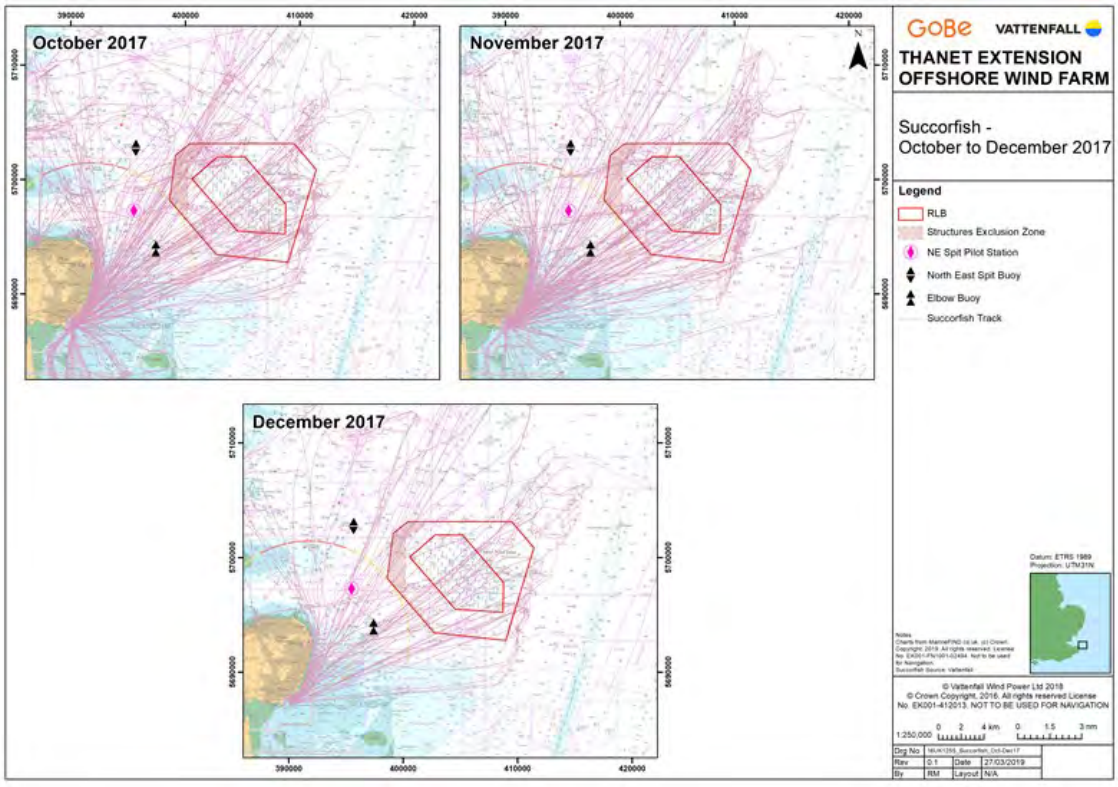

Figure 10: Anonymised Succorfish Data October to December 2017

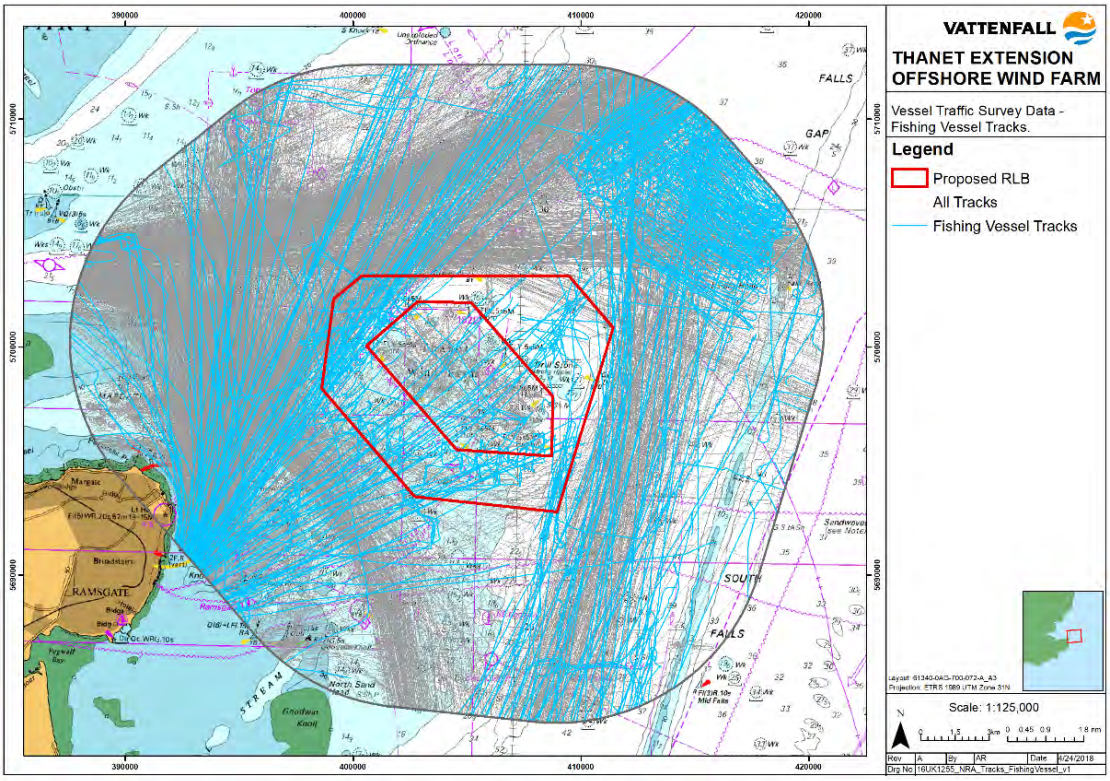

Figure 11: Reproduction of Figure 22 of the NRA: Fishing vessel tracks during the survey periods

29 **Recreational vessels** Section 5.3.4 of the NRA document integrated the vessel traffic survey of recreational vessels (yachts and pleasure boats) with the RYA's AIS based boating density maps. This dataset reviewed and validated in the Data Analysis and Validation Paper (Appendix 27 to Deadline 4 (PINS Ref REP4-030). The consistent conclusion is that the greatest usage is inshore and to the west of the Elbow buoy. Few users pass through the existing wind farm and this is principally due to the footprint not intersecting any major cruising routes.

2.5 Inshore Route and Pilotage Transfer Data Analysis

30 This section provides further detail to the baseline traffic usage of the area to the west of the wind farm forming a focal area of interest through examination and underpinning the basis of the amendment resulting in the SEZ. Activities of interest here relate to transits using the 'inshore route' and pilotage transfer associated with the NE Spit Station.

31 This section should be read in conjunction with Section 6 and 8 of the 'Data Analysis and Validation Paper' Appendix 27 to Deadline 4 (PINS Ref: REP4-030) together with 'Structures Exclusion Zone' Appendix 14 to Deadline 4 (PINS Ref: REP4-018). It draws reference from the additional data sourced by the Applicant during the examination phase (specifically the 1 year AIS SeaPlanner dataset from Mar-2017 to Feb-2018).

32 With regard to the size of vessels and their spatial use of the inshore route as presented in Figure 12 (for a subset two-week summer period of the one-year period as shown in Figure 2, Figure 3, Figure 4 and Figure 5 which reflects local stakeholders identification of likely busiest period) and Table 4 (over the one-year period) it is noted that that less than 1% of vessels transiting the inshore route (and in the transects between NE Spit Buoy and the wind farm and Elbow Buoy and the wind farm) are in excess of 240m LOA and, in reviewing the wider study area with reference to Figure 5 and Figure 6, it can be seen that the majority of vessels of this size are transiting to the north and to the east of the wind farm (with some 'dipping' towards the area of NE Spit). It is of note that a single vessel of 333m during the period December 2016 – November 2018 transited the near shore route (based on the combination of existing Applicant data for the period December 2016 – February 2018, and DWPLG/PoTLL data referred to in their Deadline 3 representation (REP3-070) for the period November 2017 – November 2018).

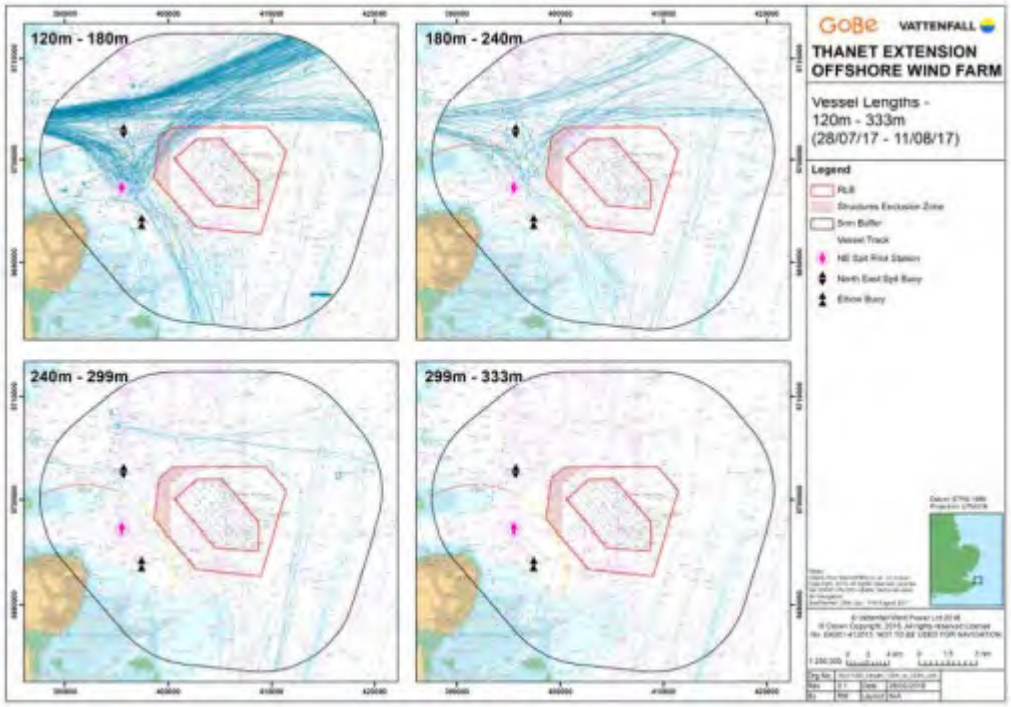

Figure 12: Tracks by Vessel Length (120m to 333m) for 2 week extract of summer transits (Data Source: Mar-2017 to Feb-2018 AIS SeaPlanner)

Table 4: Vessel Frequency by Lengths between NE Spit Buoy and existing boundary and Elbow Buoy and existing boundary (count and percentage). Data Source: Mar-2017 to Feb-2018 AIS SeaPlanner

Elbow Buoy to RLB/SEZ			NE Spit Buoy to RLB/SEZ		
Ship Length [m]	March 2017 - Feb 2018		Ship Length [m]	March 2017 - Feb 2018	
	No	%		No	%
0 – 50	433	11%	0 – 50	554	11%
50 – 90	790	20%	50 – 90	421	8%
90 – 120	1523	38%	90 – 120	1089	22%
120 – 180	885	22%	120 – 180	2049	41%
180 – 240	293	7%	180 – 240	790	16%
240 – 299	44	1%	240 - 299	65	1%
299 – 333	10	0%	299 - 333	13	0%
333 – 366	0	0%	333 - 366	0	0%
366 – 400	0	0%	366 - 400	0	0%
400 -	0	0%	400 -	0	0%
Total	**3978**		**Total**	**4981**	
*180 (<5%) tracks missing length			*126 (<3%) tracks missing length		

33 Figure 13 shows track plots of ESL launches operating within the study area over the period Mar-2017 to Feb-2018. Figure 16 shows indicative location and density concentration of areas of pilotage operations by filtering two different speeds (SOG) of the pilot launch - demonstrating locations where pilot vessel speeds are reduced to less than 10kts and 7kts. This can be compared for consistency with data provided by ESL after Deadline 4 (Figure 14 and Figure 15 and Table 5) demonstrating their working area by transfer numbers and the concentration of activity in the area of NE Spit Pilot Boarding Diamond. Both data sets are consistent in the characteristic distribution of pilot transfer activity.

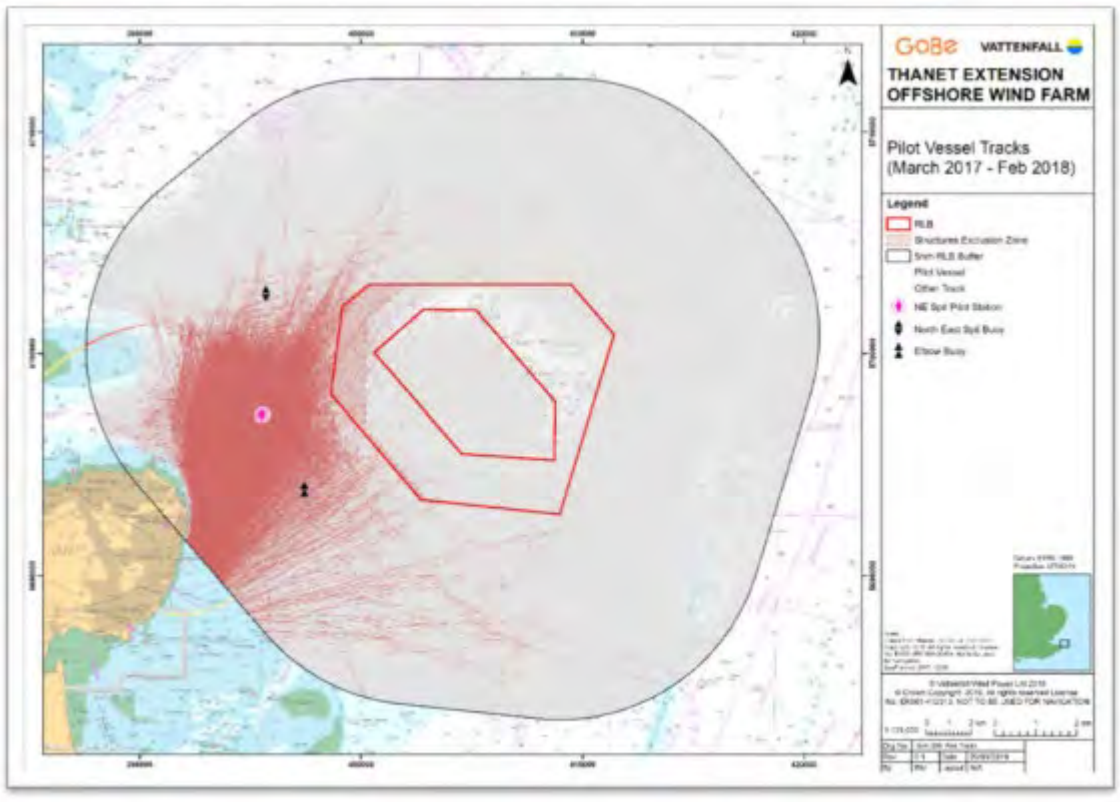

Figure 13: Pilot Vessel Tracks

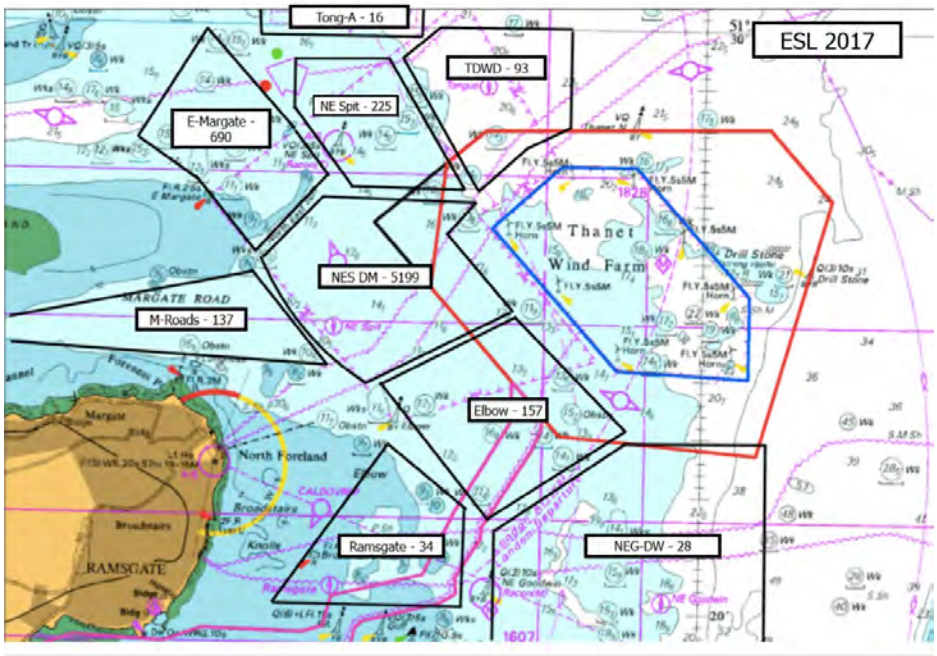

Figure 14: ESL Declared Working Area of Transfers 2017 (Source: ESL, noting the rep-SEZ RLB)

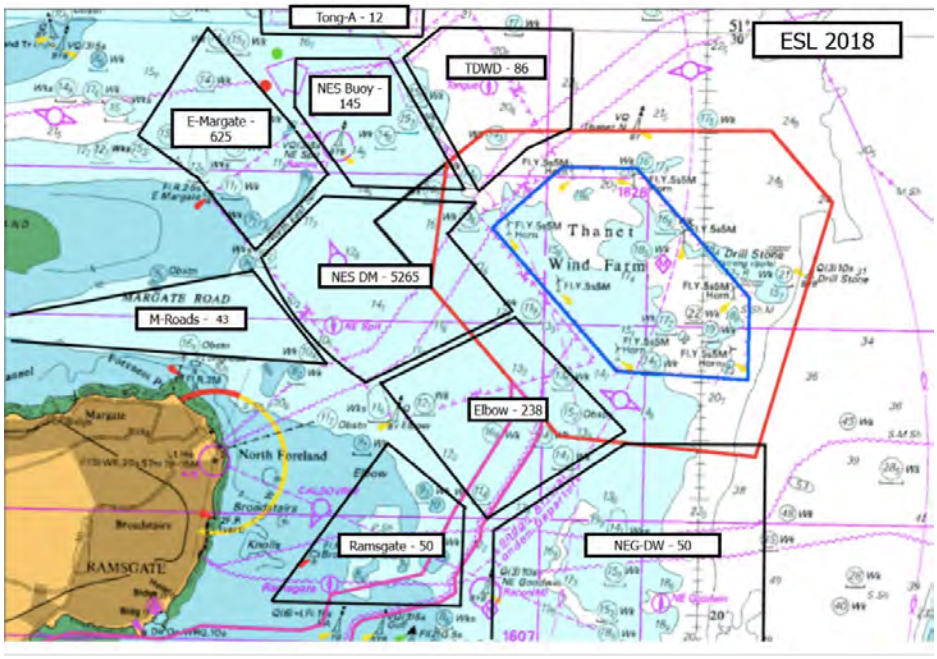

Figure 15: ESL Declared Working Area of Transfers 2018 (Source: ESL)

Table 5: Pilot boarding locations (Source: ESL)

Location	2017	% of total	2018	% of total
Tong-A	16	0.2%	12	0.2%
TDWD	93	1.4%	86	1.3%
NE Spit	225	3.4%	145	2.2%
E-Margate	690	10.5%	625	9.5%
NES DM	5199	79.0%	5265	80.0%
M-Roads	137	2.1%	43	0.7%
Elbow	157	2.4%	238	3.6%
Ramsgate	34	0.5%	50	0.8%
NEG-DW	28	0.4%	50	0.8%
Total	6579		6514	

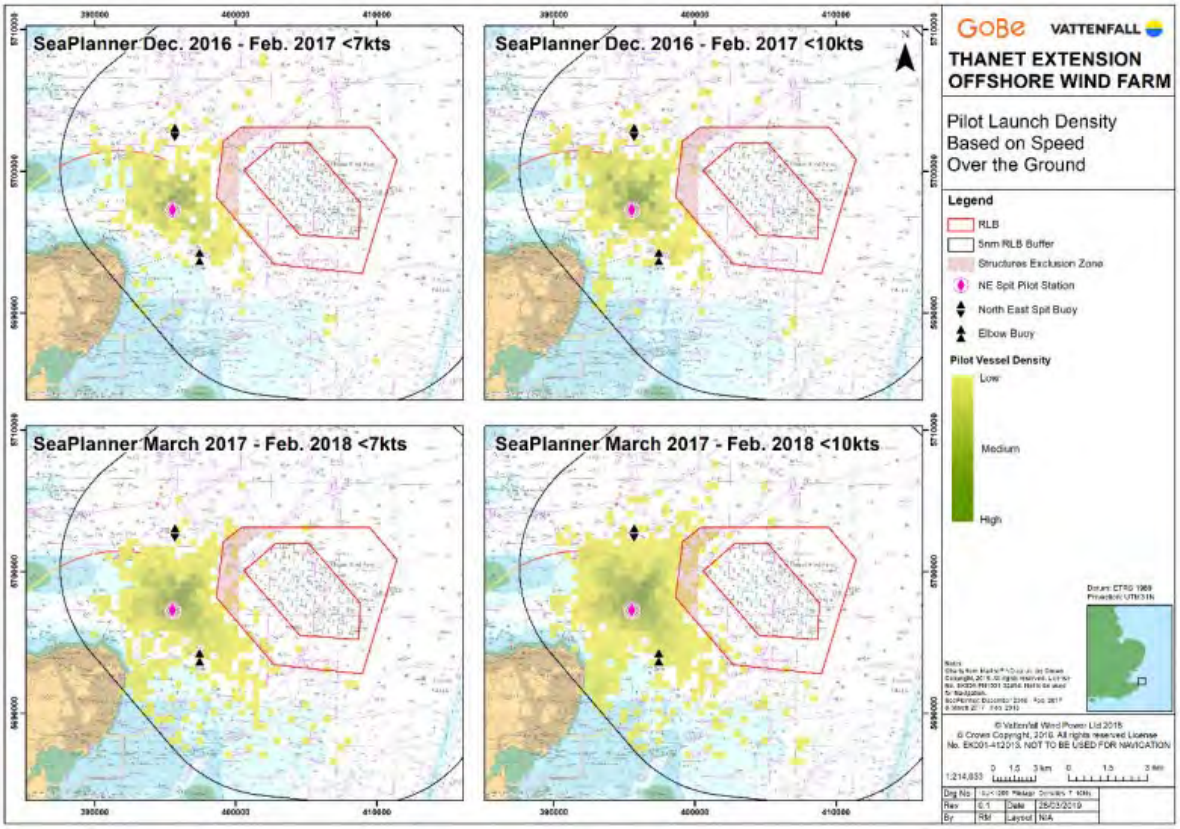

Figure 16: Pilot Vessel Density (indicative of spatial area of pilot transfer by speed filter (SOG – kts) on pilot launch)

Summary points

34 Concluding points on the data as presented are as follows:

35 The data used in the NRA is representative of both total number of vessels using the area, the spatial extent of those vessels and the average transits per day;

36 In total there are 3978 vessels transiting the inshore route between Elbow Buoy and the wind farm annually which equates to approximately 11 vessels per day. A total of 4981 vessels transit the area between NE Spit RACON Buoy and the wind farm (on through transit, transit to the Margate Roads anchorage or to the NE Spit Pilot Boarding Station area) which equates to approximately 14 vessels per day;

37 The representation of pilot transfers in the NRA is accurate as demonstrated by the data recently supplied by ESL at Deadline 4; and

38 The conclusions reached from the NRA and based on the MGN survey data are therefore robust and can be relied upon.

2.6 Incident Analysis

MAIB Data

39 Analysis of MAIB data was contained within the original NRA; this analysis has been extended to include years 2016 and 2017 for this assessment, and refined to include only vessel collisions contacts and groundings (see Table 6 and Figure 17).

Table 6: Table showing MAIB reported incidents.

Date	Type	Lat	Long	Vessel Type	Length Overall	Damage	Pollution Caused	Description
11/10/1997	Collision	51.350	1.500	Fishing vessel	9.98	Material Damage	-	-
02/11/1998	Grounding	51.333	1.567	Ro-ro/lo-lo, freight only (< 12 drivers)	109.71	-	-	-
08/04/2001	Contact	51.433	1.800	Cargo ship	77.63	Material Damage	-	-
24/05/2003	Collision	51.358	1.472	Recreational craft	0.01	Material Damage	-	-
18/11/2004	Grounding	51.390	1.438	Cargo ship	96.17	Minor Damage	-	-
15/12/2008	Collision	51.417	1.400	Tanker	109.1	Minor Damage	No	-
23/05/2010	Contact	51.350	1.550	Cargo ship	91.44	No Damage	No	-
27/05/2012	Contact | Floating object	51.334	1.581	Sailboat (sail only)	13.1	Damage - Minor	-	Yacht struck buoy
13/11/2016	Collision	51.367	1.706	Recreational craft	8.48	Damage - Minor	-	Collision between yacht and unknown ship.

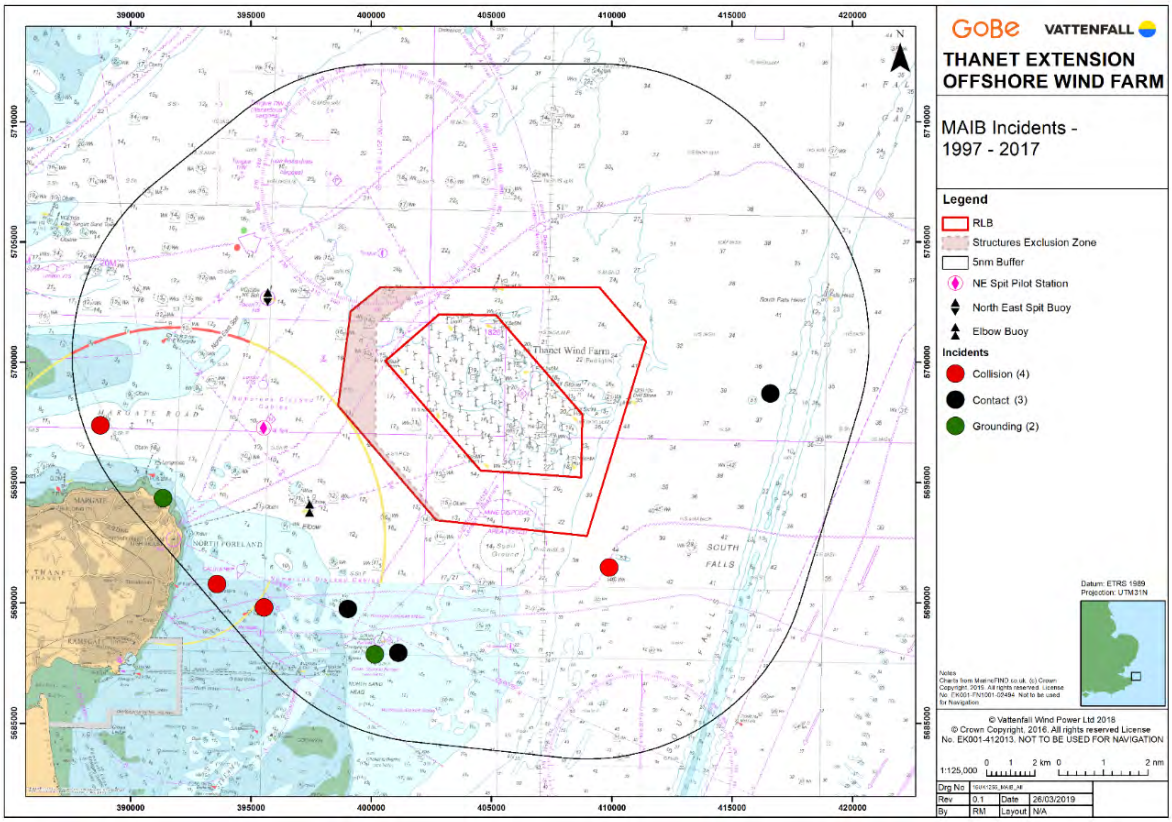

Figure 17 MAIB Incident data for study area.

40 Based on the MAIB data, and the level of damage sustained for the incident logged, then an assessment of return rate to aid hazard scoring is defined as shown in Table 7.

Table 7: MAIB Incidents Return Rates.

Incident / Hazard Type	General Cargo / Tanker	Fishing / Recreational
Collision	1 in 20 yr	1 in 7 yr
Grounding	1 in 20 yr	-
Contact	-	1 in 20 yr

Figure 18: National Incident Statistics as reported in MAIB Annual Report - https://www.gov.uk/maib-reports.

PLA Incident Data

41 The PLA provided data from their incident monitoring system from 06/02/2010 to 01/03/2019 (entries of first and last incident). Analysis of this data is contained within Table 8 and Table 9.

42 It is important to note that monitoring and recording of near misses was confirmed by PLA on the 29th March as having been through a change process in 2017 to ensure that more data are collected. As such, when reviewing year on year trends in near misses it is not possible to meaningfully compare post 2017 with pre-2017 incident rates.

43 This seems to particularly relate to pilot boarding deficiencies which show a marked increase in occurrence from 2016 to 2117 – possibly as a result of increase focuses within the ports industry on the adequacy of pilot boarding ladders. Whilst pilot boarding ladders deficiencies can be a cause of navigation hazards such as collision or contact grounding, the immediate control measure is the refusal of a vessel for a pilot until deficiencies are addressed.

44 It is also noted, and discussed at the workshop of the 29th March, that the near misses are helpful qualitative indications of potential issues in the area but do not necessarily form the basis for the quantitative assessment as near misses result in likelihoods of incident that are more frequent than may be expected and by virtue of being a near miss generally have no consequences. Research has shown that the ratio between near misses and incidents can be between reference to HSE accident triangles that ratio between near miss and low level incidents can range from 1:600 (Bird's accident triangle) to 1:400 (RIDDOR 1995 classifications).

Table 8: PLA incident data for North East Spit area – incidents by type.

Frequency [Year] Incident Synopsis Category	East Margate Buoy	Margate Roads Anchorage	NE Spit Deep Water Pilot Boarding\Landing	NE Spit Pilot Boarding\ Landing	North East Spit	Tongue Anchorage	Tongue Sand Towers	Total [yr]
Fishing in Channel	-	-	-	-	-	-	0.11	**0.11**
Hull Failure	-	0.11	-	-	-	-	-	**0.11**
Mechanical Failure	0.11	0.11	-	0.44	0.33	0.11	0.44	**1.56**
Navigation Equipment Failure	0.11	0.11	-	0.11	-	-	-	**0.33**
Near Miss	-	-	-	-	-	-	0.11	**0.11**
Near Miss Collision	0.11	-	-	0.56	0.33	0.11	0.11	**1.22**
Near Miss Grounding	0.11	-	0.11	0.11	-	0.11	-	**0.44**
Other	0.11	0.11	0.22	0.11	0.11	-	-	**0.67**
Personal Injury	-	-	-	0.11	0.11	-	-	**0.22**
Pilot Ladder Deficiency	-	-	-	3.44	2.56	-	-	**6.00**
Total [yr]	**0.56**	**0.44**	**0.33**	**4.89**	**3.44**	**0.33**	**0.78**	**10.78**

Table 9: PLA incident data for North East Spit area – incidents per year.

Frequency [Year] Incident Synopsis Category	2010	2011	2012	2013	2014	2015	2016	2017	2018
Fishing in Channel	-	-	-	-	1	-	-	-	-
Hull Failure	-	-	-	-	-	-	-	1	-
Mechanical Failure	-	-	-	-	1	3	3	2	5
Navigation Equipment Failure	-	-	-	-	1	1	-	-	-
Near Miss	-	-	-	-	1	-	-	-	-
Near Miss Collision	1	-	6	1	3	1	-	-	-
Near Miss Grounding	-	-	-	2	-	-	2	-	-
Other	-	-	2	-	1	-	1	-	1
Personal Injury	-	-	-	-	-	-	-	1	1
Pilot Ladder Deficiency	-	-	-	-	4	3	5	18	23
Total [yr]	**1**	**-**	**8**	**3**	**12**	**8**	**11**	**22**	**30**

45 The incident and near miss data supplied by the PLA have been helpful in drafting up the list of hazard causes (e.g. see hazard cause # 9 - Pilot Transfer Issues – which relates to issues associated with pilot boarding / landing including pilot ladder deficiencies).

Incidents conclusion

46 As is evidenced through reference to national, regional, and stakeholder specific incident data there are limited incidents to inform the Baseline risk profile. As such a composite approach has been taken using stakeholder and mariner expertise to inform risk scores with reference also made to MAIB scores as presented in Table 7.

3 Sea Room Assessment

47 This section details the sea room requirements of the area to the west of the wind farm underpinning the basis of the amendment resulting in the SEZ. Activities considered for the determination of sea room relate to the following key activities.

- Vessels on passage including overtaking / passing vessels
- Pilot transfer/boarding operations

48 This section should therefore be read in conjunction with the 'Structures Exclusion Zone' Appendix 14 to Deadline 4 (PINS Ref: REP4-018) which comprehensively documents the basis of change which is summarised in this section in relation to the sea room requirements at key reference locations.

3.2 Spatial Reference Locations

49 Four key points of reference locations, for consideration of spatial area for the inshore route, were agreed at a Shipping Navigation Workshop held on 27-Feb-2019. Specifically, distances to the East of the following locations are considered relevant:

- North East Spit RACON Buoy
- North East Spit Pilot Boarding Station (noting that a further 0.33nm exists to the west between the Pilot Boarding Diamond and the boundary of the pilot boarding area/no anchoring limit of the Margate Roads Anchorage)
- Elbow Buoy

3.3 'Sea Room' and 'Buffers'

50 The available distance/spatial area is considered in terms of 'sea room' for the relevant marine activity (e.g. vessels on passage or pilot transfer operations) together with a 'buffer' representing distance between the RLB boundary and the area in which the marine activity takes place.

51 Reference is made in this document to sea room and buffer requirements from guidance documentation, evidence of existing practices in the study area and submissions from IPs together with the buffers reviewed in the NRA (Section 7.1.1).

3.4 Sea Room - Guidance

52 Relevant guidance documentation includes the following documents which make reference to, and summarise guidance from broader sources including PIANC and IALA:

- MGN543 (and its predecessor MGN371)

- World Ocean Council, Nautical Institute and IALA special planning paper titled "The Shipping Industry and Marine Spatial Planning – A Professional Approach – November 2013"

3.5 Sea Room - Interested Party Submissions

53 Evidenced and substantiated submissions have been made, at Deadline 3, by Interested Parties developing on positions to date and the workshop of 27th February providing indication of sea room requirements to be considered in line with guidance and the data. Numerical references include:

- LPC (REP3-083) state: "an unrestricted sea room of at least 2 nautical miles eastwards from the NESP Racon Buoy and eastwards from the NESP boarding diamond and eastwards from the Elbow Buoy, to a yet to be determined exclusion zone, is required for general navigation and Pilot operations." Submission was also made by LPC at Deadline 2 providing MGN543 based determinations of vessel turning circles and sea room for pilotage transfers.
- PLA and ESL state (REP3-069): "…the PLA and ESL seek provision for a 2nm operational area (with 1nm buffer) so as to enable that a safe and dynamic service to remain in place."

54 These submissions from various IPs are in agreement with each other with regards to sea room requirement of 2nm although indication of exclusion zone (considered as safety buffers) are not provided by LPC and indicated as 1nm by PLA and ESL.

3.6 NE Spit Racon

55 In this area, the marine activity of interest is vessels on passage transiting through the area including to/from NE Spit Pilot Boarding Station and/or vessels transiting to/from Margate Roads Anchorage. Allowance should be made for including overtaking / passing vessels and fishing vessel transits. It is noted, with reference to Table 4that 4,981 vessels per annum navigate across the line between NE Spit RACON Buoy and the existing wind farm.

56 Pilot transfers in this area are a consideration with regards to complexity of navigation in this area and, with reference to Figure 13, Figure 14, Figure 15 and Figure 16 and IP submissions, some (limited) pilot transfers take place in this area between the NE Spit Buoy and the Tongue Pilot Diamond.

57 The largest vessels (deepest draught) transiting the inshore route, on transit to / from the Thames Estuary, do so to the East of the NE Spit RACON buoy whereas it is evidenced that the shallower area of NE Spit Bank to the West of the NE Spit RACON buoy is available and extensively used by shallower draught vessels who are able to do so.

58 Figure 19 shows a minimum total clear distance of 2.5nm between NE Spit Buoy and the SEZ boundary. The minimum sea room requirement, as per the MSP guidance (as shown in Table 10 for four side by side vessels of 333m LOA) specifies 1.53nm required sea room leaving a further 0.97nm distance available as sea room and safety buffer in recognition of the more complex vessel tracks and manoeuvres, and the level of fishing transits across this area, as described in IP responses.

Table 10: Sea Room and Buffer for 2.5nm distance

Vessel Length (m)	Sea Room required for no of vessels Side by Side [nm]			Remaining Sea Room available at location for consideration as a buffer [nm]		
	2 Vessels	3 Vessels	4 Vessels	2 Vessels	3 Vessels	4 Vessels
299	0.70	1.05	1.40	1.80	1.45	1.10
333	0.76	1.15	1.53	1.74	1.35	0.97
366	0.86	1.28	1.71	1.64	1.22	0.79
400	0.93	1.39	1.86	1.57	1.11	0.64

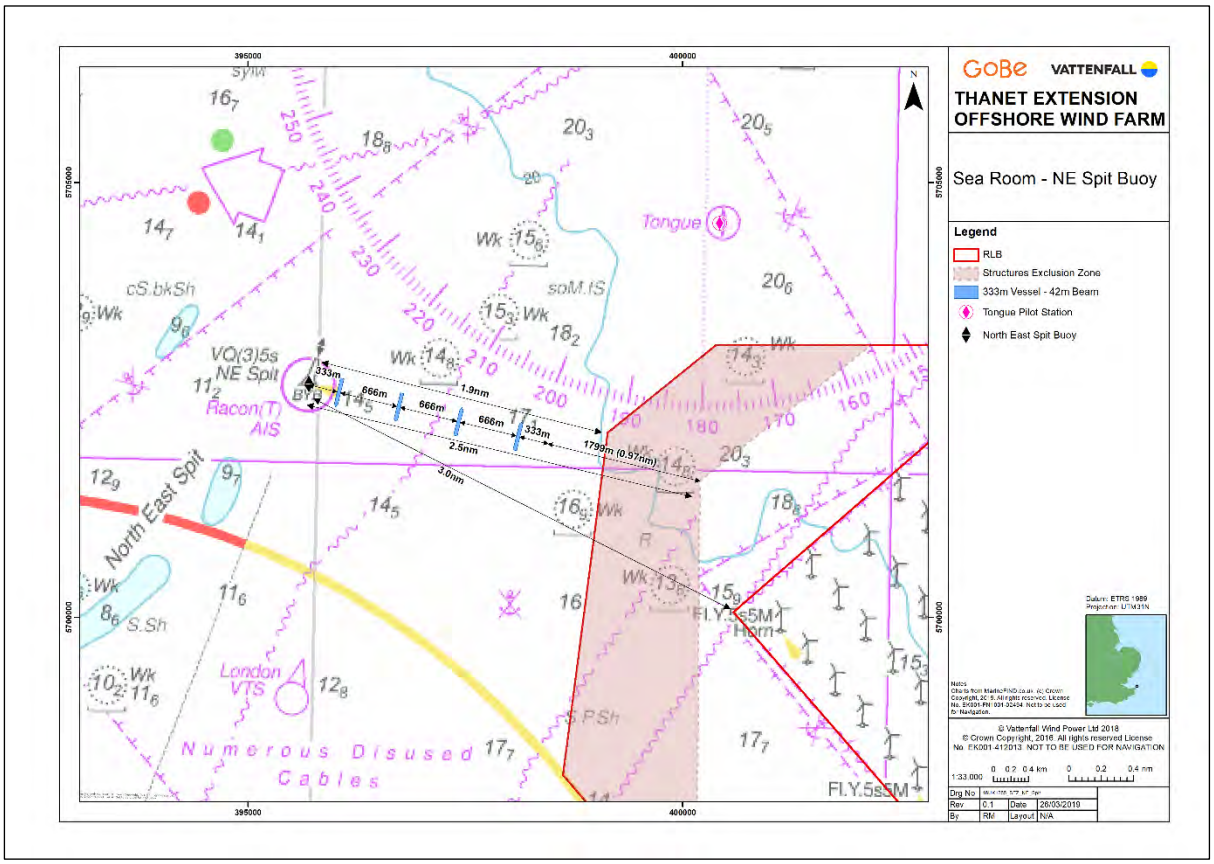

Figure 19: Sea Room between NE Spit Buoy and SEZ

3.7 NE Spit Pilot Transfer

59 In this area there are two principal marine activities of interest – vessels on passage and the utilisation of NE Spit Pilot Boarding Station and therefore this area has been highlighted by IPs as the most complex area for navigation due to these activities.

60 Vessels on passage are transiting to/from NE Spit Pilot Boarding Station, dipping traffic and/or vessels transiting to/from Margate Roads Anchorage. Allowance should be made for including overtaking / passing vessels and fishing activity.

61 The spatial area utilised for pilot transfers in present day is evidenced in Figure 13, Figure 14, Figure 15 and Figure 16 with overlay of Figure 16 provided in context with the SEZ in Figure 20. This distribution of pilot transfers, and the focus on the 2nm just in the central area is reflected in the data supplied by ESL, present in Figure 14 and Figure 15.

62 Figure 20 shows the closest point between the SEZ and the NE Spit Pilot Boarding Station is 2.5nm (with a further 0.33nm to the anchorage limit) and a larger 3.4nm width at its widest, just north of this point, in the area of greatest concentration of pilot transfers and complexity of navigation (Figure 21).

63 Larger vessels (notably those constrained principally by draught and length are considered to be restricted to the area marker 'pilot transfer box' in Figure 20 and the boundary as defined by the no anchoring area and the North Foreland sector light. For vessels of suitable draught and length, pilotage transfers and transits occur to the west of this boundary, when safe to do so, and also to the north west of the sector light (as shown in Figure 20 and marked 'additional shallow draught pilot transfer areas').

64 A minimum of 2nm of sea room recognises submissions as provided by LPC, ESL and PLA and in conjunction with the guidance and evidence from the data representing existing pilot transfers. A minimum safety buffer of 0.5nm is provided (for transiting vessels) together with a more precautionary 1.0nm buffer for vessels undertaking pilot transfers.

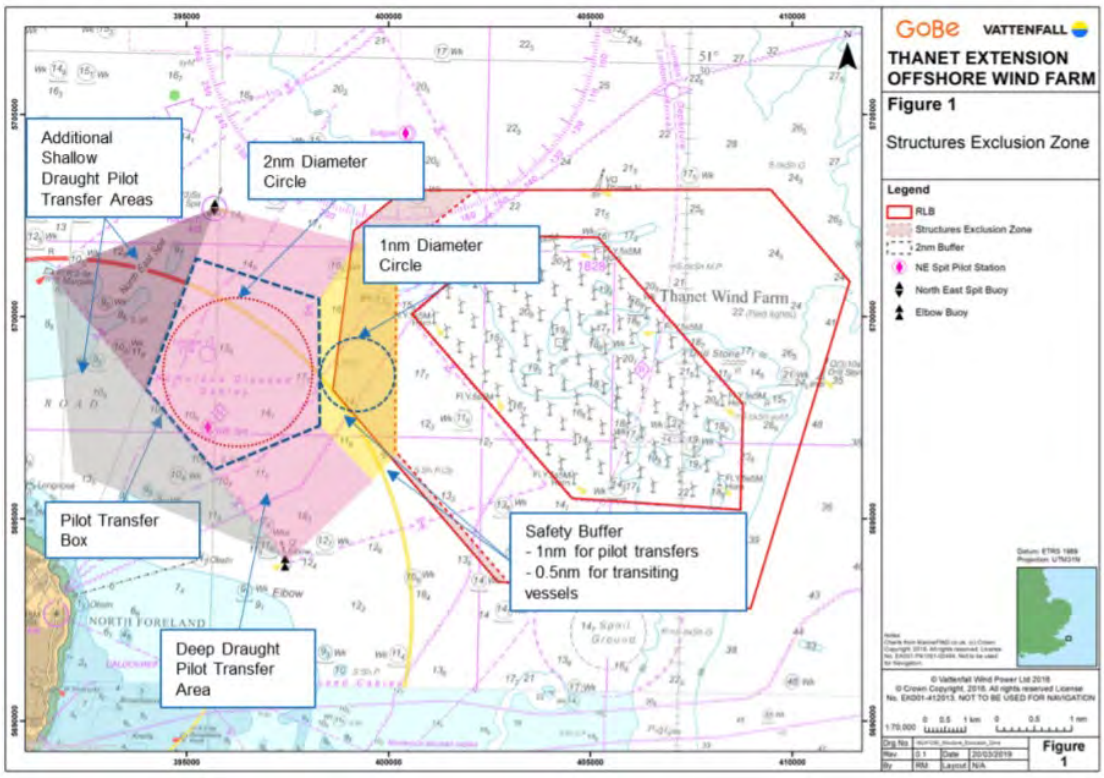

Figure 20: Sea Room at NE Spit Pilot Boarding Station

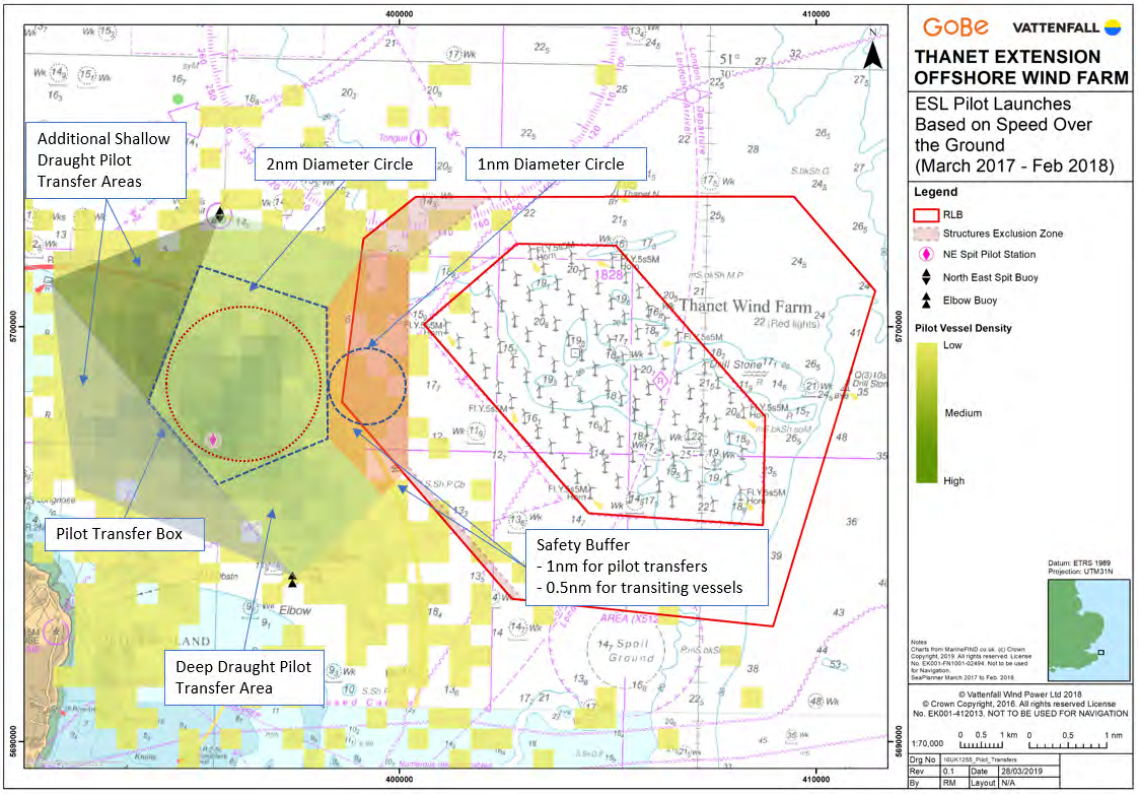

Figure 21: Sea Room at NE Spit Pilot Boarding Station and ESL Vessel Activity

3.8 Elbow Buoy

65 In this area, the marine activity of interest is vessels on passage transiting through the inshore route to/from NE Spit Pilot Boarding Station, the Thames Estuary or Margate Roads Anchorage. Allowance should be made for including overtaking / passing vessels. It is noted, with reference to Table 4 that 3,978 vessels per annum navigate across the line between Elbow Buoy and the existing wind farm.

66 Pilot transfers do, on non-frequent occasions, take place in this area, with reference to Figure 13, Figure 14, Figure 15 and Figure 16.

67 This area is considered the least navigationally complex compared to the other two reference locations.

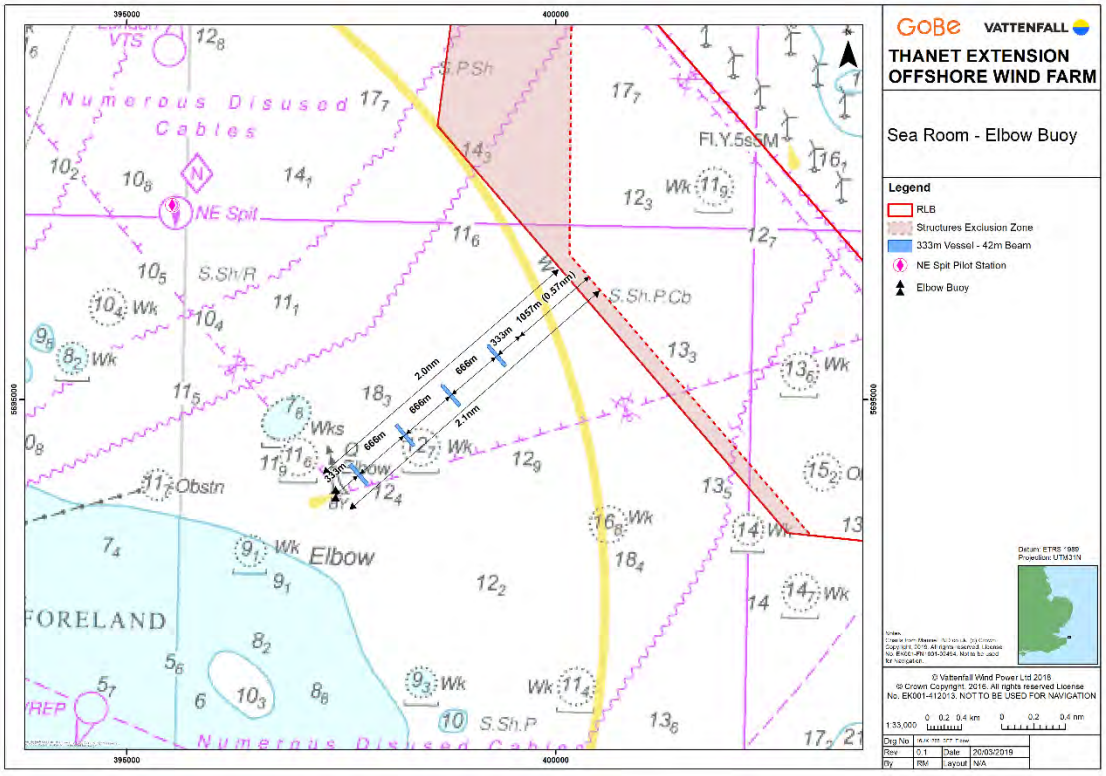

Figure 22: Sea Room between Elbow Buoy and SEZ

68 The minimum sea room requirement, as per the MSP guidance (as shown in Table 11 for four side-by-side vessels of 333m LOA which is highly precautionary given the number of vessels per annum) specifies 1.53nm required sea room leaving a further 0.57nm distance available as sea room with the proposed SEZ as per Figure 22, thereby incorporating a minimum 0.5nm safety buffer.

Table 11: Sea Room and Buffer (for 2.1nm Distance)

Vessel Length (m)	Sea Room required for no of vessels Side by Side [nm]			Remaining Sea Room available at location for consideration as a buffer [nm]		
	2 Vessels	3 Vessels	4 Vessels	2 Vessels	3 Vessels	4 Vessels
299	0.70	1.05	1.40	1.40	1.05	0.70
333	0.76	1.15	1.53	1.34	0.95	0.57
366	0.86	1.28	1.71	1.24	0.82	0.39
400	0.93	1.39	1.86	1.17	0.71	0.24

3.9 Sea room conclusions

69 The Applicant has responded to IPs submissions provided during the examination and the navigation workshop (held on 27 February), acknowledging the request for greater sea room, particularly for pilot transfers. This has been balanced with a quantitative approach reviewing current vessel traffic patterns and numbers using, where appropriate, MGN543 (and Marine Spatial Planning guidance (Annex A to this submission)) to form the basis of sea room considerations.

70 As a result, a precautionary approach to defining the SEZ has been taken, considering the relative complexity and quantity of marine activities in different areas of the inshore route.

71 The SEZ provides for the requested 2nm + 1nm sea room in the area of highest density of pilot transfers which accounts for the complexity of traffic and adverse conditions.

72 It provides 2.5nm at NE Racon buoy noting that this buoy only represents a restriction for the very largest vessels which may be required to transit east of the buoy, rather than west as is the case with the vast majority of traffic when exiting the inshore route heading north. Acknowledging that other vessel activities do occur in this area including turning to enter or exit the inshore route, and limited pilot transfers, a 1nm buffer has been applied to the already precautionary MGN543 calculations.

73 Due to the introduction of the SEZ north of the Elbow buoy, the restriction between it and the SEZ, where the majority of traffic is transiting through, is an isolated point between much wider sea room to the north and south. The line of sight for vessels entering the inshore route from the south has been vastly improved as a result of the SEZ meaning there is not the same 'channelisation' of this area of sea and it remains fully open for the largest vessels to transit.

4 Benchmarking of Navigation Safety

4.1 Port of London Authority - Navigation Risk Assessment Working Group on the Safety of Navigation in the North East Spit Area

74 A formal risk assessment to consider the evolving nature of operations in the North East Spit Area was conducted by the PLA (including personnel from the Harbour Master, Vessel Traffic Services and Pilotage departments), Peel Ports (including personnel from the Harbour Master and Pilotage departments), the Maritime and Coastguard Agency (including personnel from the Navigation Safety Department and the Channel Navigation Information System / SUNK VTS) and Estuary Services Limited in September 2015. This was provided to the Applicant by the PLA on 26 March for consideration at the Hazard workshop.

75 The terms of reference for the formal risk assessment was to:

1. *Review navigational incidents and near misses recorded in the North East Spit area during the last five years;*

2. *Using AIS track analysis to inform the NRAWG to:*
    a. *Review the predominant traffic patterns for all users of North East Spit*
    b. *Review the utility of current routing measures it he North East Spit Area*
    c. *Identify any new routing measures that may enhance the safety of navigation in the North East Spit Area.*

3. *With respect to VTS operations and the management of vessel traffic:*
    a. *Review the operational capability of the London VTS in the management of traffic in the North Est Spit Area*
    b. *Identify any requirement for modified or new VTS operational procedures to enhance the safety of navigation int eh North East Spit area*
    c. *Review the technical capabilities (including any limitations) of London VTS in the North East Spit area.*

4. *Review the utility, usage, location and operational constraints/procedures for the Tongue and Margate Roads Anchorages;*

5. *Review the current powers available to the PLA int eh North East Spit Area and consider whether they are sufficient;*

6. *Identify any new VTS rules or other guidance that may contribute to enhancing the safety of navigation int eh North East Spit.*

76 In terms of hazard identification, the assessment considered six hazards, with each hazard being applied to all vessel types navigating the North East Spit area, and hazards split by operation (pilot boarding / transit / not anchoring etc.) and hazard type (collision, contact and grounding).

77 A summary of the PLA[2] risk assessment is presented in Table 12, with the full narrative NRA provided for reference at Annex B of this Deadline 4b submission), which shows the final risk scores considered with controls measure identified and also the likelihood of occurrences given for each hazard for baseline (no controls) and residual (with controls) risk profiles. It is important to note that this risk assessment was undertaken in the PLA "Navigational Risk Assessment Pro-forma Template that is "A simple table to assist in the process of assessing the hazards to navigation associated with marine operations within the Port." It is not as comprehensive as the methodology set out within this Addendum NRA which is the same as the PLA Por Wide Risk Assessment for Compliance with the department for Transport Port Marine Safety Code.

78 The Navigational Risk Assessment Pro-forma methodology scores hazards on a scale of 0 to 25 and so any scores presented should be considered in this regard. It also does not address multiple consequence categories (people, property, environment or stakeholders).

[2] Received from the PLA Harbour Master Lower Cathryn Spain on 26/03/2019

Table 12: Summary of Port of London Authority - Navigation Risk Assessment Working Group on the Safety of Navigation in the North East Spit Area

Haz ID	Haz Title	Risk Control	Adopted	Baseline		Residual		% Effectiveness Likelihood	% Effectiveness Consequence	Baseline Risk	Residual Risk
				Hazard Likelihood Return Period	Hazard Consequence Cost	Hazard Likelihood Return Period	Hazard Consequence Cost				
1	Collision during or preparing for Pilot boarding/landing operations	ESL/PLA/MPA Pilot cutter scheduling and monitoring process	Yes	10	£1,000,000	215	£147,866	60	20	12.0	5.3
		Coordination of Pilot cutter operations on VHF Ch 69	Yes					60	60		
		Where practicable, prioritise embarking vessels	Yes					40	20		
		Planning of critical/high risk vessels with ESL/Pilot/VT	Yes					10	20		
		Additional met sensors closer to NE	Yes					5	5		
		Provision of charted Pilot boarding grounds to enhance traffic separation	Yes					30	20		
		Prohibited anchorage area/control of anchorage	Yes					10	5		
		Additional advice in Admiralty products	Yes					10	0		
		Dedicated VTS Operator	No					70	70		
2	Collision between vessels in transit	Precautionary area/exclamation mark	No	100	£1,000,000	361	£598,500	20	5	8.0	5.4
		Enhanced Pilotage/PEC navigational guidance/lessons identified	Yes					10	0		
		Additional advice in Admiralty products	Yes					10	0		
		Single channel VHF operations	Yes					60	30		
		Prohibited anchorage area/control of anchorage	Yes					5	5		
		Where practicable, prioritise embarking vessels	Yes					10	10		
		Dedicated VTS Operator	No					50	30		
3	Contact with vessel at Anchor	Modification of Tongue Anchorage location	No	1000	£100,000	1000	£100,000	20	0	3.0	3.0
		Formal charting of Margate Roads Anchorage	No					10	0		
4	Contact with windfarm or other	Use of encounter prediction VTS software	No	1000	£100,000	1000	£100,000	60	5	3.0	3.0
5	Grounding of Vessel not at Anchor	ESL/PLA/MPA Pilot cutter scheduling and monitoring process	Yes	100	£100,000	10000	£50,400	50	10	6.0	2.7
		Where practicable, prioritise embarking vessels	Yes					40	30		
		Planning of critical/high risk vessels with ESL/Pilot/VT	Yes					80	20		
6	Grounding of vessel at anchor (Margate Roads or Tongue)	Formal charting of Margate Roads Anchorage	No	100	£10,000	100	£10,000	10	0	4.0	4.0
		Undertake responsibility to monitor vessels in Tongue and Margate Roads (VTS Anchor Watch)	No					40	0		

79 The PLA residual assessment of risk is understood to be the assessment for risk of the North East Spit area which correlates to current day usage of the area and therefore correlates to the baseline assessment for the TEOW assessment. Whilst the baseline is not directly comparable due to a difference in baseline characterisation methodology (scores rated out of 25, rather than 10) it provides a useful benchmark for residual scoring.

80 This assessment is of benefit in terms of benchmarking the residual hazard risk scores generated as part of this Addendum NRA (and indeed the original NRA as well) to ensure that hazard likelihood scores are aligned where possible. Secondly there are a number of risk controls, identified within the Terms or Reference to the assessment, and the assessment itself that will reduce the baseline navigation risk in the area and therefore whilst not necessarily needed based on the traffic profile in 2015, could be used to reduce baseline navigation going forward (with the TEOW in place). The risk control measures recommended and not adopted as part of this NRA are provided in Table 13, along with those identified in the Terms of Reference but not taken into the assessment.

Table 13: Risk Controls identified as part of PLA NRA Working Group on the Safety of Navigation in the North East Spit Area.

Recommended / Existing Risk Controls	Status
Additional advice in Admiralty products	Recommended
Additional met sensors closer to NE Spit	Recommended
Coordination of Pilot cutter operations on VHF Ch 69	Recommended
Enhanced Pilotage/PEC navigational guidance/lessons identified	Recommended
ESL/PLA/MPA Pilot cutter scheduling and monitoring process	Recommended
Planning of critical/high risk vessels with ESL/Pilot/VTS	Recommended
Prohibited anchorage area/control of anchorage	Recommended
Provision of charted Pilot boarding grounds to enhance traffic separation	Recommended
Single channel VHF operations	Recommended
Where practicable, prioritise embarking vessels	Recommended
Dedicated VTS Operator	Not adopted
Use of encounter prediction VTS software	Not adopted
Precautionary area/exclamation mark	Not adopted
Modification of Tongue Anchorage location	Not adopted
Formal charting of Margate Roads Anchorage	Not adopted
Undertake responsibility to monitor vessels in Tongue and Margate Roads (VTS Anchor Watch)	Not adopted
Review the current powers available to the PLA in the North East Spit Area and consider whether they are sufficient.	Not Assessed
Identify any new VTS rules or other guidance that may contribute to enhancing the safety of navigation in the North East Spit area.	Not Assessed

5 Risk Assessment

5.1 Introduction

81 The risk methodology employed was based on the International Maritime Organisation Formal Safety Assessment risk assessment methodology (see Figure 23) and is as documented in the original NRA and further described in Examination Deadline submissions.

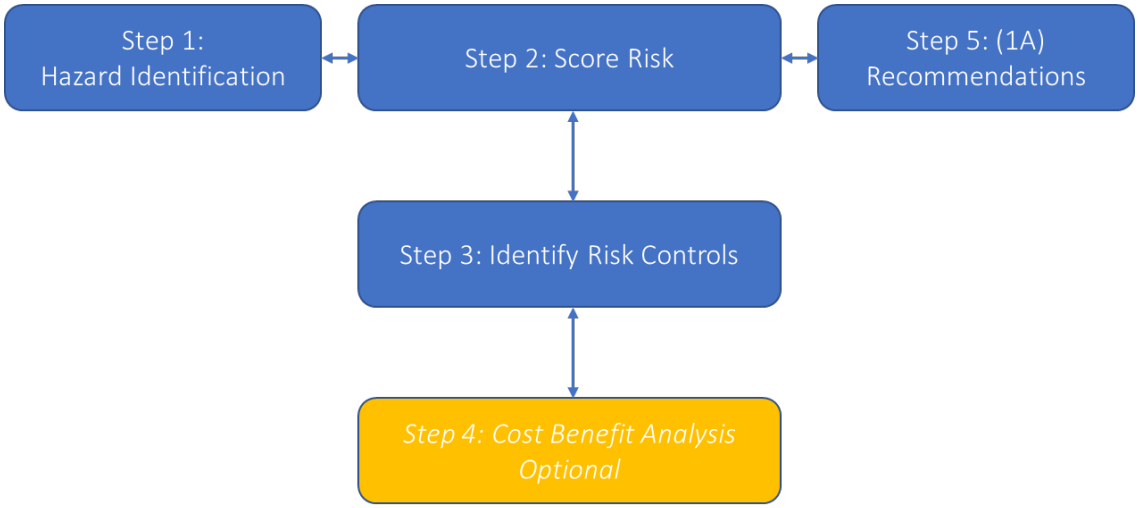

Figure 23: Formal Safety Assessment Process

82 In summary the process starts with the identification of potential hazards. It then assesses the likelihood of a hazard occurring and considers the possible consequences of the hazard. It does so in respect of two scenarios, namely the "most likely" and the "worst credible" outcomes. The quantified values of frequency and consequence are then combined using a risk matrix to produce an individual risk score for each hazard. These are collated into a "Summary Ranked Hazard List" from which the need for risk controls measures can be reviewed.

83 International Maritime Organisation (IMO) Guidelines define a hazard as "something with the potential to cause harm, loss or injury", the realisation of which results in an accident, e.g. collision, contact and grounding.

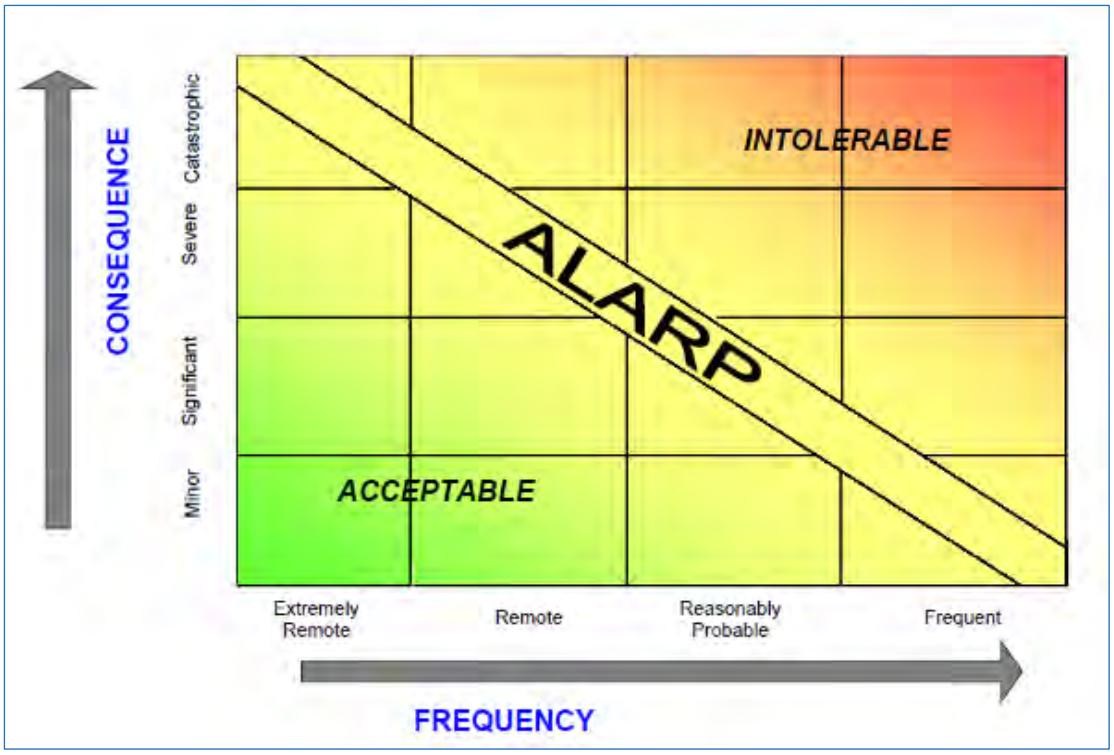

Figure 24: Generic Risk Matrix

84 The combination of consequence and frequency of occurrence of a hazard is combined using a risk matrix which enables hazards to be ranked and a risk score assigned (see generic risk matrix shown at Figure 24). The resulting scale can be divided into three general categories:

- Acceptable (Tolerable);
- As Low as Reasonable Practicable – ALARP (Tolerable with Controls); and
- Intolerable (In-tolerable).

85 At the low end of the scale, frequency is extremely remote and consequence minor, and as such the risk can be said to be "acceptable" or "tolerable", whilst at the high end of the matrix, where hazards are defined as frequent and the consequence catastrophic, then risk is termed "intolerable". Every effort should be made to mitigate all risks such that they lie in the "acceptable" or "tolerable" range. Where this is not possible, they should be reduced to the level where further reduction is not practicable.

86 The region, at the centre of the matrix is described as the ALARP region. It is possible that some hazards will lie in the "intolerable" region, but can be mitigated by measures, which reduce their risk score and moves them into the ALARP region, where they could be tolerated, albeit efforts should continue to be made when opportunity presents itself to further reduce their risk score.

87 The FSA methodology used in this NRA, determines where to prioritise risk control options for the navigational aspects of an offshore wind farm site.

88 The assessment of risk was split between the following risk profiles:

- **Baseline Risk**: Assessment of risk for the area with the current TOW in place.
- **Inherent Risk**: Assessment of risk for the area with the proposed TEOW in place including the SEZ.
- **Residual Risk**: Assessment of risk for the area with the proposed TEOW in place including the SEZ and any additional risk control or mitigation measures in place.

89 The following FSA risk assessment steps are undertaken for each hazard (see Table 14).

Table 14: FSA Risk Assessment Steps linked to Risk Profiles.

FSA Step	Baseline Risk	Inherent Risk	Residual Risk
1: Hazard Identification	✓	-	-
2. Hazard Scoring	✓	✓	
3. Identify and score Risk Controls	-	-	✓
4. Cost Benefit	-	-	N/A
5. Recommendations	-	-	✓

90 The Addendum NRA process was based on:

- Original application NRA and supporting studies;
- TEOW with Structures Exclusion Zone – presented in Section 1.2;
- Vessel Traffic Analysis – presented in Section 2;
- Vessel Incident Analysis – presented in Section 2.6
- Consultation with Stakeholders – presented below; and
- Expertise of project personnel.

5.2 Consultation and the Risk Assessment Process

91 The Addendum NRA process was designed to specifically incorporate feedback from Interested Parties received over the course of the Examination Process, with the following consultation meetings and workshops undertaken:

- **Shipping Workshop** (27 February) to seek inputs from IPs to help define the project amendment (latterly the SEZ) and to identify primary areas of sea room, attended by:
  - Port of London Authority (PLA)
  - Estuary Services Limited (ESL)
  - Chamber of Shipping (CoS)

  - Port of Tilbury London Limited (POTLL)
  - Dubai Ports World London Gateway (DPWLG)
  - Maritime Coastguard Agency (MCA)
  - Trinity House (TH)
- **Pre-Hazard Workshop Meetings** to provide rationale on SEZ and outline Addendum NRA strategy (including hazard identification approach, benchmarking to hazards to incident data, hazard workshop approach and identification of risk control measures), with:
  - MCA / TH – 21 March - MCA Head Quarters
  - PLA / ESL - 22 March - Teleconference
  - LPC / PLA – 25 March - PLA Head Quarters
  - POTLL / DWPLG - 25 March – Teleconference
  - Thanet Fishermen's Association (TFA) - 26 March - Ramsgate
- **Hazard Workshop** (see below for details) – 29 March – 10:00 – 16:00 London, attended by:
  - MCA
  - Trinity House
  - PLA
  - ESL
  - POTLL
  - DPWLG
  - TFA
  - Applicant (including Navigation Risk Assessment specialist (Workshop Chair) and Master Mariner)
- **Post Hazard Workshop Teleconference** to run through additional hazard scores as drafted by the Navigation Risk Assessment Specialist – 2 April – attended by:
  - PLA
  - ESL
  - LPC
  - MCA
  - DPWLG
  - POTLL

92 In conjunction with the meetings identified above, the following documentation was issued:

- A hazard workshop pack was issued (including Agenda, Attendees, Methodology, Initial hazard Identification, supporting analysis - track data, gate data, incident data and PLA NRA for NE Spit) with request for comment prior to hazard workshop – 26 March (presented at Annex D).
- A draft Hazard log was issued and request for comment on hazard scores – 1 April.
- Interim NRA Addendum Report on 10th April
- NRA Addendum Report at Deadline 4B
- Statement of Evidence at Deadline 4C

5.3 FSA Step 1: Hazard Identification

93 Hazard identification is the first and fundamental step in the FSA risk assessment process. The Addendum NRA was conducted with limited time as part of the Examination Process and therefore the hazard identification was primarily limited to those hazards where concern had been raised by interested parties, both in terms of vessel type, are and hazard type.

94 Hazards were identified based on:

- Hazard Type
- Vessel Type
- Area

95 Hazard types identified for the assessment were:

- Collision
- Contact
- Grounding

96 In order to minimise the total hazard numbers related to combinations of vessel types (see below) for collisions, collision hazards were considered for each vessel type only in collision with any other vessel type. This approach differs from that undertaken in original NRA but is commonly used throughout the industry, indeed the PLA NE Spit Formal Risk Assessment used the same approach.

97 Vessel types were defined by PLA Pilotage category, this was a change from the original NRA based on the content and theme of representations received from IPs, particularly London Pilot Council, Estuary Services Limited and the Port of London Authority. Whilst these categories of vessel are well known by individuals from these organisations, they are not internationally recognised ship categories and whilst accepting the need to define categories fit for the area and the scope of the Addendum NRA, some Interested Parties have passed comment that they would have preferred a different categorisation of vessel types. Whist there is a basis to these comments, as navigation concerns revolve around London Pilot Council, Port of London and Estuary Services Limited operations, these comments whilst noted were not taken any further.

98 The vessel type categories were (see Annex E to this document for PLA Pilotage Classes):

- Vessel Category 1 - Class 1 & 2 Vessels (including LNG vessels);
- Vessel Category 2- Class 3 & 4 Vessels (including DG vessels);
- Vessel Category 3- Vessels less than 90m (typically those vessels not taking a pilot);
- Vessel Category 4 - Fishing Vessels & Recreational Craft;
- Vessel Category 5 - Windfarm Service Vessel; and
- Vessel Category 6 - Pilot Launch.

99 The hazard risk area considered for the Addendum NRA was the western area of the TEOW (identified as the original study area to the west of the North Thanet buoy), which is the area that has been focused on as having navigational concerns by IPs.

100 The final hazard list is therefore made up of 18 individual hazards as shown in Table 15.

Table 15: Hazard Identification List

#	Hazard Type	Area	Hazards
1	Collision	West TEOW	Class 1 & 2 Vessels (including LNG vessels) icw another vessel
2	Collision	West TEOW	Class 3 & 4 Vessels (including DG vessels) icw another vessel
3	Collision	West TEOW	Fishing & Recreational icw another vessel
4	Collision	West TEOW	Windfarm Service Vessel icw another vessel
5	Collision	West TEOW	Pilot Launch icw another vessel
6	Collision	West TEOW	Vessels less than 90m
7	Contact	West TEOW	Class 1 & 2 Vessels (including LNG vessels)
8	Contact	West TEOW	Class 3 & 4 Vessels (including DG vessels)
9	Contact	West TEOW	Fishing & Recreational
10	Contact	West TEOW	Windfarm Service Vessel
11	Contact	West TEOW	Pilot Launch

#	Hazard Type	Area	Hazards
12	Contact	West TEOW	Vessels less than 90m
13	Grounding	West TEOW	Class 1 & 2 Vessels (including LNG vessels)
14	Grounding	West TEOW	Class 3 & 4 Vessels (including DG vessels)
15	Grounding	West TEOW	Vessels less than 90m
16	Grounding	West TEOW	Fishing & Recreational
17	Grounding	West TEOW	Windfarm Service Vessel
18	Grounding	West TEOW	Pilot Launch

101 The identified hazards were circulated to workshop attendees prior to the workshop (26 March) in the workshop pack that included details of the proposed workshop and ancillary information, so that they could pass comment on the list and provide suggested changes. The hazard list was then finalised at outset of the hazard workshop on 29 March by consensus from all parties present.

5.4 FSA Step 2: Hazard Scoring

Baseline Risk

102 Baseline hazard scoring, for the present day navigation risk to the west of the existing TOW, was undertaken at the hazard workshop by IPs (as documented above). The scoring of hazards and assessment of hazard acceptability / tolerability was the same as that contained within the original NRA and documented throughout the Examination Process.

103 As indicated above, frequency of occurrence and likely consequence were assessed for the "most likely" and "worst credible" hazard outcome. Typically, the most likely hazard likelihood score is the most tangible to stakeholders when asked to score hazards. This is typically because in most cases the individuals are aware of incidents with similar consequences that have occurred in any particular study area. The use of local incident data is frequently be used to inform the most likely hazard likelihood (and consequence).

104 The worst credible likelihood scores are however less tangible to most stakeholders as they commonly relate to catastrophic consequence incidents, of which very few stakeholders have likely come across. To help facilitate the scoring of worst credible hazard outcome, analysis of available Marine Accident Investigation Branch data, which relates to the whole of UK waters and includes a UK registered vessel anywhere in the world, shows that the worst credible hazard outcome is likely to happen around 100 times less often than the most likely occurrence. This helps guides individuals in an initial assessment of hazard likelihood (and to a lesser extent hazard consequence), which can then be refined based on local navigational features. This approach is analogous to the safety triangle principle (first introduced by Heinrich).

105 Hazard likelihoods were assessed according to the levels set out in Table 16. The ability to input hazard likelihood scores that fall between categories was utilised (as was used in the original NRA), which enabled more accurate assessment of hazards for likelihoods with well-known probability of occurrence. This typically applies to the most likely assessment of likelihood where incident data in the area is available.

106 Using the assessed notional frequency for the "most likely" and "worst credible" scenarios for each hazard, the probable consequences associated with each are assessed in terms of damage to:

- People - Personal injury, fatality etc.;
- Property – Wind farm site and third party;
- Environment - Oil pollution etc.; and
- Stakeholders - Reputation, financial loss, public relations etc.

Table 16: Hazard likelihood criteria.

Scale	Description	Definition	Operational Interpretation
F5	Frequent	An event occurring in the range once a week to once an operating year.	One or more times in 1 year
F4	Likely	An event occurring in the range once a year to once every 10 operating years.	One or more times in 10 years 1 - 9 years
F3	Possible	An event occurring in the range once every 10 operating years to once in 100 operating years.	One or more times in 100 years 10 – 99 years
F2	Unlikely	An event occurring in the range less than once in 100 operating years. (e.g. it may have occurred at a similar site, elsewhere in the UK).	One or more times in 1,000 years 100 – 999 years
F1	Remote	Considered to occur less than once in 1,000 operating years (e.g. it may have occurred at a similar site, elsewhere in the world).	Less than once in 1,000 years >1,000 years

107 The magnitude of each hazard was assessed using the consequence categories given in Table 6. These have been set such that the consequences in respect of property, environment and business have similar monetary outcomes.

108 The details of hazard scoring are as documented in Appendix 25, Annex P to Deadline 1 Submission: Applicant's Responses to the Examining Authority's First Written Questions – EXQ1 – Supplementary Note – Navigation Risk Assessment Scoring.

109 In summary there are 8 individual risk scores generated for the baseline assessment of risk based on 4 consequence categories for the most likely occurrence and 4 categories for the worst credible occurrence. Individual risk scores are calculated using Hazman II software based on the risk matrix shown in Figure 25.

110 The eight individual assessments of risk are combined together using an algorithm weighted towards the highest individual risk scores as follows:

- The average risk score of the four categories in the "most likely" set;
- The average risk score of the four categories in the "worst credible" set;
- The maximum risk score of the four categories in the "most likely" set; and
- The maximum risk score of the four categories in the "worst credible" set.

111 Resultant risk scores are benchmarked against the hazard risk score categories to identify the acceptability / tolerability of hazard scores (see Table 18). The risk scores were calculated based on the risk matrix and HAZMAN software (which is the same software used by the PLA have used to manage their port wide Navigation Risk Assessment since 2001, as mandated by the Department for Transport's Port Marine Safety Code).

Table 17: Consequence categories and criteria.

Cat.	People	Property	Environment	Stakeholders / Business
C1	**Negligible** Possible very minor injury (e.g. bruising)	**Negligible** Costs <£10k	**Negligible** No effect of note. Tier1 may be declared but criteria not necessarily met. Costs <£10k	**Negligible** Costs <£10k
C2	**Minor** (single minor injury)	**Minor** Minor damage Costs £10k – £100k	**Minor** Tier 1 – Tier 2 criteria reached. Small operational (oil) spill with little effect on environmental amenity. Costs £10K–£100k	**Minor** Bad local publicity and/or short-term loss of revenue Costs £10k – £100k
C3	**Moderate** Multiple minor or single major injury	**Moderate** Moderate damage Costs £100k - £1M	**Moderate** Tier 2 spill criteria reached but capable of being limited to immediate area within site. Costs £100k -£1M	**Moderate** Bad widespread publicity Temporary suspension of operations or prolonged restrictions at wind farm or other stakeholder Costs £100k - £1M
C4	**Major** Multiple major injuries or single fatality	**Major** Major damage Costs £1M -£10M	**Major** Tier 3 criteria reached with pollution requiring national support. Chemical spillage or small gas release. Costs £1M - £10M	**Major** National publicity, Temporary closure or prolonged restrictions on wind farm operations or other stakeholder. Costs £1M - £10M
C5	**Catastrophic** Multiple fatalities	**Catastrophic** Catastrophic damage Costs >£10M	**Catastrophic** Tier 3 oil spill criteria reached. International support required. Widespread shoreline contamination. Serious chemical or gas release. Significant threat to environmental amenity. Costs >£10M	**Catastrophic** International media publicity. Wind farm site closes or major adverse impact to stakeholders. Operations and revenue seriously disrupted for more than two days. Ensuing loss of revenue. Costs >£10M

Figure 25: Risk matrix used for hazard assessment.

Table 18: Hazard Risk Score Categories

Risk Number	*Risk*	*Tolerability*
0 to 1.9	*Negligible*	*Tolerable*
2 to 3.9	*Low Risk*	*Tolerable*
4 to 6.9	*As Low as Reasonably Practical*	*Tolerable with controls*
7 to 8.9	*Significant Risk*	*In-Tolerable*
9 to 10.0	*High Risk*	*In-Tolerable*

Hazard Workshop and Scoring

112 On the 29 March a Hazard workshop was undertaken by the Applicant with all IPs who have attended the Examination hearings and made representations invited to attend. In advance of the Hazard workshop (26 March) a hazard workshop information pack was circulated. The Hazard workshop information pack is included at Annex D. The pack included a detailed agenda, attendee list, outline of the proposed methodology to be adopted, a revised 'Hazard' list[2], the full assessment methodology, and a list of risk controls to be adopted as appropriate. Supplementary data were also included with the pack, including vessel plots derived from the 12 months AIS data validation, updated MAIB incident data, PLA incident data and a PLA provided NRA for the NE Spit region.

113 These supplementary data sources were used aid assessment of hazard likelihood and consequence see sections:

- Vessel Traffic Data – see section 2;
- Vessel incident statistics (MAIB and PLA) – see section 3; and
- PLA North East Spit NRA – See Section 4.

114 At the hazard workshop scoring for the baseline and inherent risk profile was made on 4 of the most navigational sensitive hazards from the proposed 18 hazards identified, with a full and detailed discussion held with all IPs (save MCA who were in attendance in an observation capacity only). This included the following hazards:

- Haz Id# 1: Collision - Class 1 & 2 Vessels (including LNG vessels) with another vessel
- Haz Id# 2: Collision - Class 3 & 4 Vessels (including DG vessels) with another vessel
- Haz Id# 3: Collision - Vessels less than 90m with another vessel
- Haz Id# 4: Collision - Fishing & Recreational icw another vessel with another vessel

115 It was agreed at the workshop that the remaining 14 hazards should be assessed at an initial level by the NRA lead for the Applicant, who would submit a draft list for hazards 5-18 on the 1 April for IPs consideration, prior to a further review meeting to be held on the 2 April.

116 At the post workshop meeting held on the 2 April, the PLA, ESL and LPC identified that following further consideration they felt that the scores agreed at the workshop required further internal consideration. PLA, ESL and LPC confirmed that an internal review of the scores would be undertaken and a submission made confirming the output of the internal review at a later date.

117 Other interested parties, POTLL, DPWLG, TH, TFA, MCA did not comment on the draft hazard logs for hazard 5 – 18 provided.

118 The hazard log was drafted during and following consultation with IPs, on the basis of agreed quantification of consequence and likelihood for the baseline risk and inherent risk scores for key hazards. Whilst it is noted that PLA and ESL undertook a further internal review of the categories and hazard scores. Subsequent to the post workshop meeting the wider project team consisting of two master mariners with pilotage experience reviewed the draft hazard scores and agreed with the baseline scores allocated.

Future traffic profiles

119 Future traffic profiles are considered within the NRA hazard log by applying an uplift to the hazard likelihood scores based on a projected uplift in vessel numbers by vessel type.

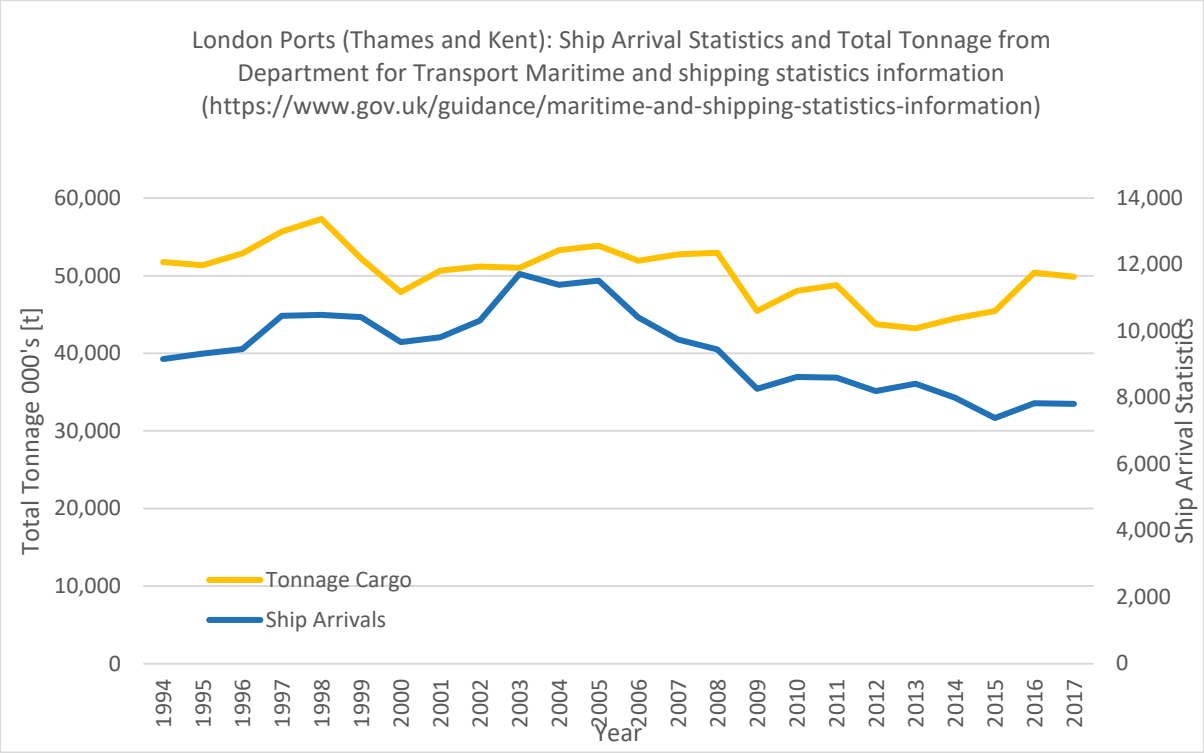

Figure 26: Ship Arrival and Cargo Tonnage data for London Ports

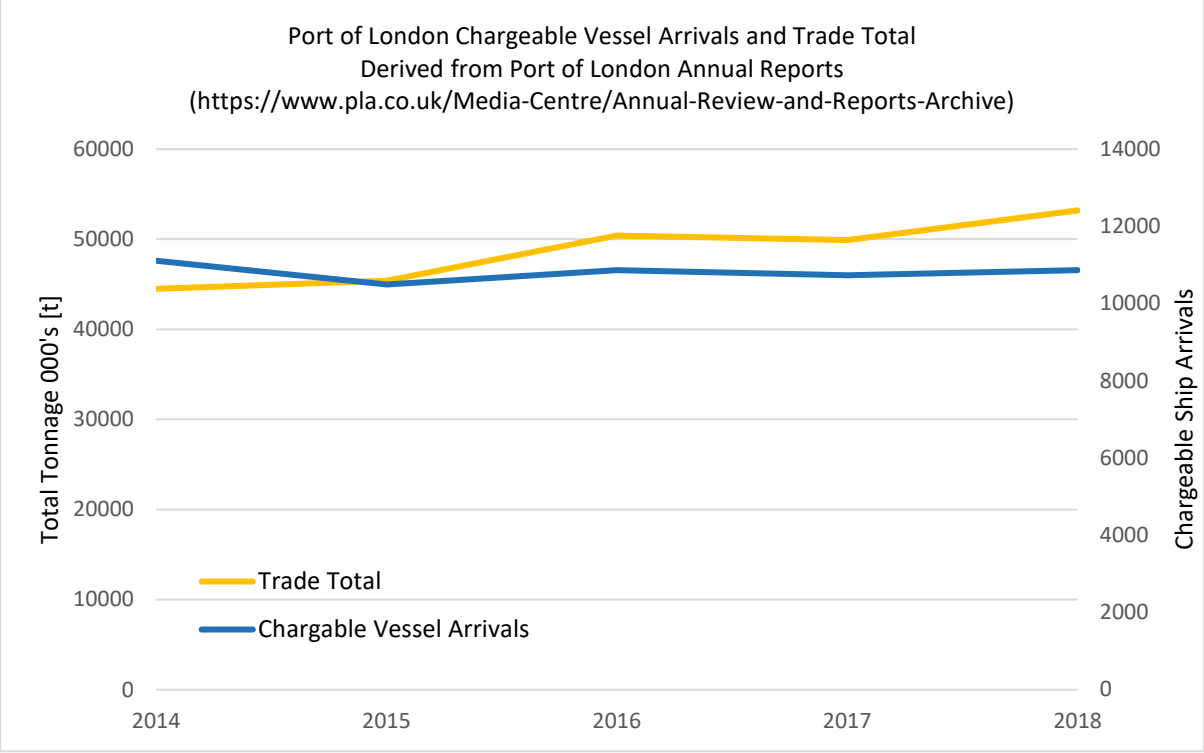

Figure 27: Port of London Chargeable Vessel Arrivals and Trade Total

120 The original NRA reviewed vessel traffic trends based on available historical cargo tonnage data for the Thames Estuary and applied an uplift of 10% to account for any change in commercial vessel activity. The original NRA made this judgment based on an uplift of all commercial vessel traffic passing the TEOW site and also on the basis of trends towards use of larger vessels. Interested Parties, especially Port of Tilbury and Dubai Ports World London Gateway have questioned whether this is conservative uplift, and whilst within both these ports development of additional berth facilities (e.g. Tilbury 2) and increased utilisation of existing infrastructures is likely, these ports individually make up a minority of vessel movements in the Thames Estuary.

121 Further analysis of the cargo tonnage data, in addition to ship arrival data from the Department for Transport (presented in Figure 26), shows that since a peak in 2003, there has been a steady decline in ship arrivals, and that in terms of cargo, following a significant turn down in 2008 from the financial crisis there has been relatively little change in cargo volumes between 2008 and 2017. This evidences the shift towards larger less frequent ship arrivals, as shown in Figure 27, which is PLA data taken from their annual report showing an increase in trade but a largely static (and in fact a slightly downward) trend in chargeable ship arrivals over recent years – it is important to note that the PLA figures do not include other estuary ports such as the Port of Sheerness and use a different unit of measurement compared to the Department of Transport figures.

122 Therefore, to account for an uplift in larger vessels, and based on an actual downward trend in vessel numbers evident from the Department for Transport data for the wider Thames Estuary, a conservative and precautionary 10% uplift in hazard likelihood has been applied to PLA pilotage Class 1 and Class 2, Class 3 and 4, and less than 90m vessels. This is in line with many other OWF NRA assessments (e.g. Galloper OWF NRA (2011), East Anglia Two OWF NRA (2019) and East Anglia One North OWF NRA (2019)) and is reflected in the Tilbury2 NRA in support of the now consented Tilbury2 DCO application.

123 Further to this it is important to note that the "MMO1127: Futures analysis for the north east, north west, south east and south west marine plan areas" report of June 2017 notes in its assumptions and impacts under the future scenarios for ports, shipping, dredging and disposal for the south east region that an allowance be made for annual growth in terms of freight tonnage of 1% between 2017 and 2027 and 2% between 2028 and 2036 under the business as usual scenario, or 1% between 2017 and 2036 under a local stewardship scenario. Under these marine planning scenarios the assumption is also made that the trend for larger vessels would continue, with minor changes to shipping routes to accommodate offshore windfarms. Indeed, it is of note that in this strategic marine planning for the region a key assumptions is that Thanet Extension is consented in its initial (scoping stage) scale. It is important to note in this context that the Marine Management Organisation future analysis for the region assumed that overall freight tonnage would increase, by between 1 and 2% per the trend for larger vessels would continue, and that the Thanet Extension OWF would be consented.

124 A downward, or static trend is also evident in recreational and fishing vessel activity categories in the area, and therefore no uplift to account for future growth has been included. This is evidenced in national trends for recreational craft (boat ownership trends show static numbers between 2007 and 2017) and fishing vessels (pg 13 of UK Sea Fisheries Statistics 2017 – MMO - shows <=10m vessel no. at 2014 – 2,573, 2015 – 2,598, 2016 – 2,569, 2017 - 2,512). Thanet Fisherman's Association have stated that due to economic industry impacting fishing.

125 An uplift in Windfarm Service Vessels (WSV) is considered within the Inherent assessment of risk as this includes additional WSV in operation associated with the TEOW. WSV engaged on other projects within the Thames Estuary and transiting through the study area are anticipated to remain largely the same as current day usage based on consultation.

Inherent Risk

126 An inherent assessment of risk was undertaken in line with the baseline assessment for risk through the hazard workshop in which the four most navigationally sensitive hazards were scored for the hazard likelihood and consequence given that the TEOW was built and the Structures Exclusion Zone was in place.

127 The hazard input scores applied to the following four hazards were agreed by workshop attendees:

- Haz Id# 1: Collision - Class 1 & 2 Vessels (including LNG vessels) with another vessel
- Haz Id# 2: Collision - Class 3 & 4 Vessels (including DG vessels) with another vessel
- Haz Id# 3: Collision - Vessels less than 90m with another vessel

- Haz Id# 4: Collision - Fishing & Recreational icw another vessel with another vessel

128 Discussion during the workshop on the inherent assessment of risk focused on attendees' view that there should in general be an allowance made and consideration given for an increasing the 'baseline' likelihood of hazard to reach an appropriate 'inherent' likelihood following the introduction of the proposed project – in the most onerous case this involved the doubling of hazard likelihood for the Class 1 or 2 vessel collision hazard from a 1 in 40 year occurrence (1 in 36 year with 10% uplift applied), to a 1 in 20 year occurrence (1 in 18 year with 10% uplift applied) for the most likely outcome of a collision which relates to a glancing blow, and minimal damage. A doubling of likelihood was also made for the worst credible inherent likelihood assessment.

129 It is important to note that a doubling of likelihood does not directly equate to a doubling of the resultant risk score – this is due to two factors:

- Risk scores are not solely a function of likelihood but also a function of consequence magnitude – to change the likelihood does not change consequence of a hazard occurring; and
- Risk matrices are logarithmic in nature in how they represent likelihood and consequence – as a result a doubling either may not relate directly to a doubling in risk score.

130 Further caution was applied to the agreed hazard logs through using the industry specific most likely / worst credible conversion factor (see above) which suggests that based on historic analysis a 'most likely' hazard likelihood is around 100 fold less likely to occur for the 'worst credible' likelihood outcome. Through the workshop, and in all hazards assessed, the likelihoods ratios between most likely and worst credible hazard scores (for hazards 1-4), were agreed with IPs without definitive reliance on this ratio, and in all cases the assessed likelihood was assessed as being significantly more likely than this, leading to higher hazard scores. This was undertaken to provide confidence that the most likely and worst credible occurrences were defined in full through the application of local stakeholder input and were based on a precautionary approach.

Residual Assessment of Risk

131 The residual assessment of risk relates to the risk of the proposed TEOW with risk controls in place aimed at mitigating any unacceptable risk to tolerable levels being in place.

132 The assessment of residual risk was not undertaken at the hazard workshop for the four hazards assessed as time did not allow, and workshop attends were not aware of the resultant hazard risk scores, so were not able to identify the need for controls based on the hazard risk score.

133 The residual assessment of risk was undertaken by the project team following review of additional risk control measures (see below).

5.5 FSA Step 3: Risk Controls

Embedded Risk Control Measures

134 The risk control measures from the original NRA were taken and refined based on those that would be expected to be included within any offshore wind farm assessment (embedded) and those specific to TEOW and the disposition of navigation risk in the study area. The following control measures are assumed to be included within TEOW project and therefore were included in the inherent assessment of risk (embedded):

- All construction, operational and maintenance vessels are to be fully compliant with legislation, guidance and best practice.
- All those involved in construction, operational and maintenance operations are to be trained and competent persons, using appropriate PPE.
- ERCOP to be drafted in conjunction with MCA/HMCG and other stakeholders.
- Inter-array / export cables to be buried to the depth agreed, or suitably protected, which provides sufficient protection without compromising UKC.
- Blade Clearance of at least 22m above MHWS.
- Layout Plan to be submitted to MCA for approval prior to construction. The layout plan should include the proposed location and foundation types of all structures, the height and clearances of blades and length and arrangement of cables.
- Cable Burial Risk Assessment and periodic cable inspections to be conducted and protection so not to exceed 5% UKC.
- Update navigational charts to show wind farm layout and cable route.
- A cable exclusion area should be implemented that covers the port limits, approach channel and dredged channel of the Port of Ramsgate. Within this area no cables will be installed associated with this project. During cable laying and or maintenance, it may be necessary for anchor spreads or moorings to be temporarily placed within this area to assist with the installation.

Additional Risk Control Measures

135 Risk controls specifically identified and designed to mitigate any potential increase in navigation risk brought about by the TEOW are as follows:

- **Enhanced Promulgation of Information (already adopted by the Applicant)**

  Enhanced information promulgated (e.g. at a greater level that included in embedded risk control measure promulgation of Information, such as issuing Notices to Mariners, WSV passage plans, maintenance programs, outputs of Shipping and Navigation Liaison Group, etc.) to:

  - Fishing vessels (linked to Fisheries Liaison and Co-existence Plan)
  - Recreational vessels (link to local yacht clubs)
  - Shipping vessels (linked to Shipping and Navigation Plan)

- **Shipping and Navigation Liaison Group (already adopted by the Applicant)**

  Shipping and Navigation Liaison Plan detailing co-operation between interested parties on navigation within the NE Spit Area to be drafted (once the project final design in known). Plan to be regularly reviewed by Shipping and Navigation Liaison Group and will consider systems and procedures that could be utilised to maintain navigation safety. Members to include (but not limited to) MCA, Trinity House, PLA, ESL, Estuary Ports (e.g. Port of Sheerness, port of Ramsgate), London Pilot Council, Vattenfall, RYA, Thanet Fisherman's Association. Terms of reference for the plan will be agreed post DCO consent, but could include review of risk assessment and risk controls in place and adopted by PLA (as part of 2015 NRA) and Vattenfall (as part of NRAA) for the NE Spit area, assessment of need for further controls (those identified but not implemented based on PLA 2015and NRAA), etc.

- **Post Consent Monitoring for Operational Phase (requested by Trinity House)**

  Post Consent monitoring using AIS (and possibly Radar) data to identify traffic disposition post construction which will feed into Shipping and Navigation Liaison Group and help validate Aid to Navigation plans.

- **Enhanced Optimisation of TEOW line of orientation and symmetry (already adopted by Applicant)**

  Ensure TEOW orientation is optimised for navigation safety through 2 lines of orientation taking into account existing TOW WTG's. This exceeds Layout Plan requirements of the embedded control which would ordinarily leave the discussion of a line of orientation to be confirmed in consultation with the MCA and Trinity House.

- **Aids to Navigation / Buoyage (already adopted by the Applicant)**
- Review Aids to Navigation in vicinity of TEOW and includes likely relocation of Drill Stone & North Thanet as necessary depending on final layout of TEOW and updated based on post consent monitoring.

Further Risk Control Measures

136 The following sections details further risk controls that have been identified either as part of the PLA 2015 NRA, or as part of the TEOW NRA (Original and Addendum).

PLA NE Spit NRA 2015 Control Measures

137 A review of the PLA "*Navigation Risk Assessment Working Group on the Safety of Navigation in the North East Spit Area*", as documented in Section 4 shows the identification of risk controls to reduce navigation risk in the area that have yet to be adopted or taken forward as risk levels did not mandate them. As such, these risk controls can be considered to reduce not only the inherent risk brought about by the TEOW, but the higher level of risk exposure present in the baseline assessment of risk.

138 The controls identified but not adopted or identified but not assessed include:

- Dedicated VTS Operator (Not adopted);
- Use of encounter prediction VTS software (Not adopted);
- Precautionary area/exclamation mark (Not adopted);
- Modification of Tongue Anchorage location (Not adopted);
- Formal charting of Margate Roads Anchorage (Not adopted);
- Undertake responsibility to monitor vessels in Tongue and Margate Roads (VTS Anchor Watch) (Not adopted);
- Review the current powers available to the PLA in the North East Spit Area and consider whether they are sufficient (Not Assessed); and
- Identify any new VTS rules or other guidance that may contribute to enhancing the safety of navigation in the North East Spit (Not Assessed).

139 It may also the case that the risk control measures in place, adopted by the NRAWG, could be further strengthened and refined.

TEOW Control Measures

140 Further to the risk controls identified above, risk controls considered but 'not applied' within the original NRA (for reasons already identified, primarily relating to the measures not being necessary in order to reduce the risk to ALARP) remain under consideration and refinement subject to stakeholder feedback and preferences. These include:

- **Relocate Pilot Transfers Area**
- Relocate pilot transfers as necessary to ameliorate concern over sea room for large vessels at NE Spit under challenging MetOcean or operational conditions. Re-location based on vessel type to north of NE Spit transfer area or alternative pilot diamond, assessed through Shipping and Navigation Liaison Plan / Group using full bridge simulation.
- **Enhanced co-ordination of Pilotage Transfer**

- The improvement of overall situational awareness and more active prior co-ordination of arriving and departing traffic at the NE Spit station could be considered after the construction of the TEOW (this is similar to the controls identified by the PLA for the NE NRA). Early sequencing and prior organisation of the transfers would assist in reducing the onboard workload of the pilot launch crew.
- **Training / Integration**
- Enhance the scope of training for pilot transfer personnel (e.g. ESL coxswains, VTS personnel and pilots) specifically regarding:
    - VTS, traffic management and awareness of themes that will be concerning a pilot or ships master before, during and after transfer.
    - The role of the pilot as a source of advice and guidance for the coxswain when present on the launch should also be explored. The authority and responsibility of the coxswain with regard to the conduct of the transfers would not be changed but discussion and the provision of real time advice by the pilots on board the launch should be actively encouraged.
    - Increase integration and training exposure between pilots, ESL and VTS. (Two days interaction in the PLA simulator between two pilots and two coxswains yielded a range of unanticipated benefits with regard to improved mutual understanding and comprehension of the challenges faced by each group. The benefits of further integration or exposure between the groups involved in pilotage transfer operations could only aid cross fertilisation of procedures, planning and mutual understanding. The inclusion of VTS officers in this process is also strongly encouraged. Inclusion of a pilot launch, TOW and TEOW within the PLA simulator would be necessary to carry out this type of training.)

Risk Control Effectiveness

141 Embedded risk control measures are included in the inherent determination of likelihood and therefore do not carry effectiveness scores for risk reduction.

142 Additional risk controls assessed to determine the residual of risk level are:

- Enhanced Promulgation of Information
- Shipping and Navigation Liaison Group
- Post Consent Monitoring for Operational Phase
- Enhanced Optimisation of TEOW line of orientation and symmetry
- Aids to Navigation / Buoyage

143 These risk controls were scored based on a scale of effectiveness for likelihood reduction (only) for each individual hazard by the project team in a precautionary manner as follows:

- N/A – 0% Reduction for Most Likely and Worst Credible Likelihood

- Low – 15% Reduction for Most Likely and Worst Credible Likelihood
- Medium – 30% Reduction for Most Likely and Worst Credible Likelihood
- High – 50% Reduction for Most Likely and Worst Credible Likelihood

144 When scoring risk control effectiveness, the project team reviewed effectiveness scores with those determined as part of the PLA 2015 NE Spit NRA, which gave effectiveness scores for both likelihood and consequence and scores of up to 80% effective – see Table 19.

Table 19: PLA Risk Control Effectiveness Scores

Haz ID	Haz Title	Risk Control	% Effectiveness Likelihood	% Effectiveness Consequence
1	Collision during or preparing for Pilot boarding / landing operations	ESL/PLA/MPA Pilot cutter scheduling and monitoring process	60	20
		Coordination of Pilot cutter operations on VHF Ch 69	60	60
		Where practicable, prioritise embarking vessels	40	20
		Planning of critical/high risk vessels with ESL/Pilot/VT	10	20
		Additional met sensors closer to NE	5	5
		Provision of charted Pilot boarding grounds to enhance traffic separation	30	20
		Prohibited anchorage area/control of anchorage	10	5
		Additional advice in Admiralty products	10	0
		Dedicated VTS Operator	70	70
2	Collision between vessels in transit	Precautionary area/exclamation mark	20	5
		Enhanced Pilotage/PEC navigational guidance/lessons identified	10	0
		Additional advice in Admiralty products	10	0
		Single channel VHF operations	60	30
		Prohibited anchorage area/control of anchorage	5	5
		Where practicable, prioritise embarking vessels	10	10
		Dedicated VTS Operator	50	30
3	Contact with vessel at Anchor	Modification of Tongue Anchorage location	20	0
		Formal charting of Margate Roads Anchorage	10	0
4	Contact with	Use of encounter prediction VTS software	60	5

Haz ID	Haz Title	Risk Control	% Effectiveness Likelihood	% Effectiveness Consequence
	windfarm or other fixed structure			
5	Grounding of Vessel not at Anchor	ESL/PLA/MPA Pilot cutter scheduling and monitoring process	50	10
		Where practicable, prioritise embarking vessels	40	30
		Planning of critical/high risk vessels with ESL/Pilot/VT	80	20
6	Grounding of vessel at anchor (Margate Roads or Tongue)	Formal charting of Margate Roads Anchorage	10	0
		Undertake responsibility to monitor vessels in Tongue and Margate Roads (VTS Anchor Watch)	40	0

5.6 FSA Step 4: Cost Benefit

145 Cost benefit is an optional step of FSA process and is aimed at determining risk controls to justify As Low As Reasonable Practical (ALARP) judgements. No steps were taken in relation to this step for the Addendum NRA. However, the assessment of cost benefit in the original NRA remains valid.

5.7 FSA Step 5: Results

146 Summary results of the hazard workshop (full details of which are provided in Annex C to this Deadline 5 submission) are given in Table 20, as they relate to the 4 hazards (Hazards Id's 1,2,3 & 4) assessed during the workshop by all attendees. Hazard Id's 4-18 were assessed based by the project team and were updated based on IP comments, provided prior to Examination Deadline 4C (DPWLG), provided by PLA / ESL within their Written Representation at Deadline 4C and clarified, such that the scores recorded in the PLA Written Representation risk assessment are only provided in relation to consequence scores, at Issue Specific Hearing 8.

Table 20: Ranked Hazard List for Baseline (no TEOW) Inherent Risk Scores (TEOW without risk controls) and Residual Risk Score (TEOW with risk controls) presented in full in Annex C to this Deadline 5 submission.

Hazard ID	Category	Vessel Type	Most Likely Hazard Occurrence							Worst Credible Hazard Occurrence							Baseline Risk Score	Baseline Risk Rank	Inherent Risk Score	Inherent Risk Rank	Residual Risk Score	ResidualRisk Rank
			Consequence				Likelihood 1 in x yrs			Consequence				Likelihood 1 in x yrs								
			People	Property	Environment	Stakeholders	Baseline Risk	Inherent Risk	Residual Risk	People	Property	Environment	Stakeholders	Baseline Risk	Inherent Risk	Residual Risk						
1	Collision	Class 1 or 2 vessels	2	2	2	2	36	18	25	4	5	5	5	450	225	307	4.47	3	4.80	1	4.65	1
2	Collision	Class 3 or 4 Vessels	2	2	2	2	27	18	21	4	5	5	4	360	240	284	4.52	1	4.72	3	4.63	2
7	Contact	Class 1 or 2 Vessels	2	2	1	3	45	23	30	4	4	4	4	486	243	329	4.44	4	4.77	2	4.62	3
8	Contact	Class 3 or 4 Vessels	2	2	1	3	40.9	27	31	4	4	4	4	451	301	346	4.48	2	4.67	4	4.60	4
4	Collision	Fishing or Recreational	2	2	1	2	10	8	9	5	3	2	4	500	400	435	4.15	5	4.26	5	4.22	5
3	Collision	Vessel less than 90m	2	2	1	1	27	18	21	4	5	4	4	401	267	316	4.06	7	4.23	6	4.16	6
14	Grounding	Class 3 or 4 Vessels	2	2	2	2	54	41	45	3	4	4	5	720	540	606	4.07	6	4.18	7	4.14	7
13	Grounding	Class 1 or 2 Vessels	2	2	2	2	72	48	57	3	4	4	5	900	600	710	3.97	8	4.13	8	4.06	8
5	Collision	WSV	2	2	1	2	50	40	44	5	4	2	4	1000	800	871	3.74	9	3.83	10	3.79	9
15	Grounding	Vessel less than 90m	2	2	2	2	54	43	47	3	4	3	4	450	360	393	3.74	10	3.83	9	3.79	9
9	Contact	Vessel less than 90m	2	2	1	2	45	30	35	4	4	4	4	900	600	690	3.64	11	3.80	11	3.74	11
11	Contact	Fishing or Recreational	2	2	1	2	20	16	17	4	3	2	3	500	400	420	3.55	12	3.65	12	3.63	12
10	Contact	WSV	2	2	1	2	50	40	42	4	4	2	4	1000	800	850	3.41	14	3.49	13	3.47	13
17	Grounding	WSV	2	2	1	2	25	23	24	4	3	2	4	1250	1125	1180	3.42	13	3.46	15	3.44	14
12	Contact	Pilot Launch	2	2	1	2	50	40	42	4	3	2	3	1000	800	841	3.24	17	3.32	16	3.30	15
18	Grounding	Pilot Launch	2	2	1	2	40	36	38	4	3	2	4	2000	1800	1889	3.25	16	3.28	17	3.27	16
6	Collision	Pilot Launch	2	2	1	2	50	40	45	4	4	2	4	1000	800	904	3.41	14	3.49	13	3.17	17
16	Grounding	Fishing or Recreational	2	1	1	2	25	23	24	4	3	2	3	1250	1125	1180	3.15	18	3.19	18	3.17	17

147 The baseline results from this assessment show that there are seven ALARP level hazards and eleven hazards which score into the low risk category. The seven hazards scored just within the ALARP category include (in order of risk score rank):

1. Collision of a Class 3 or 4 vessel with a risk score at the low end of the ALARP risk category. Risk Score 4.52 /10
2. Contact of a Class 3 or 4 vessel with a risk score at the low end of the ALARP risk category. Risk Score 4.48 /10
3. Collision of a Class 1 or 2 vessel with a risk score at the low end of the ALARP risk category. Risk Score 4.47/10

4. Contact of a Class 1 or 2 vessel with a risk score at the low end of the ALARP risk category. Risk Score 4.44 /10
5. Collision of a Fishing Vessel or Recreational Craft with a risk score at the low end of the ALARP risk category. Risk Score 4.15/10
6. Grounding of a Class 3 or 4 vessel with a risk score at the low end of the ALARP risk category. Risk Score 4.07 /10
7. Collision of a vessel less than 90m with a risk score at the low end of the ALARP risk category. Risk Score 4.06 /10

148 The narrative around the scores applied to these hazards is given in the Workshop Meeting notes appended at Annex C to this Deadline 5 submission and subsequent details received from IPs.

149 As these risk scores fall into the low end of the ALARP category within the baseline risk profile, then it is appropriate to identify risk controls to further manage these hazards where it is cost effective to do so. As ESL and PLA are the primary organisations managing navigation in the area due to the landing and boarding of pilots, despite the navigation jurisdiction being with the Maritime and Coastguard Agency, and based on similar findings in the PLA NE Spit 2015 NRA - PLA / ESL should ensure these (baseline) low ALARP level hazards are monitored and additional controls put in place as deemed necessary.

150 The hazard scores assessed as part of this NRA cannot be directly referenced to those generated within the original NRA, as in this assessment they were broken down by more definitive vessel types (as requested by the PLA / ESL / LPC – by PLA pilotage length characteristics), and the geographical area of focus is the western extent of the proposed project.

151 This approach was put forward to the workshop attendees in advance of, and at the workshop as it allowed the numbers of hazards for consideration to be refined whilst maximising differentiation of hazards pertinent to interested parties. This approach was agreed at the workshop on the 29 March, noting that representatives of London Gateway/Port of Tilbury voiced reservations but were content to go along with the general consensus.

152 It is also the case that when scoring the hazards at the workshop, in all cases hazard likelihoods were assessed as more likely than is evident in the incident data available, For example the incident data suggests that a most likely collision incident would occur for all commercial vessels around 1 in 20 years (see Section 2.6 above) The most likely hazard likelihood scores assessed at the workshop for the baseline case were:

- 1 in 36 years for Class 1 or 2 vessel collision;
- 1 in 27 years for Class 3 or 4 vessel collision; and

- 1 in 27 years for vessel less than 90m collision.

153 If these most likely hazard return rates are summed, a comparison can be made with the incident rate - this gives a return rate for all commercial vessels collisions of 1 in 10 years, double that present if historical incidents were used, and shows that stakeholder concerns have been taken in preference to historical incident rates – even for the baseline assessment of risk.

154 Whilst, as noted above, a direct comparison is not possible, based on different hazard types, these scores correlate well to the residual assessment of risk determined by the PLA in the 2015 assessment (which is effectively the baseline condition for this assessment, and includes the control measures they recommended for adoption and are assumed to be in place).

Inherent Results

155 The inherent risk results from this assessment show that eight hazards (the seven shown in the baseline assessment of risk, with the addition of 'Grounding Class 1 or 2 vessel') remain the highest hazards and the only hazards to be categorised as ALARP level hazards, with increased risk scores brought about by the increase in hazard likelihood.

156 The rank order of hazards has however changed, with the highest individual hazard being associated with collision of a Class 1 or 2 vessel. This reflects stakeholder concern raised throughout the Examination process and as such backups the qualitative judgements raised (noting this was also the case for the original risk assessment which identified that the highest risk hazard was a large commercial vessel collision).

157 The eight ALARP hazards for the inherent assessment of risk are detailed in Table 20 and include:

1. Haz ID 1 - Collision of a Class 1 or 2 vessels. Risk Score 4.79/10
2. Haz ID 7 - Contact of a Class 1 or 2 Vessels. Risk Score 4.77/10
3. Haz ID 2 - Collision of a Class 3 or 4 Vessels. Risk Score 4.71/10
4. Haz ID 8 - Contact of a Class 3 or 4 Vessels. Risk Score 4.67/10
5. Haz ID 4 - Collision of a Fishing or Recreational. Risk Score 4.26/10
6. Haz ID 3 - Collision of a Vessel less than 90m. Risk Score 4.22/10
7. Haz ID 14 - Grounding of a Class 3 or 4 Vessels. Risk Score 4.18/10
8. Haz ID 13 - Grounding of a Class 1 or 2 Vessels. Risk Score 4.12/10

Residual Assessment of Risk

158 The results of the inherent assessment of risk shows that all ALARP hazards scored towards the lowers end of the ALARP Category (4.00-6.99), where control measures would be considered to mostly relate to monitoring and refinement of existing measures, rather than risk control measures that may be considered more substantive in terms of cost.

159 The eight hazards assessed at the low end of the ALARP zone includes (in rank order):

1. Haz ID 1 - Collision of a Class 1 or 2 vessels. Risk Score 4.64/10
2. Haz ID 2 - Collision of a Class 3 or 4 Vessels. Risk Score 4.63/10
3. Haz ID 7 - Contact of a Class 1 or 2 Vessels. Risk Score 4.62/10
4. Haz ID 8 - Contact of a Class 3 or 4 Vessels. Risk Score 4.60/10
5. Haz ID 4 - Collision of a Fishing or Recreational. Risk Score 4.22/10
6. Haz ID 3 - Collision of a Vessel less than 90m. Risk Score 4.15/10
7. Haz ID 14 - Grounding of a Class 3 or 4 Vessels. Risk Score 4.13/10
8. Haz ID 13 - Grounding of a Class 1 or 2 Vessels. Risk Score 4.05/10

160 The remaining 10 hazards scored within the Low Risk category.

161 The TEOW project, through the original NRA has agreed to adopt the following risk control measures related to the operational phase of the wind farm in addition to the embedded risk control measures (for details on the risk controls see Section 5.5 FSA Step 3: Risk Controls):

- Enhanced Promulgation of Information
- Shipping and Navigation Liaison Group
- Enhanced Optimisation of TEOW line of orientation and symmetry
- Aids to Navigation / Buoyage
- Post Consent monitoring

162 Through the consultation process as part of this Addendum NRA, Trinity House have advised the need for post consent monitoring, and in so far as the industry is concerned, post consent monitoring is increasingly becoming standard for Offshore Renewable Energy Installations such as the TEOW project. The complexity of navigation in the vicinity of the TEOW, means that understanding of vessel traffic disposition following the construction of the extension will help in validating the findings of the original and addendum NRA. It will also allow the revision and update of the existing risk controls used to manage navigation in the area as identified in the 2015 PLA North East Spit NRA.

163 Post Consent monitoring is nominally undertaken at intervals post construction, based on the specific details of the project and the area in question. Post consent monitoring provides a clear and proactive evidence basis to assess effectiveness of control measures especially Aids to Navigation. When linked to the Shipping and Navigation Liaison Group it will also enable timely and accurate assessment of adopted control effectiveness.

164 As noted above these risk controls (including post consent monitoring) were assessed based on effectiveness in reducing the likelihood for each individual hazard based on the effectiveness rating scale documented above in Section "Risk Control Effectiveness". Details of the effectiveness scores related to individual hazards can be found in Annex C of the Deadline 5 Submission.

165 Post consent monitoring in self does not necessarily reduce hazard risk scores as it is a monitoring control only, however it would increase the effectiveness of the Enhanced Promulgation of Information, Shipping and Navigation Liaison Group risk and revision of any Aids to Navigation control measures and therefore has been applied within the residual assessment with a low level of effectiveness to accommodate these enhancements.

166 Residual risk scores for all 18 hazards are given in Table 20, and show that the controls mitigate the likelihood increase in risk brought about by the TEOW by approximately 50%.

167 Whilst the individual hazard risk scores assessed in this Addendum NRA demonstrate navigation risk to be acceptable or at least tolerable with controls, it is understood that concern may remain with IPs around some vessel types transiting the area for pilot boarding, particularly around the transit to/from the North East Spit Pilot Boarding area for larger vessels. A risk control, identified within the original NRA and that has not been adopted to date, is the relocation of the NE Spit Pilot Boarding area. Through the introduction of the SEZ, which ensured that the required sea room for pilot transfer was available, then the mandate for any relocation of pilot boarding has dissipated quantitatively.

168 The TEOW, depending on final turbine layout may require the relocation of the Tongue Pilot Diamond slightly further north (noting ESL pilot boarding locations as presented in Section 2).

Risk Controls Not Recommended / Adopted

Risk Control Validation

169 Allied to post-consent monitoring is the possibility of considering, on the basis of the final design of the project, the undertaking of a bridge simulation study to validate the risk controls which have been proposed as part of the project.

170 Although the Applicant does not consider validation to be necessary, a further simulation study would facilitate validation and refinement of control measures, including the placement of buoys and navigational aids.

171 The exercise could also enable improvements to training and integration of pilots and ESL crew, building on the benefits of mutual co-operation that were identified through the pilotage simulation carried out as part of the preparation of the original NRA (see Table 22 of the NRA, unadopted risk control No. 4).

Pilot Boarding

172 A risk control, identified within the original NRA (Table 22, unadopted risk control No. 2) which has not been adopted, is the relocation of the NE Spit Pilot Boarding operations. The Applicant does not consider that the scheme would require any such relocation, as the hazard risk scores assessed in this Addendum NRA demonstrate navigation risk to be acceptable.

173 The Applicant considers that this is confirmed by the introduction of the SEZ, which ensures that the required sea room for pilot transfer would be available. However, if IPs consider that there is a residual concern with pilotage operations, specifically in relation to large vessels dipping the full distance from the north to the NE Spit pilot diamond, it would be feasible for vessels to be the subject of pilot transfers further to the north of that pilot diamond, within the current area of pilot operations.

6 Conclusions and Recommendations

6.1 Conclusions

174 This NRA addendum has considered the implications of the SEZ on the original NRA taking on board concerns raised by the IPs through the Examination process. It has been developed following ongoing consultation with IPs, inclusive of workshops to define the maximum parameters that influence sea room, an introduction of the SEZ which reflected the necessary and precautionary sea room through the application of maximum vessel operation scenarios (4*333m vessels, noting that only a single vessel of this size has transited the inshore route), and through a detailed hazard identification and assessment workshop which all IPs were invited to attend and actively participate. Further a review of hazard consequence scores was provided by PLA / ESL at Examination Deadline 4C which has been used to update some hazard consequence scores.

175 The SEZ makes a marked change to the western boundary of the TEOW in meeting IP sea room requirements for the areas of most concern. As has been demonstrated in previous submissions the SEZ has substantially increased the searoom when compared with the Application boundary.

176 In order to assess the change in navigation risk that the implementation of the SEZ results in when compared to the original RLB application, this Addendum NRA updates the existing NRA through:

- Reference to the extensive data validation exercise submitted at Deadline 4 which robustly demonstrated that underlying data was fit for purpose and represented a robust baseline characterisation of the receiving environment;
- Providing a contemporary update to the incident data utilised to ensure that it represents the best available evidence to inform the analysis of risk likelihood and consequence. This has been done through updated MAIB incident data, and the PLA's incident/near miss data;
- Providing a robust benchmark to the NRA through consideration of IP input at a hazard workshop (and subsequent IP risk score clarifications), and through reference to the PLA NRA conducted for pilotage operations at the NE Spit in 2015; and
- Ensuring that a robust review of the NRA is undertaken utilising expert mariners, practitioners, statutory bodies, and local stakeholders to inform and participate in a revised hazard identification and scoring assessment.

177 The assessment of risk was undertaken, based on available input from IPs and a hazard log drawn up for the Baseline, Inherent and Residual assessment of risk for the TEOW with the SEZ in place. As is evidenced through the introduction of the SEZ the overall magnitude of impact has been reduced when compared to the assessment presented in the NRA that accompanied the application, and the Environmental Statement itself.

178 The Baseline and Inherent assessment of risk was undertaken by IPs as part of a hazard workshop for 4 hazards that represented the hazards identified as having most concern by the IPs. The remaining hazards were assessed by the project team which included a Navigation Risk Expert and two Master Mariners with local and national pilotage experience. Further to this, feedback from PLA / ESL and DPWLG on risk consequence scores from the workshop assessed hazards (HazID 1 – 4) and those scored by the project team post workshop (HazID 5-18) was integrated into the hazard log.

179 The reduction in magnitude that results from the introduction and implementation of the SEZ has led to the most significant of hazards being scored at the very low end of the ALARP risk category, which mandates additional controls be investigated for possible implementation. The assessment has employed the same approach and software employed by the PLA and the baseline hazard scoring is in line with the assessment undertaken by the PLA in 2015.

180 The inherent assessment of risk, with the TEOW in place showed that the most significant hazards increase with the introduction of the proposed project, but that the SEZ results in an overall reduction in magnitude, and therefore risk, compared to the boundary assessed in the application NRA meaning the operation of TEOW would not significantly increase risk to a level that is beyond a low ALARP level.

181 Whilst this assessment has identified that the Baseline and Inherent risks are already at the lower end of the ALARP risk category, the assessment has identified additional risk control measures to reduce the risk further in the Residual Assessment of risk.

182 The risk controls identified include those identified and applied in the original NRA (and noted as adopted and included in the residual assessment of risk), those additional measures that were not adopted, and measures identified by the PLA in the 2015 NE Spit but not applied. The latter having been identified to potentially reduce Baseline risk to a level that was aspired to, but not implemented at that stage by the PLA. It is important to note that, if implemented, the PLA risk control measures would reduce the Baseline risk, and therefore the TEOW Inherent and Residual risk further.

6.2 Recommendations

183 The recommendations of this Addendum NRA are that the following risk control measures, in addition to those identified as embedded should be adopted for the operational phase of the TEOW including:

- Enhanced Promulgation of Information (already adopted by the Applicant)
- Shipping and Navigation Liaison Group (already adopted by the Applicant)
- Post Consent Monitoring for Operational Phase (requested by Trinity House)
- Enhanced Optimisation of TEOW line of orientation and symmetry (already adopted by Applicant)
- Review Aids to Navigation / Buoyage (already adopted by the Applicant)

184 This Addendum NRA does not recommend the introduction of those risk controls not adopted by the PLA from their 2015 NE Spit NRA, and neither does it recommend the other additional risk control measures identified but not adopted. The need for the PLA risk controls resides with the PLA / ESL as primarily navigation users of the area, which should be assessed in conjunction with the MCA as navigation authority for the area. It is noted however that the Shipping and Navigation Liaison Group, as identified by and committed to by the Applicant could also be used to facilitate an update to the PLA NE Spit 2015 risk assessment, which was a recommendation of the assessment itself.