatigue - Vessel Personnel	Monitoring of met ocean conditions Passage planning Port Facility Emergency Plan Towage guidelines Towage, available and appropriate Vessel Traffic Services Harbour Authority requirements Oil spill contingency plans	The worst credible outcome for this risk (at the embedded/baseline stage) was **considered by the attendees at the HAZID workshop** to result in: People - Multiple Fatalities; Property - Major (> £8M); Planet - Major (Potential to cause catastrophic and/or widespread damage - Tier 3, requires major external assistance); Port - Major (Negative national and international publicity. Major damage to reputation. Major loss of revenue, > £8 M) It was also considered that the risk is: Unlikely - The impact of the hazard might occur but is unlikely (within the lifetime of the entity)	The most likely outcome for this risk (at the embedded/baseline stage) was **considered by the attendees at the HAZID workshop** to result in: People - Serious injury(s) (MAIB/RIDDOR reportable injury); Property - Serious (£4M - £8M); Planet - Major (Potential to cause catastrophic and/or widespread damage - Tier 3, requires major external assistance); Port - Serious (Negative national publicity. Serious damage to reputation. Serious loss of revenue, £4M - £8M) It was also considered that the risk is: Possible - The impact of the hazard could very well occur, but it also may not (within the lifetime of the entity)	Charted safety area, berthing procedures Additional pilotage training/ familiarisation Berthing criteria *Move finger pier to east side of trunk way* Moving finger pier deemed too onerous by the SHA, other controls taken forward and amended as: Project specific adaptive procedures Charted safety area, berthing procedures Specific berthing criteria for each of the three berths	The worst credible outcome for this risk (at the potential/future/residual stage, in contemplation of further controls) was **considered by representatives of the SHA, in review of the comments made by attendees at the HAZID workshop**, to result in: People - Serious injury(s) (MAIB/RIDDOR reportable injury); Property - Serious (£4M - £8M); Planet - Minor (Incident results in pollution with limited/local impact - Tier 1, Harbour Authority pollution control measures deployed); Port - Moderate (Negative local publicity. Moderate damage to reputation. Moderate loss of revenue, £750,000 - £4M) It was also considered that (in contemplation of further controls) the risk is: Rare - The impact of the hazard is realised but should very rarely occur (within the lifetime of the entity)	The most likely scenario for this risk (at the potential/future/residual stage, in contemplation of further controls) was **considered by representative of the SHA attendees at the HAZID workshop** to result in: People - Minor Injury(s); Property - Moderate (£750,000 - £4M); Planet - Significant (Has the potential to cause significant damage and impact - Tier 2, pollution control measures from external organisations required); Port - Minor (Little local publicity. Minor damage to reputation. Minor loss of revenue, £0 - £750,000) It was also considered that (in contemplation of further controls) the risk is: Unlikely - The impact of the hazard might occur but is unlikely (within the lifetime of the entity)	Deemed tolerable and ALARP **by the SHA with the controls agreed**
DFDS	Contact (Allision) - Project Vessel (Passenger /Driver) with IOT Finger Pier (or moored vessel) Most Likely: light contact with Coastal tanker / Bunker Barge moored alongside resulting in moderate damage to both vessels, IOT Finger Pier, breakaway of Coastal tanker / Bunker Barge and ruptured loading arm(s). Worst Credible: high impact contact with Coastal tanker / Bunker Barge moored alongside resulting in multiple vessel breakaway puncture of tanker / barge hull, rupture of IOT Finger Pier pipeline(s) and significant damage to IOT Finger Peir infrastructure (with extension of breakaway causing impact to IOT trunkway).	The DFDS NRA does not present a table or list of causes	Accurate tidal measurements Harbour Authority requirements Availability of latest hydrographic information Vessel Traffic Services Berthing procedures Towage guidelines Arrival/Departure, advance notice of Monitoring of met ocean conditions Byelaws Oil spill contingency plans Communications - traffic broadcast Passage planning Design criteria Adequate berth tendering Hydrographic Survey Aids to navigation, Provision and maintenance of International COLREGs 1972 (as amended) Anchors cleared and ready for use Joint emergency drills with VTS and Port staff Communications equipment Mooring analysis Local Port Service Vessel simulation study Port Facility Emergency Plan Weather limits Training of port marine/operations personnel Pilotage Vessel propulsion redundancies	The worst credible outcome for this risk (at the embedded/baseline stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Multiple fatalities; Property - Major, More than £8 million; Planet - Major, Has the potential to cause catastrophic and/or widespread damage. Tier 3, requires major external assistance; Port - Major, Negative national and international publicity. Major damage to reputation. Major loss of revenue, more than £8 million. It was also considered that this risk scenario could occur in: An event that could be expected to occur once in 1,000 years.	The most likely outcome for this risk (at the embedded/baseline stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Serious injury(s) MAIB/RIDDOR reportable injury; Property - Serious, £4 million - £8 million; Planet - Significant, Has the potential to cause significant damage and impact. Tier 2, pollution controlm easures from external organisations required; Port - Serious, Negative national publicity. Serious damage to reputation. Serious loss of revenue, £4m - £8m. It was also considered that this risk scenario could occur in: An event that could be expected to occur once in 10 years.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC06 Moving finger pier	The worst credible outcome for this risk (at the potential/future/residual stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Multiple fatalities; Property - Major, More than £8 million; Planet - Major, Has the potential to cause catastrophic and/or widespread damage. Tier 3, requires major external assistance; Port - Major, Negative national and international publicity. Major damage to reputation. Major loss of revenue, more than £8 million. It was also considered that this risk scenario could occur in: An event that could be expected to occur less than once > 1, 000 years. *It is not explained how the outcomes about allison are reached in circumstances where the controls that are being assessed include moving the finger pier.*	The most likely outcome for this risk (at the potential/future/residual stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Serious injury(s) MAIB/RIDDOR reportable injury; Property - Serious, £4 million - £8 million; Planet - Significant, Has the potential to cause significant damage and impact. Tier 2, pollution control measures from external organisations required; Port - Serious, Negative national publicity. Serious damage to reputation. Serious loss of revenue, £4m - £8m. It was also considered that this risk scenario could occur in: An event that could be expected to occur once in 100 years. *It is not explained how the outcomes about allison are reached in circumstances where the controls that are being assessed include moving the finger pier.*	Deemed 'Tolerable if ALARP' **by authors of the DFDS NRA (NASH Maritime) against tolerance suggested by DFDS,** which differs from that of the IOT Operators and the SHA.
IOT Operators	Contact (Allision) - IERRT Ro-Ro Vessel with IOT Finger Pier	The IOT Operators NRA does not present a table or list of causes	The IOT Operators NRA does not present a table or list of embedded controls	The worst credible outcome for this risk (at the embedded/baseline stage) was **considered by NASH Maritime** to result in: People - Potential for many fatalities on site or potential for serious injury or fatality off site; Property - >£10million; Planet - DETR criteria – the highest levels of harm to the receptor (long term/permanent/widespread damage); Port - International negative publicity, serious disruption to operations to port / ship register >£10million International publicity. It was also considered that the risk could occur with a: 1 in 10,000 to 1 in 100 chance per year	The IOT Oerators NRA does not consider the 'Most Likely' scenario	IOT RC1: Impact protection IOT RC2: Relocation Finger Pier IOT RC3: Marine & Liaison Plan	The worst credible outcome for this risk (at the potential/future/residual stage) was **considered by NASH Maritime** to result in: People - Potential for some (one/few) fatalities / many serious injuries on site, some potential for minor injury off site; Property - £1million - £10million; Planet - Department of the Environment, Transport and the Regions (DETR) criteria – the lowest level of harm that can be considered a MATTE; Port - Widespread negative publicity, temporary suspension of activities at port / ship register £100,000 Local publicity - £1million It was also considered that the risk could occur with a: 1 in 1,000,000 to 1 in 10,000 chance per year *It is not explained how the outcomes about allison are reached in circumstances where the controls that are being assessed include moving the finger pier.*	The IOT Oerators NRA does not consider the 'Most Likely' scenario	Deemed 'Tolerable if ALARP' **by authors of the IOT Operators NRA (NASH Maritime) against tolerance suggested by IOT Operators,** which differs from that of DFDS and the SHA

Allision with Trunk Way

Party	Risk and worst credible/most likely scenarios	Causes identified	Embedded Controls identified	Embedded Worst Credible Consequence/ Likelihood Outcomes	Embedded Most Likely Consequence/ Likeihood Outcomes	Further controls identified	Future Worst Credible Consequence/ Likeihood Outcomes	Future Most Likely Consequence/ Likeihood Outcomes	Tolerance and ALARP outcome
Applicant	Allision; Scenario: Ro-Ro allision with IOT trunk way Worst Credible: Ro-Ro vessel collides with IOT trunk way, severing the charged pipeline causing a tier 3 pollution incident. Possibility of ignition and fire when the motor spirit pipeline is burst due to its flammability. Two refineries must be closed for a considerable time in order to repair the pipeline. This causes significant impacts for multiple weeks and has national affect to petroleum production. Multiple fatalities, negative international publicity for port and greater than £8 million of damage to port infrastructure. Most Likely: Ro-Ro has a slow speed impact with IOT trunk way leading to minor damage to vessel and distortion of pipe line on trunk way. Single fatality to personnel on the trunk way and tier 3 pollution, negative international publicity and greater than £8 million of damages to the port.	Anchors not cleared Inadequate number/type tugs Failure to comply with Towage guidelines Adverse weather conditions Restricted visibility Incorrect assessment of tidal flow Vessel breakdown or malfunction Human error/fatigue - Pilot/ Vessel Personnel Poor situational awareness Excessive vessel speed Inadequate bridge resource management Inadequate procedures in place onboard vessel Communication failure - Personnel Ship/Tug/Launch failure	Anchors cleared and ready for use Towage, available and appropriate Towage guidelines Weather limits Vessel propulsion redundancies Harbour Authority requirements Vessel Traffic Services Local Port Service Port Facility Emergency Plan Oil spill contingency plans Communications equipment Training of port marine/operations personnel	The worst credible outcome for this risk (at the embedded/baseline stage) was **considered by the attendees at the HAZID workshop** to result in: People - Multiple Fatalities; Property - Major (> £8M); Planet - Major (Potential to cause catastrophic and/or widespread damage - Tier 3, requires major external assistance); Port - Major (Negative national and international publicity. Major damage to reputation. Major loss of revenue, > £8 M) It was also considered that (at the embedded/existing stage) the risk is: Possible - The impact of the hazard could very well occur, but it also may not (within the lifetime of the entity)	The most likely outcome for this risk (at the embedded/baseline stage) was **considered by the attendees at the HAZID workshop** to result in: People - Single Fatality; Property - Major (> £8M); Planet - Major (Potential to cause catastrophic and/or widespread damage - Tier 3, requires major external assistance); Port - Major (Negative national and international publicity. Major damage to reputation. Major loss of revenue, > £8 M) It was also considered that (at the embedded/existing stage) the risk is: Possible - The impact of the hazard could very well occur, but it also may not (within the lifetime of the entity)	Impact protection Berthing criteria Additional tug provisions Controls taken forward and amended as: Project specific adaptive procedures Specific berthing criteria for each of the three berths	The worst credible outcome for this risk (at the potential/future/residual stage, in contemplation of further controls) was **considered by the attendees at the HAZID workshop** to result in: People - Multiple Fatalities; Property - Major (> £8M); Planet - Major (Potential to cause catastrophic and/or widespread damage - Tier 3, requires major external assistance); Port - Major (Negative national and international publicity. Major damage to reputation. Major loss of revenue, > £8 M) It was also considered that (in contemplation of further controls) the risk is: Unlikely - The impact of the hazard might occur but is unlikely (within the lifetime of the entity)	The most likely outcome for this risk (at the potential/future/residual stage, in contemplation of further controls) was **considered by the attendees at the HAZID workshop** to result in: People - Single Fatality; Property - Major (> £8M); Planet - Major (Potential to cause catastrophic and/or widespread damage - Tier 3, requires major external assistance); Port - Major (Negative national and international publicity. Major damage to reputation. Major loss of revenue, > £8 M) It was also considered that (in contemplation of further controls) the risk is: Unlikely - The impact of the hazard might occur but is unlikely (within the lifetime of the entity)	Deemed tolerable and ALARP **by the SHA with the controls agreed**
DFDS	Contact (Allision) - Project Vessel (Passenger /Driver) with IOT Trunkway Most Likely: high impact contact resulting rupture of IOT Trunkway pipeline(s). Worst Credible: high impact contact at relative high speed resulting in puncture of hull and rupture of IOT Trunkway pipeline(s).	The DFDS NRA does not present a table or list of causes	Towage, available and appropriate Accurate tidal measurements Harbour Authority requirements Availability of latest hydrographic information Vessel Traffic Services Berthing procedures Towage guidelines Arrival/Departure, advance notice of Monitoring of met ocean conditions Byelaws Oil spill contingency plans Communications - traffic broadcast Passage planning Design criteria Adequate berth tendering Hydrographic Survey Aids to navigation, Provision and maintenance of International COLREGs 1972 (as amended) Anchors cleared and ready for use Joint emergency drills with VTS and Port staff Communications equipment Mooring analysis Local Port Service Vessel simulation study Port Facility Emergency Plan Weather limits Training of port marine/operations personnel Pilotage Vessel propulsion redundancies	The worst credible outcome for this risk (at the embedded/baseline stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Multiple fatalities; Property - Major, More than £8 million; Planet - Major, Has the potential to cause catastrophic and/or widespread damage. Tier 3, requires major external assistance; Port - Major, Negative national and international publicity. Major damage to reputation. Major loss of revenue, more than £8 million. It was also considered that (at the embedded/existing stage) the risk could occur with a: An event that could be expected to occur once in 1,000 years.	The most likely outcome for this risk (at the embedded/baseline stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Single fatality; Property - Major, More than £8 million; Planet - Major, Has the potential to cause catastrophic and/or widespread damage. Tier 3, requires major external assistance; Port - Major, Negative national and international publicity. Major damage to reputation. Major loss of revenue, more than £8 million. It was also considered that this risk scenario could occur in: An event that could be expected to occur once in 100 years.	RC01 Berthing / unberthing criteria RC02 Standby tug provision RC05 Impact protection for IOT Trunkway	The worst credible outcome for this risk (at the potential/future/residual stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Serious injury(s) MAIB/RIDDOR reportable injury; Property - Serious, £4 million - £8 million; Planet - Minor, An incident that results in pollution with limited/local impact. Tier 1, Harbour Authority pollution controls measures deployed.; Port - Serious, Negative national publicity. Serious damage to reputation. Serious loss of revenue, £4m - £8m. It was also considered that this risk scenario could occur in: An event that could be expected to occur less than once > 1, 000 years.	The most likely outcome for this risk (at the potential/future/residual stage) was **considered by NASH Maritime, DFDS and two instructed consultants** to result in: People - Serious injury(s) MAIB/RIDDOR reportable injury; Property - Moderate, £750,000 - £4 million; Planet - No Measurable Impact. An incident or event occurred, but no discernible environmental impact.Tier 1 but no pollution control measures needed.; Port - Moderate Negative local publicity. Moderate damage to reputation. Moderate loss of revenue, £750,000 - £4m. It was also considered that this risk scenario could occur in: An event that could be expected to occur once in 1,000 years.	Deemed 'Tolerable if ALARP' **by authors of the DFDS NRA (NASH Maritime) against tolerance suggested by DFDS,** which differs from that of the IOT Operators and the SHA.
IOT Operators	Contact (Allision) - IERRT Ro-Ro Vessel with IOT Trunkway	The IOT Operators NRA does not present a table or list of causes	The IOT Operators NRA does not present a table or list of embedded controls	The worst credible outcome for this risk (at the embedded/baseline stage) was **considered by NASH Maritime** to result in: People - Potential for many fatalities on site or potential for serious injury or fatality off site; Property - >£10M; Planet - DETR criteria – the highest levels of harm to the receptor (long term/permanent/widespread damage); Port - International negative publicity, serious disruption to operations to port / ship register >£10million International publicity. It was also considered that (at the embedded/existing stage) the risk could occur with a: 1 in 10,000 to 1 in 100 chance per year	The IOT Oerators NRA does not consider the 'Most Likely' scenario	IOT RC1: Impact protection	The worst credible outcome for this risk (at the potential/future/residual stage) was **considered by NASH Maritime** to result in: People - Potential for serious injury / injuries on site.; Property - £1million - £10million; Planet - Catastrophic environmental impact on 2 or more MATTE categories over the designated threshold and for greater than 1 year (widespread, requires long term additional resources considered a MATTE on 2 or more environmental receptors; Port - National negative publicity, prolonged closure or restrictions to port / ship register £1million National publicity -£10million. It was also considered that the risk could occur with a: 1 in 1,000,000 to 1 in 10,000 chance per year	The IOT Oerators NRA does not consider the 'Most Likely' scenario	Deemed 'Tolerable if ALARP' **by authors of the IOT Operators NRA (NASH Maritime) against tolerance suggested by IOT Operators,** which differs from that of DFDS and the SHA

Appendix E – HASB paper and minutes 20 November 2023, and HASB paper and minutes 8 December 2023

Title:	Immingham Eastern Ro-Ro terminal (IERRT) – General Update and Alternative Navigation Risk Assessments		
Sponsor:	Simon Bird	Status:	For Approval
HASB Board Meeting Date:	20 November 2023		

1. Executive Summary

1.1 The purpose of the paper submitted to the Harbour Authority Safety Board (**Board**) is threefold, namely -

i) To provide a general update in relation to the ongoing Immingham Eastern Ro-Ro Terminal (**IERT**) examination;

ii) To provide advance notice with regard to the agenda for the Board's meeting scheduled for Monday 27th November; and

iii) To ask the Board in its capacity as Duty Holder, how it should proceed in light of the decision taken by the Board at its meeting on 12 December 2023 with regard to the Duty Holder's approval of the IERRT development's draft Navigational Risk Assessment (**NRA**) and the approach now to be taken in the light of two alternative NRAs since submitted by operators within the Port of Immingham.

2. IERRT – General update

2.1 As the Board is aware, the public examination of the IEERT proposal commenced on 25th July 2023 and must close no later than 25th January. The Secretary of State has appointed three Inspectors to examine the project proposals, together known as the Examining Authority (**ExA**). The principal means of examination for any Development Consent Order application is by way of written representations – submissions and further responses by all parties – principally in response to questions raised by the ExA.

2.2 Interspersed within the written representation process are a series of oral examination hearings. To date, two three day examination hearing sessions have been held, and the third programmed hearing sessions will be held on Tuesday to Thursday, 21st to 23rd November.

2.3 At the examination hearing sessions, the ExA set the agenda, specifying the topics for consideration which to date have included environmental impact in terms of the designated intertidal, landside traffic, potential congestion both marine and landside and navigational risk. In addition, the submitted written representations have covered a wide range of topics.

2.4 The principal topics for discussion at the forthcoming hearings are –

- Navigational issues – including navigational risk;
- Onshore transportation, including potential traffic congestion, development site capacity;
- The Development Consent Order.

3. Request to Make Changes to the IERRT development as originally submitted

3.1 A further meeting of the Board has been scheduled for later this month. A comprehensive briefing will be provided in advance of that meeting, but in summary, for reasons that will be explained at that meeting, it has become evident that a request will have to be submitted to the ExA to allow ABP to make a number of changes to the IERRT development proposal as originally submitted. None of the changes are considered to be material or substantial. Nonetheless, there is a formal process that has to be undertaken, including publication of notices, amendments to the documentation submitted to support the application – specifically the environmental statement – a formal request application document explaining the need and justification for the changes and a public consultation. The public consultation relating to the proposed changes commenced on 20th October and closes at 23.59 on Sunday 19th November.

3.2 In summary, the proposed changes comprise –

i) The realignment of the approach jetty and related works to the marine infrastructure;
ii) The shortening and realignment of the internal link bridge;
iii) The re-arrangement of the UK Border Force facilities; and
iv) Provision for the possible inclusion of an additional impact barrier in front of the IOT finger pier.

3.3 The rationale and justification for all of these changes will be explained at the forthcoming Board meeting, but members should note that with regard to the last change, item (iv) above, the IERRT Project Team are currently engaged in discussions with the IOT Operators who have raised concerns with regard to navigational risk posed by the operation of the proposed Ro-Ro facility adjacent to the IOT marine infrastructure. These discussions are ongoing and the Board will be updated at its next meeting.

3.4 As proposed change (iv) is, however, directly relevant in the context of the issues summarised for consideration by the Board in section 4 below, it should be noted that, as detailed below, the IOT Operators have submitted an NRA as an alternative to the NRA produced by ABPmer as part of IERRT application and which was approved by the Duty Holder in December 2022. The IOT Operator's alternative NRA concludes that impact protection measures should be provided by ABP to protect both the IOT trunkway and the IOT finger pier. The NRA approved by the Board at its meeting in December 2022, did not consider that such measures were necessary although provision has been made for trunkway impact protection in the submitted draft DCO should circumstances change.

3.5 The Board should, however, be aware that this an important issue that will require resolution. As will be explained at the forthcoming meeting of the Board, current discussions between ABP and the IOT operators involve the possible provision of adaptive measures, including the use of tugs at particular states of the tide or during certain weather conditions.

3.6 As indicated, however, these discussion are still ongoing and a detailed report will be provided for the Board's consideration later this month.

4. Navigational Risk Assessment

4.1 At the meeting of the Board in December 2022, the Board, considered the submitted Report together with the papers circulated with the Report. It received a presentation given in relation to the draft Navigational Risk Assessment, the subject of the meeting, and following discussion and the independent advice provided by the acting Designated Person, the Board was requested, in its role as Duty Holder, to consider the approach taken to the marine navigation risk in relation to the IERRT proposal and if so minded, to approve:

- The descriptors for the criteria as applied in the draft NRA (Appendix A of the Board Report);
- The tolerability as detailed in each of the four criteria set out in Appendix B of the Report;
- The risk assessments set out in Appendix C, noted that all presented risks are both tolerable and ALARP.

4.2 A copy of the December 2022 Report is attached as Annex 1.

4.3 Following the presentation, discussion and consideration of the advice provided by the acting Designated Person, the Board, as Duty Holder, confirmed that –

- It was satisfied with the approach taken to the marine navigational risk in relation to the future development of IERRT; and

- It agreed with and approved the conclusion that the risks identified were as low as reasonably practicable (ALARP) and tolerable.

Current position

4.4 Since the submission of the DCO application and the commencement of the public examination, the IOT Operators and DFDS have raised concerns as to the conclusions of the ABPmer Navigational Risk Assessment as presented to the Board in December 2022. These concerns focus particularly on the risk of allision of a Ro-Ro vessel with the IOT Trunkway or Finger Pier, allision of a Ro-Ro vessel with the Eastern Jetty, and the risk of collision between a Ro-Ro vessel on passage to/ from the IERRT with another vessel.

4.5 The concerns raised by the IOT Operators and DFDS have been articulated in alternative Navigational Risk Assessments which have been prepared for those bodies and submitted as part of the examination. Copies of both alternative NRAs are provided to the Board for review and consideration in advance of this meeting.

4.6 Overall, the differences in outcomes between the Applicant's NRA and the alternative NRAs are limited. The critical difference, as will be explained at the meeting of the Board by the acting Designated Person, is the "tolerability" of the assessed risks - in that the alternative NRAs do not apply the same tolerability thresholds as it is believed are required and applied by the Statutory Harbour Authority. A detailed comparison of each of the risks deemed intolerable by the alternative NRAs is provided at Appendix 6 and 7.

4.7 The Board have also been provided with copies of the Reviews of the alternative NRA documents which have also been submitted as part of the IERRT examination. The following sections of this Report summarise those comments, and set out the reasons for the Project Team's continued confidence in the conclusions of the NRA (as previously reviewed by the Board) and submitted as part of the supporting information for the DCO application

Applicant's NRA Approach

4.8 At the meeting in December 2022, the Board as Duty Holder, by approving the recommendation, expressed its approval of the assessment and conclusions reached by its independent marine consultants in the draft NRA.

4.9 The NRA which was submitted as part of the IERRT DCO application considered the views of stakeholders and has sought to reduce risk by increasing safety and considering a wide range of potential controls. This was achieved by identifying which hazard scenarios exist, what might cause them to happen and how one might control or limit these causes. Following this, the NRA analysed the risks, which involved attributing risk outcomes (consequence and likelihood/frequency) in consultation with a diverse range of stakeholders and port users. The Hazard Identification and Risk Analysis process adopted was in full compliance with the Port Marine Safety Code's Guide to Good Practice.

4.10 In addition, the NRA considered the identified risks against the appropriate standard of acceptability for the SHAs, the Harbour Authority and the HASB to set a 'tolerability' threshold. The controls identified for a hazardous scenario were then considered, in consultation with the Humber Harbour Master and the Immingham Dock Master (amongst others), against the concepts of ALARP and ‘tolerability’. This stage, effectively the “Risk Assessment”, was accompanied by a preliminary cost-benefit analysis assessment.

DFDS and IOT’s NRA Approach

4.11 As has been explained to the appointed ExA as part of our recently submitted submissions, it is the IERRT Project Team’s view that in light of the fundamental issues identified within the IOT and DFDS alternative NRAs, it is not possible for either of the two alternative NRAs to be relied upon as part of the application/examination process.

4.12 Turning first to the IOT alternative NRA, the engagement with wider port stakeholders is non-existent. In light of this, the potential controls identified and considered are so limited that the IOT alternative NRA has had no choice but to conclude that drastic controls are required to mitigate the identified risks. No consultation was undertaken with either the Dock Master or the Humber Harbour Master.

4.13 In summary, it is the view of the IERRT Project Team that the IOT alternative NRA has been completed with:

- A narrow perspective, failing to consider either the IERRT project or the Port of Immingham as a whole;
- A lack of stakeholder engagement with other port users and fundamentally the Statutory Harbour Authority;
- An inappropriate application of the COMAH Regulations;
- Over-reliance on statistical assumptions of outcomes, rather than actual experience;
- Inappropriate definitions and application of frequency;
- No consideration of levels of tolerability set by the SHA; and
- Insufficient integration of risk controls within the risk assessment process resulting in a disproportionate assessment of residual risk and unjustified recommendations for further control measures.

4.14 It is also considered that the evidence and assessments within the DFDS alternative NRA are similarly flawed. Although attempts at a qualitative risk assessment have been made, the risk outcomes have ultimately been determined subjectively and without consultation.

4.15 In summary, the DFDS alternative NRA has been completed with:

- A narrow perspective with a failure to consider either the IERRT project or the Port of Immingham as a whole;
- A lack of stakeholder engagement with other port users and fundamentally the Statutory Harbour Authority;
- No consideration of levels of tolerability set by the SHA; and
- Insufficient integration of risk controls into the risk assessment process resulting in a disproportionate assessment of residual risk and unjustified recommendations for further control measures.

4.16 The Table below, prepared by ABPmer and part of the submission to the ExA for Deadline 6 on 13th November, provides a summary of how each element of the Applicant's NRA compared to the DFDS and IOT alternative NRAs, highlighting the differences and the fundamental shortcomings of the alternative NRAs provided by DFDS and IOT.

Aspect of NRA	Applicant NRA	DFDS Alternative NRA	IOT Alternative NRA
Stakeholder engagement	Comprehensive stakeholder engagement undertaken to inform risk assessment	No engagement undertaken, including no involvement from key stakeholders such as the dockmaster or harbourmaster. This NRA relies on the output of Applicant's NRA – with no evidence that any port stakeholder confirmed or validated DFDS' internally held opinions on risks. As a result, the frequency and consequence of risks, along with potential control measures, does not take into consideration the expertise of those personnel that are most familiar with and currently or will operate within the Port of Immingham.	No engagement undertaken, including no involvement from key stakeholders such as the dockmaster or harbourmaster. This NRA relies on the output of Applicant's NRA – with no evidence that any port stakeholder confirmed or validated IOT's internally held opinions on risks. As a result, the frequency and consequence of risks, along with potential control measures, does not take into consideration the expertise of those personnel that are most familiar with and currently or will operate within the Port of Immingham.
Hazard identification	Based on formal HAZID process involving all key stakeholders as part of the NRA.	HAZID with DFDS, Nash Maritime and an additional two consultants only.	Relied on Applicant's process and their own data - no new hazards identified.
Existing risk controls	Fully considered existing controls used to manage risk within the Port, identified at HAZID.	Fully considered existing controls used to manage risk within the Port albeit based on Applicant's NRA.	No consideration of existing controls used to manage risk within the Port.

Aspect of NRA	Applicant NRA	DFDS Alternative NRA	IOT Alternative NRA
Additional risk controls	29 additional risk controls identified during HAZID and another seven controls identified with the SHA	NRA only contemplates the use of six additional controls to help manage navigational risk during the construction and operational phases of the IERRT Project when there is quite clearly a much greater range of controls that require consideration. By failing to sufficiently identify control measures, the authors have failed to identify ways in which risks can be made tolerable and ALARP and, as a consequence, have over-inflated the assessment of residual risk.	Three additional risk controls identified in the NRA. This is considered to be a deeply flawed and inadequate assessment and ignores the range of controls that are available, as identified by a wide range of port stakeholders recorded in the Applicant's NRA. Of the three controls identified, two are included in the Applicant's NRA. The third, relocation of the IOT Finger Pier, is considered by the Applicant to be both unnecessary and not reasonably practicable to implement. Fundamentally it has been identified through the Applicant's NRA as not being required to reduce risk to an ALARP and tolerable state.
Assessment of frequency	Based on known local and extensive data, using agreed definitions of probability already accepted by Duty Holder, clearly explained to stakeholders. Aligned with SHA guidance and process.	Mixing of frequencies from one NRA with scoring matrix from another NRA. Inappropriate, not aligned with SHA accepted frequencies.	Attempts to use COMAH for navigational matters. An NRA should not include societal risk use for land use planning matters (COMAH and the use of HSE societal risk applies to landside infrastructure) nor should it be used to identify COMAH hazards. Inappropriate, not aligned with SHA accepted frequencies.

Aspect of NRA	Applicant NRA	DFDS Alternative NRA	IOT Alternative NRA
Methodology	Most Likely/Worst Credible principle (industry standard and appropriate). Transparent approach to risk scoring.	Mixing of various methodologies used in previous NRAs. Method not agreed or used by the SHA.	Worst Credible Outcomes considered only. Inappropriate mixing of COMAH and HSE methodology in marine environment. Inflates risks and receptors. Inappropriate risk scoring.
Outcomes	No intolerable risks identified with suggested risk controls.	Four intolerable risks and application of risks controls not considered reasonably practicable.	Two intolerable risks and application of risks controls not considered reasonably practicable.

5. Request to the Board

5.1 The Board should note that also attached to this Report, is a detailed comparative analysis of all three NRAs, (Appendices 1-7) which has similarly been submitted to the ExA.

5.2 In light of the above and subject –

i) To its review of this Report and the annexed supporting documentation;

ii) Its consideration of the advice of the acting Designated Person; and

iii) Discussion of any issues arising –

The Board is asked, in its capacity as Duty Holder, to determine whether –

i) In recognition and acknowledgement of the differences between the two alternative NRAs submitted by the IOT Operators and the Applicant's NRA as approved as acceptable by the Board in December 2022;

ii) It wishes to reaffirm the decision taken at its meeting on 12 December 2022 as noted at paragraph 4.3 above; and if not –

To advise the IERRT project team how it should proceed.

Paper submission dated: 16 November 2023

Appendices

Appendix 1 – Applicant's NRA

Appendix 2 – DFDS' NRA

Appendix 3 – IOT's NRA

Appendix 4 – Applicant's Interim Response to DFDS' NRA

Appendix 5 – Applicant's Interim Response to IOT's NRA

Appendix 6 – Applicant's Review of DFDS' NRA

Appendix 7 – Applicant's Review of IOT's NRA

Annex 1 – HASB Board Report December 2022 and minutes from the related Board meeting

Draft minutes, subject to approval from Board

ASSOCIATED BRITISH PORTS
AS HARBOUR AUTHORITY AND SAFETY BOARD

Minutes of a meeting held on Monday 20 November 2023 at 10.30am at 25 Bedford Street, London, WC2E 9ES

Present:	H Pedersen (HP)	CEO (Chair)
	A Welch (AW)	Director, Southampton*
	J Walker (JW)	CCO*
	S Bird (SB)	Director, Humber*
	M McCartain (MM)	Director, Safety, Engineering & Marine / Designated Person
	M Wyatt (MW)	CFO
	H van Weezel	CIO*
In Attendance:	A Morgan (AM)	General Counsel & Company Secretary*
	B Hodgkin (BH)	Group Head of Projects
	P Bristowe	Head of Marine, Humber*
	M South	Group Head of Risk
Apologies:	A Rumsey	CHRO

*By Teams

HASB 45 **IERRT NAVIGATION RISK ASSESSMENT – General Update and Alternative Navigation Risk Assessments**

The Board noted the paper "IERRT Navigation Risk Assessment – General Update and Navigational Risk Assessments" (which was taken as read) and the various material that had been attached as appendices to the paper. SB stated that the purpose of the meeting was to:

(i) provide a general update in relation to the IERRT examination;

(ii) note that in the upcoming Board meeting on Tuesday 28th November, a further update on this project would be provided;

(iii) ask the Board (acting in its capacity as Duty Holder) how it should proceed in regard to the NRA as previously approved by the Board and the two alternative navigational risk assessments which had been put forward by IOT and DFDS.

SB provided an update on the DCO process, including that the next hearing was due to commence tomorrow. Navigational risk was expected to continue to be a key focus of the examination hearing, alongside landside transportation and the content of the development consent order. SB explained that since the last hearing there had been various discussions with the operators of IOT to see if agreement could be reached to resolve the concerns of IOT, and such discussions were ongoing. However, it was not certain that agreement would be reached.

SB noted that it was intended that a change request would be submitted to the Examining Authority to make four non-material changes to the development proposal which had originally been submitted. In relation to this, two of the proposed changes related to navigational matters which would require the approval of HASB at the upcoming meeting on 28 November. One of the potential changes would be of specific relevance to the discussion today as it was proposed to amend the Development

Consent Order (**DCO**) so that it provided for the possible inclusion of an additional impact barrier in front of the IOT finger pier. Although the navigational risk assessment (**NRA**) carried out by ABP did not consider that impact protection was required, the proposal was to allow for it in the DCO in the event that circumstances changed in the future.

SB reminded HASB that in December 2022, it had approved the draft NRA which was then finalised and submitted as part of the DCO. Concerns had been raised by three stakeholders (IOT, DFDS and CLDN) in relation to the NRA. Following on from this, alternative NRAs had now been submitted by IOT and DFDS. As had been previously discussed by HASB, a key concern of the stakeholders was the risk of allision of a ro-ro vessel with the eastern jetty or with another vessel. The alternative NRA for IOT concluded that significant controls were required to mitigate the risks and it criticised the ABP NRA.

MM (acting in his capacity as Designated Person) noted that a detailed analysis had been carried out of the alternative NRAs as was summarised in the board paper. There was then a detailed discussion and consideration about the points coming out of the analysis of the alternative NRAs including the approach taken to those NRAs in relation to stakeholder engagement, hazard identification, existing risk controls, additional risk controls, assessment of frequency, methodology and outcomes. Also how the NRAs compared to the NRA carried out by ABP. There was further consideration about the deficiencies in the alternative NRAs and discussion about how the alternative NRAs did not undermine the ABP NRA.

MM also noted that additional navigational assessment work had also been carried out by the project team, the results of which had supported the conclusions of the ABP NRA. This had included additional simulator work and a very careful and thorough review of controls, including the inclusion of additional controls. MM noted that there was no official format as to the form of the NRA required and that ABP had followed a five stage process as recognised in the guidance set out in the PMSC and the supplemental Port Marine Operations: Good Practice Guide. There was a further discussion about the stakeholder engagement which ABP had carried out, the approach to defining tolerability and that under the PMSC that there was a need to ensure that risks had been formally assessed.

Following careful discussion and consideration, the Board confirmed that, on the basis of (i) its review of the paper and the supporting documentation; (ii) its consideration of the advice of MM acting as the Designated Person and (iii) the discussion which had taken place in regard to the 2 alternative NRAs and ABP's NRA, it reaffirmed the decision taken at the meeting in December 2022 that:

- it was satisfied with the approach taken to the marine navigational risk in relation to the future development of IERRT; and

- it agreed and approved the conclusion that the risks identified were as low as reasonably practicable and tolerable.

However, the Board also noted further examination hearings were scheduled to take place that week and reserved further comment following consideration of any issues raised during the hearing.

There being no further business the Chair closed the meeting.

……………………………….
Chair

Title:	Immingham Eastern Ro-Ro terminal (IERRT) – General Update and Navigation Risk Assessments (NRA)		
Sponsor:	Simon Bird	Status:	For Approval
HASB Board Meeting Date:	8th December 2023		

1. Executive Summary

1.1 The purpose of this paper submitted to the Harbour Authority Safety Board (**Board**) is twofold, namely -

i) To provide a general update in relation to the ongoing Immingham Eastern Ro-Ro Terminal (**IERT**) examination; and

ii) To ask the Board in its capacity as Duty Holder, to approve the submission by ABP of revised documentation as requested by the Examining Authority (ExA) dealing with the assessment of navigational risk.

2. IERRT – General update

2.1 The public examination of the IERRT proposal commenced on 25th July 2023 and must close no later than 25th January. No extension to the examination can be granted and timing is now critical. As the ExA is aware, the Secretary of State for Transport has appointed three Inspectors to examine the proposed development, together known as the ExA.

2.2 As the Board is aware, the principal means of examination for any Development Consent Order (**DCO**) application is by way of written representations – submissions and further responses by all parties – principally in response to questions raised by the ExA. Interspersed within the written representation process are a series of oral examination hearings. To date, three examination hearing sessions have been held, the last being held on Tuesday to Thursday, 21st to 23rd November.

2.3 At the examination hearing sessions, the ExA set the agenda, specifying the topics for consideration which to date have included environmental impact in terms of the designated intertidal, landside traffic, potential congestion both marine and landside and navigational risk. In addition, the submitted written representations have covered a wide range of topics.

2.4 ***Change Request -*** At its meeting on 28th November 2023, the Board noted the decision of the IERRT Steering Committee (24th November) to approve the submission of a Request to the ExA to allow four changes to be made to the originally submitted application, subject to the HASB's consideration of two of the proposed changes which fell specifically with the Board's remit. In summary the four changes proposed were as follows –

- ***Change 1:*** Realignment of the approach jetty and related works to the marine infrastructure;

- ***Change 2:*** Shortening of the length and realignment of the internal link bridge;

- ***Change 3:*** Re-arrangement of the UK Border Force facilities; and

- ***Change 4:*** Possible inclusion of an additional impact barrier in front of the IOT finger pier in conjunction with enhanced marine navigational controls in terms with towage.

2.5 Changes 1 and 4 above, however, fell within the Board's terms of reference bearing in mind that as Duty Holder, the "*HASB is responsible for ensuring ABP complies with its obligations under the PMSC and is accountable for the performance in ensuring safe marine operations in relation to the ports".*

2.6 Following consideration, the Board approved the IERRT Project Team and the Steering Committee's recommendation that a Change Request should be made to the ExA in relation to Changes 1 and 4.

2.7 The Change Request in relation to all four proposed changes was submitted on Wednesday 29th November.

2.8 The Board will be pleased to note that on 6th December, the ExA published its decision to allow all four changes to be made to the IERRT proposal, the ExA stating in its Procedural Decision letter that –

> *"As regards the proposed changes the ExA considers that the nature and scale of … [the four changes] … either individually or collectively would not be so substantial as to constitute a materially new project."*

2.9 By allowing the changes to be made, the ExA has adjusted the examination timescale requiring the Interested Parties to provide their comments on the changes by 20th December. The ExA will then issue a further set of questions on 22nd December, to which all parties will have to respond by 8th January 2024.

3. The assessment of navigational risk

3.1 At the examination hearing held on Tuesday 21 November, the ExA raised questions regarding the ABPmer NRA submitted as part of, and in support of, the IERRT application. The concerns raised by the ExA and indeed the IOT Operators and DFDS in relation the ABPmer NRA have already been rehearsed in the report to the HASB at its meeting on 20th November.

3.2 The ExA has expressed some confusion as to the wording of the ABPmer NRA, referencing sections which required clarification – particularly in the light of the fact that they also have before them the alternative NRAs produced by DFDS and the IOT Operators.

3.3 All topic hearings are recorded, and paraphrasing slightly in order to make sense of the transcript, Mr Stephen Bradley, a member of the ExA, stated as follows -

> *"I am going to be asking for substantial clarification in relation to the NRA …. I am going to ask the Applicant to really look very closely at the drafting of, in particular, paragraphs 9.7 to 9.9 of the NRA and resubmit after editing (and a thorough proof read of the entire document) so it is clear and coherent exactly what point is being made in each of those sections and submit that at Deadline 7 at the latest. I am also going to ask if you would please add as annexes to the resubmission (so that we have it all in one place) the briefing/ input paper for the HASBoard in December 2022 (which has been a great deal of help to the ExA), the minutes of that HASBoard and the Applicant's reviews of the IOT and DFDS NRAs (which are also very useful documents). So then we have together within a single document collection a revised NRA, and a coherent collection of evidence."*

3.4 Since the conclusion of that hearing, the ExA have issues a number of "Actions" as well as raising a number of questions, most of which are directed at ABP. Responses to both the Actions and the Questions have to be submitted by Deadline 7, Monday 11th December.

3.5 As far as the meeting of the HASB is concerned, the Board should note the following –

3.6 ***Action 3*** – *Review and resubmit sections 9.7 and 9.8 of the NRA and review the NRA and update accordingly to address how baseline NRA for the port of Immingham has been factored into the assessment*.

3.7 ***Action 4*** *– Add as annexes to the NRA the following documents:*

- *The HASB December 2022 meeting minutes;*
- *The briefing paper/report prepared for the HASB meeting in December 2022; and*
- *The Applicant's response to IOT Operators' and DFDS's NRAs.*

3.8 ***Question 3.03*** – *Harbour Authority and Safety Board (HASB) Meeting 28th November 2023 – Submit minutes of the meeting and any recommendation report and cost benefit analysis that were submitted to that meeting for consideration in respect of the Proposed Development.*

3.9 Essentially, the ExA is concerned that the NRA as originally drafted by ABPmer is confused in its terminology and approach, and in view of the various documents that have been submitted since the commencement of the examination, both by ABP and the Interested Parties, the ExA wants all of the relevant documentation drawn together in one place.

3.10 As a consequence, subject to the views of the Board, the IERRT Project Team will be submitting to the ExA for deadline 7 on Monday 11th December, the following –

3.11 ***A Revised NRA*** – this document is attached as Appendix 1. Members will recall that the Board reviewed the originally submitted NRA in draft in December 2022, approving its conclusions and agreeing its submission. The version now provided has been updated solely to increase clarity. None of the risks have changed, nor the risk scoring nor the conclusions drawn as to tolerability and ALARP.

3.12 ***A Supplementary Navigation Information Report –*** This Report has a twofold purpose -

3.13 First, together with the clarified NRA referenced above, it will enable the ExA and all participants to view all of the information/evidence provided to the examination, in one place.

3.14 Second and with specific reference to the HASB, the purpose of the Report, as set out at paragraph 1.8, is – "*to collate all key information in respect of navigational issues and to identify the key matters that have arisen during the course of the examination in terms of navigational risk. This will enable the HASB, in its capacity as Duty Holder, to undertake a fresh review of all of the information that has been provided during the examination. In so doing, the HASB, as Duty Holder, will have to decide whether it wishes, in light of the concerns raised by the Interested Parties in the context of navigational risk, to reconsider its decision made at the meeting of the HASB on 12 December 2022, namely that the risks associated with the IERRT development, taking account of mitigation, are tolerable and ALARP*."

3.15 As noted above, the documents that will be submitted with the Revised NRA and the Supplementary Navigation Information Report, comprise –

- The report and minutes of the HASB meeting on 12th December 2022;
- The report and minutes of the HASB meeting on 20th November 2023;
- The report and minutes of the HASB meeting on 28th November 2023;
- The report and minutes of this meeting;
- The IOT Alternative NRA;
- ABPmer's review of the IOT Operators' alternative NRA;
- The DFDS Alternative NRA; and
- The ABPmer's review of the DFDS alternative NRA.

3.16 As Members are aware, reports to and minutes of HASB meeting are available on Board Intelligence and have not been specifically attached as appendices to this Report.

3.17 In addition, Members of the Board will also be aware that the two Reviews referenced above were considered at the meeting of the HASB held on 20th November.

3.18 For the record and for ease of reference, the relevant meetings of the HASB are summarised below.

4. HASB meetings

4.1 ***HASB meeting – 12 December 2022 -*** At its meeting, prior to the submission of the IERRT application, the Board received a presentation given in relation to the draft NRA, the subject of the meeting and following discussion and the independent advice provided by the acting Designated Person, confirmed that –

- It was satisfied with the approach taken to the marine navigational risk in relation to the future development of IERRT; and

- It agreed with and approved the conclusion that the risks identified were as low as reasonably practicable (ALARP) and tolerable.

4.2 ***HASB meeting – 20th November 2023 –*** At this meeting, the Board was provided with an update as to the current position in terms of navigational risk in light of the fact that the IOT Operators and DFDS have raised concerns as to the conclusions of the ABPmer Navigational Risk Assessment as presented to the Board in December 2022. As was explained, these concerns focussed particularly on the risk of allision of a Ro-Ro vessel with the IOT Trunkway or Finger Pier, allision of a Ro-Ro vessel with the Eastern Jetty and the risk of collision between a Ro-Ro vessel on passage to/ from the IERRT with another vessel.

4.3 The concerns raised by the IOT Operators and DFDS had been articulated in alternative NRAs which have been prepared for those bodies and submitted as part of the examination. Copies of both alternative NRAs were provided to the Board for review and consideration in advance of that meeting.

4.4 As was explained at the meeting, overall, the differences in outcomes between the Applicant's NRA and the alternative NRAs are limited. The critical difference is the "tolerability" of the assessed risks - in that the alternative NRAs do not apply the same tolerability thresholds as it is believed are required and applied by the Statutory Harbour Authority (**SHA**). A detailed comparison of each of the risks considered intolerable by the alternative NRAs was provided at Appendix 6 and Appendix 7 of the report presented to the Board.

4.5 At that meeting, the Board were also provided with copies of the Reviews of the alternative NRAs undertaken by the Project Team which had been submitted to the ExA as part of the examination process. The report to the November meeting of the Board summarised those comments, and set out the reasons for the Project Team's continued confidence in the conclusions of the NRA (as previously reviewed by the Board) and submitted as part of the supporting information for the DCO application.

4.6 Following presentation and consideration or the Report, the Board at its meeting on 20th November, in its capacity as Duty Holder, reaffirmed the decision taken at the meeting in December 2022 that:

- It was satisfied with the approach taken to the marine navigational risk in relation to the future development of IERRT; and

- It agreed and approved the conclusion that the risks identified were as low as reasonably practicable and tolerable.

4.7 The Board also noted, however, that further examination hearings were scheduled to take place that week and reserved further comment following consideration of any issues raised during the hearing.

4.8 ***HASB meeting - 28th November 2023 –*** The purposes of this meeting was to ask the HASB, as Duty Holder, to consider the recommendation of the IERRT Project Team that a Request should be submitted to the ExA to allow four changes to be made to the originally submitted DCO application.

4.9 At a meeting of the IERRT Steering Committee on 24th November, it was agreed that four changes should be made – as summarised in paragraph 2.4 above. That decision was, however, subject to the decision of the HASB in terms of proposed Changes 1 and 4 which concerned marine matters and, therefore, fell with the specific remit of the HASB.

4.10 Following consideration of the Report and discussion, the HASB determined that in light of the explanation and justification provided, a Request to allow Change 1 (The realignment of the approach jetty) and Change 4 (The possible provision of an additional impact protection measure – in conjunction with enhanced operational marine management controls for vessels arriving at Berth 1 of the IERRT) should be submitted to the ExA.

5. Request to the Board

5.1 The Board is asked in its capacity as Duty Holder, to review the decisions made –

i) At its meeting on 12 December 2022 when it determined –

- that it was satisfied with the approach taken to the marine navigational risk in relation to the future development of IERRT, and
- It agreed with and approved the conclusion that the risks identified were as low as reasonably practicable (ALARP) and tolerable; and

ii) At its meeting on Monday 20th November when it determined that, subject to any additional points arising at the (then) forthcoming examination hearings - -

- it was satisfied with the approach taken to the marine navigational risk in relation to the future development of IERRT; and
- it agreed and approved the conclusion that the risks identified were as low as reasonably practicable and tolerable; and

iii) In light of the NRA Review exercise undertaken by ABPmer as requested by the ExA in relation to the proposed IERRT development to consider whether or not it wishes to reaffirm the decision made by the Board at its meeting on 12th December 2022 and 20th November 2023.

Paper submission dated: 7 December 2023

Appendices

Appendix 1 – Updated NRA

Appendix 2 – Supplementary Navigation Information Report

ASSOCIATED BRITISH PORTS
AS HARBOUR AUTHORITY AND SAFETY BOARD

Summary of Decision Made at Meeting on Friday 8 December 2023

Following careful consideration and review of the issues raised during the examination hearing and the updated NRA and the SNR, the Board reaffirmed the decisions made (in its capacity as Duty Holder) in the previous HASB meetings on 12 December 2022 and 20 November 2023 that:

i) it was satisfied with the approach taken to the marine navigational risk in relation to the future development of IERRT, and

ii) it agreed with and approved the conclusion that the risks identified were as low as reasonably practicable (ALARP) and tolerable.

The Board approved the submission of the updated NRA and the SNR.