

East Anglia THREE

# Appendix 15.1

## Shipping & Navigation

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# Navigation Risk Assessment

## East Anglia THREE

## Offshore Windfarm

### Appendix 15.1

Prepared by:	Anatec Limited
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**Anatec Aberdeen Office**  
Address 10 Exchange Street, Aberdeen, AB11 6PH, UK  
Tel: 01224 253700  
Fax: 0709 2367306  
Email: aberdeen@anatec.com

**Cambridge Office**  
Braemoor, No. 4 The Warren, Witchford, Ely, Cambs, CB6 2HN  
01353 661200  
0709 2367306  
cambs@anatec.com

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## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION.....</b>	<b>1</b>
1.1	BACKGROUND.....	1
1.2	SCOPE OF THE ASSESSMENT AND METHODOLOGY.....	1
<b>2</b>	<b>REGULATIONS AND GUIDANCE .....</b>	<b>2</b>
<b>3</b>	<b>PROJECT DESCRIPTION.....</b>	<b>3</b>
3.1	INTRODUCTION .....	3
3.2	EAST ANGLIA THREE BOUNDARY.....	3
3.3	STRUCTURE DETAILS .....	4
3.4	CONSTRUCTION PHASING .....	8
3.5	OFFSHORE CABLE CORRIDOR.....	10
<b>4</b>	<b>EMBEDDED MITIGATION .....</b>	<b>12</b>
<b>5</b>	<b>MARINE NAVIGATIONAL MARKINGS .....</b>	<b>16</b>
5.1	INTRODUCTION .....	16
5.2	CONSTRUCTION/DECOMMISSIONING .....	16
5.3	MARKING OF INDIVIDUAL STRUCTURES .....	16
5.4	PROPOSED MARKINGS .....	17
5.5	SUPERINTENDENCE AND MANAGEMENT .....	17
<b>6</b>	<b>CONSULTATION.....</b>	<b>18</b>
<b>7</b>	<b>EXISTING ENVIRONMENT.....</b>	<b>31</b>
7.1	INTRODUCTION .....	31
7.2	IMO ROUTEING MEASURES .....	31
7.3	NAVIGATIONAL AIDS .....	32
7.4	CHARTED ANCHORAGE AREAS.....	33
7.5	PORTS .....	33
7.6	OIL & GAS INFRASTRUCTURE.....	36
7.7	MOD EXERCISE AREAS AND EXPLOSIVES DUMPING GROUNDS – WATER BASED 39	
7.8	MARINE AGGREGATES DREDGING AREAS .....	40
7.9	SUBMARINE CABLES WITHIN THE EAST ANGLIA THREE SITE AND OFFSHORE CABLE CORRIDOR.....	42
7.10	MEHRAS.....	42
7.11	VESSEL TO VESSEL TRANSFERS .....	44
<b>8</b>	<b>METOCEAN DATA.....</b>	<b>46</b>
8.1	WIND .....	46
8.2	WAVE .....	47
8.3	VISIBILITY.....	47
8.4	TIDE .....	48

8.5	POTENTIAL EFFECTS ON WAVES AND TIDAL STREAMS .....	48
8.6	SEDIMENTATION/SCOURING IMPACTING NAVIGABLE WATER DEPTHS IN AREA... 48	
<b>9</b>	<b>MARITIME INCIDENTS .....</b>	<b>49</b>
9.1	INTRODUCTION .....	49
9.2	MARINE ACCIDENT INVESTIGATION BRANCH (MAIB) .....	49
9.3	ROYAL NATIONAL LIFEBOAT INSTITUTION (RNLI) .....	50
<b>10</b>	<b>MARITIME TRAFFIC SURVEYS .....</b>	<b>54</b>
10.1	INTRODUCTION .....	54
10.2	SURVEY DETAILS .....	54
<b>11</b>	<b>SURVEY ANALYSIS .....</b>	<b>55</b>
11.1	SURVEYS OVERVIEW .....	55
11.2	SURVEY DATA BY VESSEL TYPE .....	59
11.3	VESSEL SIZE .....	60
11.4	DESTINATIONS .....	62
11.5	CARGO VESSELS .....	62
11.6	PASSENGER AND CRUISE VESSELS .....	66
11.7	OTHER OPERATIONAL VESSELS .....	68
<b>12</b>	<b>CHANGES TO ROUTEING MEASURES WITHIN DUTCH WATERS .....</b>	<b>70</b>
<b>13</b>	<b>VALIDATION SURVEY 2014.....</b>	<b>72</b>
13.1	VESSEL SIZE (VALIDATION SURVEY) .....	77
13.2	DESTINATION (VALIDATION SURVEY) .....	79
13.3	CARGO VESSELS (VALIDATION SURVEY) .....	79
13.4	PASSENGER AND CRUISE VESSELS (VALIDATION SURVEY) .....	81
13.5	OTHER OPERATIONAL VESSELS (VALIDATION SURVEY) .....	83
<b>14</b>	<b>COMMERCIAL FERRY OPERATORS AND ACTIVITY .....</b>	<b>86</b>
<b>15</b>	<b>RECREATIONAL CRAFT ACTIVITY .....</b>	<b>89</b>
15.1	INTRODUCTION .....	89
15.2	RYA DATA .....	89
15.3	THE EAST ANGLIA THREE SITE RECREATIONAL DATA.....	89
15.4	SURVEY DATA .....	90
15.5	IMPACTS OF STRUCTURES ON WIND MASKING / TURBULENCE OR SHEAR .....	92
15.6	RECREATIONAL VESSEL BLADE AND MAST COLLISION .....	92
15.7	EFFECTS ON RECREATIONAL CRAFT .....	93
<b>16</b>	<b>COMMERCIAL FISHING VESSEL ACTIVITY.....</b>	<b>96</b>
16.1	INTRODUCTION .....	96
16.2	SURVEY TRACKS .....	96
16.3	EFFECTS ON FISHING VESSELS (SAFE NAVIGATION) .....	98
<b>17</b>	<b>BASE CASE 90<sup>TH</sup> PERCENTILE ROUTE ANALYSIS.....</b>	<b>99</b>

<b>18</b>	<b>FUTURE CASE COMMERCIAL VESSEL ROUTEING</b>	<b>103</b>
18.1	ROUTE 14 – NORTH-WEST / SOUTH-EAST TRAFFIC: STENA LINE FERRY ROUTES AND NORTH EAST UK PORTS TO THE NETHERLANDS	103
18.2	ROUTE 15 - NORTH-WEST / SOUTH-EAST TRAFFIC: NORTH EAST UK PORTS TO AMSTERDAM	107
18.3	ROUTE 16 – WEST NORTH-WEST / EAST SOUTH-EAST TRAFFIC: EAST UK PORTS TO AMSTERDAM	111
18.4	ROUTE 17 NORTH WEST / SOUTH EAST: EAST ENGLAND PORTS TO THE NETHERLANDS PORTS	115
18.5	ROUTE 19 EAST / WEST: EAST ENGLAND PORTS TO THE NETHERLANDS PORTS	119
18.6	ROUTE 21 DFDS SEAWAYS ROUTE HARWICH TO ESBJERG	123
18.7	ROUTES 8 AND 9- IMO DWRS	127
18.8	ROUTE 6 AND 7- IMO DWRS	129
<b>19</b>	<b>FUTURE CASE 90<sup>TH</sup> PERCENTILE ROUTE ANALYSIS</b>	<b>133</b>
19.1	EFFECTS ON COMMERCIAL VESSEL ROUTEING	137
19.2	EFFECTS ON COMMERCIAL VESSEL ADVERSE WEATHER ROUTEING	138
<b>20</b>	<b>OFFSHORE CABLE CORRIDOR MARITIME TRAFFIC SURVEY</b>	<b>139</b>
20.1	SURVEY OVERVIEW	139
20.2	SURVEY DATA BY VESSEL TYPE	139
20.3	VESSEL SIZE	144
20.4	OFFSHORE CABLE CORRIDOR ANCHORED VESSELS	146
20.5	EFFECTS FOR OFFSHORE CABLE CORRIDOR	148
<b>21</b>	<b>EMERGENCY RESPONSE</b>	<b>150</b>
21.1	SEARCH AND RESCUE	150
21.2	SALVAGE AND TOWING	154
21.3	EMERGENCY RESPONSE CO-OPERATION PLAN (ERCOP)	155
21.4	MARINE POLLUTION AND COUNTER POLLUTION	156
21.5	ENGAGEMENT WITH ALL RELEVANT GOVERNMENT DEPARTMENTS AND AGENCIES	156
<b>22</b>	<b>HAZARD WORKSHOP</b>	<b>157</b>
22.1	HAZARD WORKSHOP ATTENDANCE	157
22.2	RESULTS	158
<b>23</b>	<b>ALLISION AND COLLISION RISK MODELLING OVERVIEW</b>	<b>160</b>
<b>24</b>	<b>BASE CASE NO WINDFARM MODEL RESULTS</b>	<b>162</b>
24.1	ENCOUNTERS	162
24.2	VESSEL-TO-VESSEL COLLISIONS	166
<b>25</b>	<b>FUTURE CASE NO WINDFARM</b>	<b>169</b>
25.2	VESSEL ALLISION WITH STRUCTURE	169

25.3	POWERED VESSEL ALLISION .....	169
25.4	DRIFTING VESSEL ALLISION .....	173
25.5	FISHING VESSEL ALLISION .....	174
<b>26</b>	<b>FUTURE CASE WITH WINDFARM.....</b>	<b>176</b>
26.1	COMMERCIAL SHIPPING ESTIMATED FUTURE CASE.....	176
26.2	COMMERCIAL FISHING ESTIMATED FUTURE CASE.....	176
26.3	RECREATIONAL VESSEL ESTIMATED FUTURE CASE .....	176
26.4	COLLISION AND ALLISION PROBABILITIES .....	176
26.5	RISK RESULTS SUMMARY .....	176
26.6	CONSEQUENCES.....	178
26.7	EFFECTS ASSOCIATED WITH COLLISION AND ALLISION MODELLING .....	180
<b>27</b>	<b>COMMUNICATION AND POSITION FIXING .....</b>	<b>181</b>
27.1	IMPACT OF MARINE RADAR .....	181
27.2	VERY HIGH FREQUENCY (VHF) COMMUNICATIONS (INCLUDING DIGITAL SELECTIVE CALLING (DSC)).....	184
27.3	VHF DIRECTION FINDING .....	185
27.4	NAVTEX SYSTEMS.....	186
27.5	AIS.....	186
27.6	GPS.....	186
27.7	STRUCTURES AND GENERATORS AFFECTING SONAR SYSTEMS IN AREA .....	187
27.8	ELECTROMAGNETIC INTERFERENCE ON NAVIGATION EQUIPMENT.....	187
27.9	NOISE IMPACT .....	188
27.10	EFFECTS ON COMMUNICATIONS AND POSITION FIXING .....	188
27.11	EFFECTS ON VISUAL COLLISION / ALLISION AVOIDANCE .....	189
<b>28</b>	<b>CUMULATIVE AND IN COMBINATION EFFECTS .....</b>	<b>191</b>
28.1	CUMULATIVE SCREENING .....	191
28.2	INCREASED DEVIATIONS ASSOCIATED WITH OFFSHORE WIND FARM DEVELOPMENTS (INCLUDING TRANSBOUNDARY).....	194
<b>29</b>	<b>NEXT STEPS EIA AND ADDITIONAL MITIGATIONS.....</b>	<b>202</b>
<b>30</b>	<b>FUTURE MONITORING .....</b>	<b>204</b>
30.1	SAFETY MANAGEMENT SYSTEMS (SMS) .....	204
30.2	FUTURE MONITORING OF MARINE TRAFFIC .....	204
30.3	SUBSEA CABLES.....	204
30.4	DECOMMISSIONING PLAN.....	205
<b>31</b>	<b>SUMMARY .....</b>	<b>206</b>
31.1	MARINE TRAFFIC.....	206
31.2	MODELLING .....	207
31.3	HAZARD WORKSOP.....	207
31.4	EMERGENCY RESPONSE.....	208
31.5	CUMULATIVE IMPACTS .....	208
31.6	RECEPTORS FOR THE ENVIRONMENTAL IMPACT ASSESSMENT .....	208



**32 REFERENCES..... 210**

**TABLE OF FIGURES**

Figure 3.1	Chart Overview of East Anglia THREE within Round 3 Zone .....	4
Figure 3.2	Partial Fill Build Scenario Wind Turbines (172) and Substations .....	6
Figure 3.3	100% Fill Build Scenario Wind Turbines (172) and Substations.....	7
Figure 3.4	Offshore cable corridor associated with the East Anglia THREE Project 10	
Figure 7.1	IMO Routeing Measures, Navigational Aids and Anchorages Relative to the proposed East Anglia THREE project .....	32
Figure 7.2	Ports in the vicinity of East Anglia THREE Offshore windfarm.....	34
Figure 7.3	Vessel Arrivals to Principal Ports in proximity to the East Anglia Zone 1994 – 2013.....	35
Figure 7.4	Vessel Tonnage to Principal Ports in proximity to the East Anglia Zone 1984 – 2013.....	36
Figure 7.5	Oil & Gas UKCS Current Licence Areas (February 2014) .....	37
Figure 7.6	Oil and Gas Infrastructure and Existing Oil Fields in the vicinity of the proposed East Anglia THREE project .....	38
Figure 7.7	Military Practice Areas relative to the East Anglia THREE site .....	40
Figure 7.8	Aggregate Dredging Areas relative to the East Anglia THREE site ....	41
Figure 7.9	Cables in the vicinity of the proposed East Anglia THREE project ....	42
Figure 7.10	Marine Environmental High Risk Areas .....	44
Figure 7.11	Vessel to Vessel Transfers .....	45
Figure 8.1	Annual Average Wind Direction .....	46
Figure 8.2	Annual Average Wind Speed.....	47
Figure 8.3	Significant Wave Height Exceedence Curve.....	47
Figure 9.1	MAIB Incident Locations by Type within 10nm of the East Anglia THREE site .....	50
Figure 9.2	RNLI Incidents by Casualty Type within 10nm of the East Anglia THREE site .....	51
Figure 9.3	RNLI Incidents by Cause within 10nm of the East Anglia THREE site	52
Figure 9.4	RNLI Incidents by Station within 10nm of the East Anglia THREE site (2001-10) .....	53
Figure 11.1	Combined AIS and Radar Tracks by Type – August / September 2012 (10 days).....	56
Figure 11.2	Combined AIS and Radar Tracks by Type – May 2013 (10 days) .....	57
Figure 11.3	Combined AIS and Radar Tracks by Type – July / August 2013 (10 days)	58
Figure 11.4	Vessel Type Distribution Passing through East Anglia THREE (30 days)	59
Figure 11.5	Detailed DECC Vessel Type Distribution Passing through East Anglia THREE.....	60
Figure 11.6	Distribution of Vessels Draught (30 Day Combined Baseline Survey Period) .....	61

Figure 11.7	Distribution of Vessel Length (30 Days Combined Baseline Survey Period)	62
Figure 11.8	Main Destination Ports of Vessels passing through East Anglia THREE	62
Figure 11.9	Cargo Vessels (10 days – August and September 2012)	63
Figure 11.10	Cargo Vessels (10 days – May 2013)	64
Figure 11.11	Cargo Vessels (10 days – July / August 2013)	65
Figure 11.12	Passenger Vessels (Combined – 30 days 2012/2013)	67
Figure 11.13	Other Operational Vessels (Combined – 30 days)	69
Figure 12.1	Pre August 1st 2013 Routeing Measures	70
Figure 12.2	Post 1st August 2013 Routeing Measures	71
Figure 13.1	Combined AIS and Radar Tracks by Type – January / February 2014 (10 days)	73
Figure 13.2	Vessels per day Intersecting East Anglia THREE	74
Figure 13.3	Vessels Intersecting the East Anglia THREE site – Joint Busiest Day (28 <sup>th</sup> January 2014)	75
Figure 13.4	Vessel Types Distribution passing through the East Anglia THREE site (10 Days)	76
Figure 13.5	Detailed DECC Vessel Type Distribution Passing through the East Anglia THREE site (10 Days January/February 2014)	77
Figure 13.6	Distribution of Vessel Draught (10 Day Winter Validation Survey Period)	78
Figure 13.7	Distribution of Vessels Length (10 Day Winter Validation Survey Period)	78
Figure 13.8	Main destination ports of vessels passing within 10nm of the East Anglia THREE site	79
Figure 13.9	Cargo Vessels Recorded within 10nm of the East Anglia THREE site (10 Days)	80
Figure 13.10	Passenger Vessels within 10nm of the East Anglia THREE site (10 Days)	82
Figure 13.11	Other Operational Vessels Recorded within 10nm of the East Anglia THREE site (10 Days)	84
Figure 14.1	Vessel Tracks of Commercial Ferries	87
Figure 15.1	Recreational Information for the East Anglia THREE Site	90
Figure 15.2	All Recreational Vessel Tracks (40 days)	91
Figure 15.3	Air Draught Data – IRC Fleet (2002)	93
Figure 16.1	All fishing vessel tracks (40 days)	97
Figure 17.1	90% Shipping Lanes Relative to the East Anglia THREE site	100
Figure 18.1	Route 14 Traffic (40 days)	104
Figure 18.2	Route 14 Vessel Type Distribution	105
Figure 18.3	Alternative Routeing for Route 14– Post construction of the proposed East Anglia THREE project	106
Figure 18.4	Route 15 Traffic (40 days)	108
Figure 18.5	Vessel Type Distribution north north-west / south south-east Traffic	109
Figure 18.6	Alternative Routeing for Route 15 – Post construction of the proposed East Anglia THREE project	110

Figure 18.7	Route 16 Traffic (40 days)	112
Figure 18.8	Route 16 Vessel Type Distribution	113
Figure 18.9	Anticipated Routeing – Post construction of the proposed East Anglia THREE project	114
Figure 18.10	Route 17 Traffic (40 days)	116
Figure 18.11	Route 17 Vessel Type Distribution	117
Figure 18.12	Anticipated Routeing for Route 17 Post construction of the proposed East Anglia THREE project	118
Figure 18.13	Route 19 Traffic (40 days)	120
Figure 18.14	Route 19 Vessel Distribution	121
Figure 18.15	Anticipated Routeing for Route 19 Post Construction of the Proposed East Anglia THREE Project	122
Figure 18.16	Route 21 (40days)	124
Figure 18.17	Route 21 Vessel Type Distribution	125
Figure 18.18	Anticipating Routeing for Route 21 Post East Anglia THREE	126
Figure 18.19	Routes 8 and 9 Traffic (40 Days)	128
Figure 18.20	DWRs 8 and 9 Vessel Type Distribution	129
Figure 18.21	Routes 6 and 7 Traffic (40 Days)	130
Figure 18.22	Route 6 and 7 (including subdivisions) Vessel Type Distribution	131
Figure 19.1	Anticipated 90% Shipping Lanes- Post Construction of the Proposed East Anglia THREE Project (Partial Fill)	134
Figure 19.2	Anticipated 90% Shipping Lanes- Post Construction of the Proposed East Anglia THREE Project (100% Fill)	135
Figure 19.3	10 days of Simulated AIS Data (Partial Fill)	136
Figure 19.4	10 days of Simulated AIS Data (100% Fill)	137
Figure 20.1	Offshore Cable Corridor AIS Tracks by Type (20 days May – August 2013)	140
Figure 20.2	Offshore Cable Corridor Vessel Type Distribution (20 Days May-August 2013)	141
Figure 20.3	Cargo Vessels Recorded within 5nm of Cable Corridor (20 Days)	142
Figure 20.4	Passenger Vessels Recorded within 5nm of Cable Corridor (20 Days)	143
Figure 20.5	Other Operational Vessels within 5nm of Cable Corridor (20 Days)	144
Figure 20.6	Offshore Cable Corridor Vessel Draught Distribution (20 days May – August 2013)	145
Figure 20.7	Offshore Cable Corridor Vessel Length Distribution (20 days May – August 2013)	145
Figure 20.8	Anchored Vessels within 5nm of Offshore Cable Corridor (20 days May – August 2013)	147
Figure 20.9	Daily Count and Vessel Type Distribution of Anchored Vessels (20 days May – August 2013)	148
Figure 21.1	SAR Helicopter Bases relative to the East Anglia THREE Site	152
Figure 21.2	RNLI Bases relative to the East Anglia THREE site	153
Figure 22.1	East Anglia THREE Hazard Ranking Results	159
Figure 24.1	Vessel Encounters Density	163

Figure 24.2	Encounters per day within 10nm of the East Anglia THREE Site .....	164
Figure 24.3	Encounter Vessel Type Distribution .....	165
Figure 24.4	Overview of 1nm encounters during 40 days (AIS & Radar).....	166
Figure 24.5	Vessel-to-Vessel Collision Study Area.....	167
Figure 24.6	Base Case Vessel-to-Vessel Collision Risk.....	168
Figure 25.1	Annual Passing Powered Allision Frequency (Partial Fill Build Scenario)	171
Figure 25.2	Annual Passing Powered Allision Frequency (100% Fill Build Scenario)	172
Figure 26.1	Summary of Change in Annual Collision and Allision Risk Result ....	178
Figure 27.1	Partial Fill Layout and Indicative Radar Buffer Zones .....	183
Figure 27.2	100% Fill Layout and Indicative Radar Buffer Zones .....	184
Figure 28.1	Anticipated Routeing for Route 16 Post Cumulative Scenario .....	198
Figure 28.2	Anticipated Routeing for Route 19 - Cumulative Scenario .....	200

## TABLE OF TABLES

Table 3.1	Corner Co-ordinates of East Anglia THREE site (Longitude / Latitude WGS 84)	3
Table 3.2	Dimensions for Minimum and Maximum Size Machines	5
Table 4.1	Embedded Mitigation	12
Table 4.2	Summary of Safety Zones	14
Table 6.1	Shipping and Navigation Consultation Summary	18
Table 11.1	Cargo and Passenger Vessel Subtypes (DECC Categories)	59
Table 14.1	Commercial Ferry Routes	87
Table 17.1	Main Shipping Lane Descriptions	101
Table 19.1	Summary of Main Route Deviations	133
Table 21.1	Lifeboats held at nearby RNLI stations	154
Table 22.1	Hazard Workshop Invitees	157
Table 25.1	Powered Vessel-to-Structure Allisions – Base Case with Windfarm	170
Table 25.2	Drifting Vessel-to-Structure Allision Frequency (Base Case with Windfarm)	174
Table 25.3	Fishing Vessel-to-Structure Allision Frequency (Base Case with Windfarm)	175
Table 26.1	Summary of Annual Collision and Allision Frequency Results (Partial Fill Build Scenario)	177
Table 26.2	Summary of Annual Collision and Allision Frequency Results (100% Fill Build Scenario)	177
Table 26.3	Annual Predicted change in Potential Loss of Life (PLL) due to the proposed East Anglia THREE project.	179
Table 26.4	Annual Oil Spilled due to the proposed East Anglia THREE project	179
Table 27.1	Summary of Communication and Position Fixing Equipment Effects	188
Table 28.1	Cumulative Screening (10nm around the site)	192
Table 28.2	Cumulative Screening (Routeing)	194
Table 28.3	Summary of Cumulative Main Route Deviations (100% Fill)	201
Table 28.4	Summary of Cumulative Main Route Deviations (Partial Fill)	201

Table 29.1 Additional Mitigation

202

## ABBREVIATIONS

AIS	-	Automatic Identification System
ALARP	-	As Low as Reasonably Practicable
ALB	-	All-Weather Lifeboat
ARPA	-	Automatic Radar Plotting Aid
AtoN	-	Aid to Navigation
ASMS	-	Active Safety Management System
BERR	-	Department for Business Enterprise & Regulatory Reform
BWEA	-	British Wind Energy Association (now RenewableUK)
CA	-	Cruising Association
CAA	-	Civil Aviation Authority
CAST	-	Coastguard Agreement on Salvage and Towage
COLREGS	-	Collision Regulations
CoS	-	Chamber of Shipping
dB	-	Decibels
DECC	-	Department of Energy and Climate Change
DfT	-	Department for Transport
DSC	-	Digital Selective Calling
DWR	-	Deep Water Route
EATL	-	East Anglia THREE Limited
EIA	-	Environmental Impact Assessment
ERCoP	-	Emergency Response Cooperation Plan
EC	-	European Commission
ESE	-	east south-east
EU	-	European Union
FSA	-	Formal Safety Assessment
GIS	-	Geographical Information System
GPS	-	Global Positioning System
GRP	-	Glass Reinforced Plastic
GT	-	Gross Tonnage
HAT	-	Highest Astronomical Tide
HSE	-	Health and Safety Executive
HVAC	-	High Voltage Alternating Current
HVDC	-	High Voltage Direct Current
IALA	-	International Association of Marine Aids to Navigation and Lighthouses
ICES	-	International Council for the Exploration of the Seas
ILB	-	Inshore Lifeboat
IMO	-	International Maritime Organisation
ITOPF	-	International Tanker Owners Pollution Federation Limited
kHz	-	Kilohertz
km	-	Kilometre
LAT	-	Lowest Astronomical Tide
LORAN	-	Long Range Navigation
LPG	-	Liquefied Petroleum Gas
m	-	Metres

MAIB	-	Marine Accident Investigation Branch
MBS	-	Maritime Buoyage System
MCA	-	Maritime and Coastguard Agency
MEHRA	-	Marine Environmental High Risk Area
MF	-	Medium Frequency
MGN	-	Marine Guidance Notice
MHWS	-	Mean High Water Springs
MMO	-	Marine Management Organisation
MOD	-	Ministry of Defence
MRSC	-	Maritime Rescue Sub-Centre
MSL	-	Mean Sea Level
MW	-	Mega-Watt
Navtex	-	Navigational Telex
NCP	-	National Contingency Plan
nm	-	Nautical Miles
NOREL	-	Nautical and Offshore Renewable Energy Liaison
NRA	-	Navigation Risk Assessment
NUC	-	Not Under Command
NVG	-	Night Vision Goggles
OREI	-	Offshore Renewable Energy Installations
OCU	-	Onshore Command Unit
PEXA	-	Practice and Exercise Area
PLA	-	Port of London
PLL	-	Potential Loss of Life
PPE	-	Personal Protective Equipment
QHSE	-	Quality, Health, Security and Environment
RAF	-	Royal Air Force
REWS	-	Radar Early Warning System
REZ	-	Renewable Energy Zones
RNLI	-	Royal National Lifeboat Institution
Ro-Ro	-	Roll-on Roll-off
RYA	-	Royal Yachting Association
SAR	-	Search and Rescue
SPS	-	Significant Peripheral Structure
SNSOWF	-	Southern North Sea Offshore Wind Forum
SMS	-	Safety Management System
T	-	Tonnes
TCE	-	The Crown Estates
THLS	-	Trinity House Lighthouse Service
TSS	-	Traffic Separation Scheme
UK	-	United Kingdom
UKCS	-	United Kingdom Continental Shelf
UKHO	-	United Kingdom Hydrographic Office
VHF	-	Very High Frequency

## GLOSSARY

Term	Definition
Allision	The act of striking or collision of a moving vessel against a stationary object.
Automatic Identification System (AIS)	Automatic Identification System. A system by which vessels automatically broadcast their identity, key statistics e.g. length, brief navigation details e.g. location, destination, speed and current status e.g. survey. Most commercial vessels and EU fishing vessels over 15m are required to have AIS.
Broadly Acceptable	Risk Acceptable with no additional mitigations or monitoring required above industry standard risk reduction measures.
Collision	The act or process of colliding (crashing) between two moving objects.
Cumulative Effect	Refers to impacts on shipping and navigation arising from all the planned and consented UK offshore windfarms (and their associated activities) including those in EU Member State waters. For the purposes of EIA this assessment also includes in-combination impacts which are other receptors and their cumulative impact associated with the development.
Deep Water Route	A deep water route is defined as a route in a designated area within the definite limits which has been accurately surveyed for under keel clearance. It is primarily intended for use by ships which because of their draught in relation to the available water depths are restricted in their choice of route. Through traffic not restricted by draught should, if practicable, avoid following the Deep Water Route.
Marine Guidance Note	A system of guidance notes issued by the Maritime and Coastguard Agency which provide significant advice relating to the improvement of the safety of shipping and of life at sea, and to prevent or minimise pollution from shipping.
Not Under Command (NUC)	Under Part A of the International Regulations for Preventing Collisions at Sea (COLREGS), the term “vessel not under command” means a vessel which through some exceptional circumstance is unable to manoeuvre as required by these Rules and is therefore unable to keep out of the way of another vessel.



<b>Term</b>	<b>Definition</b>
Offshore Renewable Energy Installations (OREI)	<i>Offshore Renewable Energy Installations (OREIs) as defined by Guidance on UK Navigational Practice, Safety and Emergency Response Issues, MGN 371. For the purpose of this report and in keeping with the consistency of the Environmental Impact Assessment, OREI could mean offshore wind turbines and the associated electrical infrastructures such as offshore collector stations, offshore converter stations and offshore reactive stations.</i>
Radar	Radio Detection And Ranging - an object-detection system which uses radio waves to determine the range, altitude, direction, or speed of objects.
Safety Zone	A marine zone demarcated for the purposes of safety around a possibly hazardous installation or works/ construction area. It may exclude other vessels.
Tolerable	Risk Acceptable with suitable and sufficient mitigation measures and monitoring in place.
Traffic Separation Scheme	A Traffic Separation Scheme (TSS) is a traffic-management route-system ruled by the International Maritime Organization. The traffic-lanes (or clearways) indicate the general direction of the ships in that zone; ships navigating within a TSS all sail in the same direction or they cross the lane in an angle as close to 90 degrees as possible.
Unacceptable	Risk Mitigation or Design Modification required.

## **1 Introduction**

### **1.1 Background**

1. Anatec was commissioned by East Anglia THREE Limited (hereby referred to as EATL) to undertake a Navigation Risk Assessment (NRA) for the proposed East Anglia THREE project which is being developed in the Round 3 East Anglia Zone.
2. The report presents information on the preferred project relative to the baseline navigational activity and features for the area. Following this, an assessment of the impact of the East Anglia THREE site on navigation is presented.

### **1.2 Scope of the Assessment and Methodology**

3. An Environmental Impact Assessment (EIA) is a process which identifies the environmental effects, both negative and positive, in accordance with European Union (EU) Directives. A key requirement of the EIA is the Navigational Risk Assessment.
4. The assessment methodology principally followed the Department of Energy and Climate Change (DECC) Risk Assessment Methodology (DECC, 2013 including updates) and the Maritime and Coastguard Agency's (MCA) Marine Guidance Notice 371 (hereby referred to as MGN 371) (MCA, 2008a).
5. The main part of the assessment considers the impact of the surface structures associated with the operational phase of the windfarm on the following maritime activities:
  - Commercial shipping;
  - Commercial Fishing; and
  - Recreational activities including sailing.
6. In addition to these activities, consideration is given to the following impacts:
  - Impacts of Structures on marine radar;
  - Impact of subsea cables;
  - Impacts associated with construction / decommissioning phases; and
  - Cumulative impacts with other nearby developments.

## 2 Regulations and Guidance

7. The assessment methodology principally followed the DECC Risk Assessment Methodology for Assessing Marine Navigational Safety Risks of Offshore Windfarms (DECC, 2013) and the Maritime and Coastguard Agency's (MCA) Marine Guidance Notice 371 (MGN) (MCA, 2008a). This MGN 371 highlights issues that need to be taken into consideration when assessing the impact on navigational safety from offshore renewable energy developments, proposed for United Kingdom internal waters, territorial sea or Renewable Energy Zones; agreed changes made by the Nautical Offshore Renewable Energy Liaison (NOREL) Committee have been included where applicable.
8. A checklist referencing the sections in this report which address all MCA requirements is presented in Annex 15.1.3 MGN Checklist.

### 3 Project Description

#### 3.1 Introduction

9. This section presents details on the East Anglia THREE site and the associated offshore electrical infrastructure, off the coast of East Anglia.

#### 3.2 East Anglia THREE Boundary

10. The East Anglia THREE site is located approximately 36.9 nautical miles (nm) (69 kilometres (km)) east of the port of Lowestoft, on the East Anglian coast. The total area of the site is approximately 88.6nm<sup>2</sup> (305km<sup>2</sup>).

11. The corner coordinates of the East Anglia THREE site are presented below in Table 3.1.

**Table 3.1 Corner Co-ordinates of East Anglia THREE site (Longitude / Latitude WGS 84)**

<b>Corner</b>	<b>Latitude (N)</b>	<b>Longitude (E)</b>
A	52° 45' 10.58364"	002° 45' 33.9894"
B	52° 46' 18.0783"	003° 02' 15.84114"
C	52° 30' 20.025648"	002° 48' 33.265404"
D	52° 31' 31.420308"	002° 45' 33.499116"

12. A chart of the East Anglia THREE site, within the East Anglia Round 3 Zone, is presented in Figure 3.1.

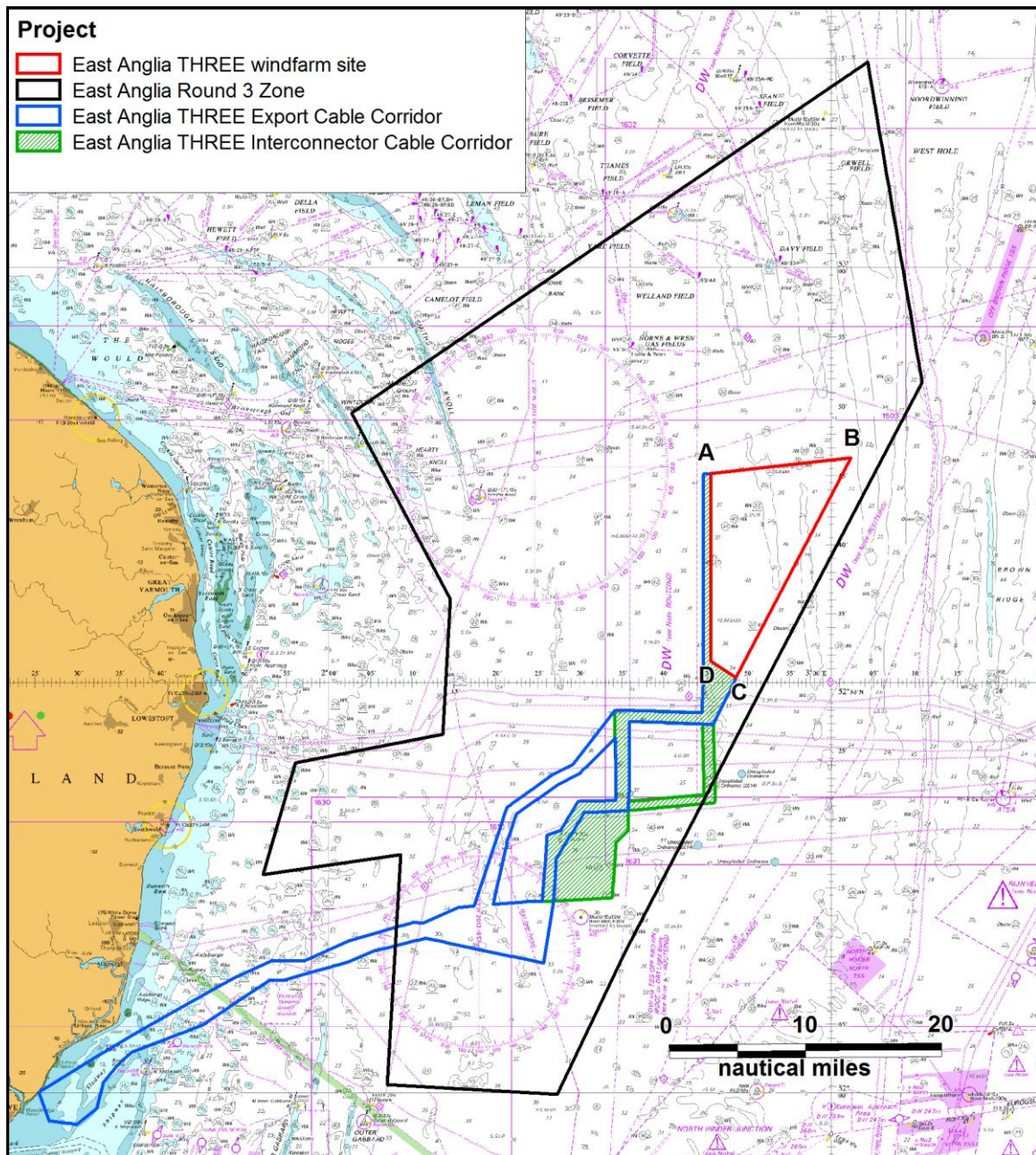


Figure 3.1 Chart Overview of East Anglia THREE within Round 3 Zone

13. The charted water depth (recorded throughout geophysical surveys) of the East Anglia THREE site are typically 35 to 45m with a maximum depth of 49m and a minimum depth of 25m, relative to lowest astronomical tide (LAT)..

### 3.3 Structure Details

14. It is possible that more than one wind turbine type would be used within the East Anglia THREE site, with wind turbine sizes of between 7 Mega Watt (MW) and 12MW being considered. The final windfarm layout would comprise of between 100 (12MW) and 172

(7MW) wind turbines and is expected to generate up to 1,200MW.

15. The table below summarises the dimensions of the smallest and largest possible wind turbines.

**Table 3.2 Dimensions for Minimum and Maximum Size Machines**

<b>Turbine parameter (7-12MW)</b>	<b>Estimated Envelope</b>
Rotor Diameter	154 metres (m) to 220 m
Tip height range	178 m to 247 m (LAT)
Hub height	99m to 150m (Mean Sea Level (MSL))

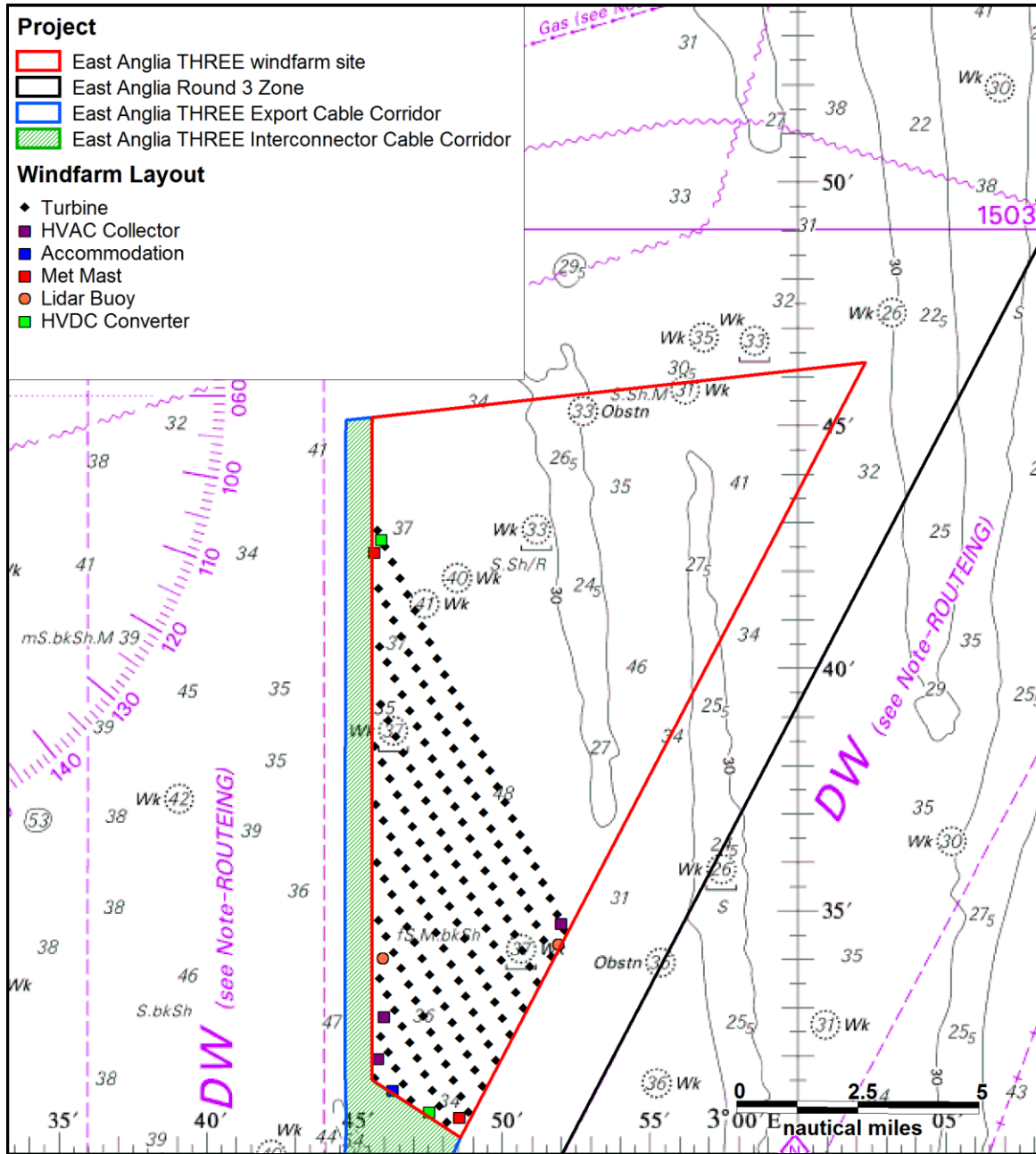
16. There would be a minimum 22m rotor blade tip clearance (air draft over Mean High Water Springs (MHWS)) in accordance with MCA guidance contained within MGN 371.

17. In addition to the wind turbines, there would be up to two offshore converter stations, up to four offshore collector stations, up to one accommodation platform, up to two meteorological masts and two buoys within the East Anglia THREE site.

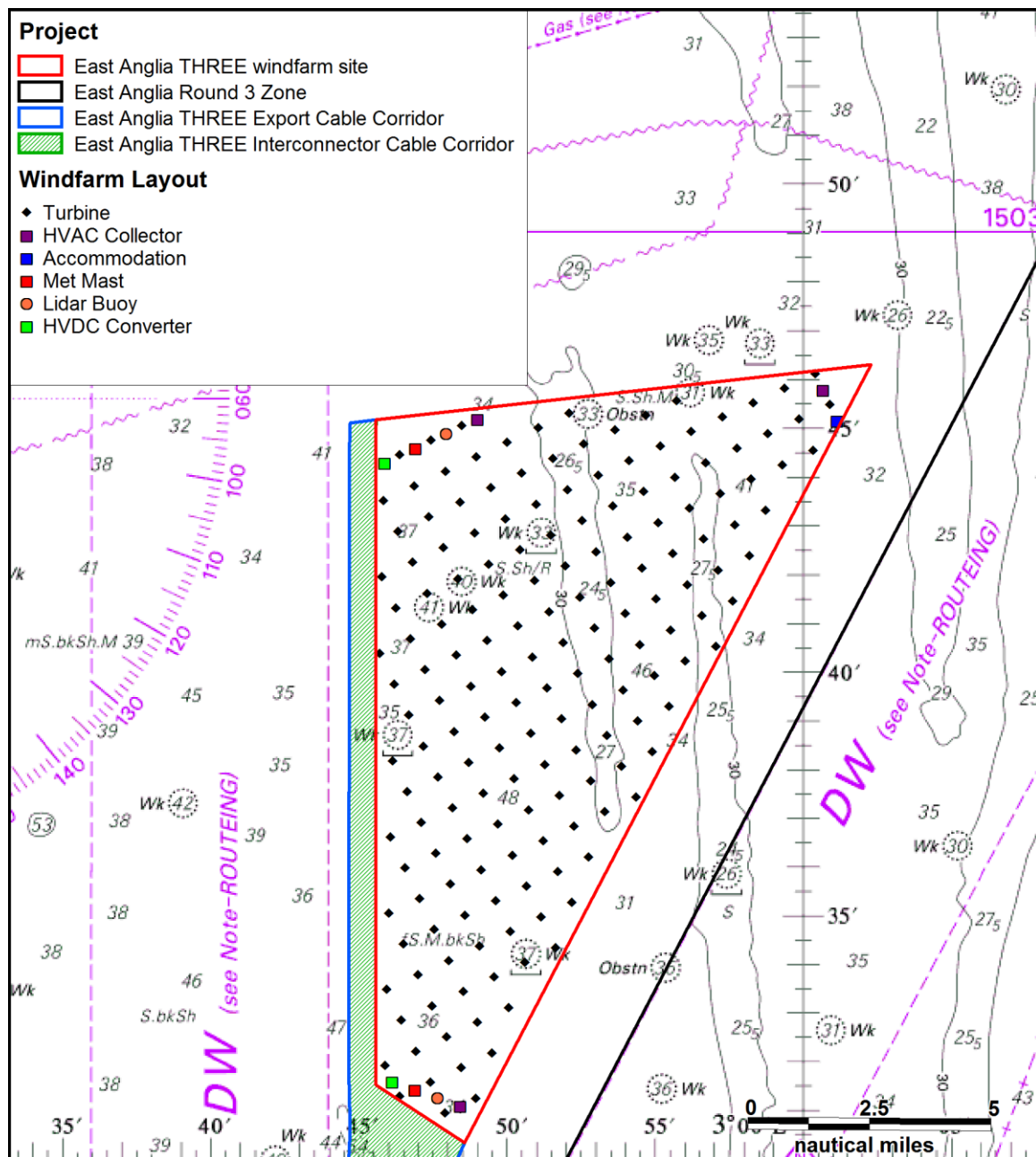
18. The positions of wind turbines and offshore substations in two indicative layouts for risk modelling are presented in the following figures. Figure 3.2 shows the maximum number of wind turbines envisaged for the proposed East Anglia THREE project (172 x 7MW machines) with the minimum spacing between wind turbines (675m x 900m turbine separation), with wind turbines filling the southern part of the site. Figure 3.3 shows a layout with the same number of wind turbines (172 x 7MW machines) with a minimum spacing of 1,250m x 1,250m. This layout (100% fill build scenario) has wind turbines across the entire East Anglia THREE site, leading to the maximum loss in navigable sea room. It should be noted that all addition structures within the windfarm (HVDC converter stations, HVAC collector stations, accommodation platforms, meteorological masts and buoys) have been positioned within the windfarm site where the greatest risk to shipping and navigation is presented.

19. It should be noted that following updates to the construction approach (inclusions of phasing) there is potential for an additional offshore substation (total of six) throughout the Two Phased approach. Furthermore, an additional ten buoys (giving a total of 12) have been proposed. The additional substation or ten buoys have not been considered throughout the allision risk modelling. However EATL will carefully assess the location of any buoys prior to deploying and that final sign off on any layout plans (including construction phase layouts and buoyage) will be a condition within the Development Consent Order (DCO) which allows the the key maritime regulators to confirm that they are content that the additional buoys would not cause any increased risk.

20. The layouts modelled within the NRA are considered worst case due to the placement of additional structures (substations, meteorological masts, accommodation platform and buoys) on the periphery of the East Anglia THREE site in proximity to passing traffic, something which EATL have committed to avoiding.



**Figure 3.2 Partial Fill Build Scenario Wind Turbines (172) and Substations**



**Figure 3.3 100% Fill Build Scenario Wind Turbines (172) and Substations**

- Four foundation concepts have been considered for the East Anglia THREE site. Foundation types could either be jackets, gravity base structures, suction caissons or monopiles, with the possibility of a combination of these foundation types being used across the site.
- In accordance with industry practice, EATL is undertaking the impact assessment based on the worst case scenario of predicted impacts, or Rochdale Envelope. For the worst case collision risk assessment, the maximum wind turbine foundation of 38 x 38m has been assumed (largest jacket suction bucket foundation), although the dimensions of jacket foundations would be dependent on water depths.



23. The largest topside dimensions for the HVAC substations (26 x 41m), HVDC converter stations (120 x 80m) and accommodation platforms (70 x 70m) have been used within the collision risk modelling.
24. Meteorological Masts 25 x 25m and buoys (2.8m diameter) have also been considered with the realistic worst case. It should be noted that the location of the buoys are indicative only.

### **3.4 Construction Phasing**

25. EATL are considering constructing the proposed East Anglia THREE project using a Single Phase or a Two Phased approach. EATL have an agreement for lease for up to 1.2GW, however for commercial reasons and in particular under the new Contracts for Difference regime, the DCO will maintain the aforementioned two options for construction.

#### **3.4.1 Single Phase**

26. The key elements of the single phase approach are as follows:
- A single build period (up to 1200MW installed in a single construction period);
  - It is expected that the construction period would commence at some point between 2020 and 2025; and
  - Overall construction would be 43 months including:
    - Offshore construction including offshore cable laying for approximately 43 months;
    - Onshore substation and cable installation for approximately 14 months.

#### **3.4.2 Two Phased**

27. The key elements of the Two Phased approach are as follows:
- Two phases of construction, of up to 600MW each (essentially two smaller projects);
  - The start of Phase 1 would be separated from the start of Phase 2 by no more than 18 months (from commencement of Phase 1 onshore works to the commencement of Phase 2 onshore works);
  - It is expected that the construction period would commence at some point between 2020 and 2025;
    - The total construction period for Phase 1 and Phase 2 would span approximately 45 months, (based on two overlapping construction periods of approximately 28 months and 23 months).
28. The Two Phased approach to construction has implications in terms of infrastructure, even though the final installed windfarm capacity would remain the same. Throughout the Two Phased approach the maximum number of offshore electrical platforms and vessel movements increases to a total of six platforms and 7,600 vessel movements compared to a total of five platforms and 5,700 vessel movements throughout the single phase approach.

29. Throughout the Two Phased approach the number of vessel movements (7,600) increases compared to the Single Phase approach (5,700). However, the total number of construction vessels (total of 55) remains consistent for both the Single Phase and Two Phased approach (and the same as originally assessed within the initial NRA undertaken in 2014). For the purposes of this assessment the increase in the total number of vessel movements throughout the Two Phased approach is assumed to increase the overall risk. However, the overall risk is assumed to remain within the same risk ranking due to the implementation of embedded mitigation measures such as designation of construction traffic corridors and entry / exit points to the East Anglia THREE site. Furthermore, all works traffic shall be under the control of the EATL marine traffic coordinator. Therefore the increase in vessel movements throughout the Two Phased approach is assumed not to alter the final outcomes of the impact assessment.

### 3.5 Offshore Cable Corridor

30. An overview of the offshore cable corridor is presented in Figure 3.4.

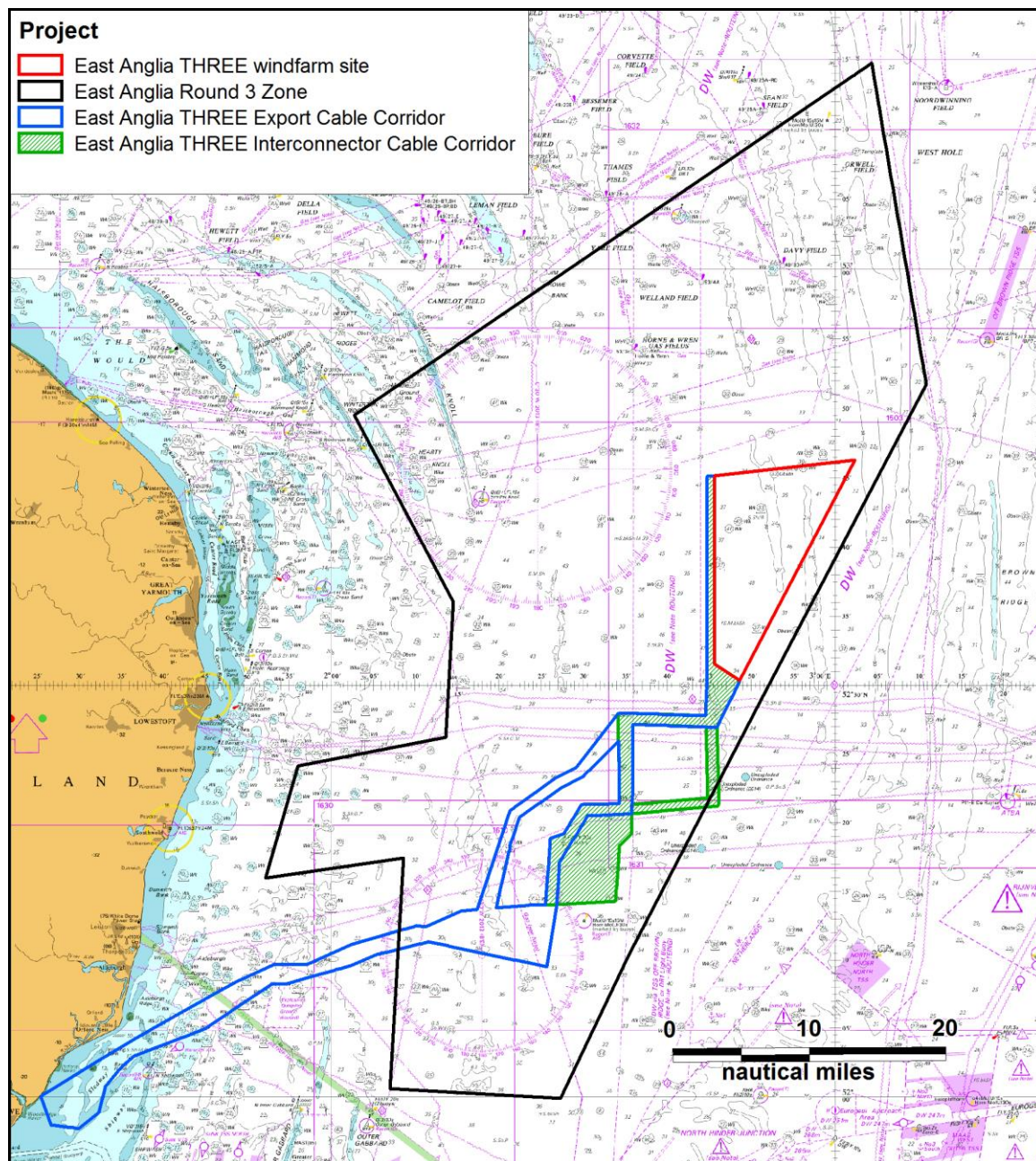


Figure 3.4 Offshore cable corridor associated with the East Anglia THREE Project

31. The export cable corridor runs for approximately 70nm west and south from the western boundary of the East Anglia THREE site making land fall to the north of Felixstowe, at Bawdsey (Suffolk).

32. The interconnector cable corridor runs south from the western boundary of the East Anglia THREE site to the East Anglia ONE project.

## 4 Embedded Mitigation

33. As well as compliance with MGN 371 the following table notes standard industry practices that are considered embedded mitigation. The impact assessment within Chapter 15 Shipping and Navigation, as well as any assessment within the NRA considered all of the following to be embedded and significance assessed accordingly.

Table 4.1 Embedded Mitigation

Mitigation	Description
<b>Marked on Admiralty Charts</b>	The windfarm would be charted by the UK Hydrographic Office (UKHO). This could include turbines, offshore cable corridor (specific location of export cables) and inter array cables for the appropriate scale charts.
<b>Promulgation of Information</b>	Appropriate liaison and dissemination of information and warnings through Notices to Mariners and other appropriate media, (e.g. Admiralty Charts and fishermen’s awareness charts) would enable vessels to effectively and safely passage plan around the East Anglia THREE site.
<b>Navigational Marking and Lighting</b>	Structures within the windfarm site would be marked and lit in accordance with International Association of Lighthouse Authorities (IALA) Recommendation O-139 on the Marking of Man-Made Offshore Structures (IALA, 2008), but may also include the use of other visual and sounds aids to navigation as agreed with THLS.
<b>Minimum Blade Clearance</b>	Wind turbines would be constructed to ensure that the minimum rotor blade clearance (air draught) is at least 22m above MHWS.
<b>Inter-array and export cable protection</b>	Inter-array and export cables would be protected appropriately taking into account fishing and anchoring practices and an appropriate burial protection index study. Positions of cables would be promulgated and charted by appropriate means.
<b>Compliance with MCA’s Marine Guidance Notice (MGN) 371 including Annex 5</b>	Annex 5 specifies ‘standards and procedures for generator shutdown and other operational requirements in the event of a Search and Rescue, counter

Mitigation	Description
	pollution or salvage incident in around an Offshore Renewable Energy Installations (OREI)'. Where required 500msafety zones could be used around current areas of constructions, major maintenance and decommissioning.
<b>Application and Use of Safety Zones of up to 500 metres during Construction, operations &amp; maintenance and Decommissioning (see table 4.2)</b>	Additionally a 50m safety zone may also be applied for around the structures where construction works have been completed but prior to the windfarm being commissioned.
<b>Pre-commissioning safety zones</b>	An Emergency Response and Cooperation Plan (ERCoP) is being developed and implemented for the construction, operational & maintenance and decommissioning phases. The ERCoP is based on the standard MCA template and would consider the potential for self-help capability as part of the ongoing process.
<b>Development and implementation of an Emergency Response and Cooperation Plan (ERCoP)</b>	Guard vessels would be used during construction, decommissioning and significant maintenance to both protect the installations and workers on the wind turbines, particularly in areas in proximity to main traffic routes. Their role would be to both alert vessels to the development activity and provide support in the event of an emergency situation.
<b>Guard vessels during construction and decommissioning</b>	

Mitigation	Description
<b>Monitoring</b>	Active monitoring of development to ensure that the structures and / or cables to not become a hazard to navigation over time. For example export or inter-array cables becoming exposed.
<b>Automatic Identification System (AIS) Carriage on Support Vessels</b>	All support craft associated with the development would carry a minimum of AIS B Class system.
<b>A minimum of one single line of orientation required with the final agreed layout</b>	Recent changes to marine guidance (MGN 371) require all offshore windfarm sites to maintain at least one single direction of orientation to assist surface craft navigation and also used as search and rescue corridors. Phased development will also be required to consider cumulative impacts of alignment.
<b>ID Marking</b>	Individual OREI marking should conform to a spread sheet layout, i.e. lettered on the horizontal axis, and numbered on the vertical axis. The detail of this will depend on the shape, geographical orientation of the final sites. Again cumulative considerations with phasing shall also be considered

34. The expected safety zones are summarised in Table 4.2.

Table 4.2 Summary of Safety Zones

Type of Safety Zone	Area Covered
<b>Construction</b>	Typically up to 500m around single wind turbines under construction.
<b>Construction (pre-commissioning)</b>	Typically up to 50m around wind turbines where construction has finished but some work is on-going e.g. wind turbine incomplete or in the process of being commissioned.
<b>Operation</b>	Typically up to 50m where justified by risk assessment and successfully applied for.
<b>Major Maintenance</b>	Typically up to 500m when major maintenance is in progress. This is usually evidenced by the presence of a jack-up rig or other large vessel.

<b>Type of Safety Zone</b>	<b>Area Covered</b>
<b>Decommissioning</b>	Typically up to 500m at the end of the working life of a windfarm when it is being decommissioned.

35. The existence of safety zones would be published electronically and via Notices to Mariners.

## **5 Marine Navigational Markings**

### **5.1 Introduction**

36. Throughout the life of the project marine navigational marking would be provided in accordance with the Trinity House Lighthouse Services (THLS) requirements, which would comply with IALA Recommendation O-139 on the Marking of Offshore Wind Farms (IALA, 2008) and the additional requirements of MCA MGN 371 (MCA, 2008a).
37. Aviation lighting would be as per Civil Aviation Authority (CAA) requirements; however it is likely that specific requirements will be made with regards to flash sequences and Search and Rescue (SAR) lighting.
38. THLS have stated throughout consultation a requirement for all aviation lighting to be synchronised and to exhibit red Morse code “W” light characteristics. EATL shall consult with the CAA to seek agreement on this along with the other aviation requirements.

### **5.2 Construction/Decommissioning**

39. During the construction / decommissioning of an offshore windfarm, working areas would be established and marked in accordance with the IALA Maritime Buoyage System (MBS). In addition to this, where advised by THLS, additional temporary marking would be applied.
40. Notices to Mariners, Radio Navigational Warnings (Navtex) and / or broadcast warnings would be promulgated in advance of and during construction / decommissioning of any individual structure / windfarm.
41. The markings for the East Anglia THREE site would be agreed in consultation with THLS once the final wind turbine layout has been selected

### **5.3 Marking of Individual Structures**

42. The tower of every wind generator would be painted yellow all around from the level of Highest Astronomical Tide (HAT) to 15m or the height of the Aid to Navigation, if fitted, whichever is greater.
43. As per MGN 371, each of the structures would be marked with clearly visible unique identification characteristics at a location that is easily and readily serviceable. The identifications characteristics would each be illuminated by a low-intensity light, so that the sign is visible from a vessel thus enabling the structure to be identified at a suitable distance to avoid a collision with it. This would be such that under normal conditions of visibility and all known tidal conditions, they are clearly readable by an observer (with naked eye), stationed three metres above sea levels, and at a distance of at least 150 metres from the turbine. The light would be either hooded or baffled so as to avoid unnecessary light pollution or confusion with navigation marks.
44. Turbines would also comply with CAA however it is likely that THLS would require Morse W. Agreement on which wind turbines will be marked would be required upon final site design.



#### **5.4 Proposed Markings**

45. The markings for the East Anglia THREE site would be agreed in consultation with THLS once the final turbine layout has been selected and would be in line with IALA Recommendation O-139.

#### **5.5 Superintendence and Management**

46. EATL would ensure that they have a reliable maintenance and response regime in place such that the required 99% availability targets are met. The method of ensuring this availability would be defined with the Aids to Navigation monitoring plan which may include remote sensing, secondary lighting or maintenance regimes.

## 6 Consultation

47. Consultation on navigational issues has been carried out with key stakeholders. Table 6.1 summarised the main consultation meetings held to date for the East Anglia THREE site and the East Anglia zone.

**Table 6.1 Shipping and Navigation Consultation Summary**

Stakeholder	Contact Type and Date	Summary	EATL Action
MCA	(East Anglia ONE consultation)	<ul style="list-style-type: none"> <li>i. Due cognisance needs to address cable burial and protection, particularly close to shore where impacts on navigable water depth may become significant.</li> <li>ii. Existing charted anchorage areas should be avoided.</li> <li>iii. It is imperative that international trade routes remain fully open and unrestricted. Any mitigation measures required must ensure that routes are not compromised.</li> <li>iv. The potential volume of shipping that could be anchored off Southwold should be noted. It should be noted that a number of ship-to-ship incidents have been previously reported but not formally recorded.</li> <li>v. Many more drifting vessel incidents occur offshore than are</li> </ul>	<ul style="list-style-type: none"> <li>i. Section 4 summarises embedded mitigations including cable burial and protection. Any resultant reduction in navigable water depth would be consulted on and marked with aids to navigation where necessary.</li> <li>ii. Section 7.4 summarises charted anchorage areas in proximity to the proposed East Anglia THREE project.</li> <li>iii. Section 18 assesses the impact of the East Anglia THREE site on commercial vessel routeing. Section 28 assesses cumulative and in combination effects.</li> <li>iv. Section 20.4 assesses anchoring activity in proximity to the offshore cable corridor, including off</li> </ul>

		<p>formally reported, the realistic risk of a drifting ship allision can be assumed to be far greater than that presented. While the risk of hitting one turbine remains small the risk of hitting one turbine within a group is clearly greater, the developer will need to ensure this is addressed within its emergency response plans.</p> <p>vi. Coastguard Agreement on Salvage &amp; Towing (CAST) is a tool the MCA has which may be invoked in situations where there is significant risk of major pollution to the UK Pollution Control Zone (it is not something that the developer can request). CAST should not be considered by the developer as its first line of defence.</p>	<p>Southwold.</p> <p>v. Noted and will be considered throughout development of the ERCoP.</p> <p>vi. Section 21.2 summarises EATLs commitment to emergency salvage and towing. It should be noted that EATL would attempt to provide salvage and towage, where immediate assistance is necessary, within the limits of its own vessel and crew capabilities.</p>
Trinity House Lighthouse Services	(East Anglia ONE consultation)	<p>i. Should the required export cable burial depth not be reached, careful consideration and consultation should be given to identify the best way forward. If cable protection is required and deemed to be a hazard to navigation by Trinity House, this will need to be permanently marked with aids to</p>	<p>i. Section 4 summarises embedded mitigation measures including cable burial and protection. Any resultant reduction in navigable water depth would be consulted on and marked with aids to navigation where necessary.</p>

		navigation for as long as the danger exists.	
Royal Yachting Association	(East Anglia ONE consultation)	i. The approaches to the intended cable landfall area of Bawdsey Cliff and the area for at least a mile out to the sea is seldom deeper than 6m below Chart Datum. The inshore route and general sailing area is a popular with recreational boaters on this part of the coast. The RYA would therefore object to any cable protection measures that reduce the current charted depth of water in this area.	i. Section 4 summarises embedded mitigation measures including cable burial and protection. Any resultant reduction in navigable water depth would be consulted on and marked with aids to navigation where necessary.
Nautical and Offshore Renewable Energy Liaison navigation sub group (NOREL)	May 2011 (East Anglia ONE consultation)	i. Discussed the safety of shipping within the southern North Sea.	i. Noted and considered throughout Sections 18 and 28.2.
Trinity House Lighthouse Services, MCA, Department for Transport, SMart Wind & Forewind.	October 2011 (East Anglia ONE consultation)	i. Discussed transboundary issues and cumulative impacts across the North Sea.	i. Noted and considered throughout Section 28- cumulative and in combination effects.
Forewind, SMart Wind and Maritime Transport – Belgian Federal Public Service Mobility & Transport.	November 2011 (East Anglia ONE consultation)	i. Discussed transboundary issues and cumulative impacts across the North Sea. EATL clarified that there should be no real impact to Belgian shipping by the proposed developments.	i. Noted and considered throughout Section 28- cumulative and in combination effects.

Forewind, Smart Wind & Rijkswaterstaat	November 2011 (East Anglia ONE consultation)	i. Discussed transboundary issues and cumulative impacts across the North Sea.	i. Noted and considered throughout Section 28- cumulative and in combination effects.
Forewind, Smart Wind & the German BMVBS and WSD	January 2012 (East Anglia ONE consultation)	i. Discussed transboundary issues and cumulative impacts across the North Sea.	i. Noted and considered throughout Section 28- cumulative and in combination effects.
Forewind, Smart Wind, MCA, Department for Transport & Minister for Shipping	January 2012 (East Anglia ONE consultation)	i. Discussed transboundary issues and cumulative impacts across the North Sea and emergency response and port development.	i. Noted and considered throughout Section 28 (cumulative and in combination effects) and Section 21 (emergency response).
Trinity House Lighthouse Services	December 2012	i. The possible cumulative and in-combination effects on shipping routes and patterns should be fully assessed.	i. Section 28 summarises cumulative and in combination effects (including transboundary).
MCA	December 2012	i. Particular consideration will need to be given to the implications of the site size and location on SAR resources and emergency Response & Co-operation Plans (ERCoP) and Guard Vessel provisions.	i. Section 21 summarises existing emergency response resources including provision of an ERCoP (Section 21.3).
CLdN (formerly Cobelfret)	January 2014	i. Main concern was additional fuel cost from rerouteing of ferries, rather than any safety concerns regarding the placement of turbines, or construction or operation and maintenance vessels.	i. Section 18 assesses the impact of the East Anglia THREE site on commercial vessel routing.

DFDS Ferries	February 2014 (Hazard Workshop)	<ul style="list-style-type: none"> <li>i. Ferry routeing is well represented by the marine traffic survey data.</li> <li>ii. Due to the implementation of low sulphur fuel requirements (beginning 2015), it is possible existing (longer) routes could be removed.</li> <li>iii. Vessel collision / allision with a windfarm structure were identified as greatest concern. However, the four engine configuration of most ferries minimised the likelihood of a ferry drifting and alliding with a windfarm structure.</li> <li>iv. Indicated a preference for inclusion of electronic aids to navigation to mark windfarm.</li> <li>v. Stated that adverse weather routeing is crucial for this area and loss of adverse weather routes could be problematic.</li> <li>vi. Raised concerns over the impact of ancillary windfarm support craft on normal ferry operations i.e. the need for a passing ferry to respond to an incident involving a windfarm support vessel.</li> </ul>	<ul style="list-style-type: none"> <li>i. Sections 11 &amp; 13 summarise maritime traffic surveys carried out and Section 14 summarises commercial shipping operating in proximity to the East Anglia THREE site.</li> <li>ii. Noted.</li> <li>iii. Section 26 assesses the risk of vessel collision / allision with a windfarm structure.</li> <li>iv. Section 4 summarises embedded mitigations including the requirement of aids to navigation.</li> <li>v. Section 19.2 summarises effects on commercial vessel adverse weather routing.</li> <li>vi. Noted.</li> </ul>
P&O Ferries	February 2014 (Hazard Workshop)	<ul style="list-style-type: none"> <li>i. Ferry routeing is well represented by the marine traffic survey data.</li> <li>ii. It is likely that P&amp;O</li> </ul>	<ul style="list-style-type: none"> <li>i. Sections 11 &amp; 13 summarise maritime traffic surveys carried out and Section 14 summarises</li> </ul>

		<p>vessels would route further north of current route when passing East Anglia THREE during periods of reduced visibility.</p> <p>iii. Vessel collision / allision with a windfarm structure were identified as greatest concern.</p> <p>iv. Indicated a preference for inclusion of electronic aids to navigation to mark windfarm.</p> <p>v. Stated that adverse weather routeing is crucial for this area and loss of adverse weather routes could be problematic.</p>	<p>commercial shipping operating in proximity to the East Anglia THREE site.</p> <p>ii. Noted and considered throughout Section 18- Future case commercial vessel routeing.</p> <p>iii. Section 26 assesses the risk of vessel collision / allision with a windfarm structure.</p> <p>iv. Section 4 summarises embedded mitigations including the requirement of aids to navigation.</p> <p>v. Section 19.2 summarises effects on commercial vessel adverse weather routeing.</p>
<p>Hanson Marine Aggregates</p>	<p>February 2014 (Hazard Workshop)</p>	<p>i. No concerns regarding the potential impact of East Anglia THREE on current active dredge regions.</p> <p>ii. No concerns regarding the risk of an emergency anchoring situation.</p> <p>iii. Forecasts that dredging activity in the area will be operational for up to 25 years and due to increasing demand for coarse material, has significant potential to increase and therefore future vessel routeing should be considered.</p>	<p>i. Noted.</p> <p>ii. Noted.</p> <p>iii. Section 28.2 assesses the impact of cumulative offshore windfarm developments on vessel routeing.</p> <p>iv. Section 19.2 summarises effects on commercial vessel (including dredgers) adverse weather routeing. It should be noted that the development of the</p>

		<p>iv. Satisfied that the current zonal scenario (East Anglia ONE, East Anglia THREE and East Anglia FOUR) was satisfactory and did not significantly impact upon dredge operations, including routeing. However, the loss of adverse weather routes and future cumulative impacts, following further zonal development, were of concern.</p>	<p>East Anglia Zone beyond East Anglia ONE and East Anglia THREE has not been considered throughout this assessment. East Anglia FOUR was previously considered throughout the hazard workshop. However following amendments to the development schedule East Anglia FOUR has not been included in the cumulative assessment. .</p>
Royal National Lifeboat Institute	February 2014 (Hazard Workshop)	<p>i. Adequate marking of turbines (coding and lettering) was identified to be of high importance.</p> <p>ii. Primary emergency response is much more likely to be by helicopter given distance offshore and likely response time of lifeboat.</p> <p>iii. Main concern was the creation of ‘choke points’ on the landward side of East Anglia THREE due to increases in construction traffic.</p>	<p>i. Section 4 summarises embedded mitigations including the marking of wind turbines.</p> <p>ii. Noted and considered throughout Section 21.1- Search and Rescue.</p> <p>iii. Noted and considered throughout assessment of future case commercial vessel routeing (Section 18).</p>
Brown & May Marine Ltd.	February 2014 (Hazard Workshop)	<p>i. Indicated that fishing vessel gear snagging on windfarm structures would be a potential problem.</p> <p>ii. Highlighted the importance of ensuring final turbine layout is</p>	<p>i. Impacts associated with fishing activity are considered in Chapter 14- Commercial Fisheries.</p> <p>ii. Noted and will be</p>



		<p>orientated with the dominant tide direction.</p> <p>iii. If deemed necessary, use of 50m safety zones during operational phase were supported.</p> <p>iv. Stated that the likelihood of vessel-to-vessel collisions occurring within the windfarm was low.</p>	<p>considered throughout final layout design; noting the potential limitations based on MCA SAR requirements.</p> <p>iii. Noted.</p> <p>iv. Noted and considered throughout Section 16.3- Fishing Vessel Allision.</p>
Rederscentrale (Belgian Fisheries)	February 2014 (Hazard Workshop)	<p>i. Stated that rock dumping as a form of cable protection is not a preferential method.</p> <p>ii. If deemed necessary, use of 50m safety zones during operational phase were supported.</p> <p>iii. Stated that the likelihood of vessel-to-vessel collisions occurring within the windfarm was low. Stated that larger spacing between turbines would lower the risk.</p>	<p>i. Noted.</p> <p>ii. Noted.</p> <p>iii. Noted and considered throughout Section 16.3- Fishing Vessel Allision.</p>
VisNed (Netherlands Fisheries)	February 2014 (Hazard Workshop)	<p>i. Highlighted the need for adequate cable burial or protection given the stochastic nature of the seabed and typical penetration depths (20cm) of beam trawling.</p> <p>ii. If deemed necessary, use of 50m safety zones during operational phase were supported.</p> <p>iii. Stated that the likelihood of vessel-to-vessel collisions occurring within the windfarm was</p>	<p>i. Section 4 summarises embedded mitigations including cable burial or protection.</p> <p>ii. Noted.</p> <p>iii. Noted and considered throughout Section 16.3- Fishing Vessel Allision.</p>

		low with fishermen likely to be more alert whilst fishing within the windfarm.	
Cruising Association	February 2014 (Hazard Workshop)	<ul style="list-style-type: none"> <li>i. Raised concerns on the potential for increased vessel-to-vessel encounters following construction of the windfarm, including potential consequences of a large vessel encountering recreational craft and the risk of a recreational vessel-to-vessel collision occurring within the windfarm. However it was agreed that the likelihood of such an event was low.</li> <li>ii. Stated that current mitigation measures were sufficient to adequately reduce the risk to recreational craft.</li> <li>iii. Requested that cable protection methods ensure 'no humps' over the cable route in depths of less than 10m.</li> </ul>	<ul style="list-style-type: none"> <li>i. Section 24.1 assesses baseline vessel-to-vessel encounters in proximity to the East Anglia THREE site. Section 26 assesses recreational vessel collision / allision risk.</li> <li>ii. Section 4 summarises embedded mitigation measures.</li> <li>iii. Noted.</li> </ul>
Rijkswaterstaat Zee en Delta	July 2014 (S42 Response)	<ul style="list-style-type: none"> <li>i. Stated concerns regarding the risk related to shipping movements south of East Anglia THREE. Stated that the situation on the southern boundary of East Anglia THREE is unlikely to be safe without additional measures.</li> <li>ii. The distance to the deep water route on the West side of East</li> </ul>	<ul style="list-style-type: none"> <li>i. Section 26 assesses the risk of vessel collision / allision with a windfarm structure. Section 29 summarises potential additional mitigations.</li> <li>ii. Appendix 15.1.5 Deep Water Route Buffer Analysis (2015)</li> <li>iii. Regulation and</li> </ul>

		<p>Anglia THREE is not sufficient regarding our guidelines determining safe shipping distance. These guidelines require a minimum distance of 1.87nm to an object. Though this DWR is currently of lesser interest to Dutch ports, we kindly ask you to take into account the regulations on this matter.</p> <p>iii. Regarding safe distance from DWR to objects, please also take into consideration the guidance: MCA MGN 371 on Offshore Renewable Energy Installations – Guidance on UK Navigation Practice, Safety and Emergency Response Issues.</p>	<p>Guidance considered throughout this NRA (including MGN 371) is summarised in Section 2.</p>
The Danish Maritime Authority	June 2014 (S42 Response)	i. The Danish Maritime Authority has no comments as East Anglia THREE is located in UK waters outside sailing routes.	i. Noted.
Norfolk County Council	July 2014 (S42 Response)	i. While no objection is proposed to the East Anglia THREE offshore wind farm, this is subject to appropriate mitigations measures being found to overcome any potential impact on shipping and navigation, which might have an impact on East Port (Great Yarmouth).	i. Section 4 summarises embedded mitigation measures and Section 29 summarises potential additional mitigation measures.
Trinity House Lighthouse	July 2014 (S42)	i. Stated that the 2nm buffer from the eastern	i. Noted ii. Annex 15.1.5 Deep

Service	Response)		
		<p>boundary of East Anglia THREE to the DWR via Off Brown Ridge TSS was satisfactory.</p> <p>ii. Raised concerns, given the volume of traffic and the need for sea room to allow safe collision avoidance whilst manoeuvring along the western boundary within the DWR via DR1 light buoy, that the current 1nm buffer should be increased to 2nm.</p> <p>iii. Advised that a minimum separation distance of 6nm between East Anglia THREE and East Anglia FOUR would be satisfactory.</p> <p>iv. Stated structures on the wind farm boundary should be in as linear form as possible and isolated structures should be avoided. Accommodation platforms must also be at least 500m from the wind farm red line boundary to allow for the appropriate safety zone to remain inside the Rochdale envelope.</p> <p>v. Stated that consideration should be given to producing a through life Aids to Navigation Management Plan.</p> <p>vi. Stated that the UK Hydrographic Office</p>	<p>Water Route Buffer Analysis (2015).</p> <p>iii. Section 29 summarises additional mitigation measures including final site design consultation. Trinity House shall be consulted throughout this process.</p> <p>iv. EATL note Trinity House’s comments on layout (preference for linear form of structures on boundary and avoidance of isolated structures). Following assessment of the collision risk modelling (Sections 23 - 26) EATL have made the commitment not to place additional structures on the periphery of the windfarm in proximity to areas of high density shipping, thus avoiding any issues with the presence of 500m safety zones around permanently manned structures.</p> <p>v. Section 29 summarises</p>

		<p>should be consulted to ensure East Anglia THREE is charted on an appropriately scaled chart.</p> <p>vii. Stated that all aviation lighting must be synchronised and exhibit Morse code “W” light characteristics.</p>	<p>additional mitigation measures including the production of an Aids to Navigation Management Plan.</p> <p>vi. Section 4 summarises embedded mitigation measures including appropriately scaled charting of the proposed East Anglia THREE project.</p> <p>vii. Section 5 summarises marine navigational markings including Trinity House’s requirement for all aviation lighting to be synchronised and exhibit Morse code “W” light characteristics.</p>
MCA	March 2015 (Written Consultation)	<p>i. MCA is content with the volume of marine traffic survey data collected assuming a November 2015 submission of the ES.</p> <p>ii. MCA request that an additional 14 day traffic survey be carried out if the ES is submitted after November 2015 in order to comply with current requirements.</p>	<p>i. Marine traffic survey data collected is summarised in Section 10.</p> <p>ii. Noted.</p>
MCA	July 2015 (Consultation Meeting)	<p>i. Overview of NRA change included.</p> <p>ii. MCA confirmed that the</p>	<p>i. No Comment.</p> <p>ii. No Comment.</p>

		1nm buffer was acceptable of the western boundary of East Anglia THREE.	
Trinity House Lighthouse Service	July 2015 (Consultation Meeting)	<ul style="list-style-type: none"> <li>i. Overview of NRA changes included.</li> <li>ii. THLS requested two lines of orientation</li> <li>iii. THLS noted a preference for a 2nm buffer but did not raise any navigational safety issues with 1nm.</li> <li>i. Aids to Navigation Management Plan will now be required as part of the DCO.</li> </ul>	<ul style="list-style-type: none"> <li>i. No Comment Required.</li> <li>ii. Noted; MGN 371 guidance, which shall be complied with throughout final layout design, currently indicated single line of alignment for SAR.</li> <li>iii. Noted.</li> <li>i. Noted.</li> </ul>
Royal Yachting Association	August 2015 (Consultation Meeting)	<ul style="list-style-type: none"> <li>i. Overview of NRA changes included.</li> <li>ii. RYA noted no impact on small craft for the DWR buffer.</li> <li>iii. EATL agreed no requirement for Safety Zones during the operational phase, other than during periods of significant maintenance.</li> </ul>	<ul style="list-style-type: none"> <li>iv. No Comment Required.</li> <li>v. Noted.</li> <li>vi. No Comment Required.</li> </ul>

## 7 Existing Environment

### 7.1 Introduction

48. This section presents the following baseline information relating to navigation in the vicinity of the East Anglia THREE site:

- International Maritime Organisation (IMO) Routeing Measures
- Navigational Aids
- Chartered Anchorages
- Ports
- Oil & Gas Infrastructure
- Ministry of Defence (MOD) Exercise
- Aggregates Dredging Areas
- Submarine Cables
- Marine Environmental High Risk Areas (MEHRAs)
- Metocean data

### 7.2 IMO Routeing Measures

49. Important navigational features in the vicinity of the East Anglia THREE site (considered features include those that have the potential to be impacted by the development of the proposed East Anglia THREE project including the effect of displaced routes) include the IMO routeing measures. The East Anglia THREE site is located between two IMO adopted Deep Water Routes (DWR): DWR via the DR1 light-buoy is, at its minimum, 1.0nm to the west of the East Anglia THREE site and the DWR via TSS Off Brown Ridge is at its minimum 2.0nm west of the East Anglia THREE site. These two DWRs merge towards the southern boundary of the East Anglia THREE site and continue to the North Hinder Junction.

50. The Off Brown Ridge Traffic Separation Scheme (TSS) is the nearest TSS in proximity to the East Anglia THREE site, located approximately 13nm northeast of the site. The North Hinder North TSS and associated North Hinder Junction is located approximately 21nm southeast of the site. The Off Botney Ground TSS and West Friesland TSS are located 36nm and 40nm, respectively north of the East Anglia THREE site.

51. The IMO routeing measures in the vicinity of the proposed East Anglia THREE project are presented in Figure 7.1.

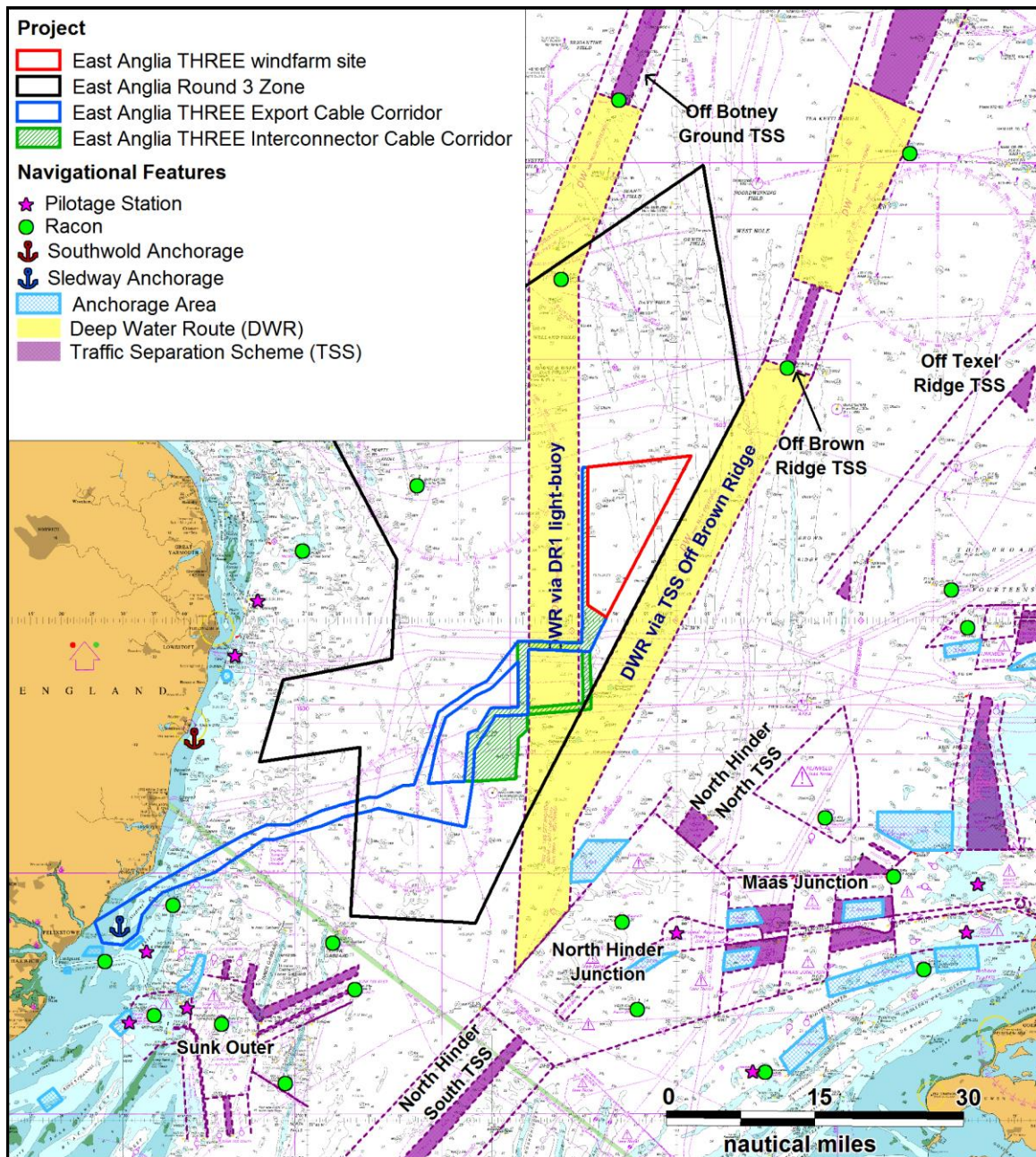


Figure 7.1 IMO Routing Measures, Navigational Aids and Anchorages Relative to the proposed East Anglia THREE project

### 7.3 Navigational Aids

52. A plot of the principal navigational aids in the vicinity of the proposed East Anglia THREE project is presented in Figure 7.1. The nearest to the East Anglia THREE site is the Off Brown Ridge TSS Racon, located 15nm to the northeast of the site.

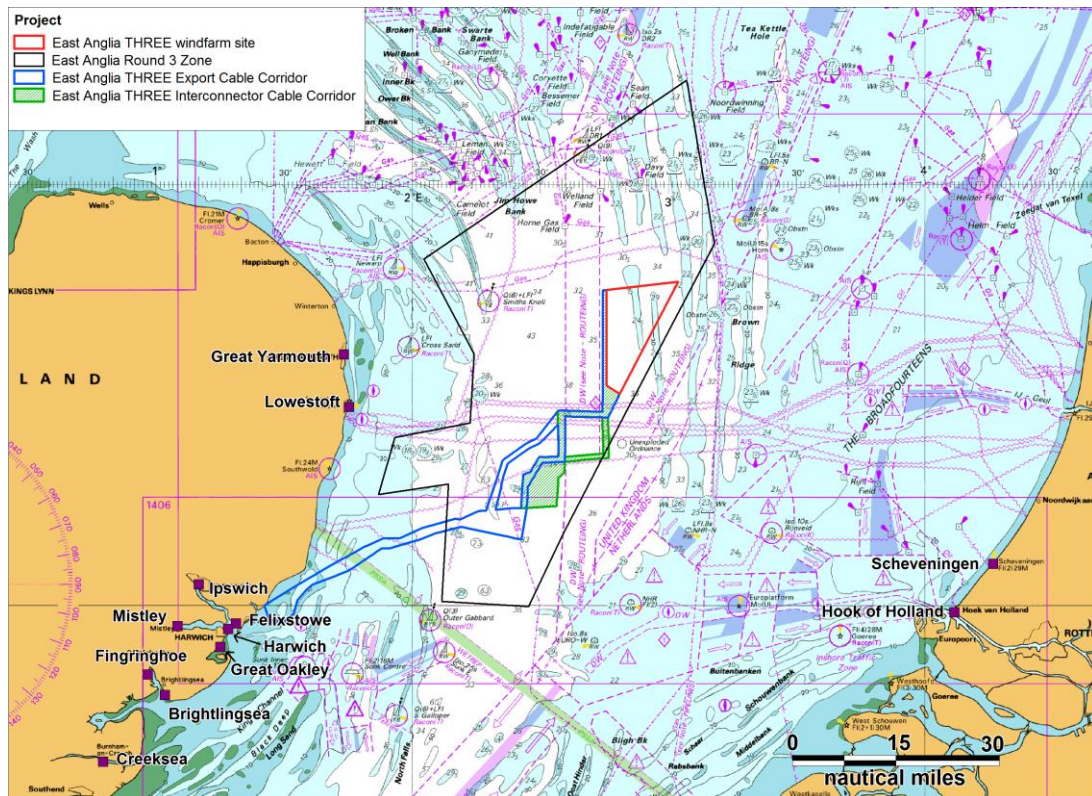


## **7.4 Charted Anchorage Areas**

53. There are several charted anchorages in the vicinity of the East Anglia THREE site, as presented in Figure 7.1. The closest of these to the East Anglia THREE site is the “DW1 Anchorage” associated with the North Hinder Junction, 25.5nm south of the site. The “DW1 Anchorage” is a long term anchorage on the northwest side of North Hinder Junction, and vessels may remain at anchor in this area under the most extreme conditions.
54. It is noted that in addition to the charted anchorage areas in the vicinity of the East Anglia THREE site and the offshore cable corridor, anchoring activity is known to take place to the southwest of the East Anglia THREE site, off Southwold. This area was designated by the UK government as the preferred location within UK territorial waters for ship-to-ship oil transfers (see Section 7.11). A recognised anchorage area (Sledway) intersects the offshore cable corridor. Sledway anchorage provides good holding ground in depths of approximately 12m. Throughout consultation with the UKHO and MCA it was stated that the Sledway anchorage was an unofficial anchorage with no recorded source. Harwich and Felixstowe harbour authorities also confirmed that the area is only very occasionally used by larger vessels. Therefore the UKHO have agreed to remove the anchorage symbol from Admiralty Charts throughout the November 2015 edition. Harwich and Felixstowe harbour authorities indicated they were content with this decision.

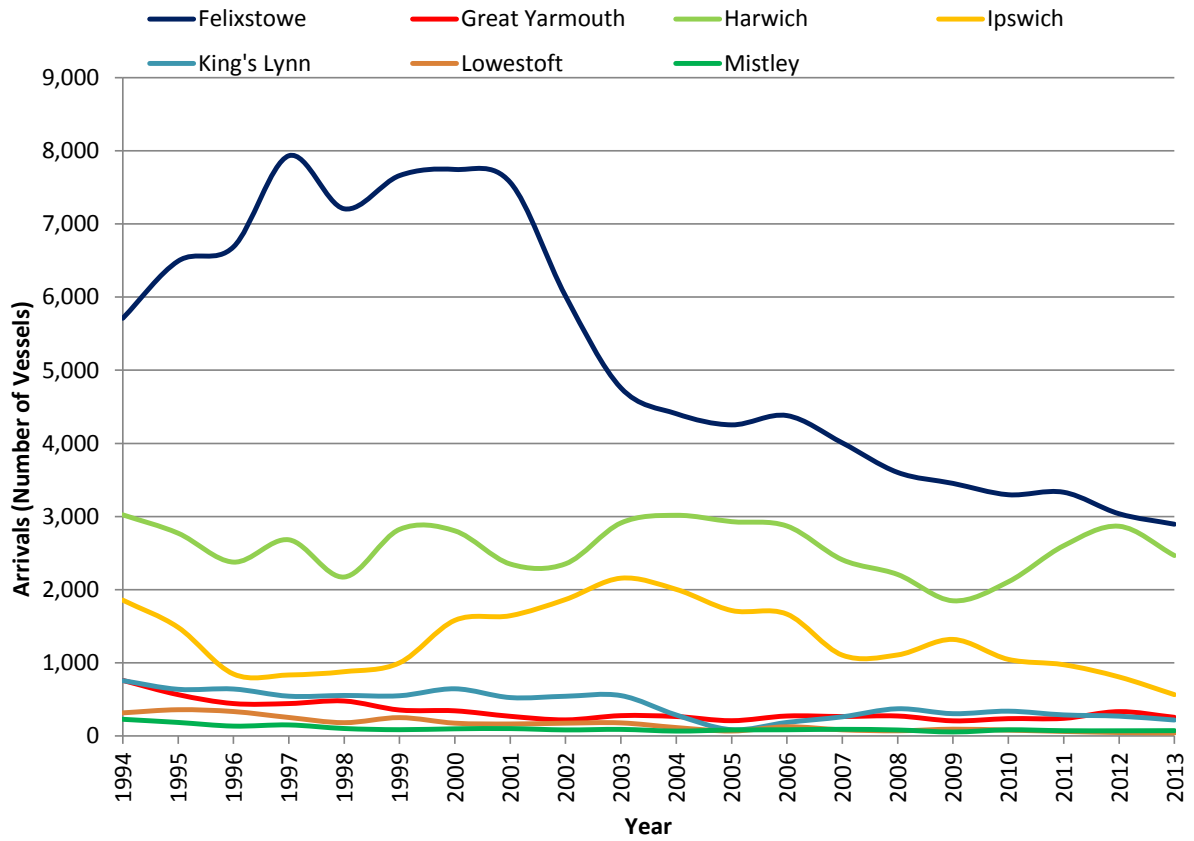
## **7.5 Ports**

55. A chart of principal ports, relative to the proposed East Anglia THREE project, is presented in Figure 7.2. The nearest ports to the East Anglia THREE site are Lowestoft and Great Yarmouth, located approximately 42nm and 43nm west of the site respectively.



**Figure 7.2** Ports in the vicinity of East Anglia THREE Offshore windfarm

56. The number of vessel arrivals in recent years to the ports nearest to the proposed East Anglia THREE project, based on the latest published Department for Transport (DfT) statistics (DfT, 2010) is presented in Figure 7.3. Following this, Figure 7.4 presents the total tonnage per annum at the ports nearest to the proposed East Anglia THREE project. It is noted that these statistics exclude some movements but provide a good indication of the relative traffic levels and trends.



**Figure 7.3** Vessel Arrivals to Principal Ports in proximity to the East Anglia Zone 1994 – 2013

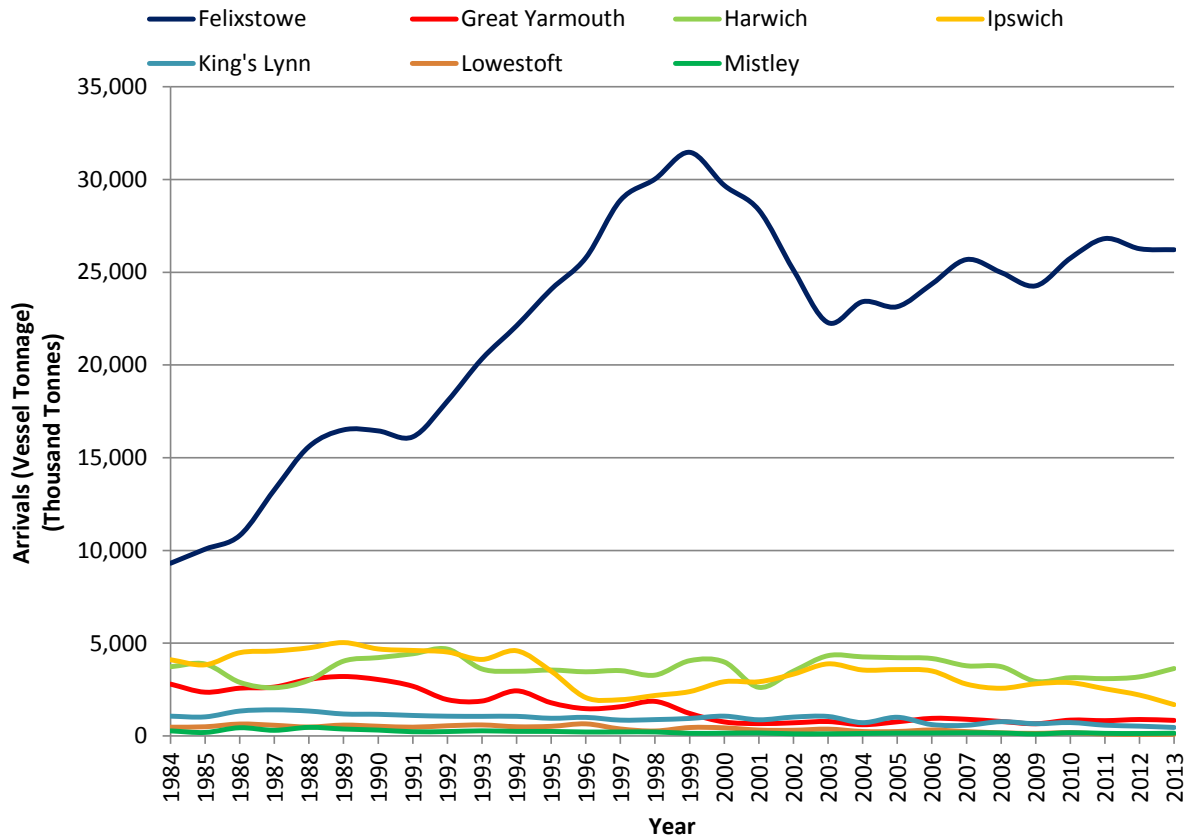
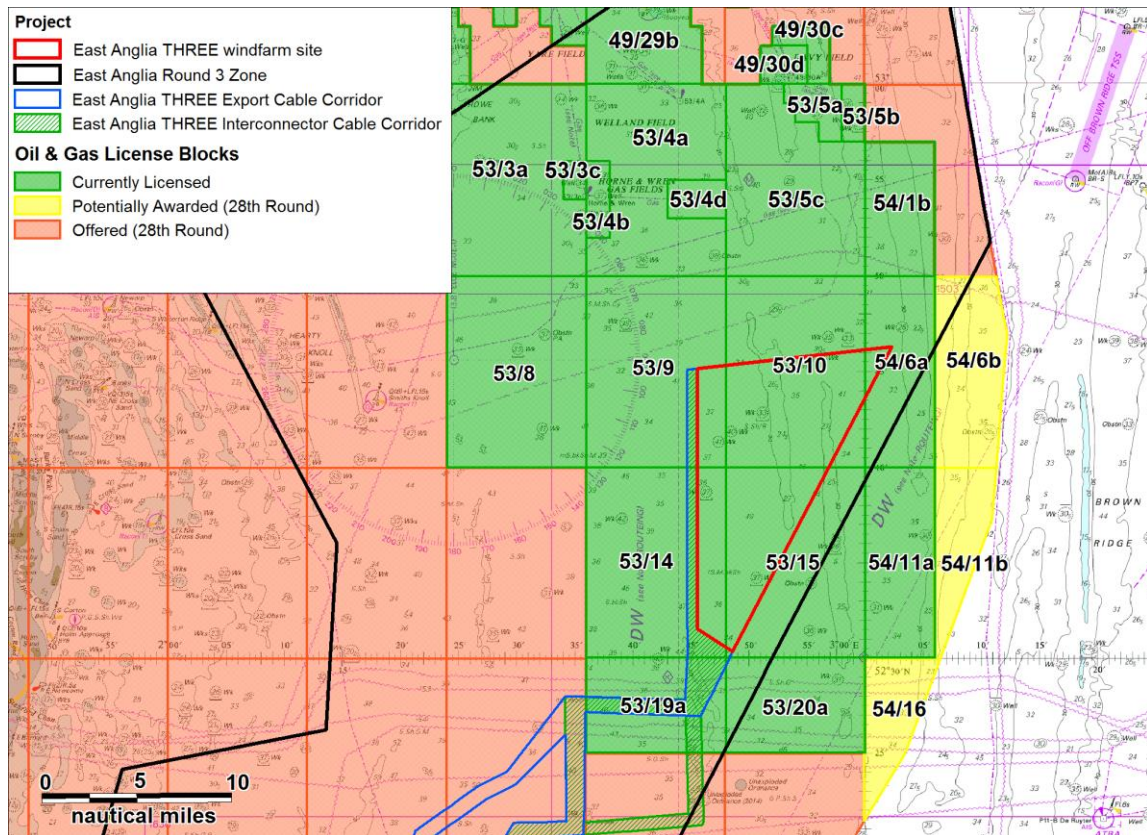


Figure 7.4 Vessel Tonnage to Principal Ports in proximity to the East Anglia Zone 1984 – 2013

## 7.6 Oil & Gas Infrastructure

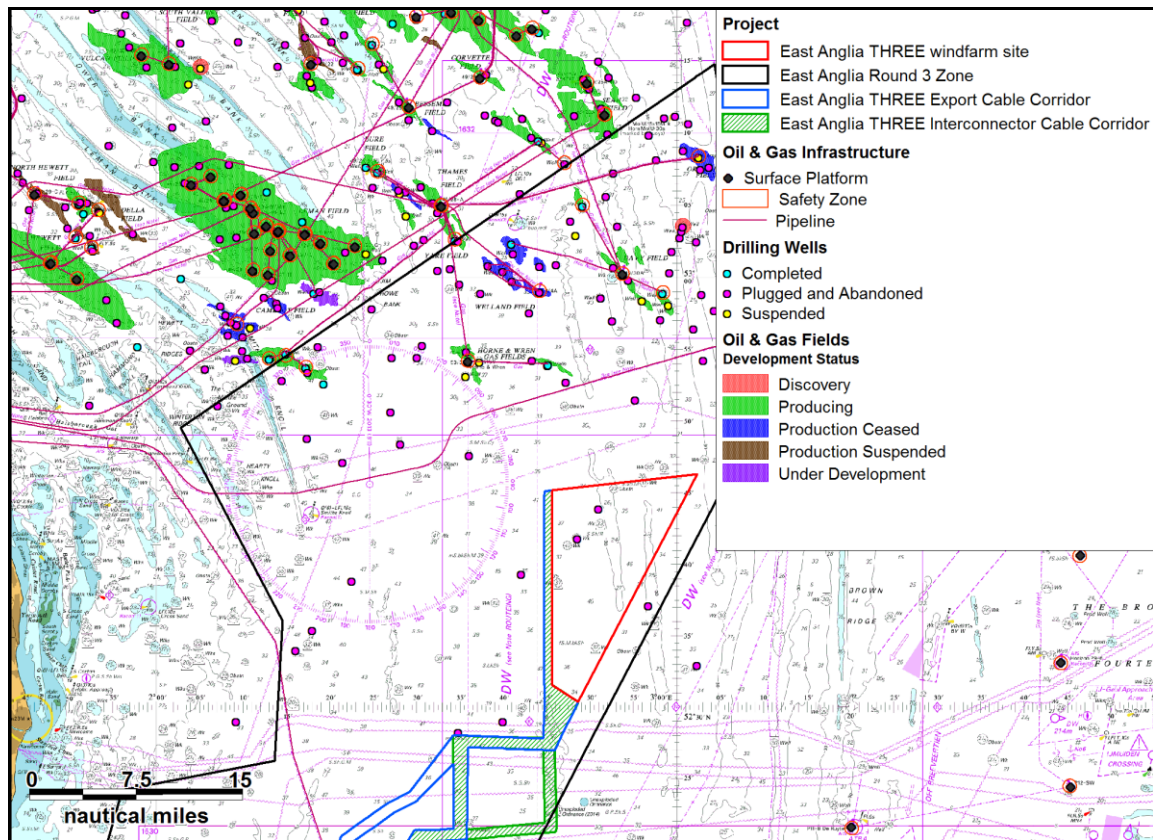
57. The license blocks and oil and gas infrastructure in the area of the proposed windfarm are presented in Figure 7.5.



**Figure 7.5 Oil & Gas UKCS Current Licence Areas (February 2014)**

58. The East Anglia THREE site is within UKCS Block 53/9, 53/10, 53/14, 53/15, and 54/6a. All of these blocks are currently licensed for oil and gas development by the operator ENI UK Ltd. and were licenced in the 27<sup>th</sup> round of licencing. In addition, Blocks 54/16, 54/11b and 54/6b located to the east of the East Anglia THREE site, have been licensed to ENI UK Ltd. as part of the 28<sup>th</sup> round of licensing.

59. Existing oil and gas infrastructure along with safety zones, oil and gas fields and drilling wells, colour coded by status, are shown in Figure 7.6.



**Figure 7.6 Oil and Gas Infrastructure and Existing Oil Fields in the vicinity of the proposed East Anglia THREE project**

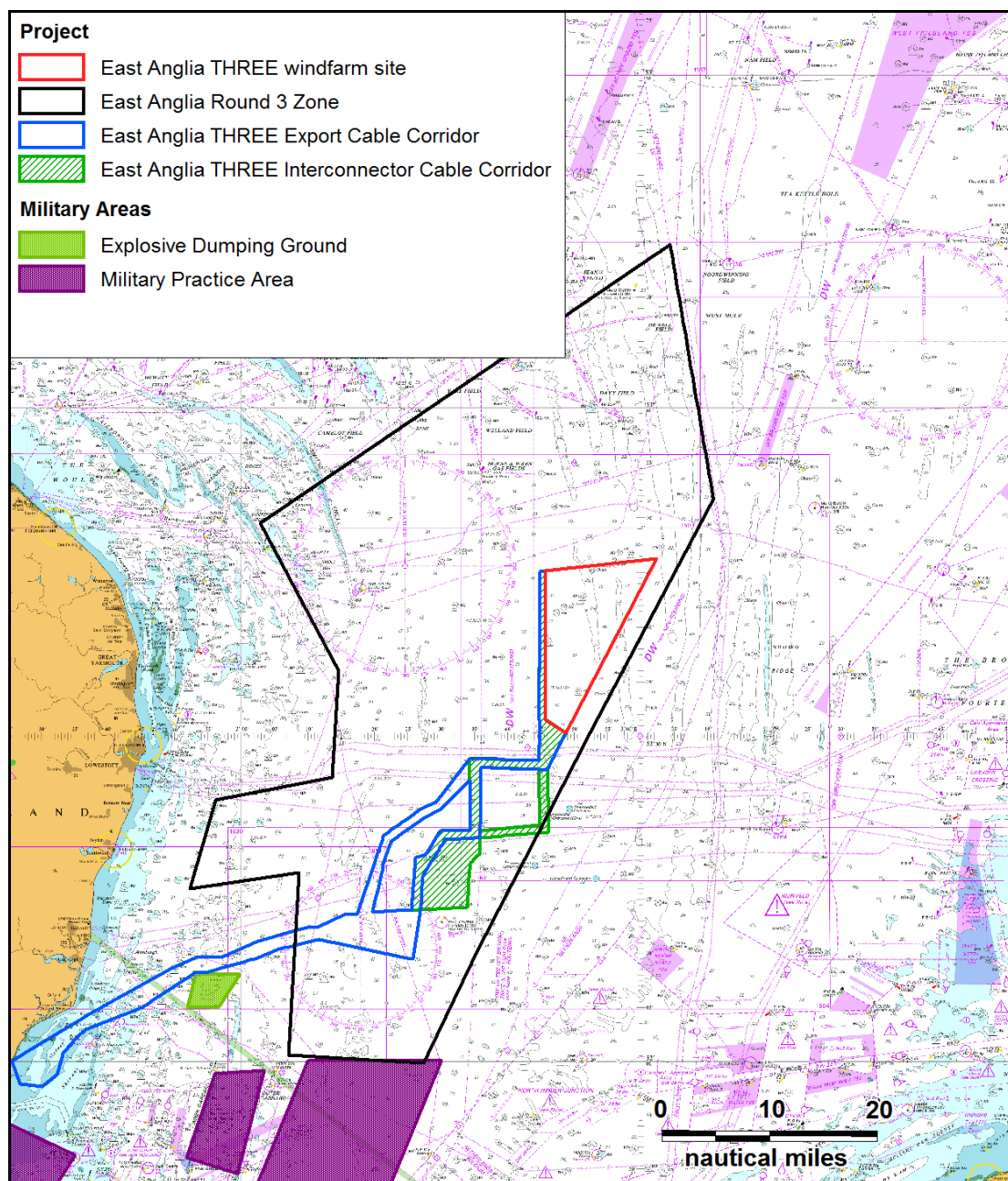
60. The Zeebrugge to Bacton gas pipeline passes approximately 6.5nm to the north of the East Anglia THREE site. The nearest existing offshore surface installation is the Horne & Wren platform which is approximately 10.5nm to the north north-west of the site.
61. The East Anglia THREE site is located south of a concentration of oil fields, most of which are producing or are under development. The closest producing gas field is the Wissey Field, currently operated by the Tullow Oil, located approximately 9nm north of the site. The Davy East Gas Field, operated by Perenco is located approximately 11nm north of the site and the Wren Gas Field operated by Tullow Oil is located approximately 9nm to the north-west. The closest under development field is the Leman South Gas Field, located approximately 20nm northwest of the East Anglia THREE site. The closest discovery field is an unnamed field (discovered by well 50/26b-6) and is located approximately 17nm north of the site.
62. There are two plugged and abandoned wells within the East Anglia THREE site. Completed and suspended wells are located mainly to the north of the East Anglia THREE site, with the closest being 8.8nm north of the site.

### 7.7 MOD Exercise Areas and Explosives Dumping Grounds – Water Based

63. Figure 7.7 presents the military practice areas in the vicinity of the East Anglia THREE site. No restrictions are placed on the right to transit the practice areas at any time

although mariners are advised to exercise caution. Exercise and firing only takes place when the areas are considered to be clear of all shipping.

- 64. There are no military practice areas within the boundaries of the East Anglia THREE site. The nearest practice areas to the East Anglia THREE site are “North Galloper”, which is 32.3 nm to the south south-west of the site and “Outer Gabbard”, which is 41.5nm southwest of the site. The closest explosive dumping ground is located approximately 42nm southwest of the East Anglia THREE site.
- 65. Approximately 10.3nm offshore of Aldeburgh, the export cable corridor intersects the aforementioned explosives dumping ground located southwest of the East Anglia THREE site.



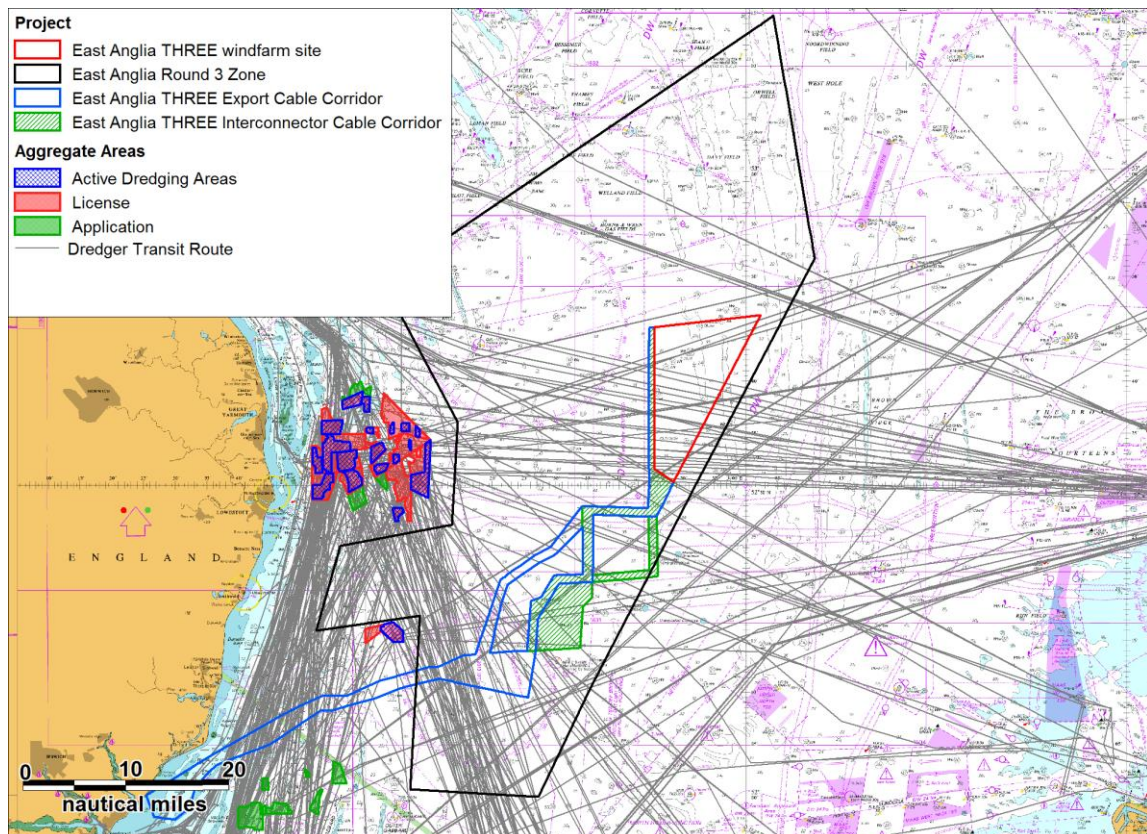
**Figure 7.7 Military Practice Areas relative to the East Anglia THREE site**

### 7.8 Marine Aggregates Dredging Areas

66. Figure 7.8 presents the active, licensed and application aggregate dredging areas in proximity to the East Anglia THREE site. The closest active dredging area to the site is Area 401/2A Yarmouth, which is operated by Hanson Aggregates Marine Ltd, located approximately 23nm to the west of the East Anglia THREE site.

67. The aggregate areas are generally located approximately 10 to 13nm west of the offshore cable corridor. However, marine aggregate extraction vessels (dredgers) operating in the vicinity of the aggregate areas frequently intersect the offshore cable route whilst on transit from active dredging sites to the Netherlands and vice versa.

68. BMAPA passage plans shown in Figure 7.8 indicate dredgers transit routes in vicinity of the East Anglia THREE site. Several dredger tracks intersect the site transiting from Ijmuiden and other ports in the Netherlands to the UK.



**Figure 7.8 Aggregate Dredging Areas relative to the East Anglia THREE site**

69. Following the hazard workshop (Annex 15.1.1 Hazard Log), the marine aggregates representative noted that the majority of dredgers transit from dredge areas to the west of the East Anglia Zone to the Thames Estuary in the south, but on occasion dredgers also transit east to Ijmuiden and Amsterdam. Vessels currently transit eight to ten loads, transporting approximately 50,000 tonnes (t) of dredge material per week and estimated to be operational for up to 25 years (plus) and due to increasing demand for coarse

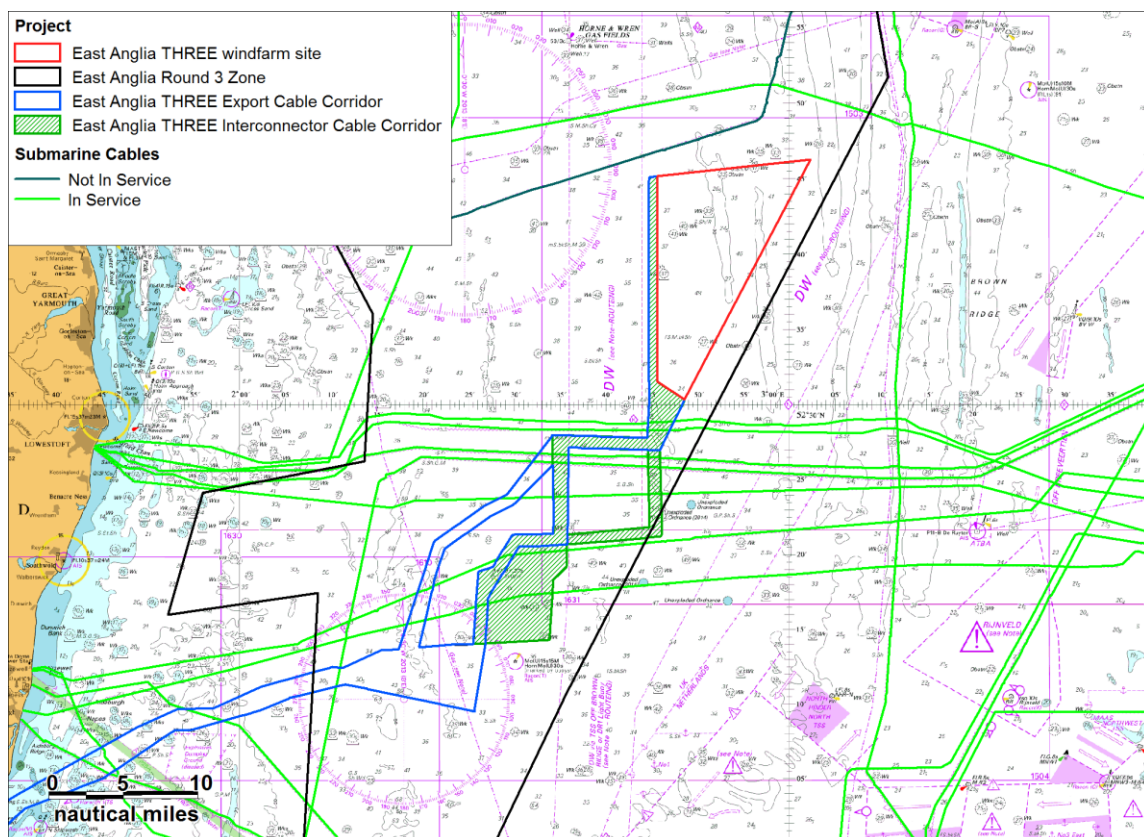


material to mainland Europe. However following consideration of the baseline environment, current development levels within the East Anglia Zone including the proposed East Anglia THREE project are not expected to adversely impact on routeing for dredgers bound from UK east coast dredge sites to Amsterdam. Following review of the marine traffic survey data a 90th percentile could not be established due the low levels and infrequency of traffic.

70. The transits of dredgers recorded in the vicinity of the East Anglia THREE site throughout the marine traffic surveys are presented Section 11.

### 7.9 Submarine Cables within the East Anglia THREE site and Offshore Cable Corridor

71. The submarine cables in the vicinity of the East Anglia THREE site and offshore cable corridor are presented in Figure 7.9. It could be seen that there are no submarine cables passing within the East Anglia THREE site. The closest cables to the East Anglia THREE site are an active telecommunication cable from Lowestoft (UK) to Egmond (Netherlands,) passing approximately 1.3nm south of the site and an inactive telecommunication cable from Winterton (UK) to Norddeich (Germany) passing approximately 1.6nm from the northern boundary of the East Anglia THREE site.



**Figure 7.9** Cables in the vicinity of the proposed East Anglia THREE project

## **7.10 MEHRAs**

72. The nearest MEHRA are approximately 59.4nm, to the south west of the East Anglia THREE site, at Harwich and Felixstowe. The South Foreland to Ramsgate MEHRAs are over 84nm to the south south-west of the site. These areas have been identified as MEHRAs by the UK Government, (i.e. areas of environmental sensitivity and at a high risk of pollution from ships). Throughout the construction of the proposed East Anglia THREE project significant works shall not be undertaken at the mouth of the river Deben.
73. The Government expects mariners to take note of MEHRAs and either keep well clear or, where this is not practicable, exercise an even higher degree of care than usual when passing nearby.
74. Figure 7.10 presents the nearest MEHRAs in the vicinity of the East Anglia THREE site and the offshore cable corridor.

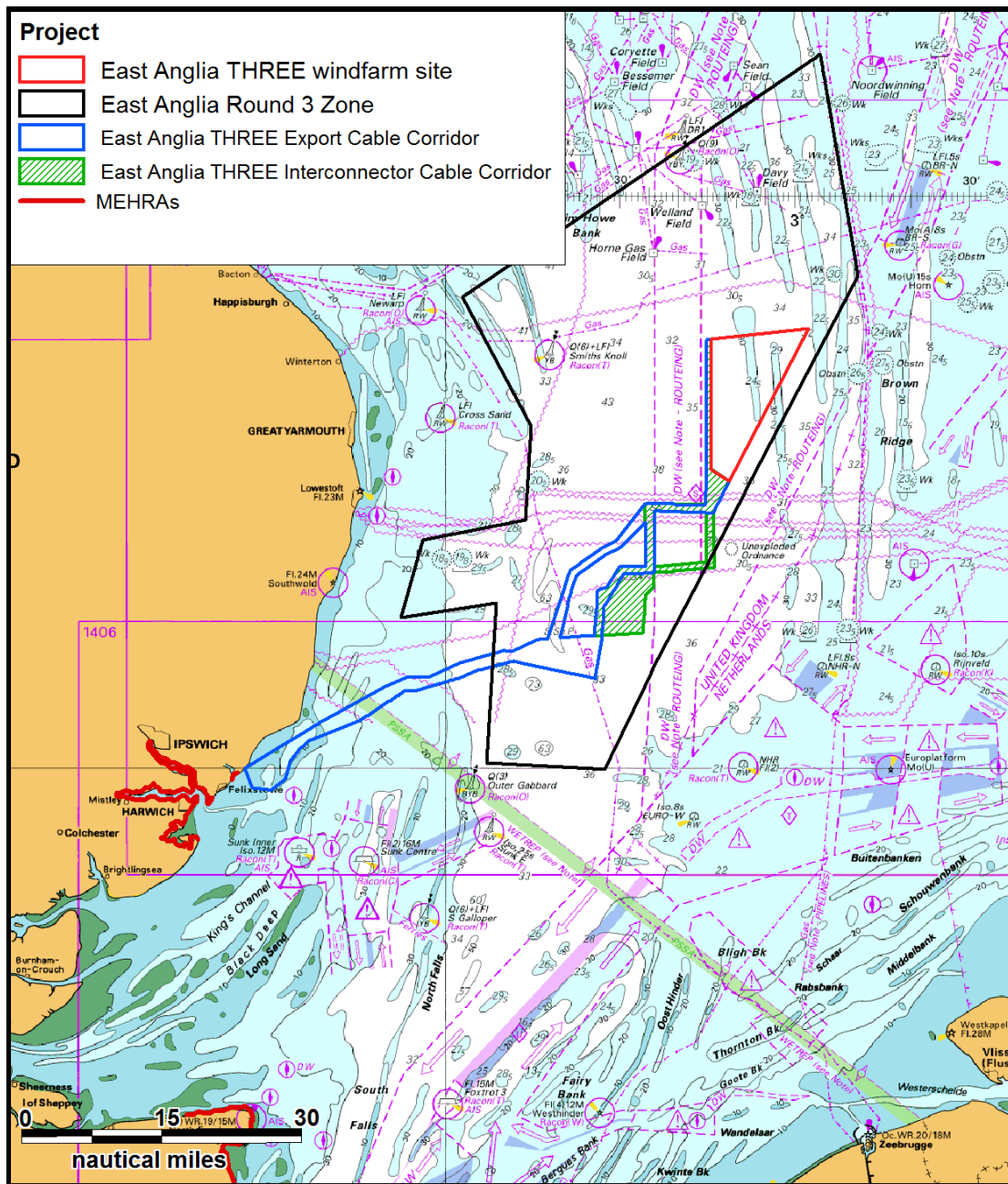
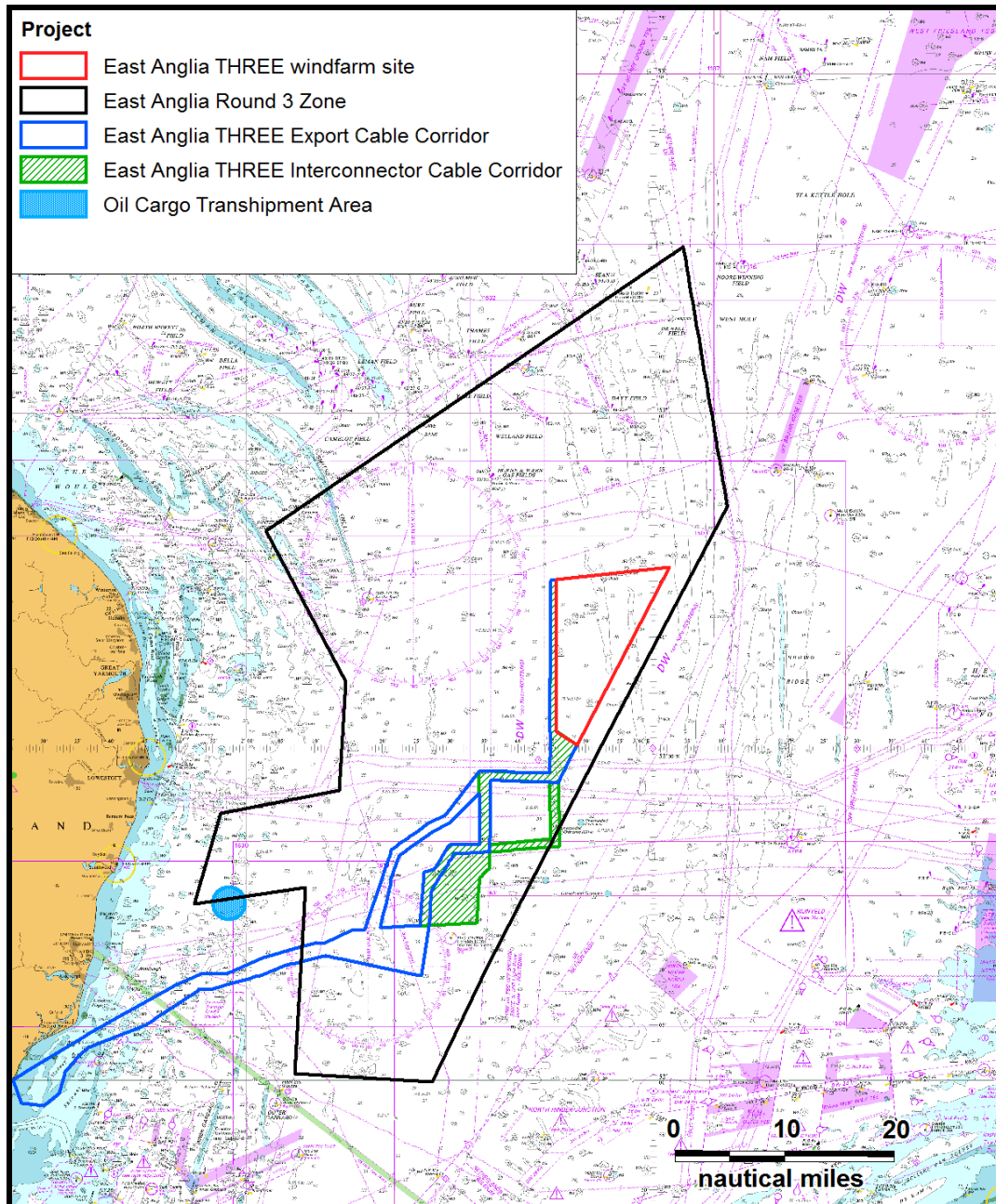


Figure 7.10 Marine Environmental High Risk Areas

### 7.11 Vessel to Vessel Transfers

- 75. The north Suffolk coast between Southwold and Lowestoft has been designated by the UK government as the preferred location within UK territorial waters for ship-to-ship oil transfers.
- 76. The Merchant Shipping (Ship-to-Ship Transfers) Regulations (2010) proposed to limit vessel-to-vessel oil transfers to licensed harbour authority areas and to this single designated area within the UK Territorial Sea, between Southwold and Lowestoft. The

Regulations also require vessels undertaking vessel-to-vessel oil transfers to obtain a permit from the MCA (2012).



**Figure 7.11** Vessel to Vessel Transfers

## 8 Metocean Data

77. The following section presents nearby meteorological and oceanographic statistics for the proposed East Anglia THREE project which have been used as an input to the risk assessment.

78. This section presents nearby metocean statistics for the East Anglia THREE site which have been used as an input throughout the collision/allision risk assessment.

### 8.1 Wind

79. The wind data for the area in terms of average direction and speed is presented in Figure 8.1 and Figure 8.2 respectively (Anatec, 2014). The predominant wind direction is from the southwest and the occurrence of wind speeds of gale force and higher is relatively low (approximately 1.3% of year winds exceed Beaufort Force 8 – Gale Force).

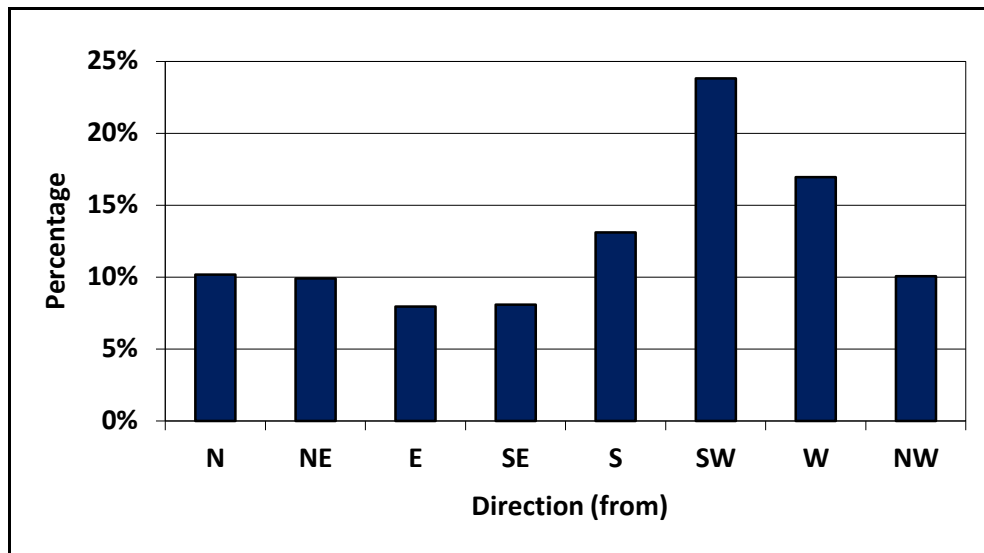
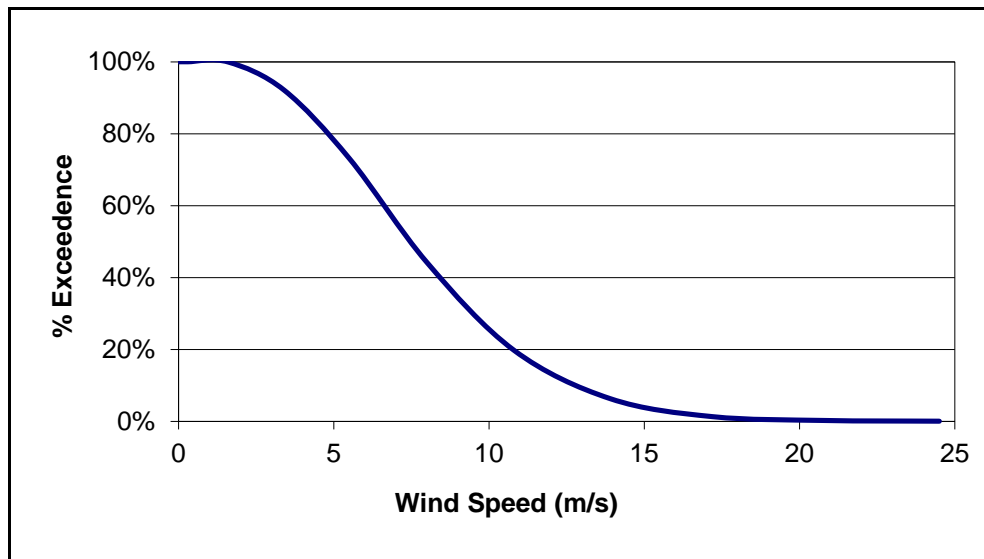


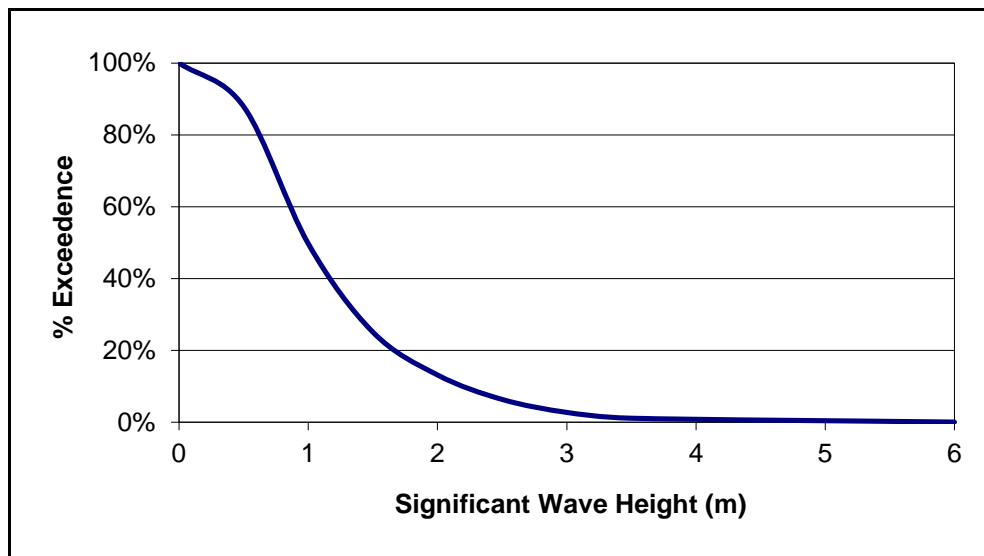
Figure 8.1 Annual Average Wind Direction



**Figure 8.2 Annual Average Wind Speed**

## 8.2 Wave

80. Significant wave height data for the area is presented in Figure 8.3.



**Figure 8.3 Significant Wave Height Exceedence Curve**

81. Therefore, the frequency of average wave height exceeding 5m is approximately 0.5%.

## 8.3 Visibility

82. Historically, visibility has been shown to have a major influence on the risk of vessel collision. The annual average probability of bad visibility (defined as less than 1km) for the UK North Sea is approximately 0.03, i.e., an average of 3.0% of the year (UKHO, 2011).

## **8.4 Tide**

83. Admiralty Chart 1408\_0 indicates that tidal streams in the area set in a generally southwest direction on the flood and northeast direction on the ebb. The tidal stream rates through the windfarm are estimated to be a peak spring tidal rate of approximately 1.5 knots and peak neap rate of 0.9 knots.

## **8.5 Potential Effects on Waves and Tidal Streams**

84. Based on a specialist study, it was concluded that there would be no significant or measurable impact from the East Anglia THREE site on local tidal streams. Any impact on the waves would be localised and in close proximity to the wind turbines. Further information can be found in Chapter 7 Marine Geology, Oceanography and Physical Processes.

## **8.6 Sedimentation/Scouring Impacting Navigable Water Depths in Area**

85. There is the potential for structures positioned in the tidal stream to produce siltation, deposition of sediment or scouring which could affect the navigable water depths in the East Anglia THREE site or adjacent to the area.

86. The specialist work carried out as part of the proposed project is contained within Chapter 7 Marine Geology, Oceanography and Physical Processes has shown that no significant impact on navigation would result from the development of the proposed East Anglia THREE project.

## 9 Maritime Incidents

### 9.1 Introduction

87. This section reviews maritime incidents that have occurred in the vicinity of the East Anglia THREE site in recent years.

88. The analysis is intended to provide a general indication as to whether the area of the East Anglia THREE site is currently a low or high risk area in terms of maritime incidents. If it was found to be a particular high risk area for incidents, this may indicate that the preferred project could exacerbate the existing maritime safety risks in the area.

89. Data from the following sources has been analysed:

- Marine Accident Investigation Branch (MAIB)
- Royal National Lifeboat Institution (RNLI)

90. (It is noted that the same incident may be recorded by both of the sources.)

### 9.2 Marine Accident Investigation Branch (MAIB)

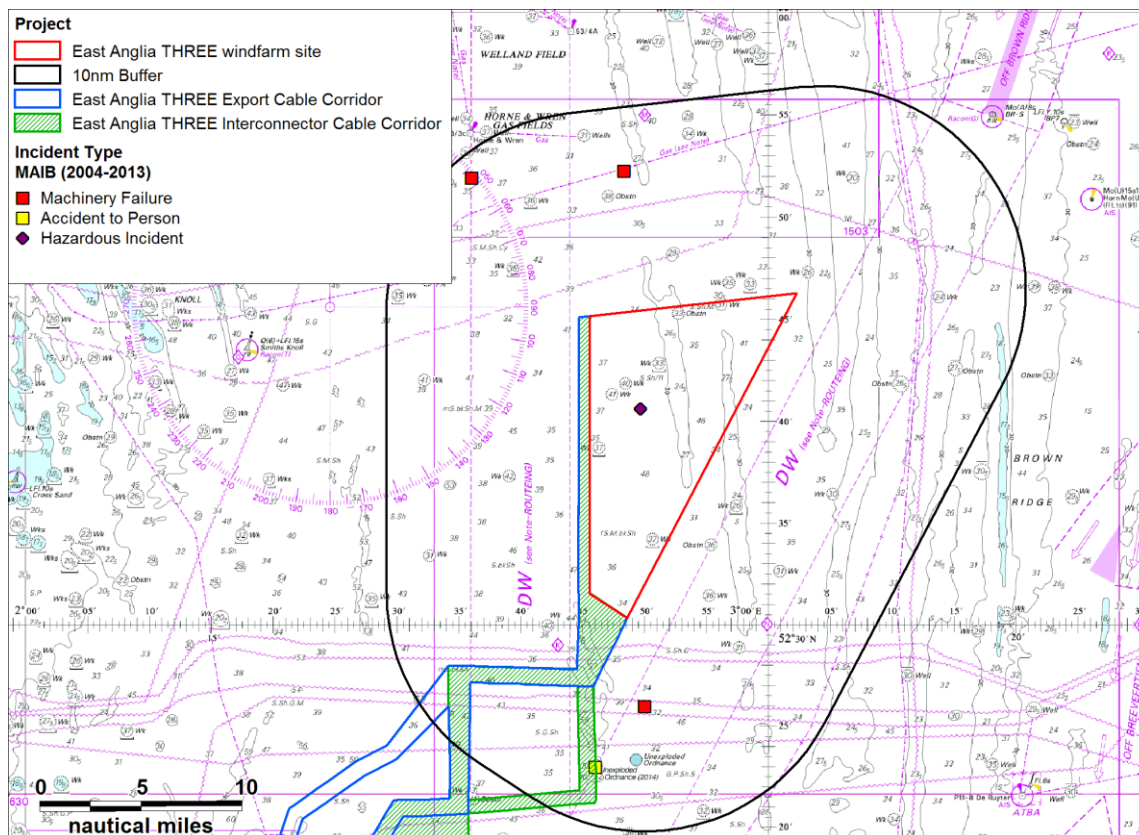
91. All UK commercial vessels are required to report accidents to MAIB. Non-UK vessels do not have to report unless they are in a UK port or are in 12nm territorial waters and carrying passengers to a UK port. There are no requirements for non-commercial recreational craft to report accidents to MAIB.

92. The locations<sup>1</sup> of accidents, injuries and hazardous incidents reported to MAIB within 10nm of the East Anglia THREE site between January 2004 and December 2013 are presented in Figure 9.1, colour-coded by type.

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<sup>1</sup> MAIB aim for 97% accuracy in reporting the locations of incidents.





**Figure 9.1 MAIB Incident Locations by Type within 10nm of the East Anglia THREE site**

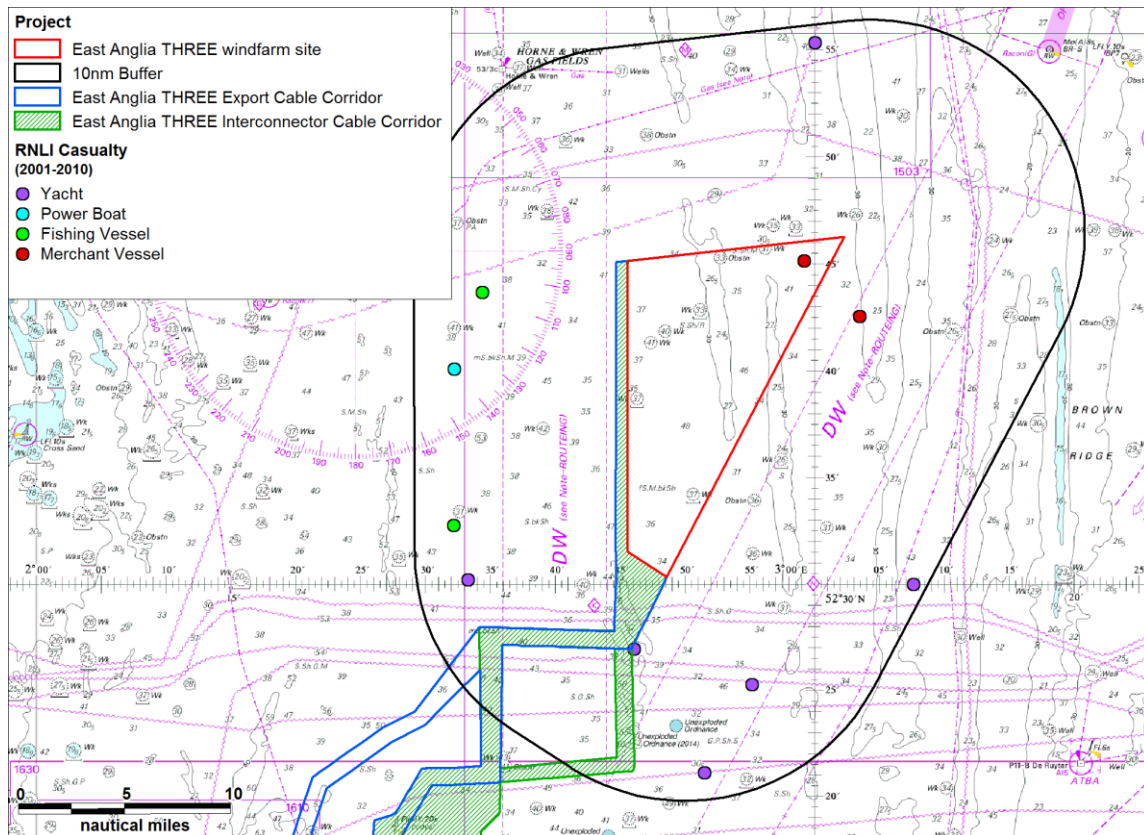
93. A total of five unique incidents involving five vessels were reported in the area within 10nm, corresponding to an average of less than one incident per year (0.5 per year). It is noted that one of the incidents occurred within the East Anglia THREE site, when a hazardous incident occurred on board a fishing vessel on 6<sup>th</sup> October 2005. It should be noted that no further details on the nature of this hazardous incident are available. There were no collision incidents reported in the area during the ten year period.

94. The highest number of incidents within 10nm of the East Anglia THREE site was recorded in 2009 with two incidents reported. It is noted that no incidents were recorded during 2006, 2007, 2010, 2011, 2012 and 2013.

### 9.3 Royal National Lifeboat Institution (RNLI)

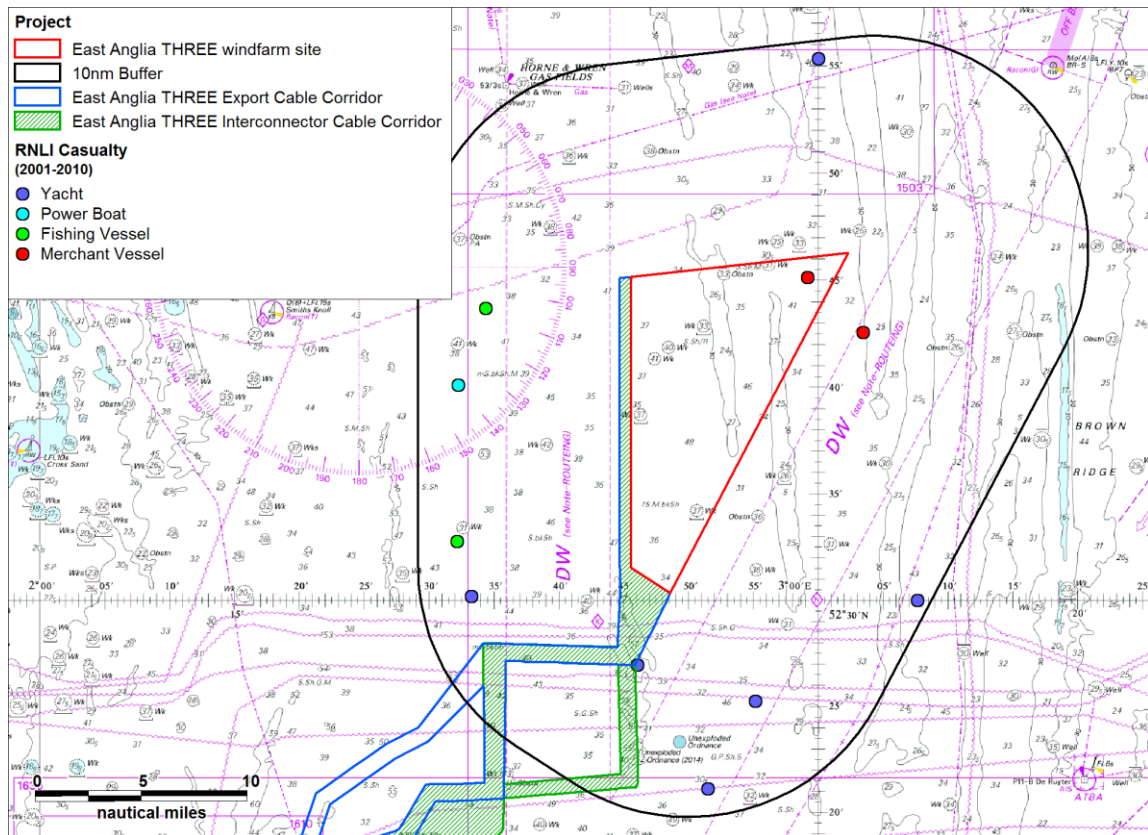
95. Data on RNLI lifeboat responses within 10nm of the East Anglia THREE site in the ten-year period between 2001 and 2010 have been analysed. A total of 11 launches to ten unique incidents were recorded by the RNLI (excluding hoaxes and false alarms).

96. Figure 9.2 presents the geographical location of incidents colour-coded by casualty type.



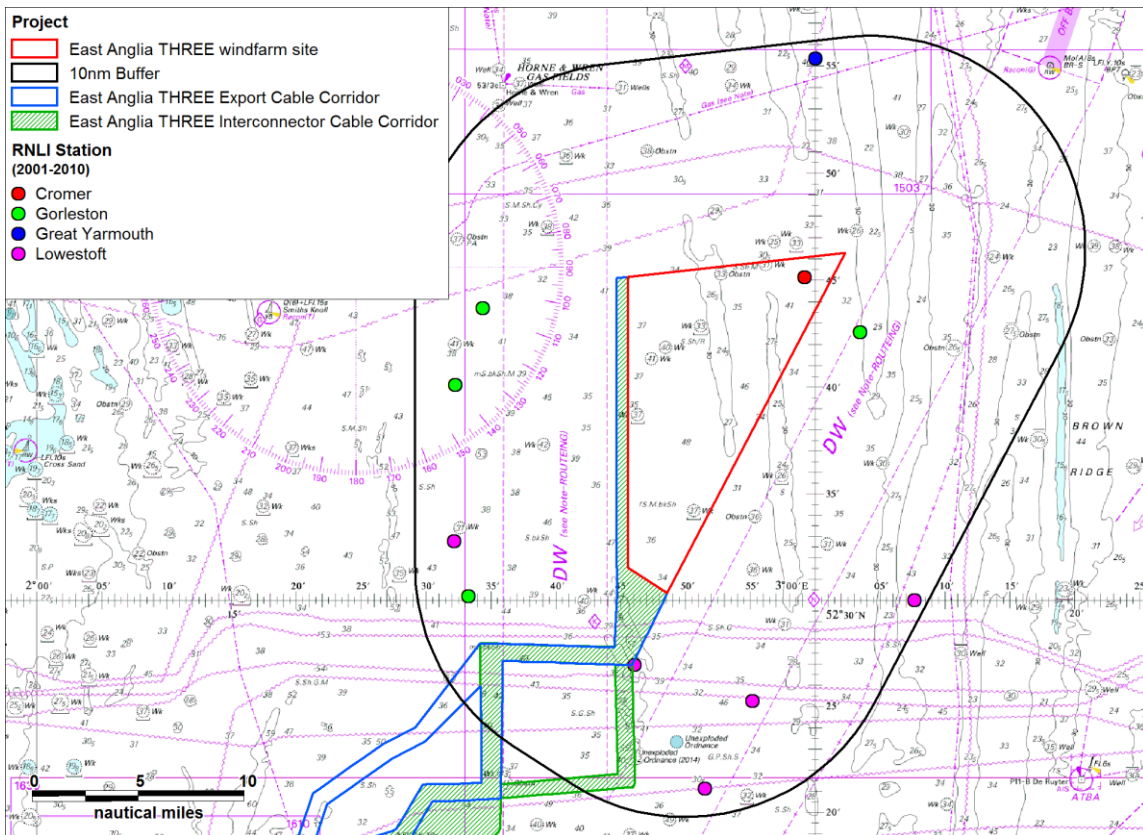
**Figure 9.2 RNLI Incidents by Casualty Type within 10nm of the East Anglia THREE site**

97. There was one incident recorded within the East Anglia THREE site over the ten year period analysed. This incident involved a large merchant vessel that was affected by adverse conditions. The Gorleston all-weather lifeboat (ALB) responded first followed by the Cromer ALB.
98. In Figure 9.2 there are 11 incidents shown even though it was previously stated that there were ten unique incidents recorded by the RNLI. This is because the incidents marked with the casualty type “merchant vessel” are one incident that was responded to twice by both the Cromer and Gorleston ALBs who recorded the location of the incident differently. Both records have been kept in the subsequent figures as one of the incidents is recorded within the East Anglia THREE site. However, throughout analysis of this data it is being counted as one incident.
99. The most common vessel types involved were yachts (60%). The four remaining incidents involved fishing vessels, a power boat, and a merchant vessel. A chart of the incidents colour-coded by cause is presented in Figure 9.3.



**Figure 9.3 RNLi Incidents by Cause within 10nm of the East Anglia THREE site**

100. The main cause of incidents in the vicinity of the East Anglia THREE site was machinery failure, accounting for 30% of all reported incidents.
101. There was an average of one incident per year reported to the RNLi within 10nm of the East Anglia THREE site between 2001 and 2010. All incidents within 10nm of the East Anglia THREE site were responded to by ALBs, with the majority of these (45%) being responded to by the Lowestoft ALB. The East Anglia THREE site is outside the operational range of inshore lifeboats (ILBs) and is approaching the maximum practical range for ALB response. Therefore, it is likely that all incidents would be responded to by the RNLi using ALBs only.
102. RNLi incidents, colour-coded by the response station are illustrated in Figure 9.4.



**Figure 9.4 RNLi Incidents by Station within 10nm of the East Anglia THREE site (2001-10)**

103. The RNLi lifeboat stations and other SAR resources relative to the East Anglia THREE site are presented in Section 21.1.

104. However, this may, to an extent, result from the limitations within the data used as RNLi responses would tend to be more coastal and MAIB data are only required to record UK registered vessels beyond the 12 mile limit reliably.

## 10 Maritime Traffic Surveys

### 10.1 Introduction

105. This section summarises the results of the maritime traffic surveys carried out for the East Anglia THREE site, using a combination of AIS and Radar survey data supplemented by visual observations where possible.

### 10.2 Survey Details

106. Two dedicated survey vessels, the *Shemarah II* and the *Northern Viking* recorded marine traffic data for the East Anglia THREE site. Three baseline maritime traffic surveys were carried out from these vessels throughout 2012 and 2013 in order to capture seasonality and a range of tidal states. In addition to this, a ten day validation survey was carried out from the *Northern Viking* throughout January / February 2014 (see Section 12).

107. These vessels operated towards the centre of the East Anglia THREE site throughout the maritime traffic surveys. Therefore, AIS coverage of the entire East Anglia THREE site was obtained with coverage typically extending at least 20nm from the East Anglia THREE site.

108. The marine radar data was recorded from the ARPA systems onboard the survey vessels, with radar data logging equipment set-up to record each target acquired on radar. The target positional data was recorded from a feed from the radar to the serial port of the survey laptops.

109. The radar range varied based on conditions and target details but typically vessels were tracked up to 12nm from the survey vessel and some targets were tracked up to 20nm. The radar range during the survey period may have resulted in under-representation in terms of small vessel activity at the extremities of the 10nm buffer surrounding the East Anglia THREE site.

110. During the surveys a visual lookout was maintained at all times and all visual observations recorded in a logbook.

## 11 Survey Analysis

### 11.1 Surveys Overview

111. The following section includes the three survey periods assessed within the main body of the NRA, in section 13, a validation of more recent survey data (February 2014) has been undertaken.

112. Plots of the tracks recorded during each of the three baseline survey periods, colour-coded by general vessel type categories, are presented in Figure 11.1, Figure 11.2 and Figure 11.3. In each case the tracks of the survey vessel have been excluded.

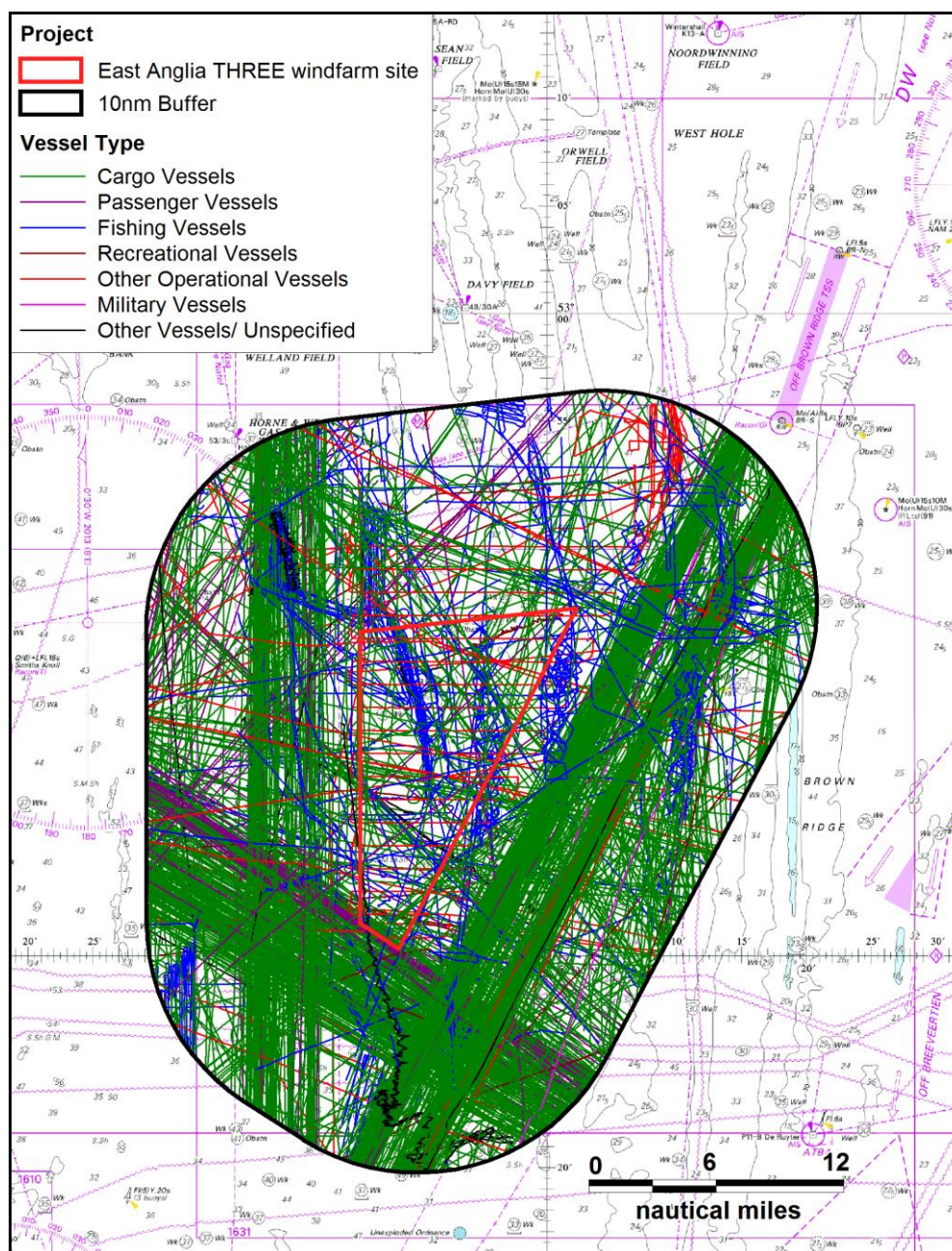


Figure 11.1 Combined AIS and Radar Tracks by Type – August / September 2012 (10 days)

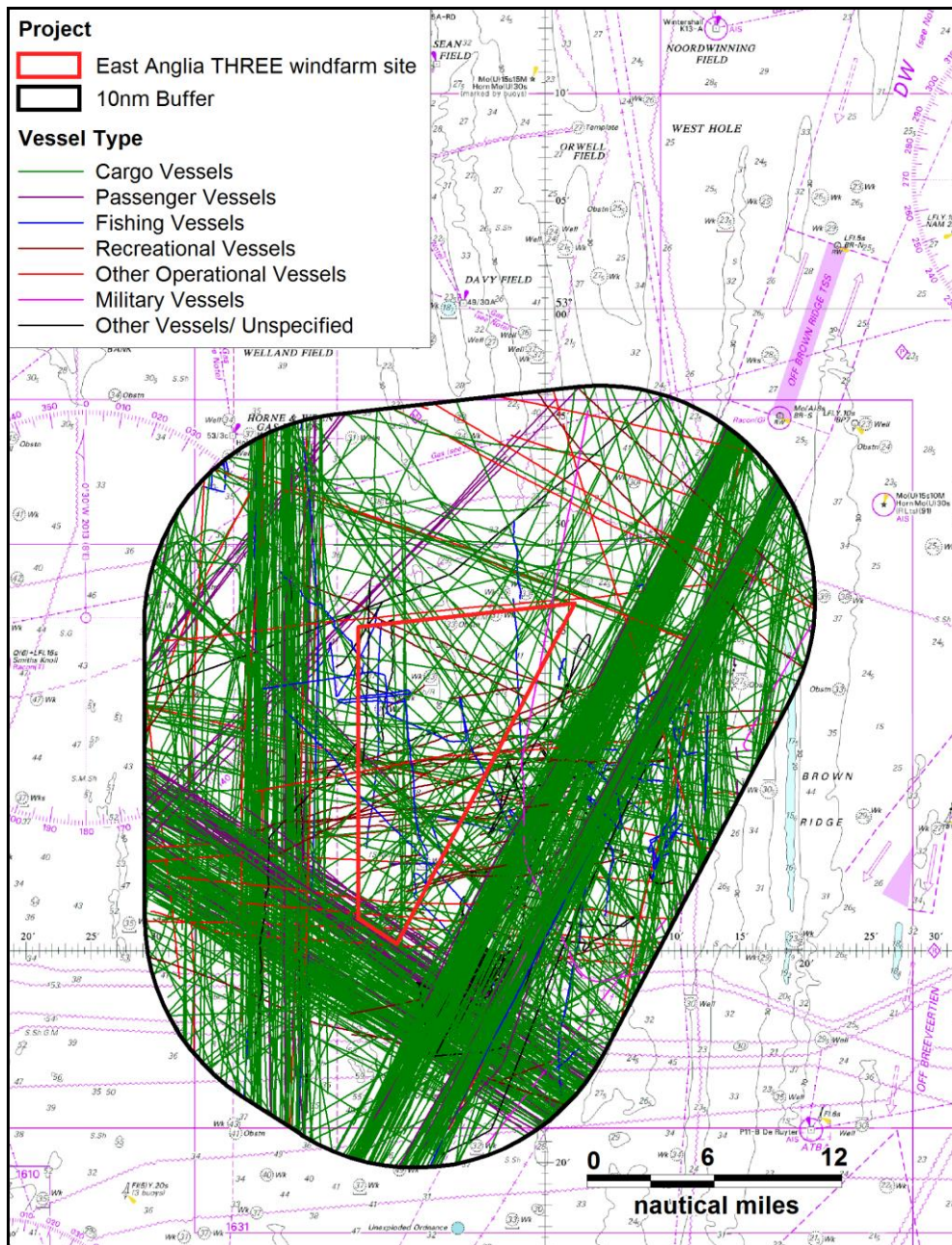


Figure 11.2 Combined AIS and Radar Tracks by Type – May 2013 (10 days)

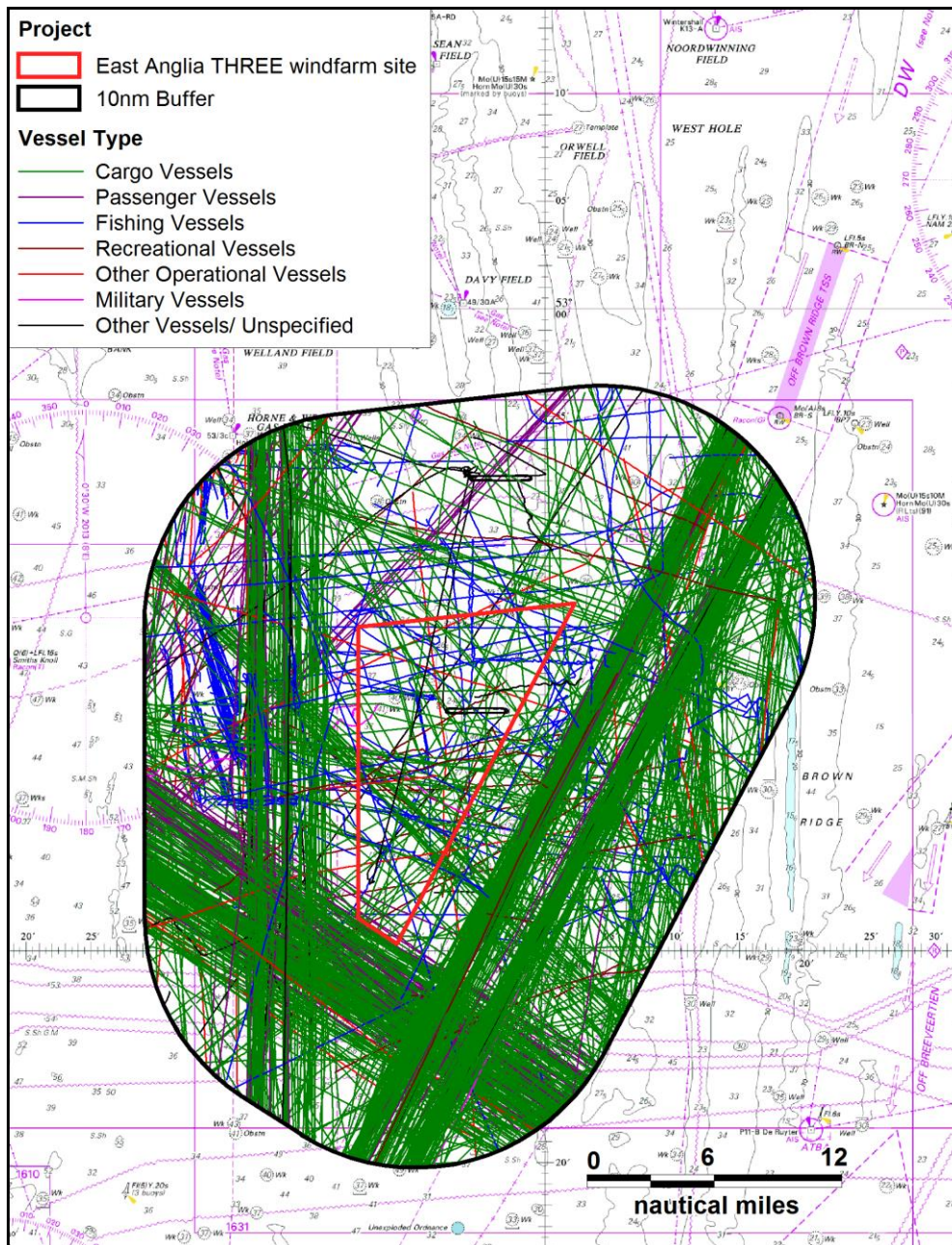


Figure 11.3 Combined AIS and Radar Tracks by Type – July / August 2013 (10 days)

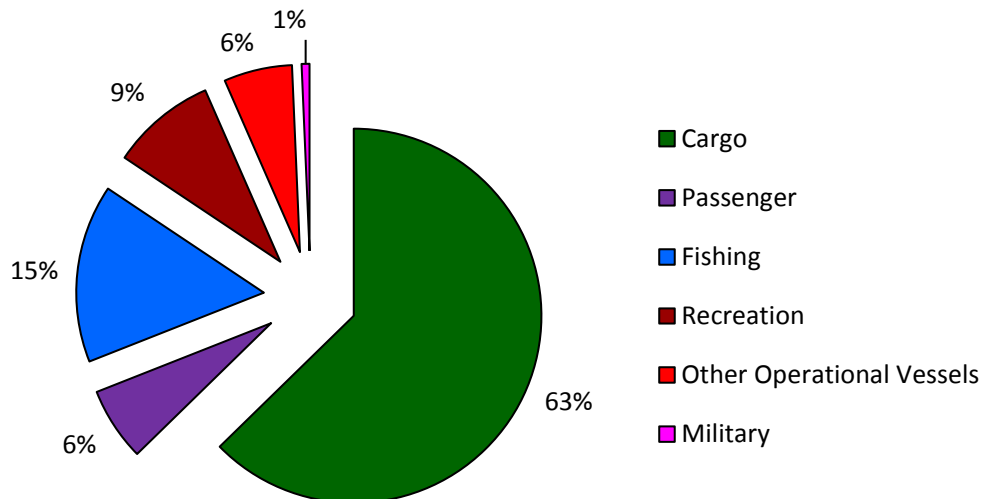
113. Excluding the *Shemarah II* and *Northern Viking* survey vessels, there was an average of 14 unique vessels per day passing through the East Anglia THREE site (based on the effective combined survey duration of 30 days – 10 days August / September 2012, 10 days May 2013 and 10 days July / August 2013).

114. Overall, the busiest day during the survey periods was 4<sup>th</sup> September 2012, 19<sup>th</sup> May 2013, and the 25<sup>th</sup> of August 2013 which each had 21 unique vessels passing through the boundary of the East Anglia THREE site.



## 11.2 Survey Data by Vessel Type

115. Figure 11.4 presents the general vessel type distribution of vessels passing through the East Anglia THREE site during the combined 30 day baseline survey period (excluding 2.5% unspecified).



**Figure 11.4 Vessel Type Distribution Passing through East Anglia THREE (30 days)**

116. Unspecified vessels accounted for 2.5% of vessels recorded within the East Anglia THREE site across the three baseline surveys, and these were generally radar targets with no visual identification. Cargo vessels were recorded most frequently within the site during the surveys, accounting for 63% of traffic. Fishing vessels made up 15% of traffic, followed by recreational vessels (9%).

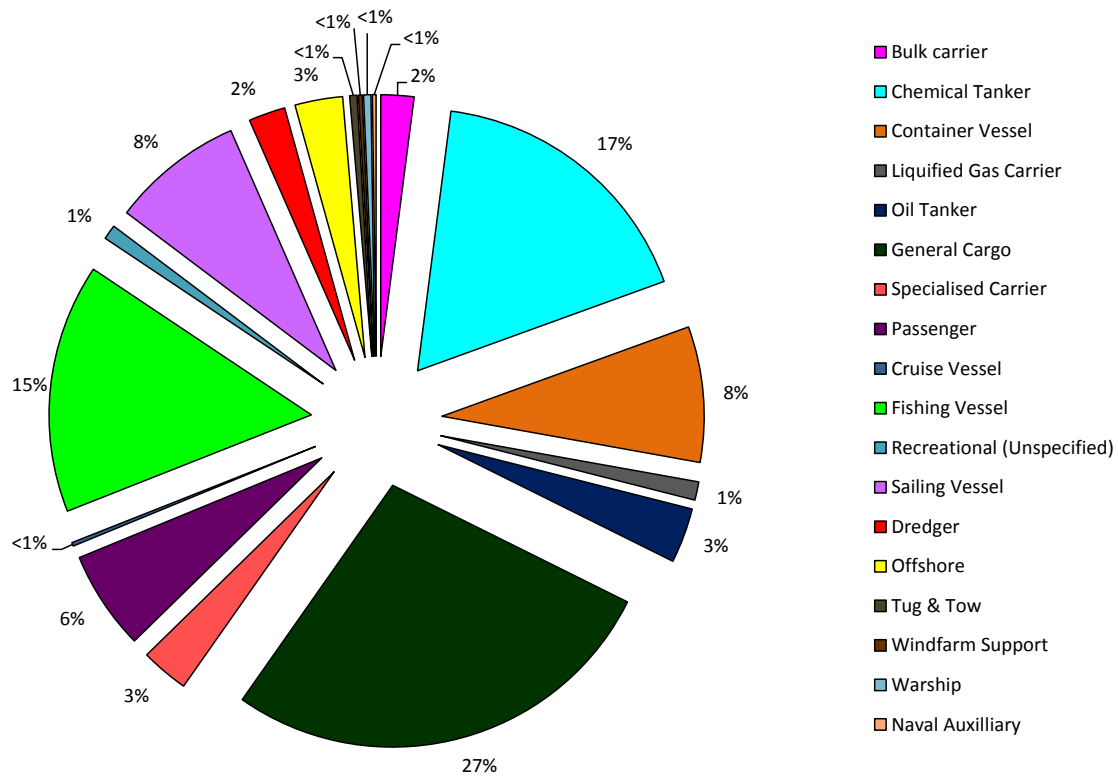
117. Dividing the types further using more detailed DECC categories (Table 11.1), the distribution of vessels within the East Anglia THREE site (excluding unspecified vessels) is presented in Figure 11.5.

**Table 11.1 Cargo and Passenger Vessel Subtypes (DECC Categories)**

Type	Subtypes
Cargo	Bulk Carriers Bulk/Oil Carriers Chemical Tankers Container vessels Liquefied Gas Carriers Oil Tankers General Cargo Specialised Carriers

Passenger     	Cruise Vessels Passenger Passenger Ferries High Speed Ferries Other High Speed Craft
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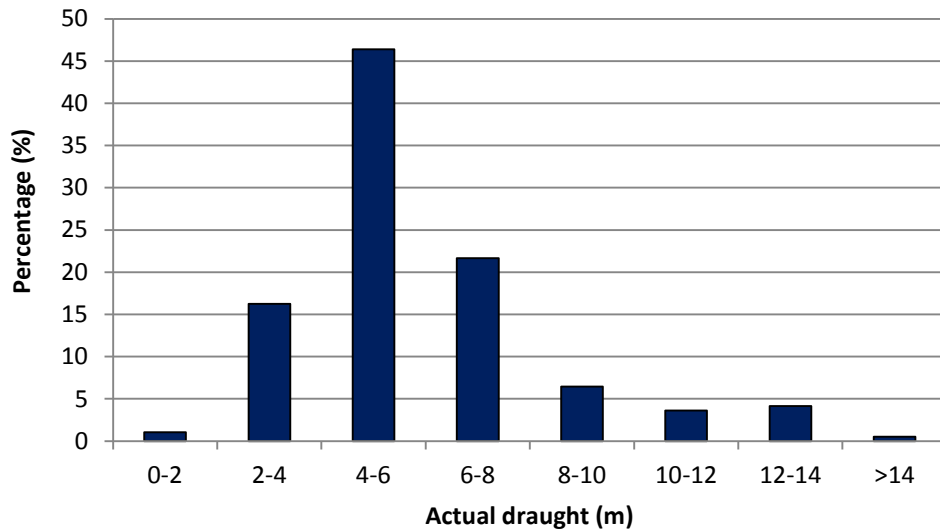
<sup>[1]</sup> Includes Ro-Ro cargo vessels



**Figure 11.5 Detailed DECC Vessel Type Distribution Passing through East Anglia THREE**

### 11.3 Vessel Size

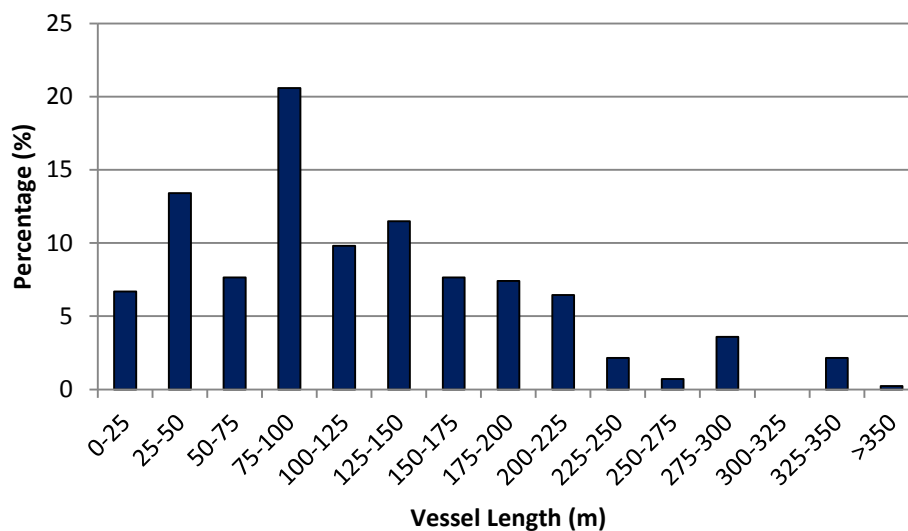
118. The distribution of vessels passing through the East Anglia THREE site by draught (excluding 14% unspecified) for the three combined baseline survey periods is presented in Figure 11.6.



**Figure 11.6 Distribution of Vessels Draught (30 Day Combined Baseline Survey Period)**

119. The average draught of vessels passing through the East Anglia THREE site was 6.0m for the combined 30 day baseline survey period, with the majority of vessels having draughts between 4 and 6m (46%).

120. The vessel broadcasting the deepest draught recorded passing through the East Anglia THREE site was the bulk carrier *Cape Maria* at 16.2m. This vessel passed through the East Anglia THREE site on 1<sup>st</sup> August 2013 headed to Immingham. The distribution of vessels passing within the East Anglia THREE site by length (excluding 7.7% unspecified) for the combined 30 day baseline survey period is presented in Figure 11.7.



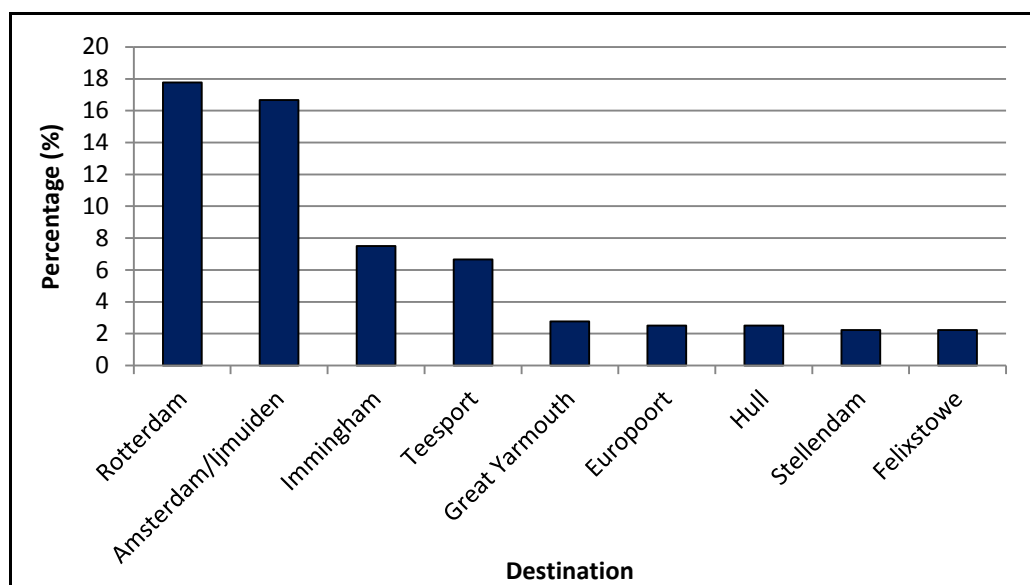
**Figure 11.7 Distribution of Vessel Length (30 Days Combined Baseline Survey Period)**

121. The average length of vessels recorded passing through the East Anglia THREE site over the combined 30 day baseline survey period (excluding 7.7% unspecified) was 121.7m. It can be seen that a large proportion of vessels had lengths between 75 to 100m (21%) and 25 to 50m (13%).

122. The longest vessel tracked passing through the East Anglia THREE site was the container vessel *Cosco Excellence* measuring 366m. The *Cosco Excellence* was recorded passing through the centre of the site on the 28<sup>th</sup> August 2012 whilst on passage to Hamburg, Germany.

### 11.4 Destinations

123. The main destinations of vessels tracked within the East Anglia THREE site are summarised in Figure 11.8.



**Figure 11.8 Main Destination Ports of Vessels passing through East Anglia THREE**

124. The most commonly recorded destinations for vessels travelling through the East Anglia THREE site were ports in The Netherlands, Rotterdam (18%), Amsterdam / Ijmuiden (17%), Europort (3%) and Stellendam (2%) and ports on the east coast of England, such as Immingham (8%), Teesport (7%), Great Yarmouth (3%), Hull (3%) and Felixstowe (2%).

### 11.5 Cargo Vessels

125. Plots of the cargo vessel tracks recorded in each of the three surveys are presented in Figure 11.9, Figure 11.10 and Figure 11.11.

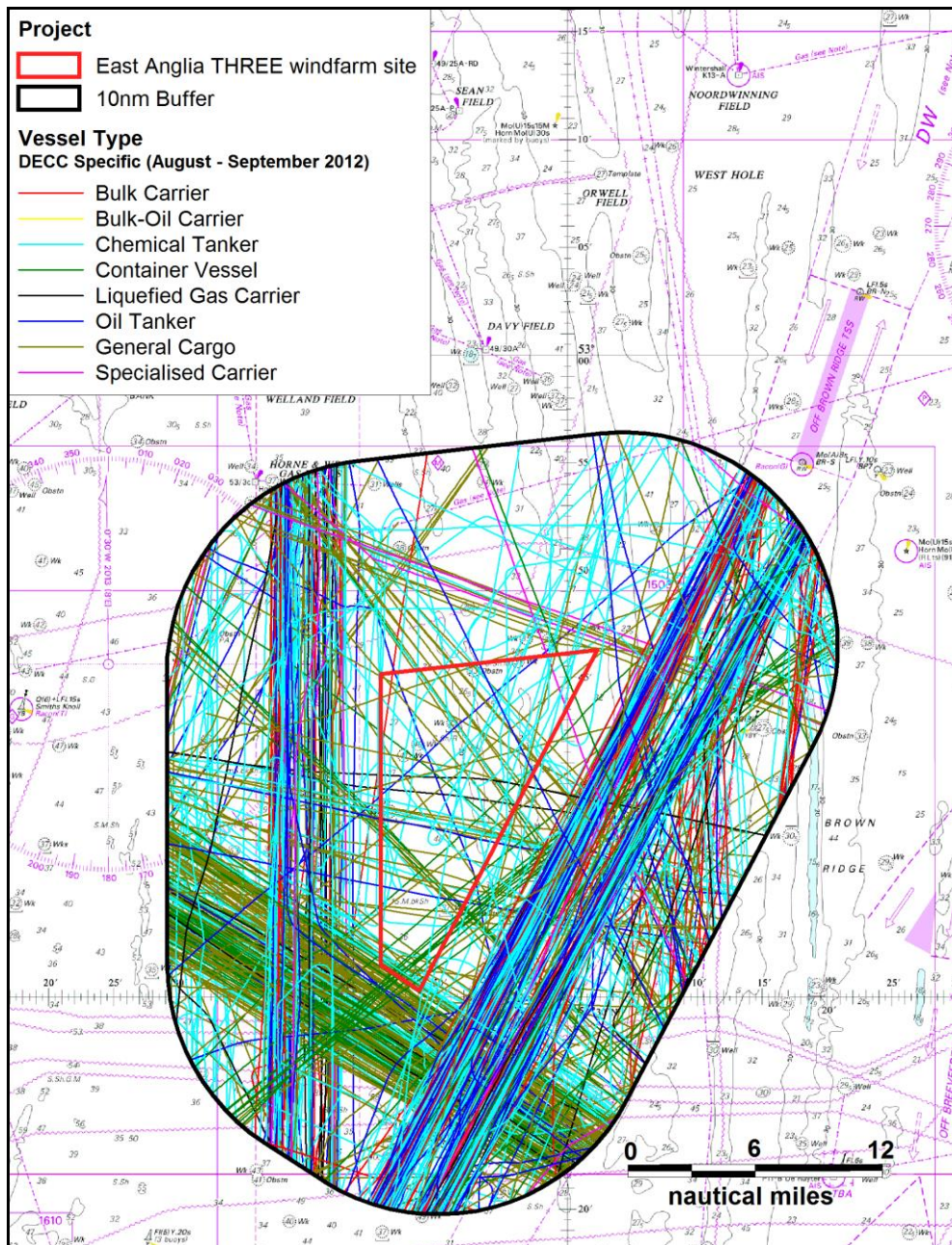
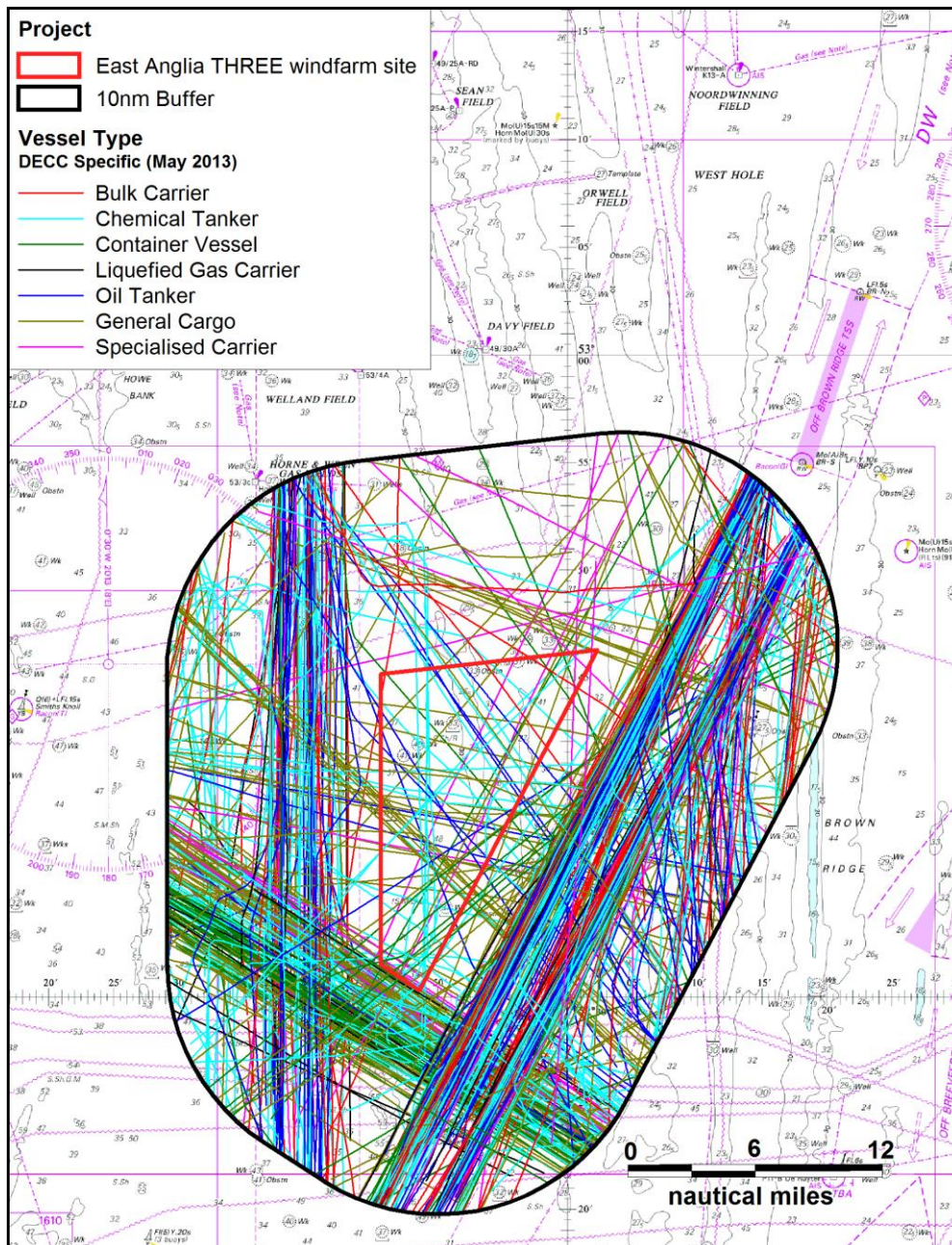
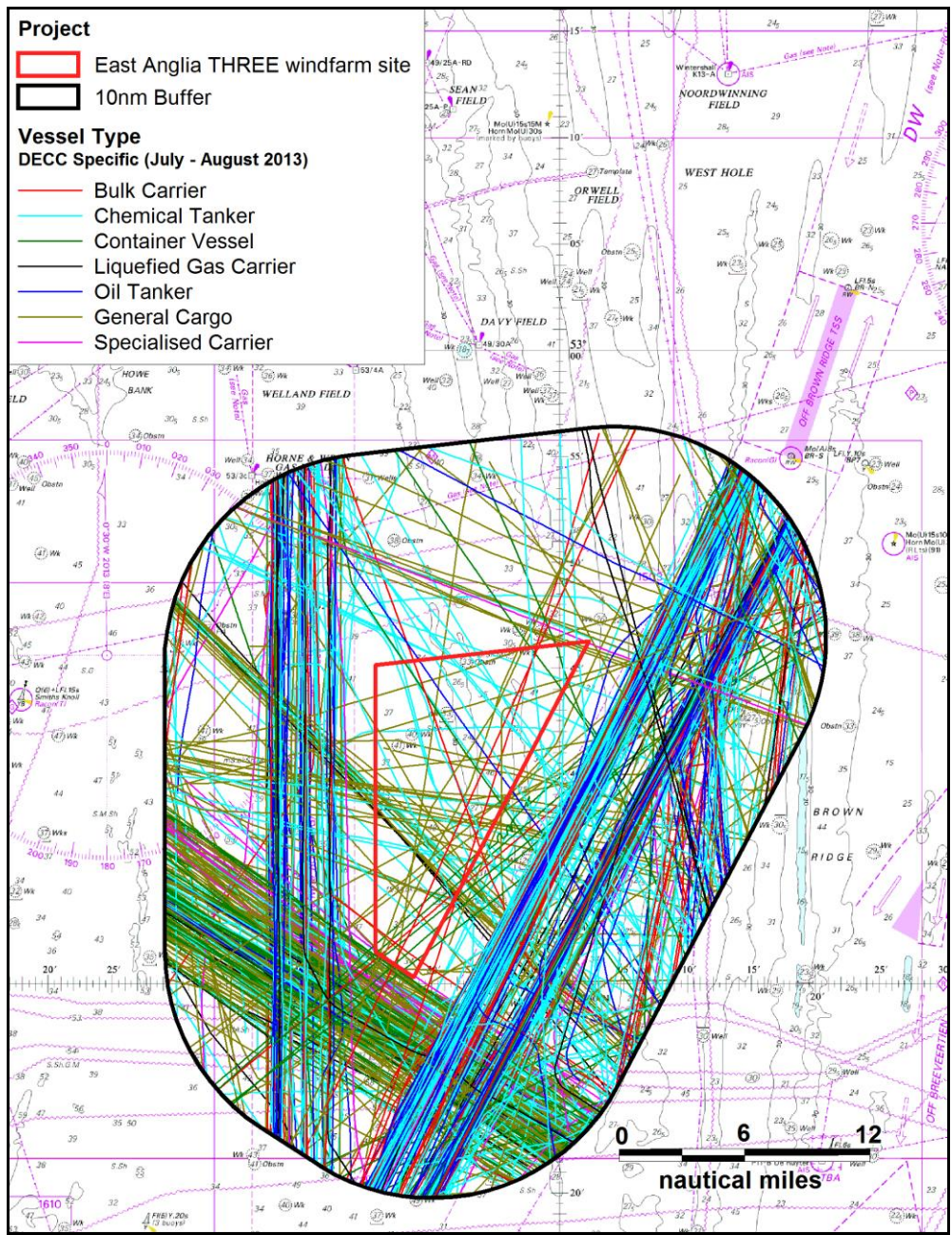


Figure 11.9 Cargo Vessels (10 days – August and September 2012)



**Figure 11.10** Cargo Vessels (10 days – May 2013)



**Figure 11.11 Cargo Vessels (10 days – July / August 2013)**

126. Cargo vessels were the most frequently recorded vessel type in the vicinity of the East Anglia THREE site, with a large proportion of the cargo vessels tracked within 10nm of the site using the Deep Water Routes (DWRs), passing to the east and west of East Anglia THREE.
127. General cargo vessels were the cargo vessel type recorded most frequently passing through the East Anglia THREE site, followed by chemical tankers, with the majority of vessels passing through the site heading north north-west or south south-east.
128. Several cargo vessels were identified to be regularly passing through the East Anglia

THREE site. The cargo vessel that most frequently passed through the East Anglia THREE site was the general cargo vessel *Christine Y* which was recorded transiting the site on nine separate occasions operating between Amsterdam and Humber ports. Other frequently recorded vessels include the Ro-Ro cargo vessels *Wilhelmine*, operating on the P&O freight route between Rotterdam and Teesport and the Ro-Ro cargo vessel *Norsky* operating between Teesport and Europort which were each recorded on eight separate occasions.

### **11.6 Passenger and Cruise Vessels**

129. A plot of the passenger vessel tracks recorded over the combined 30 day baseline survey period is presented in Figure 11.12.



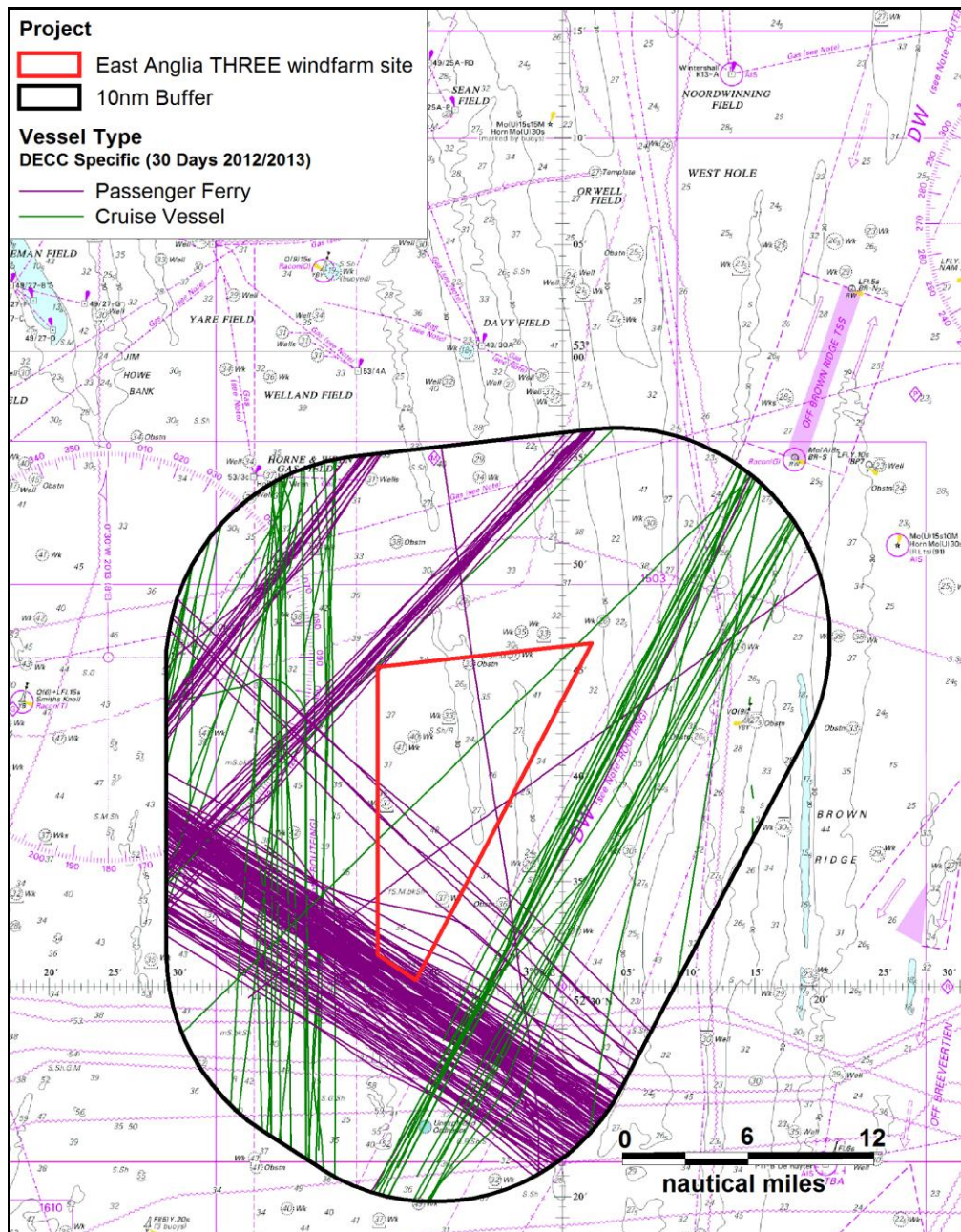


Figure 11.12 Passenger Vessels (Combined – 30 days 2012/2013)

130. The passenger vessel recorded most frequently operating in proximity to the East Anglia THREE site during the combined 30 day survey period was the *Sirena Seaways*, previously known as the *Dana Sirena*, which was recorded on 18 separate days operating on the DFDS Seaways Esbjerg to Harwich route.

131. Other regular ferry routes recorded operating in the vicinity of the site include the P&O Hull to Europort (operated by the *Pride of Hull* and *Pride of Rotterdam*) and the Stena Lines Hook of Holland to Killingholme (operated by the *Stena Transporter* and the *Stena Transit*). All vessels operating on these routes were each recorded on 16 separate days throughout the combined 30 day baseline survey period.

132. One cruise vessel, *The Jewel of the Seas*, was tracked passing through the East Anglia THREE site on the 30<sup>th</sup> August 2012. There was an average of two to three passenger vessels per day tracked within 10nm of the East Anglia THREE site during the August and September 2012 survey, an average of two per day during the May 2013 survey and an average of two per day during the July and August 2013 survey.

### **11.7 Other Operational Vessels**

133. Figure 11.13 presents a plot of the other operational vessel tracks recorded in the vicinity of the East Anglia THREE site during the 30 day combined baseline survey period.

134. It can be seen that the majority of vessels transiting through the East Anglia THREE site are vessels associated with the offshore industry such as oil and gas support vessels, tug and tow vessels and dredgers.

135. Offshore vessel activity was constrained mainly to the DWRs east and west of the East Anglia THREE site. However, a proportion of offshore vessels were also recorded intersecting the East Anglia THREE site whilst on passage to Amsterdam. The offshore research vessel *Aurelia* was recorded carrying out a survey throughout the August / September 2013 survey resulting in the looped tracks passing through the East Anglia THREE site.

136. Dredgers were recorded intersecting the East Anglia THREE site throughout the combined survey period whilst on passage to / from aggregate dredge areas off the east coast of the UK and Amsterdam. The *Arco Humber* and *Arco Dijk* were recorded intersecting the East Anglia THREE site on six and three occasions respectively throughout the combined 30 day baseline survey period.

137. Tug and Tow vessels were mainly recorded transiting within the DWRs to the east and west of the East Anglia THREE site with only two tug and tow vessels recorded intersecting the East Anglia THREE site throughout the combined 30 day baseline survey period: The 25m-long *Afon Alaw* on passage to Brunsbuttel (Germany) and the 23m-long *Marineco Hathi* on passage to Delfzijl (The Netherlands).

138. One windfarm support vessel, the high speed crew transfer vessel *Lynas Point*, was recorded passing through the East Anglia THREE site on passage to Ijmuiden (Amsterdam, The Netherlands) on the 1<sup>st</sup> August 2013.

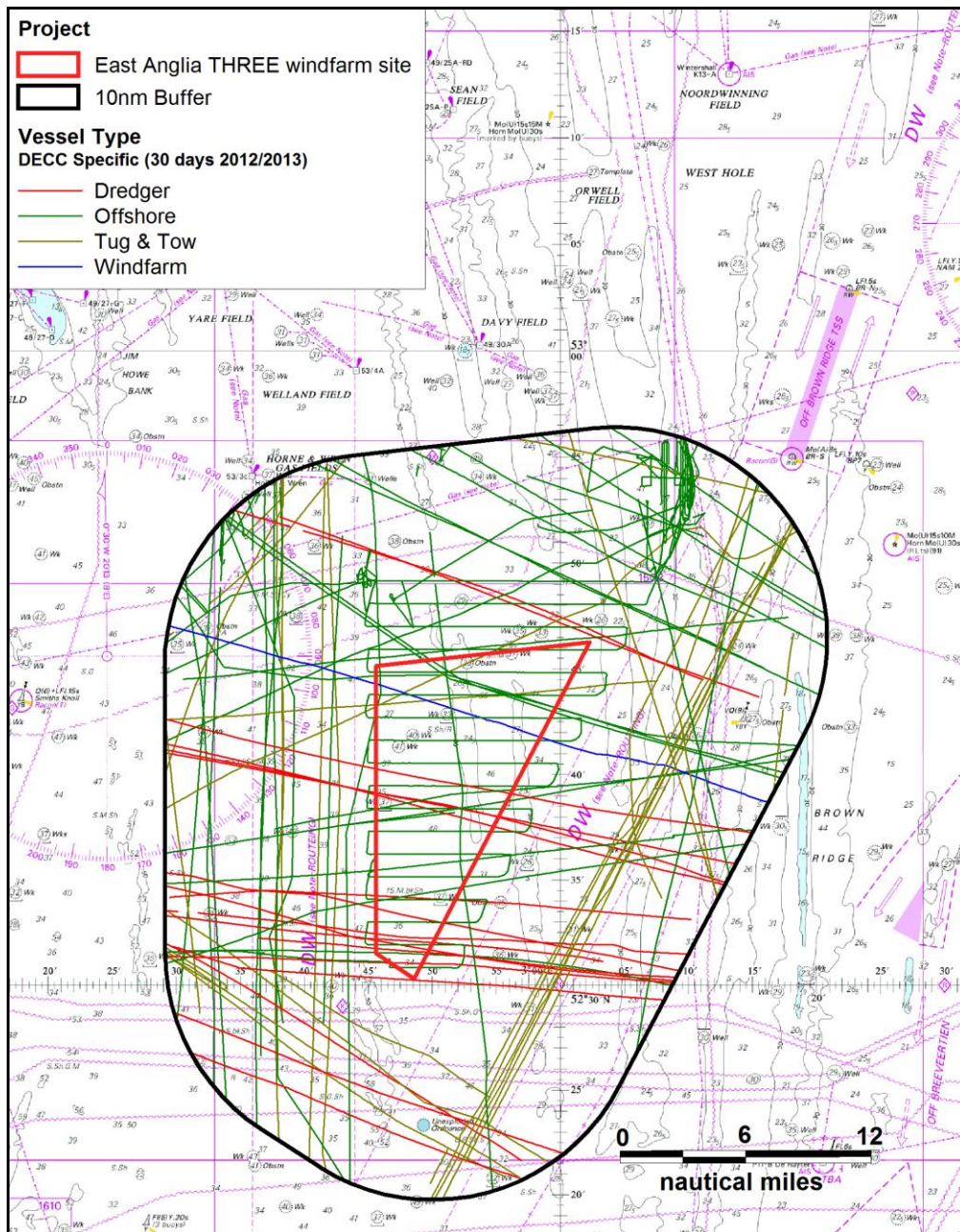


Figure 11.13 Other Operational Vessels (Combined – 30 days)

## 12 Changes to Routeing Measures within Dutch Waters

139. On the 1st August 2013 the routeing measures in Dutch waters were updated. A new TSS has been introduced as well as revisions made to existing schemes. These changes would also have effects on routes passing through the East Anglia THREE site. Figure 12.1 and Figure 12.2 present the changes to the routeing measures in the area and section 18 shows where routes have initially been deviated by changes in the routeing measure and then by the development of the proposed East Anglia THREE project.

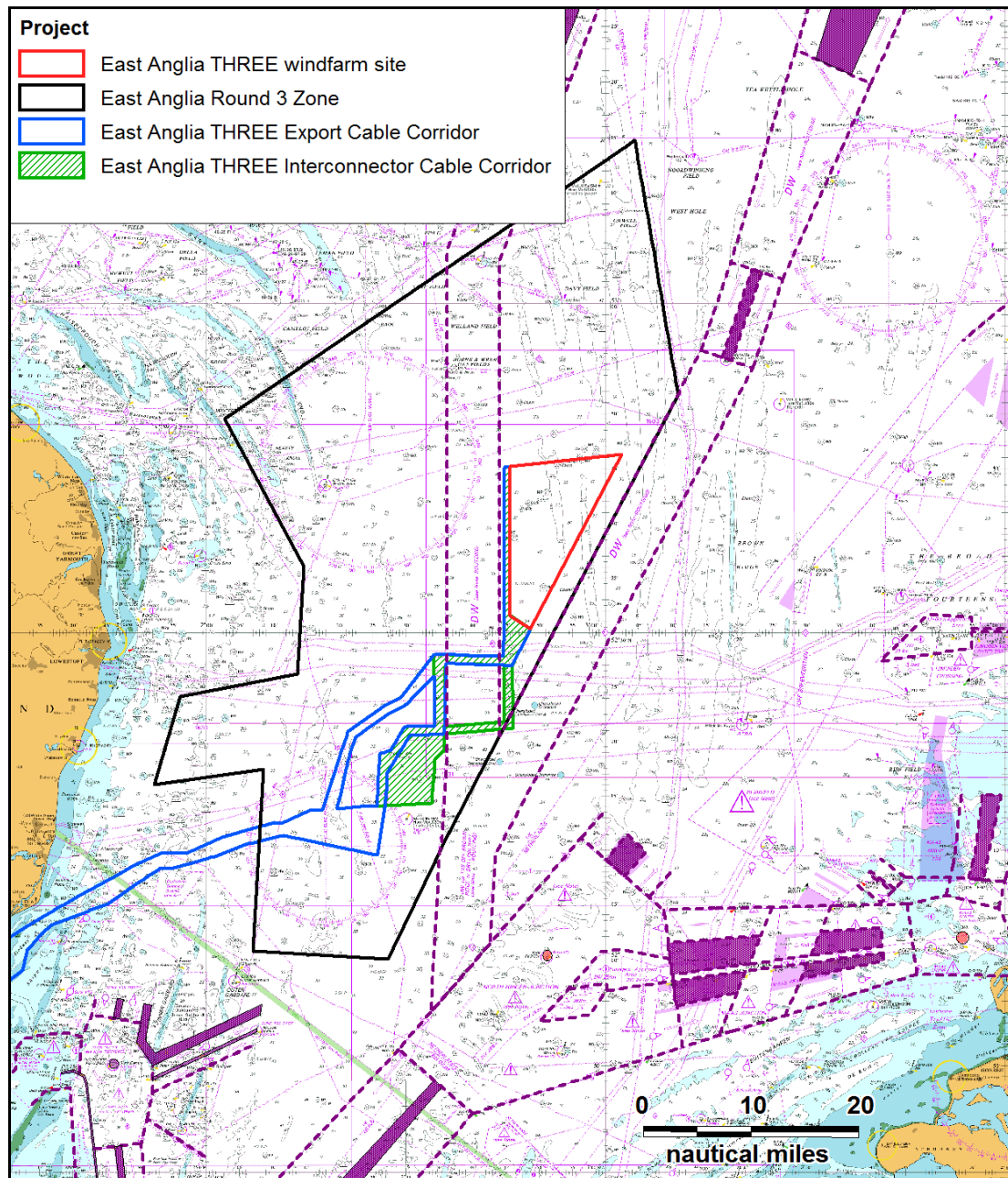
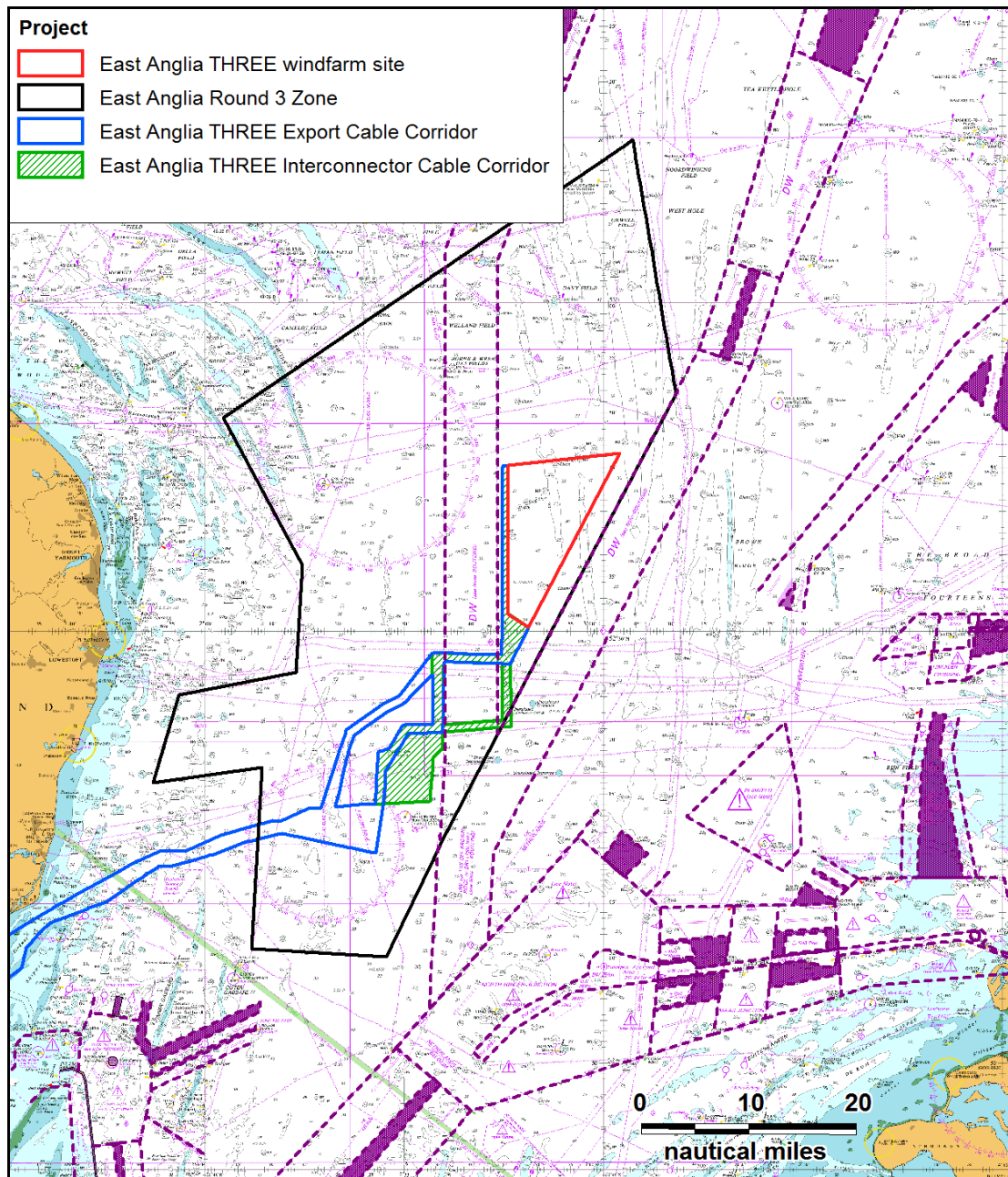


Figure 12.1 Pre August 1st 2013 Routeing Measures



**Figure 12.2 Post 1st August 2013 Routing Measures**

### 13 Validation Survey 2014

140. The section presents the results of a validation survey took place between Thursday 23rd January 2014 and Sunday 2nd February 2014 from the *Northern Viking* survey vessel. The survey is being considered separately and as a validation to ensure that any changes to routeing since the 2012 and 2013 surveys are clearly identified including changes to the Dutch routeing measure as noted in section 12. The following section analyses traffic and was used to identify the current 90th percentile routs shown in section 14.
141. A plot of the tracks recorded during the winter (January/February 2014) validation survey, colour-coded by general vessel type categories, is presented in Figure 13.1.

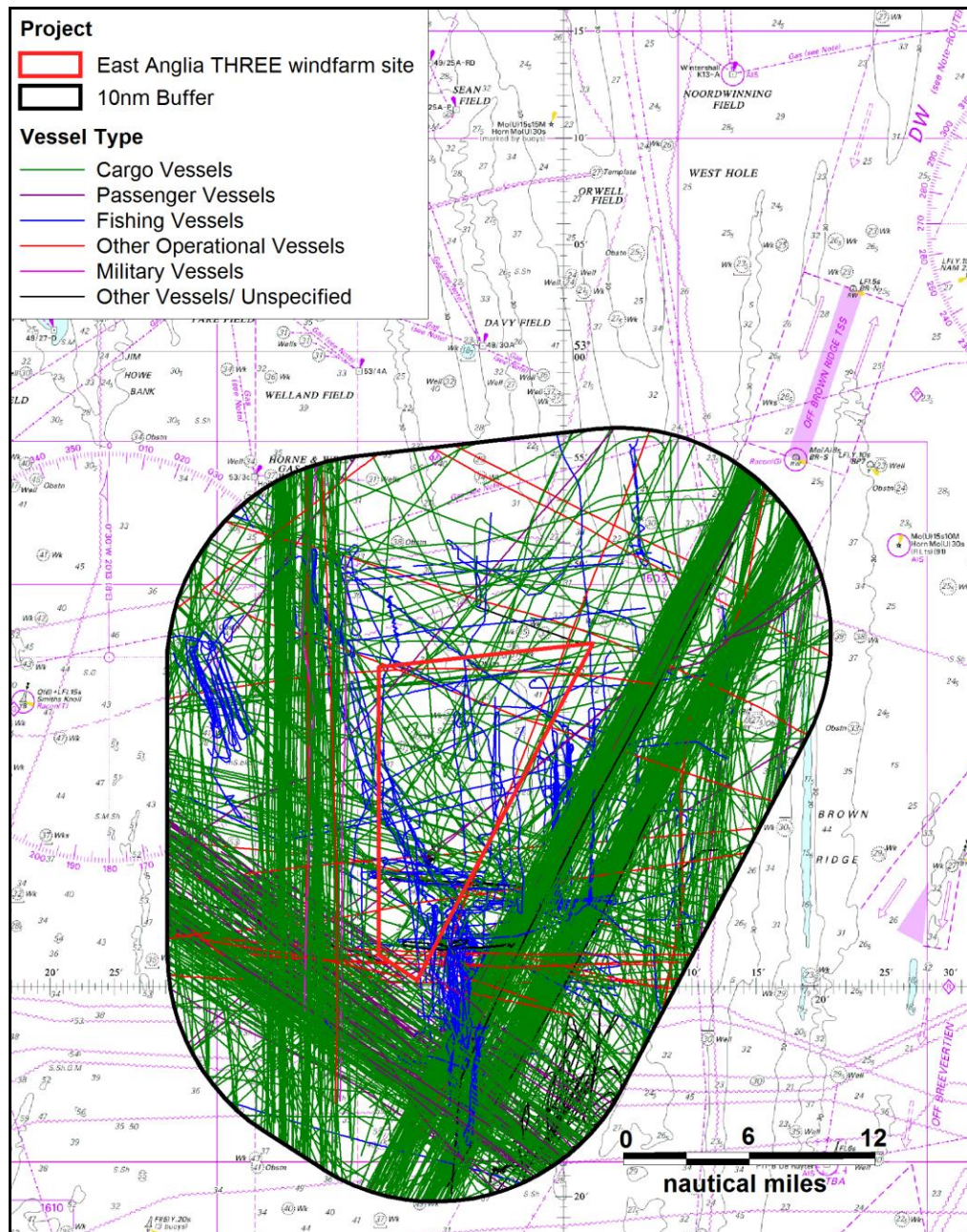
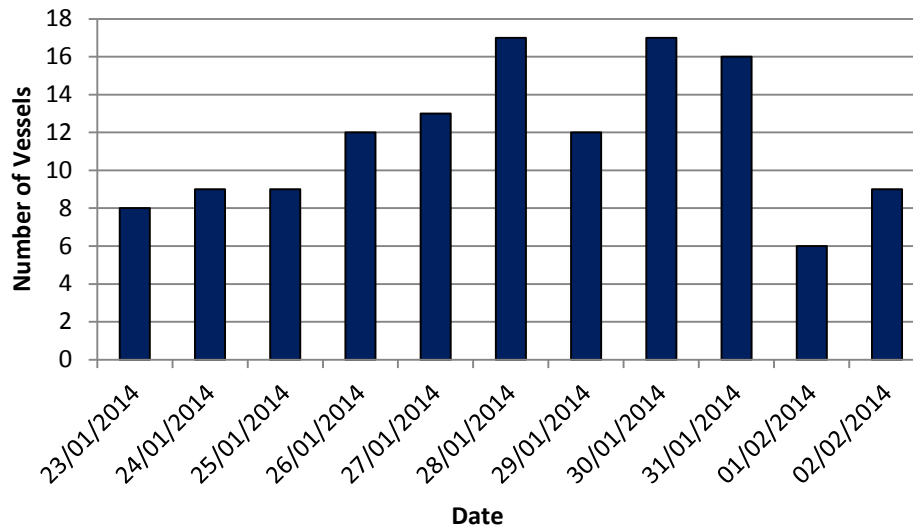


Figure 13.1 Combined AIS and Radar Tracks by Type – January / February 2014 (10 days)

142. There was an average of 84 unique vessels per day passing within 10nm of the East Anglia THREE site during the ten day survey period in January / February 2014.

143. Figure 13.2 presents the daily number of vessels intersecting the East Anglia THREE site during the survey period.



**Figure 13.2 Vessels per day Intersecting East Anglia THREE**

144. Excluding the *Northern Viking* there was an average of 12 unique vessels per day passing through the East Anglia THREE site, with the majority of tracks recorded on AIS (92%) as opposed to non-AIS radar tracks (8%). It is noted that this is the lowest activity recorded of all surveys performed at the East Anglia THREE site. This could be in part due to the poor weather conditions which were recorded throughout the winter validation survey.
145. The busiest days were Tuesday 28<sup>th</sup> January and Thursday 30<sup>th</sup> January when 17 unique vessels were recorded passing through the East Anglia THREE site. The quietest day was Saturday 1<sup>st</sup> February, when six unique vessels were recorded passing through the East Anglia THREE site.
146. A plot of the vessel tracks passing through the site on one of the busiest days (28th January) is presented in Figure 13.3.



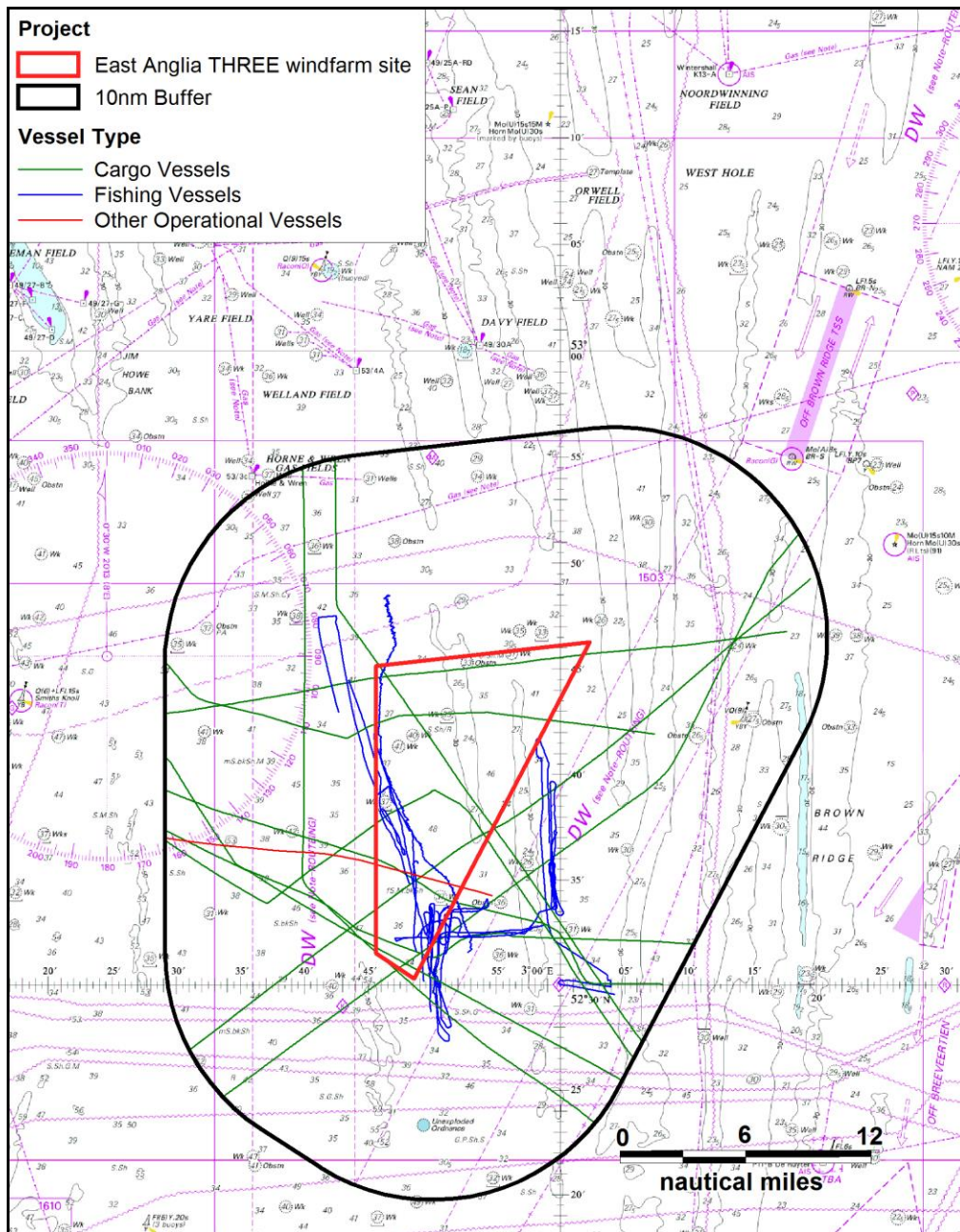
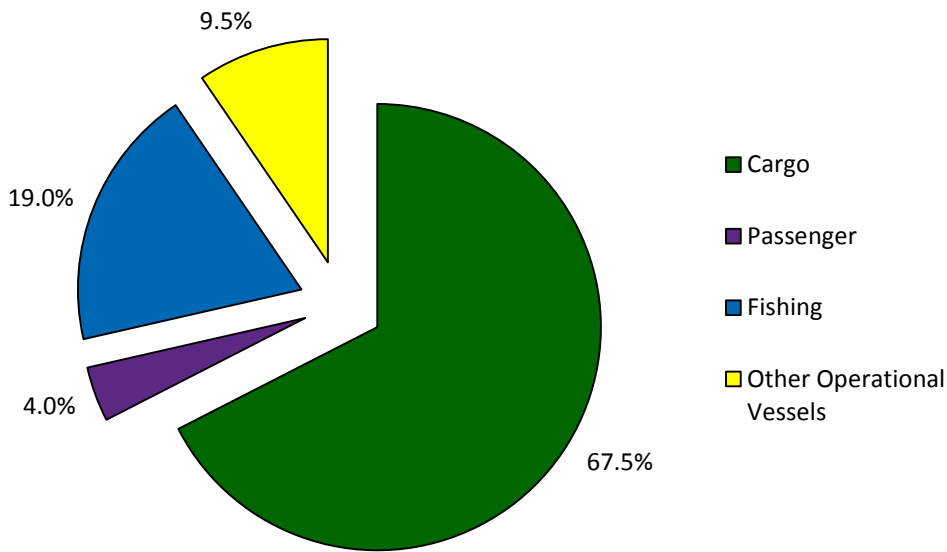


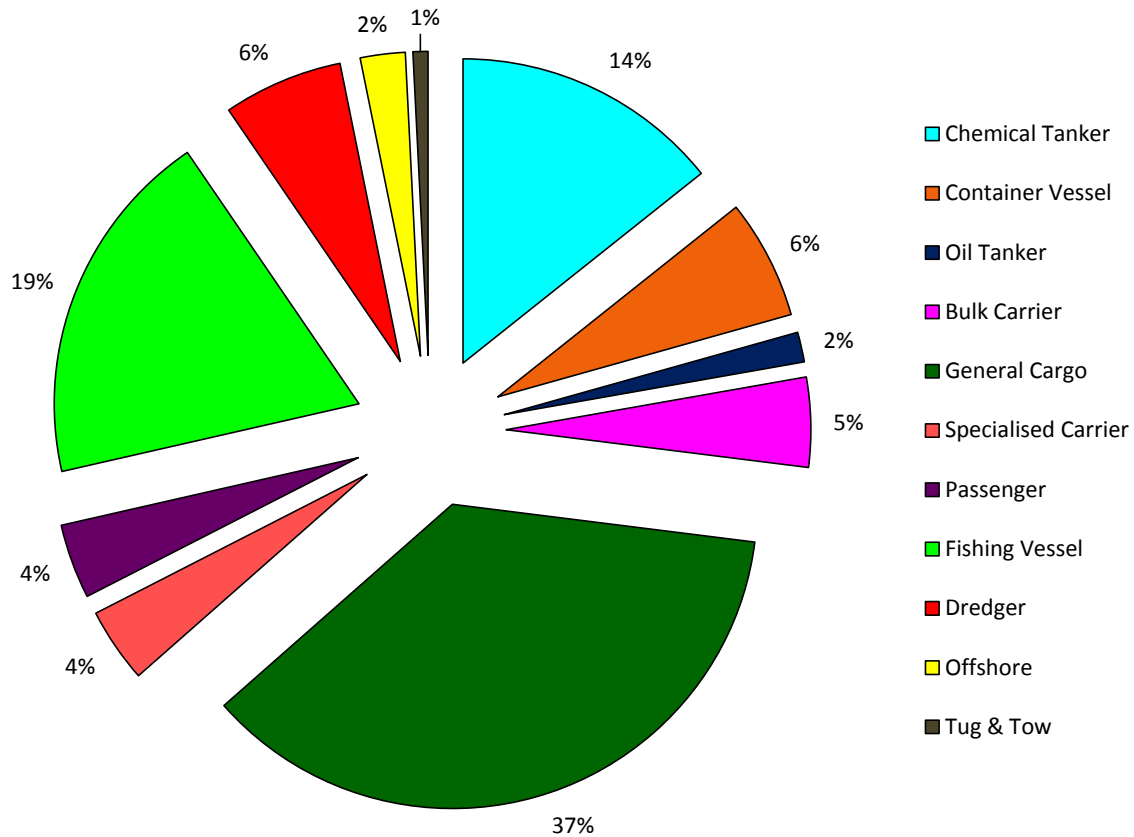
Figure 13.3 Vessels Intersecting the East Anglia THREE site – Joint Busiest Day (28<sup>th</sup> January 2014)

147. Figure 13.4 presents the vessel type distribution for vessels passing through the East Anglia THREE site during the winter validation survey (excluding 0.8% unspecified).



**Figure 13.4 Vessel Types Distribution passing through the East Anglia THREE site (10 Days)**

148. Unspecified ships accounted for 0.8% of vessels recorded within the East Anglia THREE site throughout the winter validation survey and these were generally radar targets with no visual identification. The most common vessel types recorded within the site during the survey were cargo vessels (67.5%), fishing vessels (19%) and other operational vessels (9.5%).
149. Dividing the types further using the more detailed (second-level) DECC categories (as defined in Table 11.1), the distribution of vessels within the East Anglia THREE site (excluding unspecified vessels) is presented in Figure 13.5.



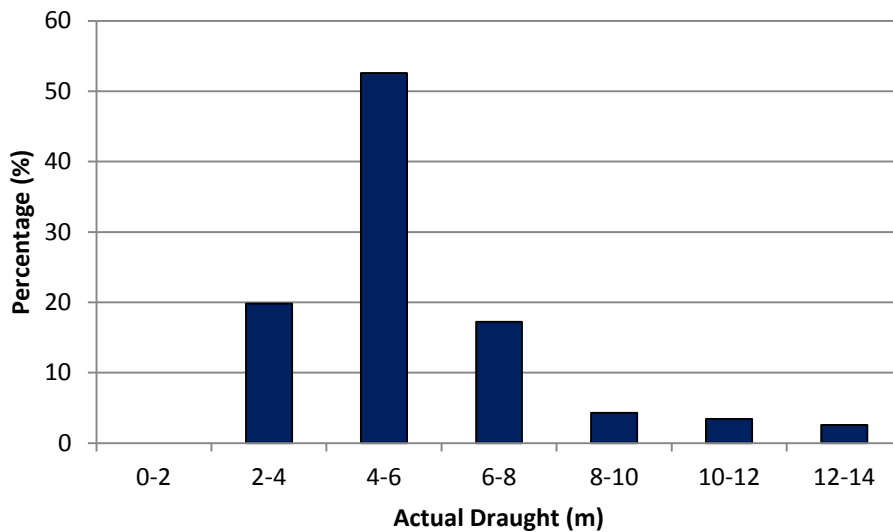
**Figure 13.5 Detailed DECC Vessel Type Distribution Passing through the East Anglia THREE site (10 Days January/February 2014).**

150. The most frequently recorded vessel type passing through the East Anglia THREE site throughout the winter validation survey was general cargo vessels, representing 37% of marine traffic. Other vessel types which represent a significant proportion of marine traffic are fishing vessels (19%) and chemical tankers (14%).

151. The vessel type distribution of the winter validation survey is in good agreement with the baseline 30 day survey period analysed.

### **13.1 Vessel Size (Validation Survey)**

152. The distribution of vessels passing through the East Anglia THREE site by draught for the ten day winter validation survey period is presented in Figure 13.6. It should be noted that there were no vessels with an unspecified draught throughout this survey period.

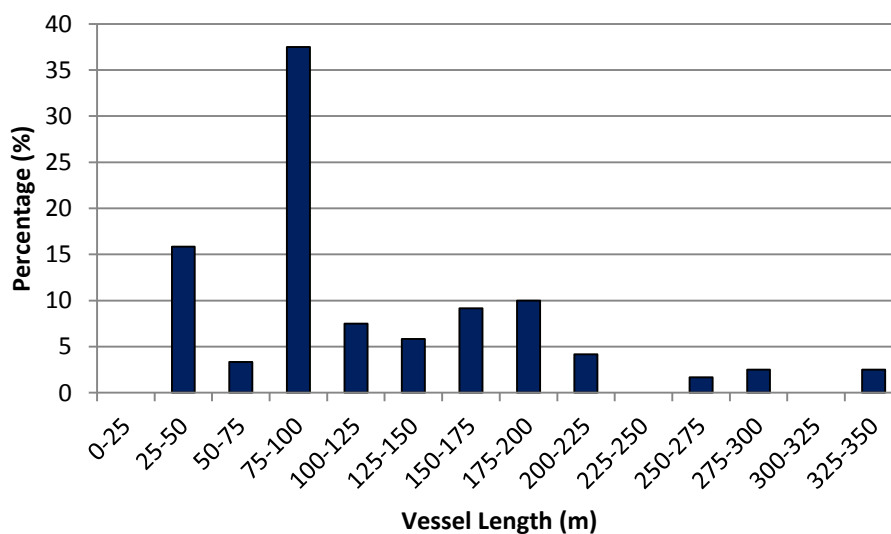


**Figure 13.6 Distribution of Vessel Draught (10 Day Winter Validation Survey Period)**

153. The average draught of vessels which passed within the East Anglia THREE site during the survey was 5.7m, with the majority of vessels having draughts between 4 and 6m (53%).

154. The vessel broadcasting the deepest draught recorded intersecting the East Anglia THREE site was the bulk carrier *Maersk Iowa* recorded on 26<sup>th</sup> January headed to Felixstowe, UK. This vessel is 292m long and 35m wide at the beam and broadcast a draught of 13.2m.

155. The distribution of vessels passing within the East Anglia THREE site by length for the ten day winter survey period is presented in Figure 13.7



**Figure 13.7 Distribution of Vessels Length (10 Day Winter Validation Survey Period)**

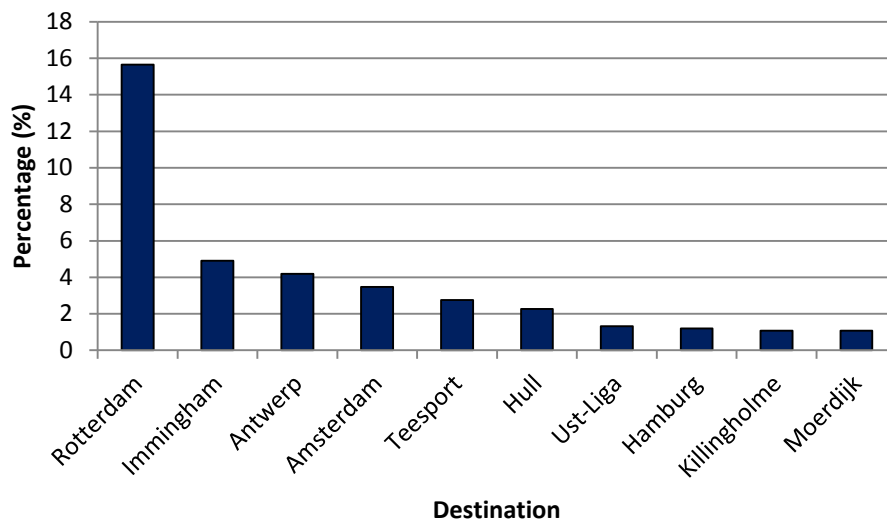
156. The average length of vessels passing within the East Anglia THREE site during the survey was 119.1m. It can be seen that a large proportion of vessels had lengths between 75-100m (38%) and 25-50m (16%).

157. The longest vessel recorded intersecting the East Anglia THREE site was the bulk carrier *Ever Lotus* measuring 335m recorded on 29<sup>th</sup> January whilst on passage to Hamburg, Germany. This vessel is 46m wide at the beam and broadcast a draught of 11m.

158. From analysis of the distribution of vessel sizes recorded throughout the winter validation survey, it could be concluded that the distribution has not differed significantly from the baseline survey data, with the majority of vessels measuring between 75 and 100m in length and 4 to 6m in draught throughout both analyses.

### 13.2 Destination (Validation Survey)

159. The main destinations of vessels tracked within the East Anglia THREE site are summarised in Figure 13.8. This data was available for AIS targets only.

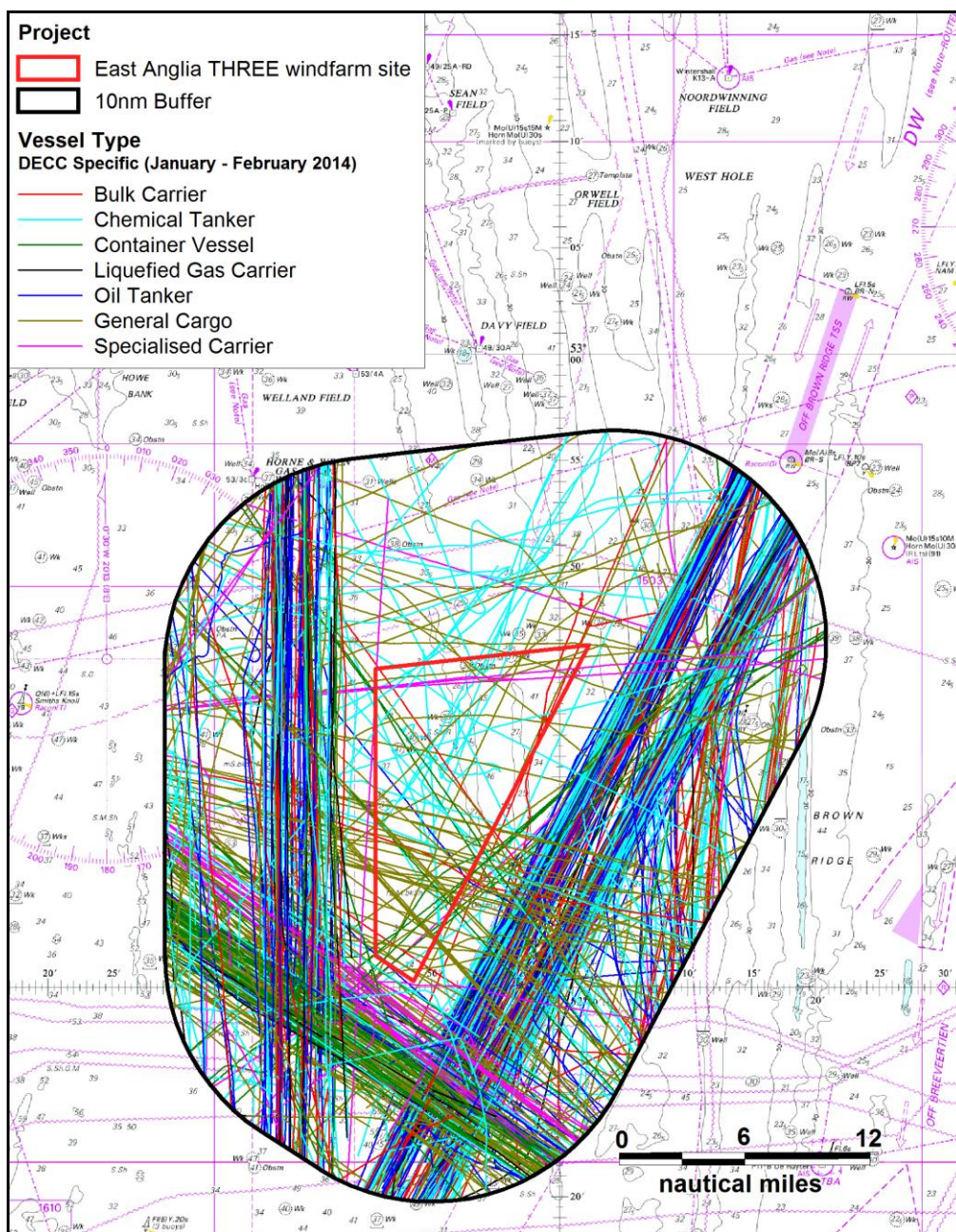


**Figure 13.8** Main destination ports of vessels passing within 10nm of the East Anglia THREE site

160. The most commonly recorded destinations were ports in the Netherlands such as Rotterdam (15%) and Amsterdam (4%) and ports on the East coast of England, such as Immingham (5%), Teesport (3%), Hull (3%) and Killingholme (1%). Antwerp (Belgium) was also a common destination for vessels (4%).

### 13.3 Cargo Vessels (Validation Survey)

161. The cargo vessels tracked within 10nm of the East Anglia THREE site throughout the winter validation are shown in Figure 13.9



**Figure 13.9 Cargo Vessels Recorded within 10nm of the East Anglia THREE site (10 Days)**

162. Cargo vessels were the most frequently recorded vessel type in the vicinity of the East Anglia THREE site throughout the winter validation survey, representing 67.5% of marine traffic. A large proportion of the cargo vessels tracked within 10nm of the site were recorded transiting within the DWR to the east and west of the site. Relatively high numbers of cargo vessels were also recorded passing to the south of the East Anglia THREE site in south-east and north-west direction.

163. General cargo vessels were the most frequently recorded cargo vessel type passing through the East Anglia THREE site, representing 37% of marine traffic. Chemical tankers, container vessels and bulk carriers were also frequently recorded representing

14%, 6% and 5% of marine traffic respectively.

164. The Ro-Ro cargo vessel *Wilhelmine*, was the cargo vessel recorded intersecting the East Anglia THREE site most often, passing through the site on six occasions whilst operating on the P&O freight route between Rotterdam and Teesport.

165. An average of eight unique cargo vessels per day passed through the East Anglia THREE site. The busiest day was 31<sup>st</sup> January when 14 cargo vessels were recorded crossing the East Anglia THREE site. The quietest days were 23<sup>rd</sup> January and 1<sup>st</sup> of February, when five unique cargo vessels were recorded intersecting the site.

### **13.4 Passenger and Cruise Vessels (Validation Survey)**

166. The passenger vessels tracked within 10nm of the East Anglia THREE site throughout the winter validation are shown in Figure 13.10. No cruise ships were noted during the validation survey due to the seasonal variation in this type of activity in the North Sea.

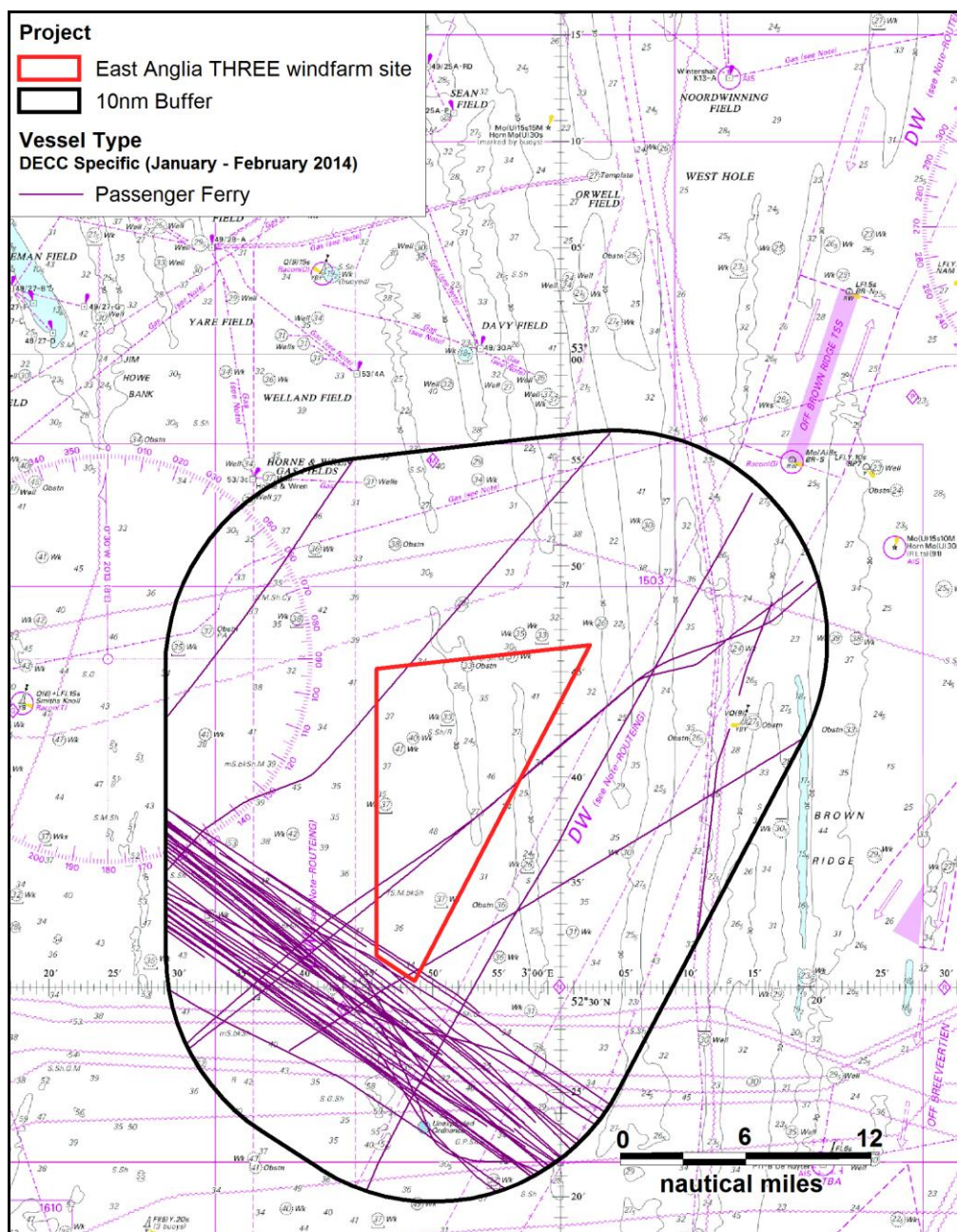


Figure 13.10 Passenger Vessels within 10nm of the East Anglia THREE site (10 Days)

167. The most frequently recorded passenger vessel passing through the East Anglia THREE site during the winter validation survey period was the *Sirena Seaways*, operating on the DFDS Seaways Esbjerg to Harwich route. The *Sirena Seaways* passed through the site on four occasions travelling in a north east or southwest direction. This vessel also passed once more northwest of the East Anglia THREE site whilst operating on the same route.

168. The *Pride of Hull* and *Pride of Rotterdam* were recorded operating on the P&O Ferries Hull to Rotterdam route. The *Pride of Hull* was recorded intersecting the East Anglia THREE site on one occasion (25<sup>th</sup> January 2014) and passing south of the East

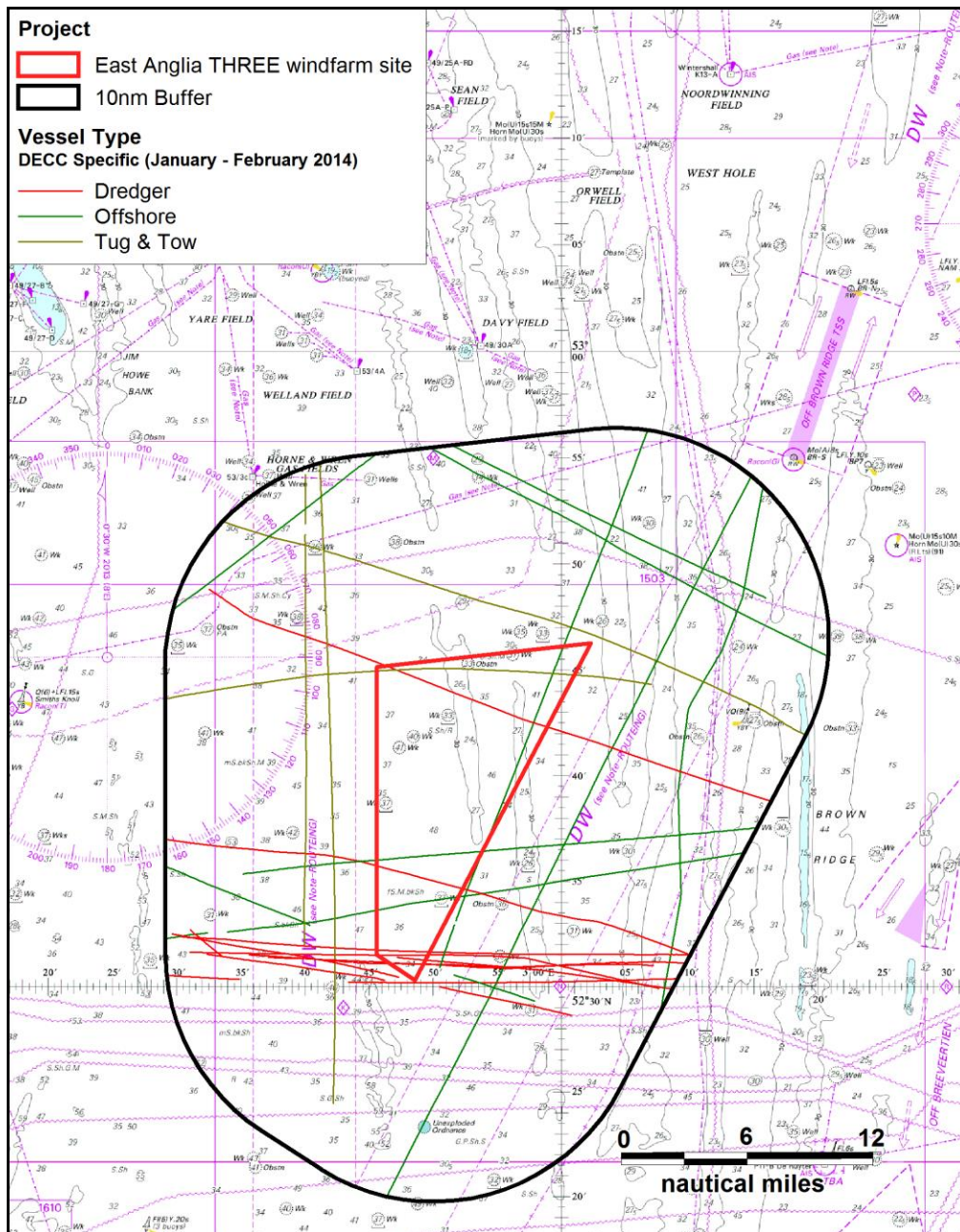


Anglia THREE site on a further nine occasions throughout the survey period. The *Pride of Rotterdam* did not intersect the East Anglia THREE site throughout the winter validation survey period but was recorded passing in close proximity to the southern boundary of the site on 12 occasions whilst operating on this route.

169. The *Stena Transit* and *Stena Transporter* were recorded operating on the Stena Line Killingholme to Hook of Holland route. The *Stena Transporter* was recorded passing through the East Anglia THREE site on one occasion (26<sup>th</sup> January 2014) and passing south of the East Anglia THREE site on a further eight occasions. The *Stena Transit* was recorded passing south of the East Anglia THREE site on ten occasions throughout the winter validation survey whilst operating on this route.
170. There were no cruise ferries recorded within 10nm of the East Anglia THREE site during the winter validation survey period.
171. It could therefore be concluded that overall passenger vessel routeing in the vicinity of the proposed East Anglia THREE project has not differed greatly throughout the baseline survey data period.

### **13.5 Other Operational Vessels (Validation Survey)**

172. Figure 13.11 presents a chart overview of the tracks of other operational vessels recorded during the winter validation survey.



**Figure 13.11 Other Operational Vessels Recorded within 10nm of the East Anglia THREE site (10 Days)**

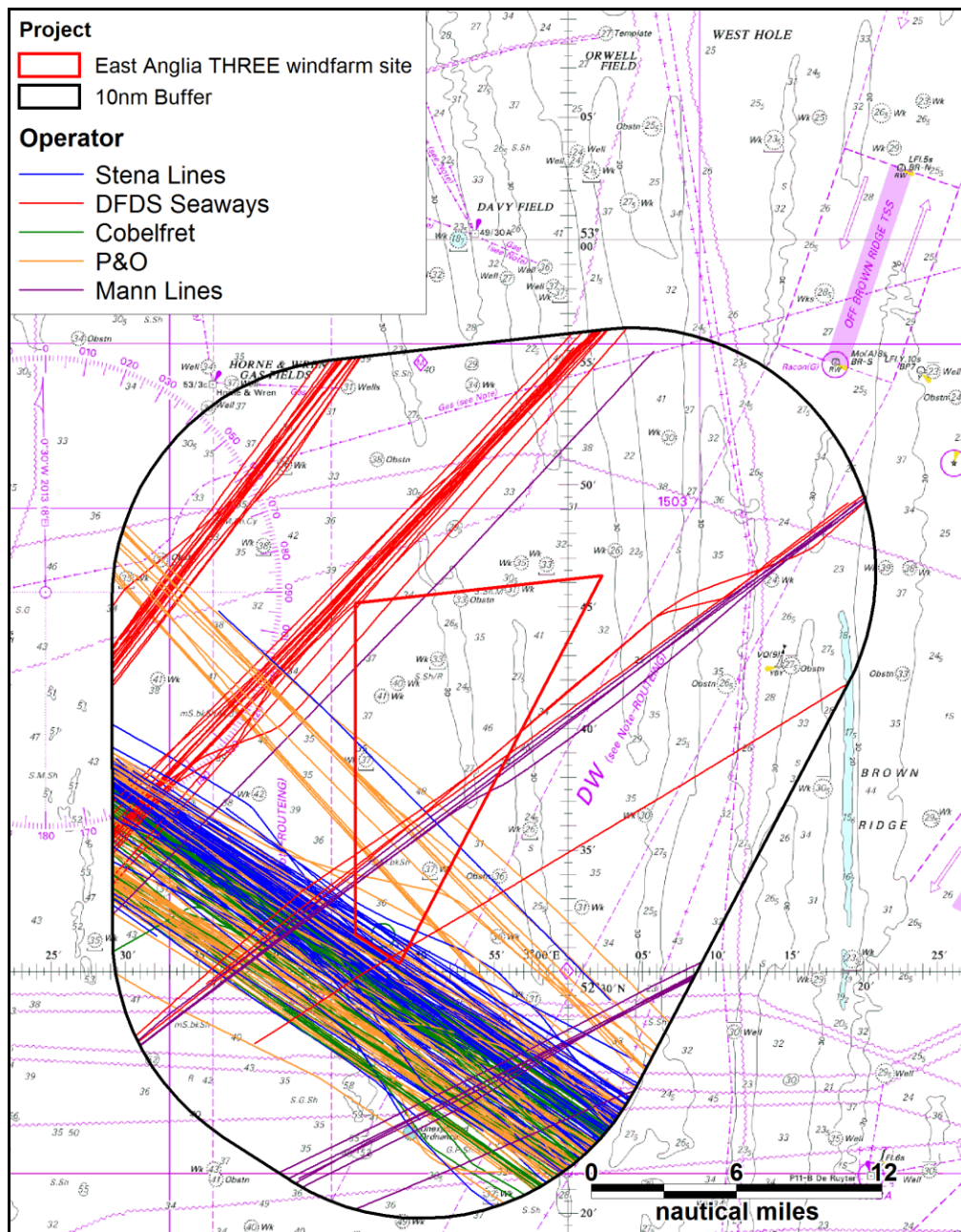
173. Nine unique other operational vessels were recorded intersecting the East Anglia THREE site during the survey period. Dredgers were the most frequently recorded other operational vessel type to intersect the East Anglia THREE site, representing 70%. Of these dredgers, the *Arco Dijk* was the most frequently recorded which passed through the site three times whilst transiting between Amsterdam and aggregate dredge areas off the east coast of the UK. Other operational vessel types which were recorded transiting through the East Anglia THREE site include offshore vessels (representing 20% of marine traffic) and tug and tow vessels (representing 10% of marine traffic).

174. This vessel type distribution and vessel routing of other operational vessels is in good agreement with the baseline survey data.

## 14 Commercial Ferry Operators and Activity

175. Figure 14.1 presents vessel tracks of commercial ferries recorded during the 40 day survey period colour-coded by operator. Following this, Table 14.1 summarises commercial ferry operations recorded operating in proximity of the East Anglia THREE site, including the number of vessels operating on each route per day.

176. It should be noted that the DFDS Harwich – Esbjerg route ceased on the 28<sup>th</sup> September 2014 due to increased running costs.



**Figure 14.1 Vessel Tracks of Commercial Ferries**

**Table 14.1 Commercial Ferry Routes**

<b>Operator</b>	<b>Vessel</b>	<b>Route</b>	<b>Vessels Per Day</b>
Stena Line	<i>Stena Transit</i>	Killingholme – Hook of Holland (Route 14)	1 every day
	<i>Stena Transporter</i>		
DFDS Seaways	<i>Sirena Seaways</i>	Harwich – Esbjerg (Route 21)	1 every 2 days
Cobelfret	<i>Palatine</i>	Killingholme – Rotterdam (Route 14)	2 every day
	<i>Vespertine</i>		
	<i>Amandine</i>		
	<i>Opaline</i>		
P&O Ferries	<i>Pride of Rotterdam</i>	Hull – Europort (Routes 13&14)	1 every day
	<i>Pride of Hull</i>		
	<i>Wilhelmine</i>	Teesport – Rotterdam (Route 15)	1 every 2 days
Mann Lines	<i>Estraden</i>	Bremerhaven – Harwich – Cuxhaven	1 every 7 days

177. The impact of the proposed East Anglia THREE project on each of the commercial ferry routes recorded operating in proximity to the development is assessed in Section 18.

## 15 Recreational Craft Activity

### 15.1 Introduction

178. This section reviews recreational vessel activity at the East Anglia THREE site based on information published by the Royal Yachting Association (RYA) and tracking of recreational craft during the three maritime traffic surveys.

### 15.2 RYA Data

179. Historically there has not been a database of recreational use of the UK's marine environment. As a response to the lack of information, the RYA, supported by the Cruising Association (CA), started to identify recreational cruising routes, general sailing and racing areas. This work was based on extensive consultation and qualitative data collection from RYA and Cruising Association members, through the organisations' specialist and regional committees and through the RYA affiliated clubs. The consultation was also sent to berth holder associations and marinas.

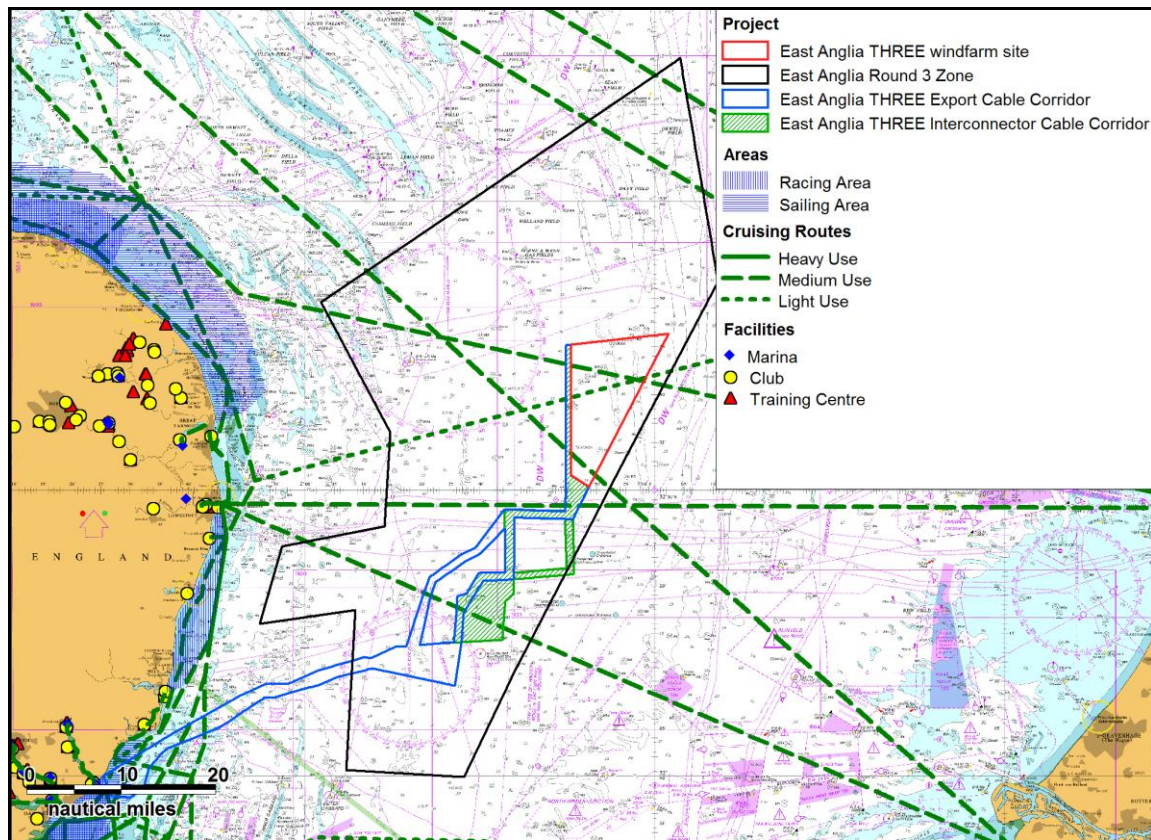
180. The results of this work were initially published in *Sharing the Wind* (RYA, 2004) and updated in the *UK Coastal Atlas of Recreational Boating*.

181. The reports note that recreational boating, both under sail and power is highly seasonal and highly diurnal. The division of recreational craft routes into Heavy, Medium and Light Use is therefore based on the following classification:

- Heavy Recreational Routes: - Very popular routes on which a minimum of six or more recreational vessels would probably be seen at all times during summer daylight hours. These also include the entrances to harbours, anchorages and places of refuge.
- Medium Recreational Routes: - Popular routes on which some recreational craft would be seen at most times during summer daylight hours.
- Light Recreational Routes: - Routes known to be in common use but which do not qualify for medium or heavy classification.

### 15.3 The East Anglia THREE site Recreational Data

182. A summary plot of the recreational sailing activity and facilities off the East Anglia coast (to enable assessment and due to the nature of recreational craft routeing this is shown at a zonal context) is presented in Figure 15.1. This is based on the 2010 data from the Coastal Atlas (RYA, 2010) in terms of coastal facilities (clubs, marinas and training centres), general sailing and racing areas, and indicative cruising routes (dark green lines).



**Figure 15.1 Recreational Information for the East Anglia THREE Site**

183. Based on RYA published data there are three cruising routes passing through the East Anglia THREE site, two of which are medium use and one of which is light use. The medium use route that passes through the southern end of the site is headed for Ostend (Belgium) and the medium use route that passes through the northern part of the site is headed to Amsterdam (The Netherlands). The light use route which intersects the centre of the site is bound for Den Helder (The Netherlands). A further medium use route passes approximately 2nm to the south of the site which is also headed for Amsterdam.

184. A number of additional cruising routes (six medium and one light use) also intersect the offshore cable corridor, the majority of which intersect at the near shore area transiting in a north/south direction.

### 15.4 Survey Data

185. The recreational tracks recorded during the four maritime traffic surveys are presented as follows..

186. During the combined 40 day survey period from the *Northern Viking* and *Shemarah II* vessels, a total of 56 unique recreational vessels were recorded within 10nm of the East Anglia THREE site, an average of between one and two vessels per day. Of these, 33 recreational vessels were recorded within the site itself. The vast majority of recreational vessels recorded in the area during the survey were sailing yachts. It is noted that 91% of vessels tracks had AIS and 9% were recorded on Radar.

187. A plot of all the recreational vessel tracks recorded passing within 10nm of the East Anglia THREE site during the 40 days combined survey is presented in Figure 15.2.

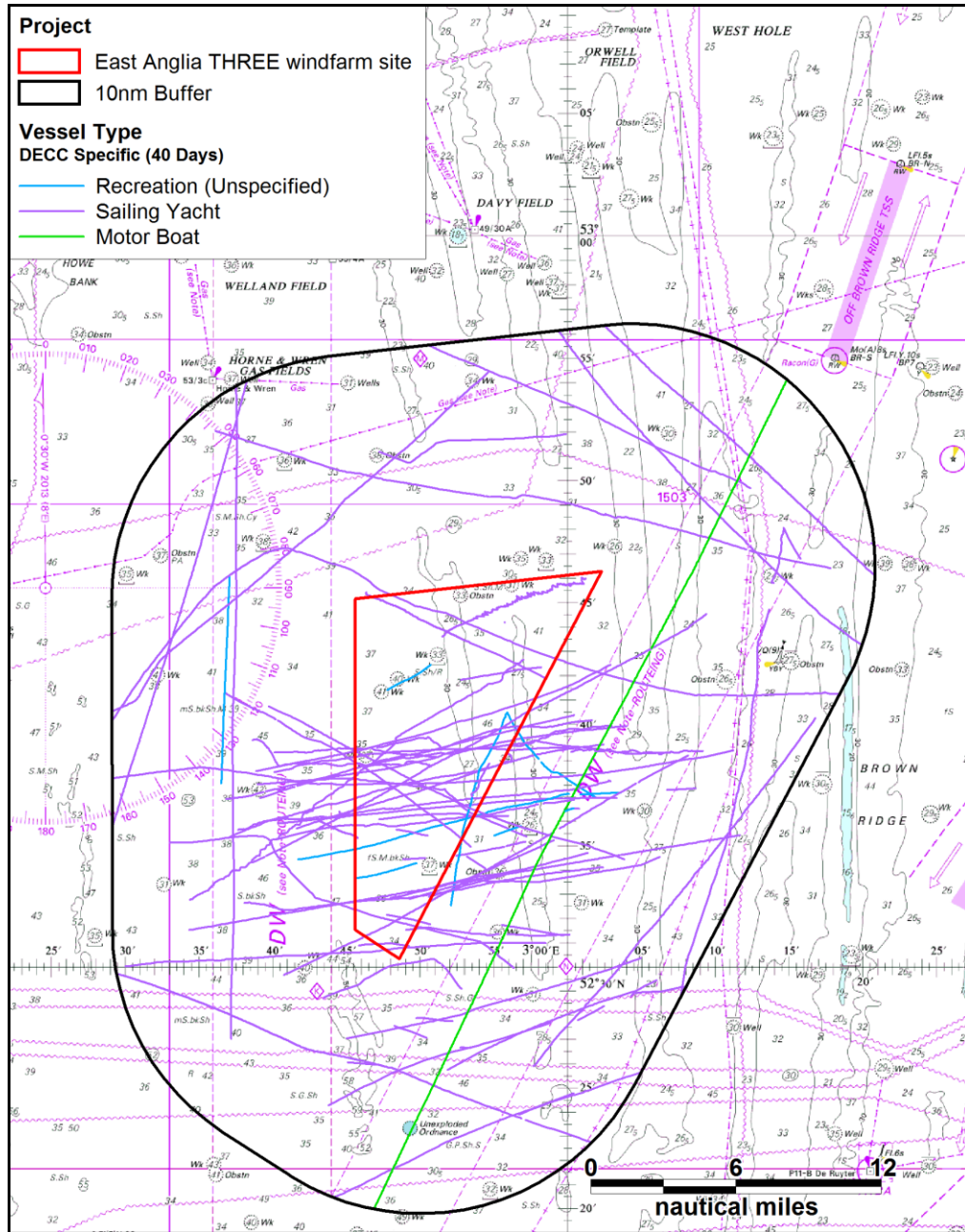


Figure 15.2 All Recreational Vessel Tracks (40 days)

**15.5 Impacts of Structures on Wind Masking / Turbulence or Shear**

188. The offshore wind turbines have the potential to affect vessels under sail when passing through the site from effects such as wind shear, masking and turbulence.

189. From previous studies of offshore windfarms it was concluded that wind turbines do reduce wind velocity by the order of 10% downwind of a wind turbine. The temporary



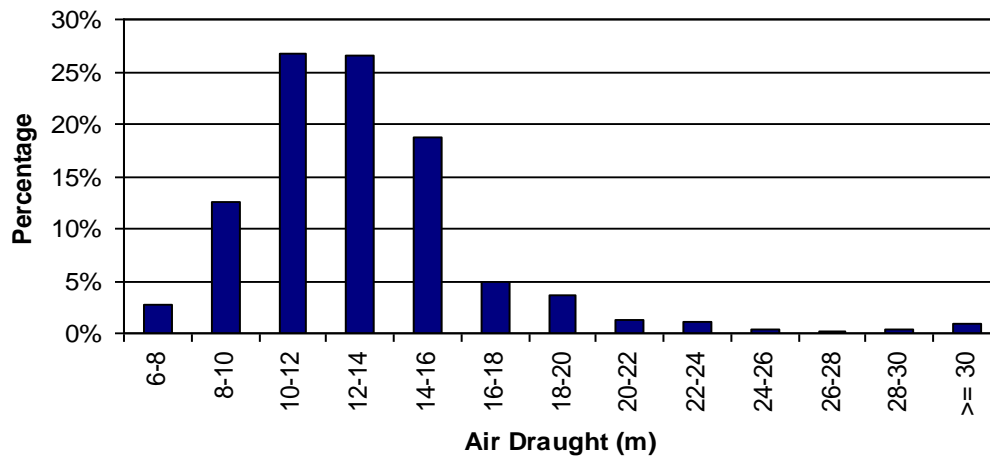
effect is not considered as being significant and similar to that experienced passing a large vessel or close to other large structures (e.g. bridges) or the coastline. In addition, practical experience to date from RYA members taking vessels into other sites indicates that this is not likely to be an issue.

### 15.6 Recreational Vessel Blade and Mast Allision

190. The RYA considers the largest risk to recreational craft from offshore wind developments is the risk of rotor blade allision and grounding associated with scour protection which reduces the under keel clearance. An allision between a wind turbine blade and the mast of a yacht or damage to the keel could result in structural failure of a yacht.

191. In order to mitigate this risk, the development of the proposed East Anglia THREE project would adhere to guidance on the construction of windfarms including ensuring that the minimum rotor blade clearance (air draught) for the wind turbines is at least 22m above MHWS. This is the clearance when the blade is in its lowest (six o'clock) position. The actual clearance at a given time would depend upon the prevailing tide and wave conditions, i.e., lower clearance at high water and rough seas, greater clearance at low water and calm seas.

192. To determine the extent to which yacht masts could interact with the rotor blades, details on the air draughts of the IRC fleet are provided in Figure 15.3 based on a fleet size of over 3,000 vessels. IRC is a rating used worldwide which allows boats of different sizes and designs to race on equal terms. The UK IRC fleet, although numerically only a small proportion of the total number of sailing yachts in the UK, is considered representative of the range of modern sailing boats in general use in UK waters.



**Figure 15.3 Air Draught Data – IRC Fleet (2002)**

193. From this data, just under 4% of boats have air draughts exceeding 22m. Therefore, only a fraction of vessels could potentially be at risk of dismasting if they were directly under a rotating blade in the worst-case conditions.

194. It is further noted that the windfarm would be designed and constructed to satisfy the requirements of the MCA in respect to control functions and safety features, as specified

in the MGN 371 (MCA 2008a)

195. Throughout consultation during the hazard workshop it was suggested that the vessels in this area would be larger voyage recreational vessels and as a result are likely to be better equipped with VHF radio and other safety equipment.
196. These measures mean that whilst the allision risk cannot be completely eliminated it would be reduced to a level as low as reasonably practicable. In terms of consequences, most allisions with the wind turbines should be relatively low speed and hence low energy. If the seaworthiness of the recreational craft was threatened by the impact, the wind turbines would be equipped with access ladders for use in emergency, placed in the optimum position taking into account the prevailing wind, wave and tidal conditions, as required by the MCA. This should provide a place of safety/refuge until such time as the rescue services arrive.

### **15.7 Effects on Recreational Craft**

197. Minimum spacing is 675 x 900 metres which should allow adequate sea room for recreation craft to navigate through the proposed project especially as the majority of the vessels in the area would be equipped for longer navigational transit. It is noted that there are factors that would influence a mariner's decision (including recreational sailors) to navigate through, around or avoid a windfarm and that the choice is influenced by a number of factors including the vessels characteristics, the weather and sea condition. The MCAs MGN 372 (MCA 2008b) concluded that "Although offshore renewable energy installations present new challenges to safe navigation around the UK coast, proper voyage planning, taking into account all relevant information, should ensure a safe passage and the safety of life and the vessel should not be compromised". The recreational sailor are likely to take due consideration for the weather conditions and passage plan accordingly to ensure safe passage. It is assumed that in adverse weather and winter periods limited recreational activity would be present within the East Anglia THREE site.
198. The air clearance between wind turbine rotors and sea level at mean conditions at MHWS would not be less than 22 metres, as per guidance and minimises the risk of interaction between rotor blades and yacht masts.
199. Effects on recreational craft are assessed in full in Chapter 15 Shipping and Navigation, section 14.7.

#### **15.7.1 Recreational Craft Navigating Through the Array**

200. In good conditions the wind turbines should be visible. In this case, vessels, if competently skippered, would be able to navigate safely to avoid the structures. Even if a vessel were to get into difficulty, most should be able to keep clear of the structures. However, it is noted that a proportion of recreational craft may not be able to anchor in the water depths found in and around the East Anglia THREE site and in the event of machinery failure may drift towards the windfarm due to the effects of the tide and / or wind. However, it is noted that small craft may have alternate systems such as Drogues to slow their movement.
201. The main risk of allision is considered to be in adverse weather, especially poor

visibility, where a small craft could fail to see the windfarm and inadvertently end up closer than intended. If there was reduced visibility combined with adverse weather and / or strong tides, the vessel may not be able to anchor.

202. Given the ready availability of weather forecasts and growing use of Global Positioning System (GPS), the risk of a vessel being in proximity to the windfarm in adverse weather is considered to be low but not negligible. In this scenario, a vessel unable to make its way from the windfarm and at risk of allision may alert help by using a mobile phone (if signal allows), VHF or flares.

203. To minimise the risk of allision in this worst-case scenario, mitigation in line with regulator guidance would be put in place. It would be ensured, consistent with the requirements of THLS, that the structures are marked in such a way as to enhance the prospect of visual observation by passing recreational craft even in adverse conditions.

204. These measures mean that whilst the allision risk cannot be completely eliminated it would be reduced to a level as low as reasonably practicable. In terms of consequences, most allisions with the wind turbines should be relatively low speed and hence low energy. The wind turbines would be equipped with access ladders for use in emergency, placed in the optimum position taking into account the prevailing wind, wave and tidal conditions, as required by the MCA. Therefore, if the seaworthiness of the recreational craft was threatened by the impact, this should provide a place of safety or refuge until such time as the rescue services arrive.

205. Collision and allision risk modelling is contained within Section 23.

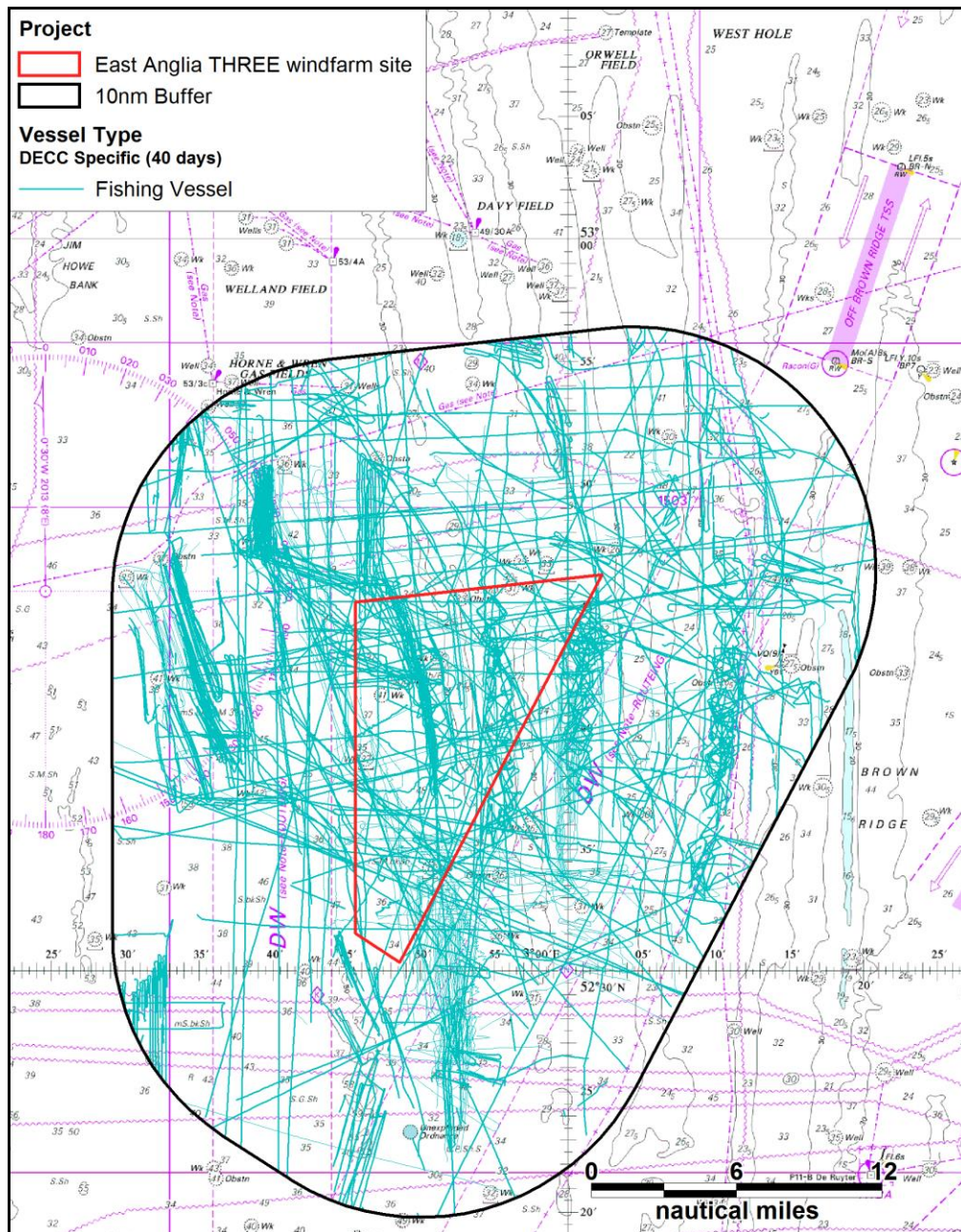
## **16 Commercial Fishing Vessel Activity**

### **16.1 Introduction**

206. This section reviews the fishing vessel activity at the proposed project based on the maritime traffic survey and Chapter 14 Commercial Fisheries.

### **16.2 Survey Tracks**

207. The fishing vessel tracks recorded during the four maritime traffic surveys undertaken are presented in Figure 16.1.



**Figure 16.1 All fishing vessel tracks (40 days)**

208. Fishing vessel activity was recorded on AIS (93%) and radar (7%). Where possible, the vessels tracked by radar were identified by manual observation. However, in most cases it was possible to identify the type of vessel but not the vessel name. Those that were visually identified were primarily beam trawlers.

209. Overall 67 unique fishing vessels were tracked during the combined survey period. An average six unique fishing vessels per day were recorded within 10nm of the East Anglia THREE site throughout the combined 40 day survey period. The level of fishing vessel activity recorded in the area was higher during the August and September 2012 and July and August 2013 surveys when an average of seven to eight unique fishing

vessels were tracked per day, compared with the May 2013 survey when an average of two fishing vessels were recorded per day. During the January / February 2014 winter validation survey an average of five unique fishing vessels per day were recorded within 10nm of the East Anglia THREE site.

210. In terms of fishing vessel activity within the East Anglia THREE site, the greatest level of activity was recorded during the August / September 2012 and July / August 2013 surveys when an average of four fishing vessels per day were logged within the East Anglia THREE site. During the May 2013 survey and January / February 2014 surveys a lower level of fishing was recorded within the East Anglia THREE site, with an average of two fishing vessels per day and two to three vessels per day respectively recorded. The greatest density of fishing vessel activity was recorded within the northern area of the site.

211. It should be noted that a proportion of the unidentified vessels tracked on radar (non-AIS) are also likely to be fishing vessels.

### ***16.3 Effects on Fishing Vessels (Safe Navigation)***

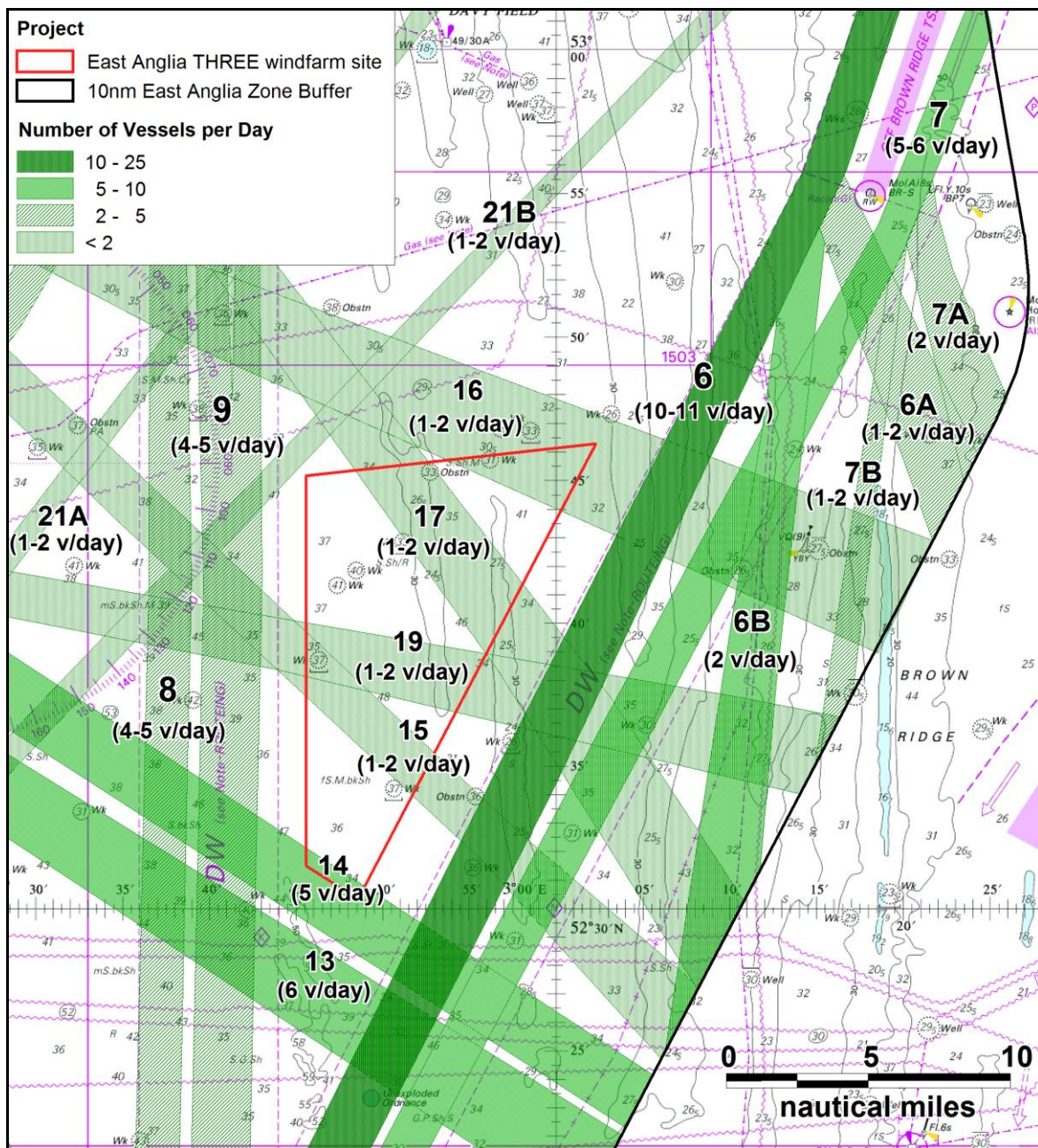
212. Site design should take into consideration the ability of fishing vessels to navigate within the windfarm including a minimum spacing of 675 x 900 metres and alignment of wind turbines. However, a final layout would require agreement with key navigational stakeholders such as the MCA and THLS. It is likely that smaller fishing vessels operating in the area would be able to navigate around including during construction and decommissioning (out with the current area of operation) activities as well as navigate safely within the array. There is potential that larger vessels may be displaced from the site especially during construction. It is noted that fishing vessels are primarily local to the area and would be familiar with the current phase of operation and likely areas of activity especially during the construction and decommissioning phases.

213. Effects on fishing vessels are considered in full in Chapter 15 Shipping and Navigation, Section 15.6 .3.

## 17 Base Case 90<sup>th</sup> Percentile Route Analysis

214. The identification of main shipping lanes was undertaken on a Zonal level, based on the AIS shipping surveys. This is ensure that routing outside of the study area for the site is effectively assessed as impact on vessels routes could be noted, due to the nature of shipping, at the start of their transit / track as well as on the approach to the site.

215. The tracks following each lane have been identified and their lateral distribution analysed to define the 90% traffic level. The 90% lane boundaries identified in the vicinity of the East Anglia THREE site are presented in Figure 17.1. Following this, a description of each of the shipping lanes identified in the area is presented in Table 17.1.



**Figure 17.1 90% Shipping Lanes Relative to the East Anglia THREE site**



**Table 17.1 Main Shipping Lane Descriptions**

Route No.	Avg. Ships (per day)	Description
6	10 to 11	Southbound traffic using DWR via the TSS Off Brown Ridge. Main vessel types on this route include chemical and oil tankers, and bulk carriers. Vessels headed to Benelux ports or Dover Strait
6A	2	Southbound traffic leaving DWR via TSS Off Brown Ridge, headed for Antwerp (Belgium), Amsterdam and Rotterdam (The Netherlands).
6B	3	Southbound traffic leaving DWR via TSS Off Brown Ridge, headed for Rotterdam, Amsterdam (The Netherlands), Hamburg (Germany), Ghent (Belgium), Bilbao (Spain) and Alexandria (Egypt).
7	6	Northbound traffic using DWR via the TSS Off Brown Ridge, headed for ports in Scandinavia, Denmark, Latvia, Lithuania, Germany, Russia and other ports in Baltic sea.
7A	2	Northbound traffic joining the DWR from Belgium and The Netherlands, travelling to ports in Russia, Norway, Sweden, Denmark and Lithuania.
7B	2	Northbound traffic joining the DWR from ports of Benelux and France, heading to Russia (Ust Luga, St Petersburg, Murmansk), Norway, Denmark, Baltic Sea ports (Gdansk, Swinoujscie, Gdynia, Klaipeda, Liepaja).
7C	3	Northbound traffic from Germany, The Netherlands ( mainly Rotterdam and Hamburg) heading for ports in Russia and Baltic Sea,
8	4 to 5	Southbound traffic using DWR via the DR1 light-buoy. Generally used by large merchant vessels headed for Benelux ports or Dover Strait.
9	4 to 5	Northbound traffic using DWR via the DR1 light-buoy. Generally used by large merchant vessels headed for ports in Scandinavia.
13	6	Rotterdam – north-east UK ports. Used by a variety of merchant vessel types. Includes P&O freight and passenger ferry routes to Rotterdam.
14	5	Rotterdam – north-east UK ports. Regular users include Stena Line route between Killingholme and Hook of Holland, and DFDS route between Immingham and Vlaardingen.
15	1-2	Rotterdam – north-east UK ports. Used by a variety of merchant vessel types. Includes P&O freight and passenger ferry routes to Rotterdam.

Route No.	Avg. Ships (per day)	Description
16	1 to 2	Humber Estuary ports (Grimsby and Immingham) to the Netherlands (Amsterdam, Ijmuiden) and Belgium (Antwerp). Main vessel types on this route include general cargo and other operational vessels (dredgers, tugs and offshore).
17	1 to 2	North-east UK ports – Rotterdam. Traffic on this route includes vessels on the P&O route between Tees and Rotterdam.
18	1	Newcastle – Amsterdam. Route 18 is the DFDS ferry route from Newcastle to Amsterdam.
19	1 to 2	Amsterdam – north-east UK ports. Vessel types include general cargo vessels and dredgers.
20	2	Route 20 is used by offshore industry traffic between Great Yarmouth and oil and gas fields in the area.
21A	1 to 2	DFDS Seaways Harwich – Esbjerg. Main vessel to operate on this route is the <i>Sirena Seaways</i> .
21B	1 to 2	

## **18 Future Case Commercial Vessel Routeing**

216. This section considers the impact on commercial shipping navigation of the East Anglia THREE site based on the maritime traffic surveys. Based on the shipping survey data presented in Sections 11 and 12, it is considered that six main routes could be potentially affected by the proposed East Anglia THREE project. These six routes are described in more detail below and the likely impacts are assessed. In addition, due to the proximity of the site to the IMO adopted DWRs to the east and west of the site, the impacts on shipping using these routeing measures has also been considered. The cumulative impact of the East Anglia THREE site and other transboundary wind developments on vessel routeing has been assessed in Section 28.2.

### ***18.1 Route 14 – north-west / south-east traffic: Stena Line Ferry Routes and North East UK ports to the Netherlands***

217. Route 14 represents traffic transiting in a north-west and south-east direction between east coast UK ports (e.g. Teesport and Immingham) and ports in the Netherlands, mainly Rotterdam. The tracks of vessels recorded on this route are presented in Figure 18.1.

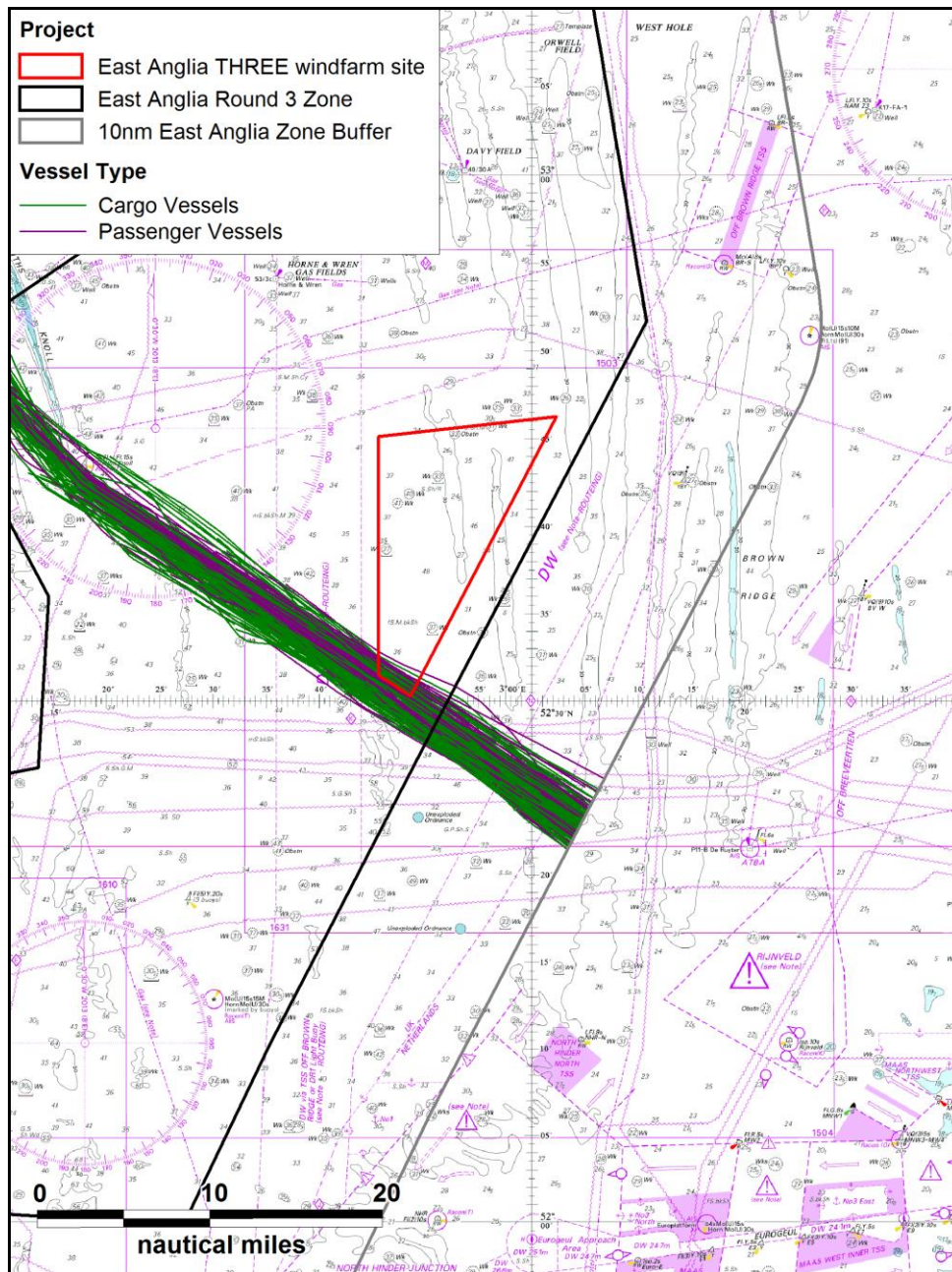
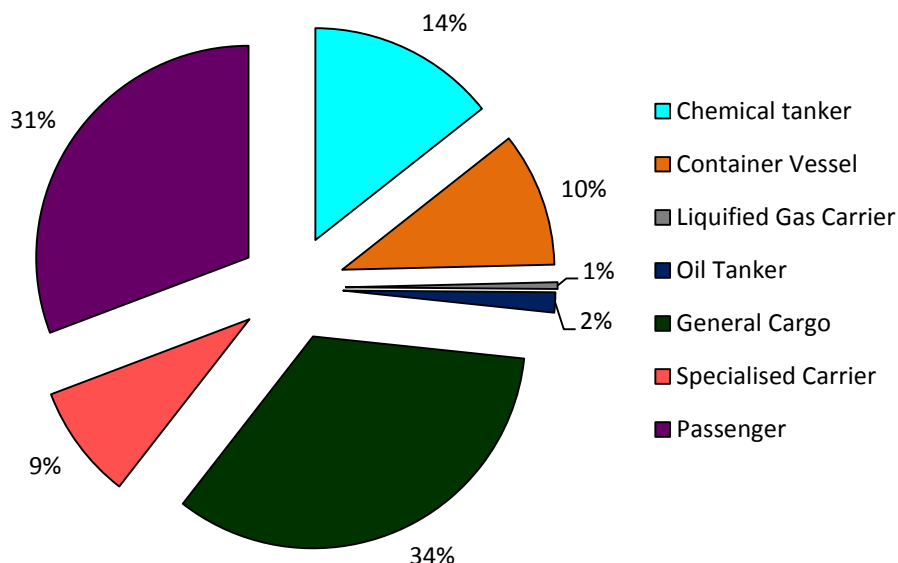


Figure 18.1 Route 14 Traffic (40 days)

218. Taking into account the combined effective survey duration of 40 days, an average of approximately five vessels per day were recorded using this route, of which approximately 23% (one to two vessels per day) passed through the East Anglia THREE site.

219. The type distribution of the traffic that on this route is presented in Figure 18.2



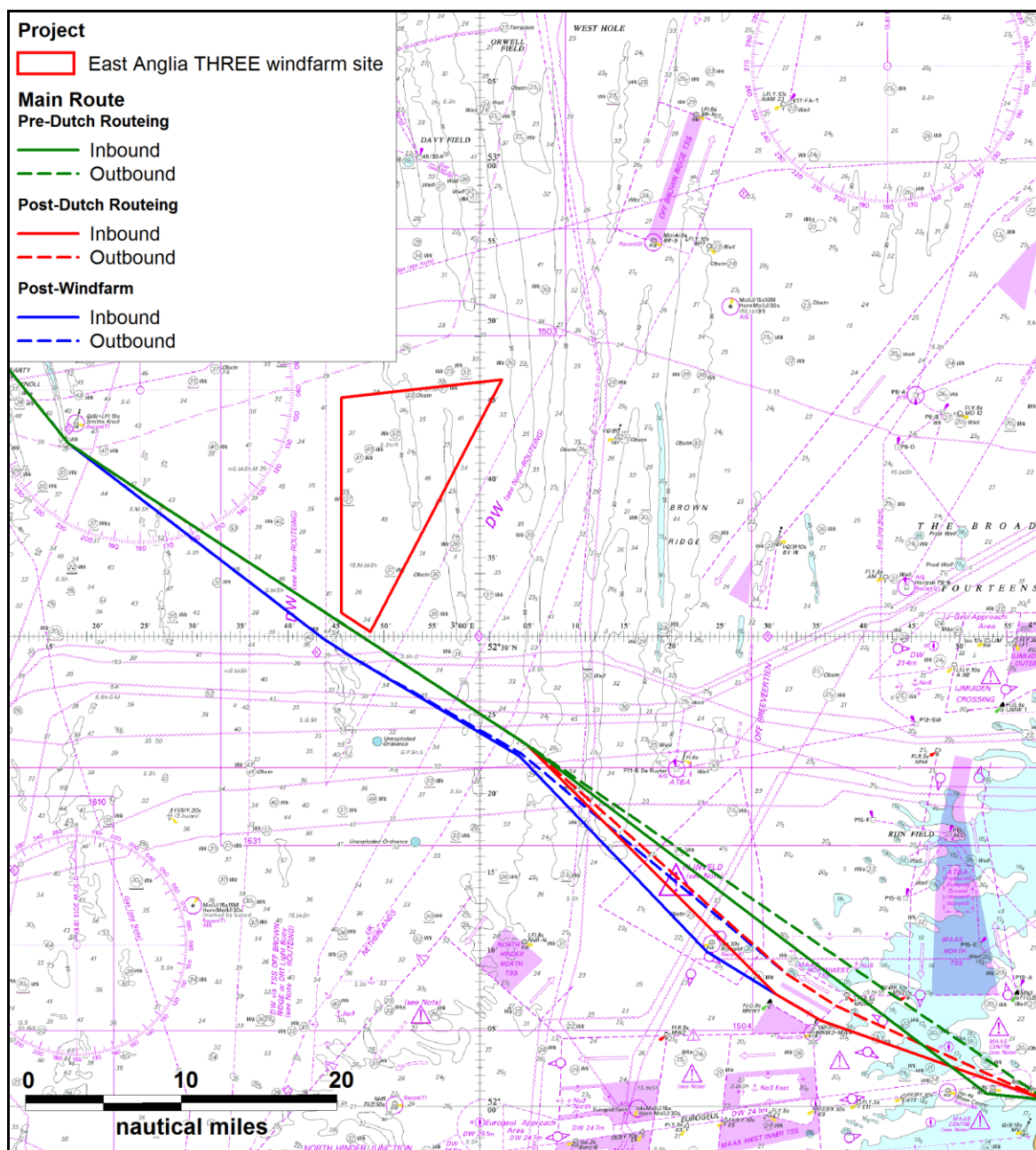
**Figure 18.2 Route 14 Vessel Type Distribution**

220. The most frequently recorded vessel types recorded operating on route 14 were general cargo vessels (34%) and passenger vessels (31%). The most frequently recorded vessels were the passenger vessels *Stena Transporter* and *Stena Transit* which were recorded operating on the P&O Ferries Killingholme to Hook of Holland route on 32 occasions and 26 occasions throughout the combined 40 day survey period.

221. Other frequently recorded vessels include: The Ro-Ro cargo vessel *Hafnia Seaways*, which was recorded on 18 separate occasions, whilst operating on the DFDS Seaways freight Immingham to Rotterdam route. The Ro-Ro cargo vessel *Amandine*, which was recorded operating on 16 separate occasions, whilst operating on the Cobelfret Killingholme to Rotterdam route. The *Pride of Rotterdam* and *Pride of Hull*, which were recorded on 14 and 13 separate occasions respectively, whilst operating on the P&O Ferries Hull to Europort route.

222. In order to conform to Dutch routeing measure changes (see Section 11), vessels operating on route 14 have been required to alter their entry / exit to the Maas Northwest TSS. However, the crossing point across both DWRs to the east and west of the East Anglia THREE site has not been altered following these changes. As a result, the route length has increased by approximately 0.4nm (0.4% of route length) for both the inbound and outbound route. Following the development of the proposed East Anglia THREE project it is expected that a proportion of shipping on route 14 would route further to the south.

223. Figure 18.3 presents the mean route position for vessels operating on route 14 pre and post Dutch routeing measure changes and alternative routeing options post construction of the proposed East Anglia THREE project.



**Figure 18.3 Alternative Routing for Route 14– Post construction of the proposed East Anglia THREE project**

224. A degree of re-routing is likely to be required for a proportion of the vessels on this route, although some vessels already pass up to 2nm to the south of the site and therefore may not consider it necessary to alter their passage.

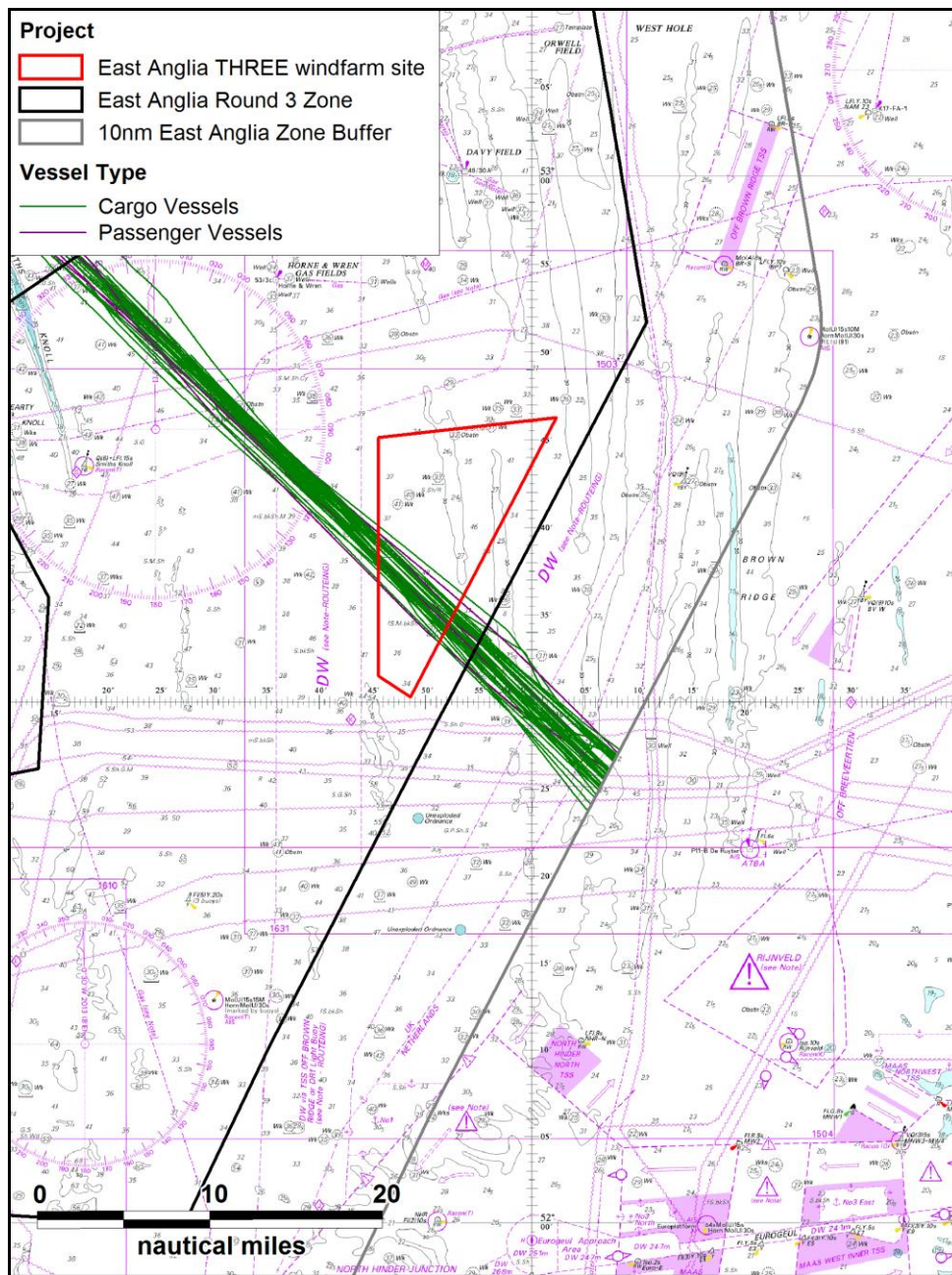
225. The worst case deviation for vessels on this route is estimated to be approximately 0.06nm (0.06% of route length), based on a vessel transiting route 14 re-routing in order to achieve a minimum passing distance of 2nm from the windfarm (based on experience of shipping behaviours around existing offshore renewable projects it is anticipated that a proportion of vessels would pass in closer proximity to the site, as shown by the shipping

lane position in the figure above). This assumes that ships would be able to pre-plan their revised passage in advance of encountering the windfarm, due to effective mitigation, enabling them to make course adjustments early, minimising the resulting deviations.

226. Re-routeing of vessels would cause a very small increase in mileage (0.06nm) for a small proportion of vessels on route 14. The development of the proposed East Anglia THREE project would not alter the angle at which route 14 traffic crosses the DWRs.

### ***18.2 Route 15 - north-west / south-east traffic: North East UK Ports to Amsterdam***

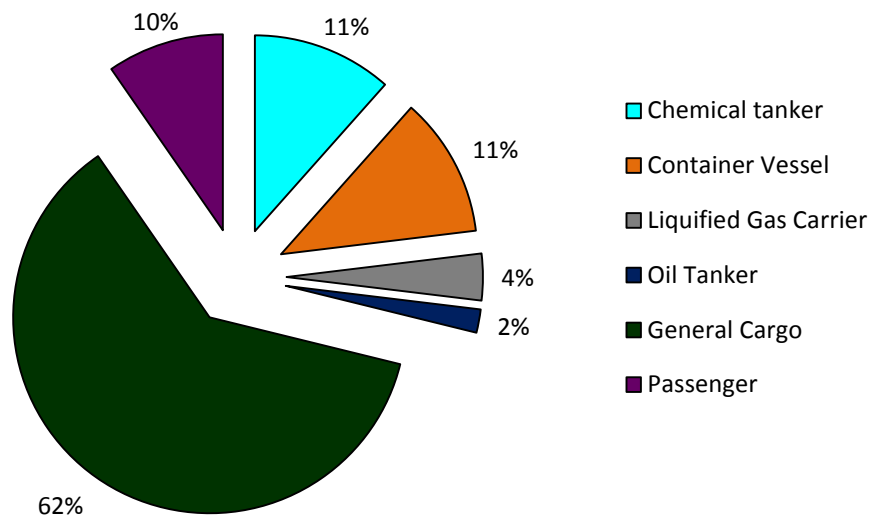
227. Traffic transiting route 15 includes vessels travelling from north east UK ports (such as Teesport and Hull) and ports in the Netherlands, mainly Rotterdam and Amsterdam.
228. The tracks of the vessels recorded on this route during the combined 40 day survey period are presented in Figure 18.4.



**Figure 18.4** Route 15 Traffic (40 days)

229. An average of approximately one to two vessels per day passed through the East Anglia THREE site whilst transiting on this route throughout the combined 40 day survey period. The vessel type distribution of this traffic is presented Figure 18.5.



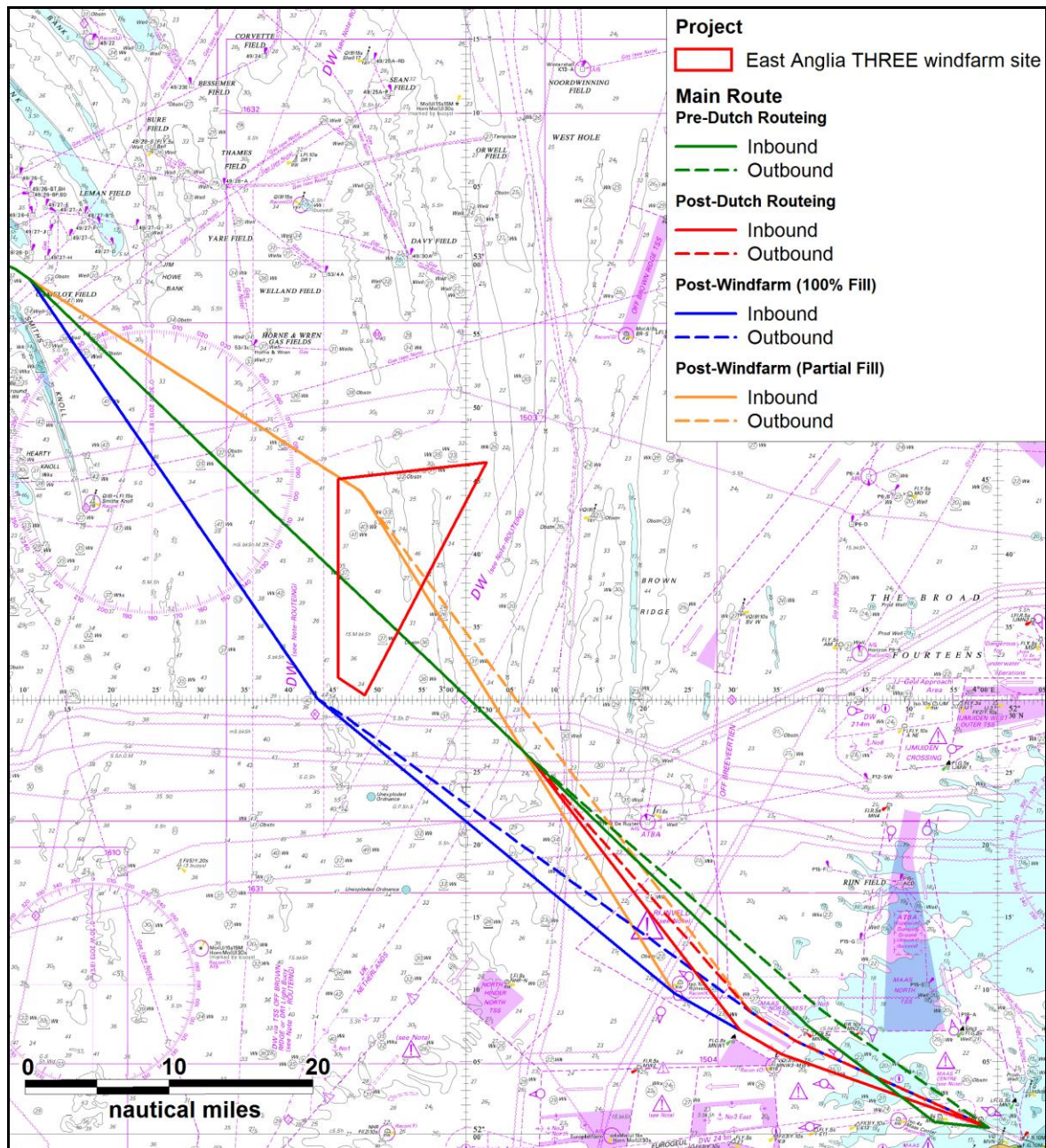


**Figure 18.5 Vessel Type Distribution north north-west / south south-east Traffic**

230. The majority of vessels on this route are general cargo vessels, representing 62% of marine traffic on this route. The most frequently recorded vessel recorded operating on this route was the Ro-Ro cargo vessel *Wilhelmine*, which was recorded on 22 separate occasions whilst operating on the P&O freight ferry route between Rotterdam and Teesport.

231. In order to conform to Dutch routeing measure changes (see Section 12), vessels operating on route 15 have been required to alter their entry / exit to the Maas Northwest TSS. However, the crossing point across both DWRs to the east and west of the East Anglia THREE site has not been altered following these changes. As a result, the route length has increased by approximately 0.85nm (0.9% of route length) for both the inbound and outbound route. Following development of the East Anglia THREE site (100% fill) it is expected that all traffic on route 15 would route further to the south. If development of the proposed East Anglia THREE project proceeded with a partial fill, akin to that illustrated in Figure 3.2, it is anticipated that shipping on route 15 would route both north and south of the East Anglia THREE site.

232. Figure 18.6 presents the mean route positions for vessels operating on route 15 pre and post Dutch routeing measure changes and alternative routeing options post construction (both partial and 100% fill) of the proposed East Anglia THREE project.



**Figure 18.6 Alternative Routing for Route 15 – Post construction of the proposed East Anglia THREE project**

233. The worst case deviation for vessels on this route is estimated to be approximately 1.63nm (1.7% of route length) for vessels transiting north of the East Anglia THREE site (partial fill scenario) whilst on passage inbound to Amsterdam. A deviation of 0.96nm (1.01% of route length) is anticipated for outbound transiting vessels passing north of the East Anglia THREE site (partial fill scenario).

234. For vessels transiting south of the East Anglia THREE site a deviation of approximately 1.1nm (1.12% of route length), outbound from Rotterdam, and 0.8nm (0.83% of route length), inbound to Rotterdam is anticipated.

235. Route deviations are based on vessels seeking a minimum passing distance of 2nm from the windfarm (as previously noted, based on analysis of shipping data around offshore windfarms, a proportion of vessels are likely to pass in closer proximity to the site). It is assumed that ships would be able to pre-plan their revised passage in advance of encountering the windfarm, due to effective mitigation, enabling them to make course adjustments early, minimising the resultant deviations.
236. Re-routeing of vessels would cause a small increase in mileage (1.6nm worst case) for a proportion of vessels on route 15. The development of the proposed East Anglia THREE project would not alter the angle at which route 15 traffic crosses the DWRs.

### ***18.3 Route 16 – West North-West / East South-East traffic: East UK Ports to Amsterdam***

237. Traffic transiting route 16 includes vessel travelling from Humber Estuary ports (e.g. Grimsby and Immingham) to Amsterdam/Ijmuiden. Vessel tracks recorded on route 16 are presented in Figure 18.7.

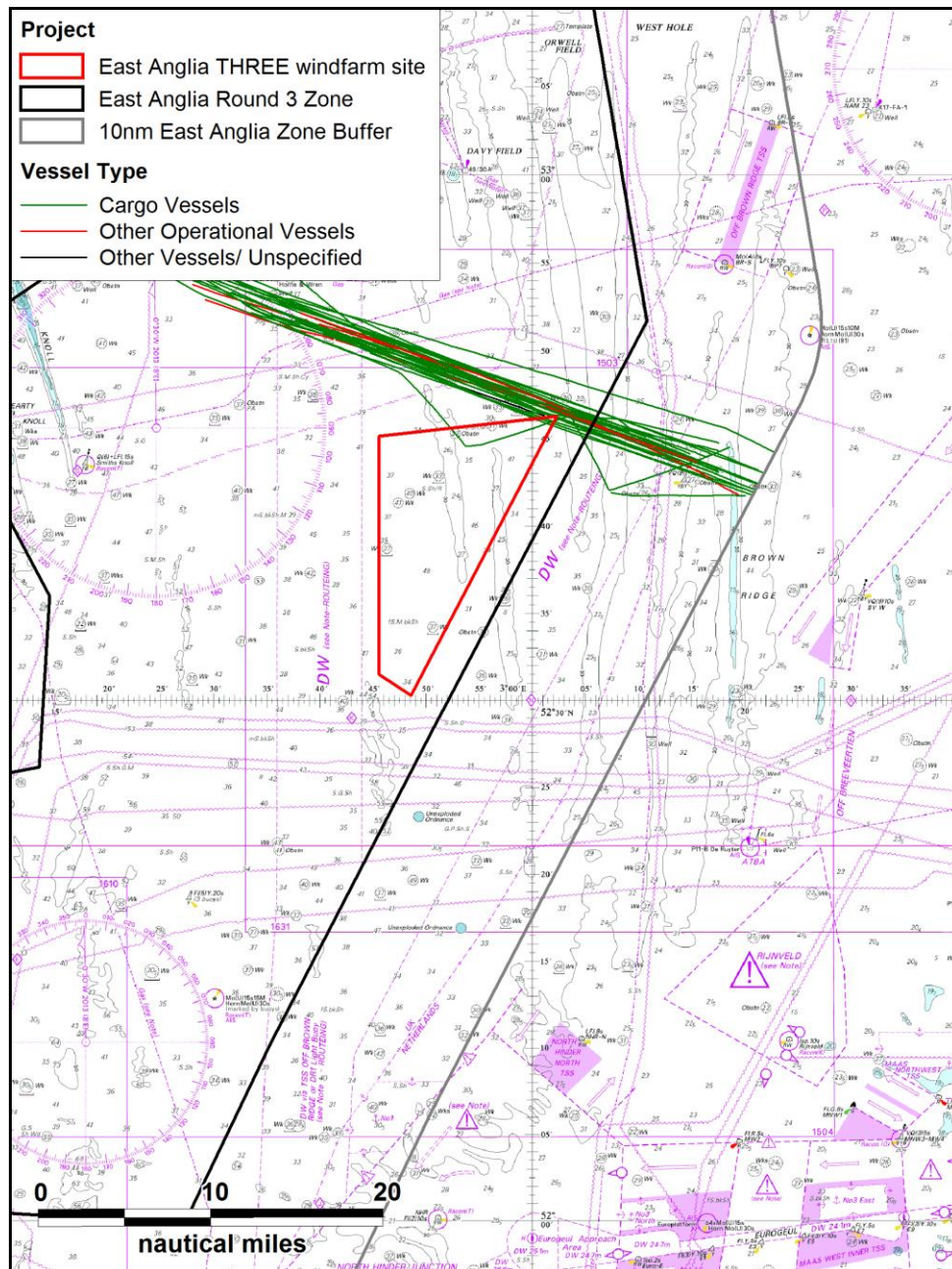
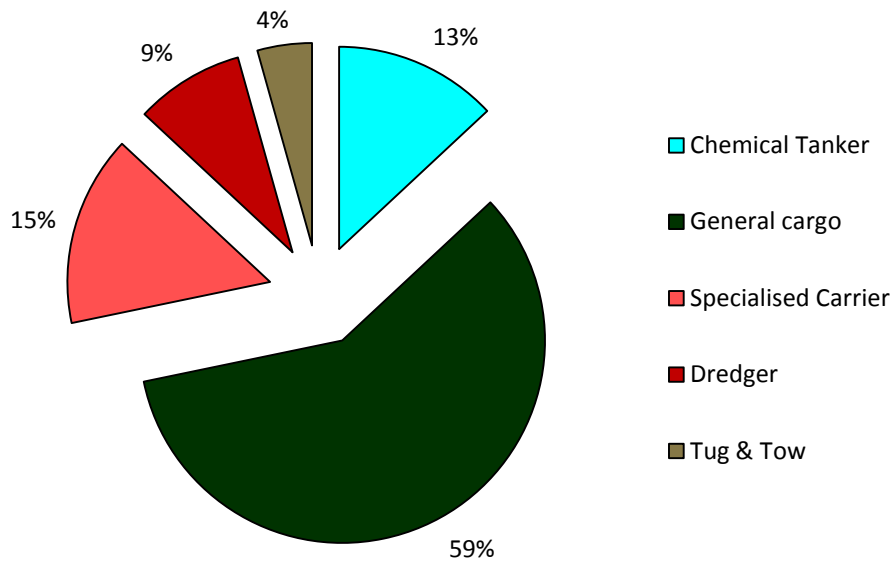


Figure 18.7 Route 16 Traffic (40 days)

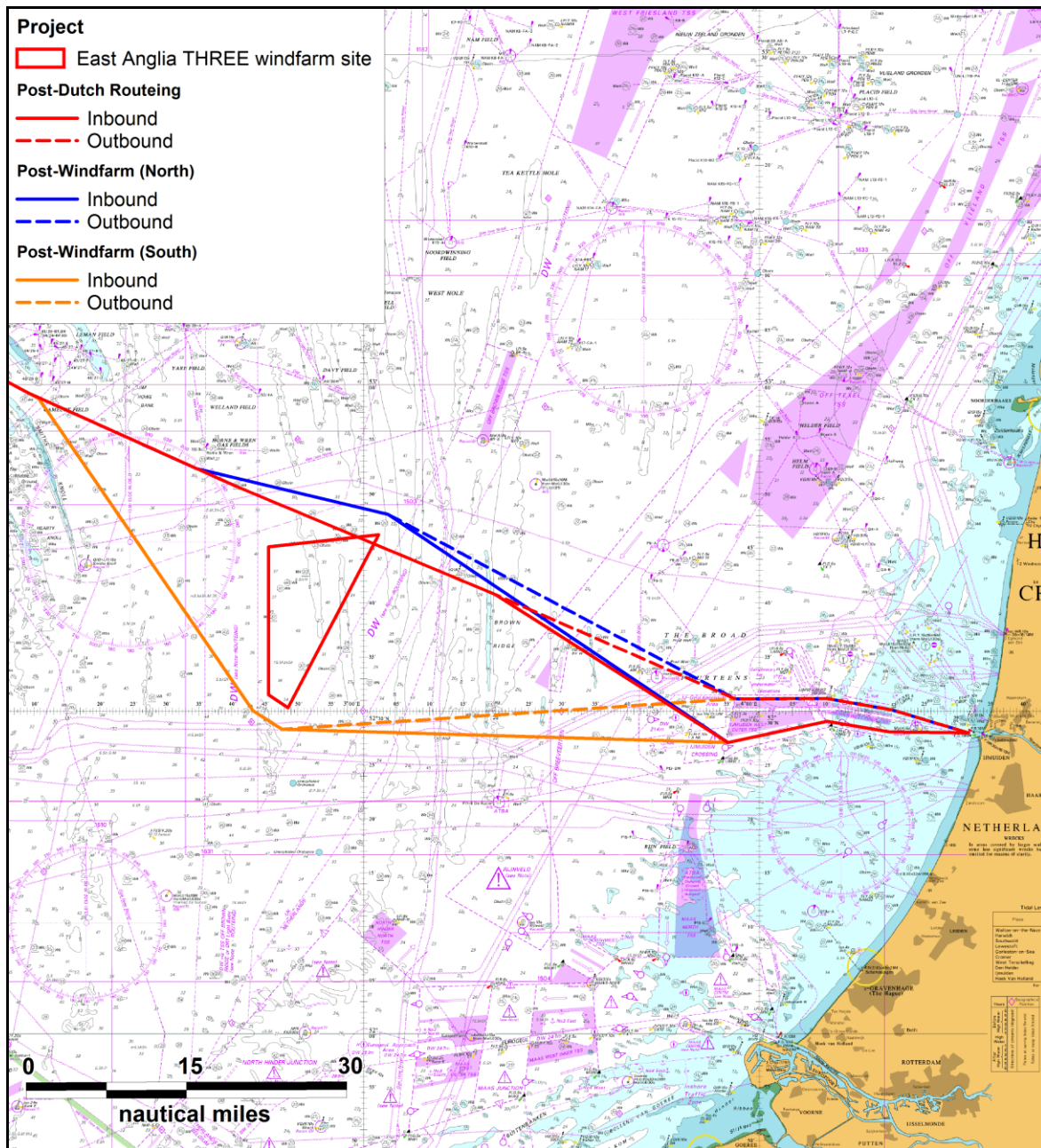
238. Taking into account the combined effective survey period of 40 days, an average of one to two vessels per day were recorded using this route, of which approximately 21% (less than one vessel per day) passed within the East Anglia THREE site.

239. The vessel type distribution (excluding 2% unspecified) of traffic on this route is presented in Figure 18.8.



**Figure 18.8 Route 16 Vessel Type Distribution**

240. The majority of vessels on this route are general cargo ships, representing 59% of marine traffic. The most frequently recorded vessel on this route was the general cargo vessel *Eems Delfia*, which was recorded on 17 separate days.
241. Other regularly recorded vessel types were specialised carrier (15%) and chemical tankers (13%). The trailing suction hopper dredger *Arco Dijk* was recorded transiting on this route two separate days.
242. Changes to Dutch routeing measures have not altered the Ijmuiden West Outer TSS, which route 16 enters/exits and therefore vessel routeing has not been altered following changes made to Dutch routeing measures.
243. Following development of the proposed East Anglia THREE project (partial fill) it is expected that traffic on route 16 would not be required to deviate from the current main route. If development of the proposed East Anglia THREE project proceeded with a 100% fill, akin to that illustrated in Figure 3.3, it is anticipated that shipping on route 16 would route further north to pass clear of the East Anglia THREE site.
244. Figure 18.9 presents the mean route position for vessels operating on route 16 post Dutch routeing measure changes and alternative routeing options post construction of the proposed East Anglia THREE project.



**Figure 18.9 Anticipated Routeing – Post construction of the proposed East Anglia THREE project**

245. The worst case deviation for vessels on this route is estimated to be approximately 10.30nm (10.57% of route length) for vessels transiting south of the East Anglia THREE site (100% fill scenario) whilst on passage outbound from Amsterdam. A deviation of 8.25nm (8.30% of route length) is anticipated for inbound transiting vessels to Amsterdam on this route.

246. It is also possible that vessels on this route may pass to the north of the East Anglia THREE site resulting in a deviation of approximately 0.35nm (0.36% of route length) for vessels transiting outbound from Amsterdam and 0.55nm (0.56% of route length) for

vessels transiting inbound to Amsterdam.

247. This is based on vessels seeking a minimum passing distance of 2nm from the windfarm (as previously noted, based on analysis of shipping data around offshore windfarms, a proportion of vessels are likely to pass in closer proximity to the site, as shown by the anticipated shipping lane in the figure above). It is assumed that ships would be able to pre-plan their revised passage in advance of encountering the windfarm, due to effective mitigation, enabling them to make course adjustments early, minimising the resultant deviations.

248. Re-routeing of vessels would cause a small increase in mileage (0.55nm worst case) for a proportion of vessels on route 16. The development of the East Anglia THREE site would not alter the angle at which route 16 traffic crosses the DWRs.

#### ***18.4 Route 17 North West / South East: East England Ports to the Netherlands Ports***

249. Vessels recorded transiting route 17 were recorded travelling between ports on the east coast of England (e.g. Teesport and Hull) to Rotterdam. Traffic transiting this route included the P&O ferry freight route between Teesport and Europort. Figure 18.10 presents the traffic, colour-coded by vessel type, recorded operating on route 17 during the combined 40 day survey period.

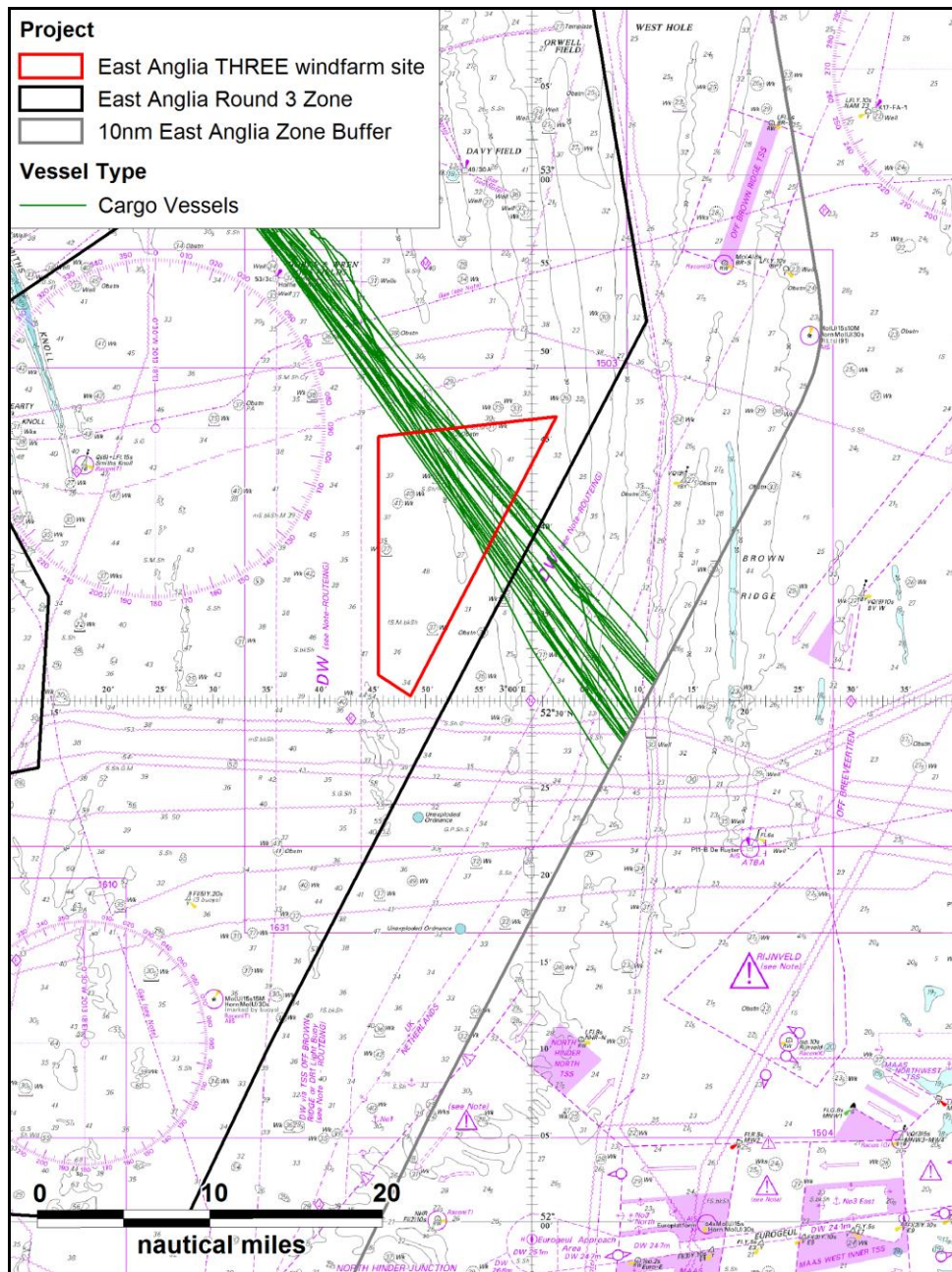
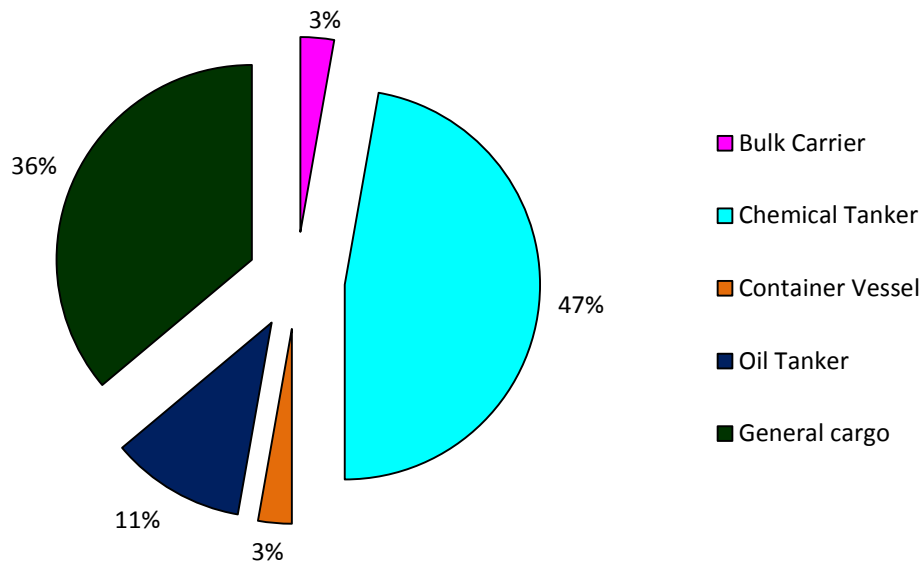


Figure 18.10 Route 17 Traffic (40 days)

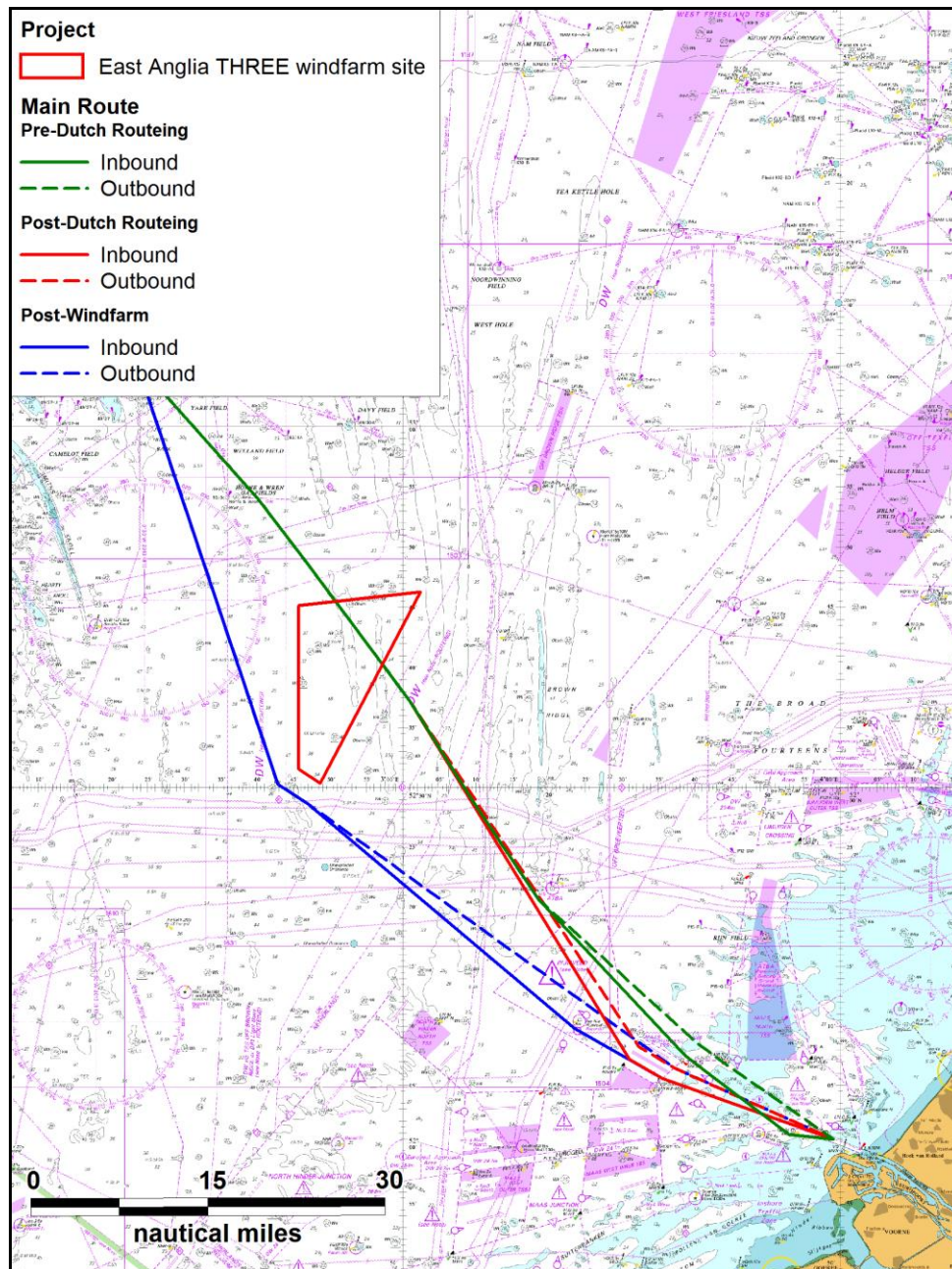
250. An average of one to two vessels per day intersected the East Anglia THREE site via route 17. All the vessels tracked transiting this route intersected the northeast corner of the site. The distribution of vessel types on this route is presented in Figure 18.11





**Figure 18.11 Route 17 Vessel Type Distribution**

251. It can be seen the most common vessel type to transit the East Anglia THREE site via route 17 were chemical tankers (47%), followed by general cargo vessels (36%). The Ro-Ro cargo vessel *Norsky*, operating on the P&O Teesport to Europort, was the most frequently recorded vessel and transited route 17 on nine occasions.
252. In order to conform to Dutch routeing measure changes (see Section 12), vessels operating on route 17 have been required to alter their entry and exit to the Maas Northwest TSS. However, the crossing point across both DWRs to the east of west of the East Anglia THREE site has not been altered following these changes. As a result, the route length has increased by approximately 1.2nm (1.29% of route length) for the inbound route and 1.11nm (1.21% of route length) for the outbound route.
253. Following development of the proposed East Anglia THREE project (partial fill) it is expected that traffic on route 17 would not be required to deviate from the current main route. If development of the proposed East Anglia THREE project proceeded with a 100% fill, akin to that illustrated in Figure 3.3, it is anticipated that shipping on route 15 would route further south to pass clear of the East Anglia THREE site.
254. Figure 18.12 presents the mean route position for vessels operating on route 17 pre and post Dutch routeing measure changes and alternative routeing options post construction of the East Anglia THREE site.



**Figure 18.12 Anticipated Routeing for Route 17 Post construction of the proposed East Anglia THREE project**

255. The worst case deviation for vessels on route 17 is expected to be approximately 3.38nm (3.63% of route length) for vessels transiting south of the East Anglia THREE site (100% fill scenario) whilst on outbound passage from the Maas Northwest TSS. A deviation of 3.02nm (3.22% of route length) is anticipated for inbound transiting vessels to the Maas Northwest TSS.

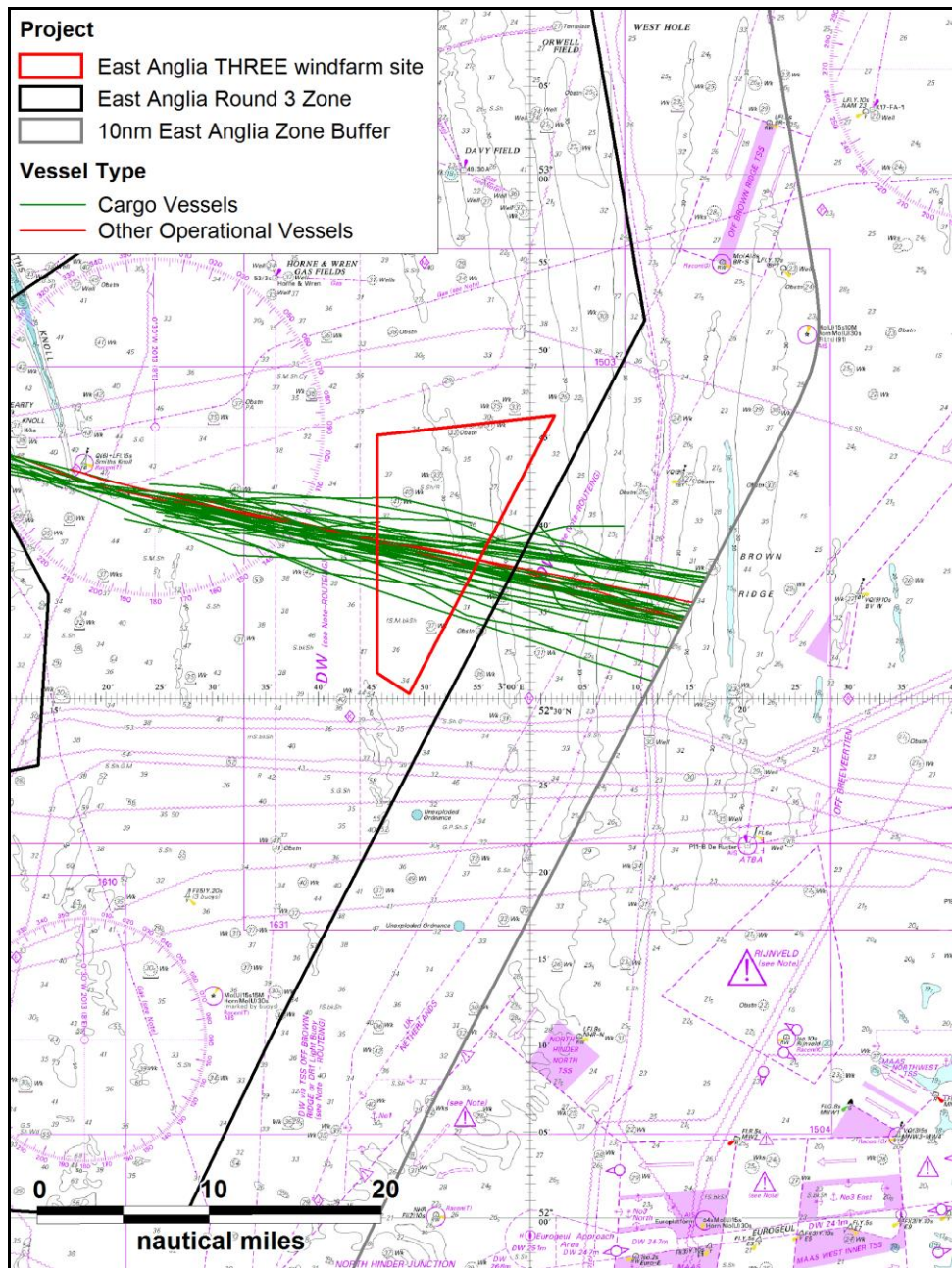
256. Based on experience of shipping behaviours around existing offshore renewable projects it is anticipated that a proportion of vessels would pass in closer proximity to the site, as shown by the shipping lane position in the figure above. This assumes that ships

would be able to pre-plan their revised passage in advance of encountering the windfarm, due to effective mitigation, enabling them to make course adjustments early, minimising the resulting deviations.

257. Re-routeing of vessels would cause a moderate increase in mileage (3.38nm worst case) for a proportion of vessels on Route 17. The development of the East Anglia THREE site would also alter the angle at which vessels on route 17 cross the DWR via DR1 Light-Buoy.

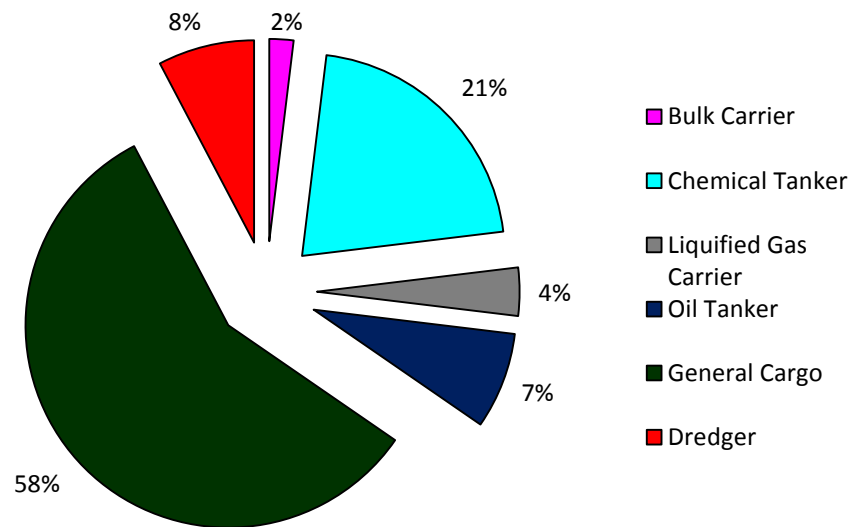
### ***18.5 Route 19 East / West: East England Ports to the Netherlands Ports***

258. Route 19 represents traffic transiting east/west between ports on the east coast of England (e.g. Hull, Immingham and Teesport) and Amsterdam. Figure 18.13 presents the traffic, colour-coded by vessel type, recorded operating on route 19 during the combined 40 day survey period.



**Figure 18.13** Route 19 Traffic (40 days)

259. An average of one to two vessels per day was recorded transiting route 19 throughout the combined 40 day survey period. All vessels transiting this route intersected the East Anglia THREE site. The distribution of vessel types transiting route 19 is presented in Figure 18.14



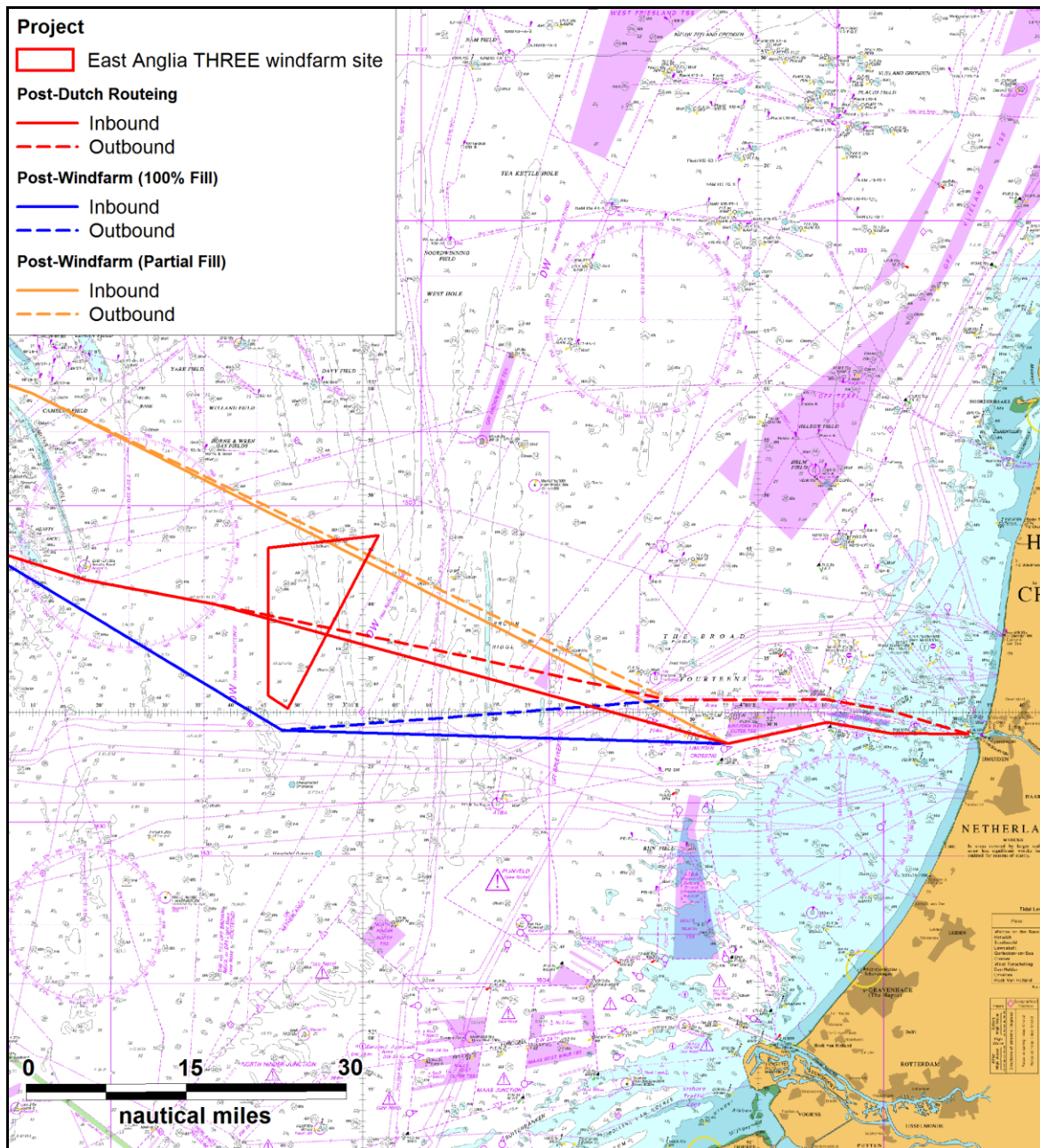
**Figure 18.14 Route 19 Vessel Distribution**

260. The majority of vessels recorded transiting route 19 were general cargo vessels, representing 58% of vessel traffic on this route. The general cargo vessels *Christine Y* and *Douwent* were recorded transiting on route 19 most frequently, recorded transiting on route 19 on five occasions each. The suction hopper dredger *Arco Dijk* was also recorded operating on this route whilst transiting between aggregate dredge areas off the east coast of the UK and Amsterdam.

261. Changes to Dutch routing measures have not altered the Ijmuiden West Outer TSS, which route 19 enters/exits and therefore vessel routing has not been altered following changes made to Dutch routing measures.

262. Following development of the proposed East Anglia THREE project (100% fill) it is expected that all traffic on route 19 would route further to the south. If development of the proposed East Anglia THREE project proceeded with a partial fill, akin to that illustrated in Figure 3.2, it is anticipated that shipping on route 19 would route both north and south of the East Anglia THREE site. As a consequence of this, it is probable that routing would also be impacted at a later stage of transit: it is probable that vessels passing north of the partially filled site would be required to transit between Leman Bank and Smiths Knoll rather than between Hapisborough Sand and the UK coast.

263. A plot of possible alternative routing for vessels transiting route 19 through the East Anglia THREE site is presented in Figure 18.15.



**Figure 18.15 Anticipated Routeing for Route 19 Post Construction of the Proposed East Anglia THREE Project**

264. The worst case deviation for vessels on this route is estimated to be approximately 3.42nm (2.69% of route length) for vessels transiting south of the East Anglia THREE site whilst on passage outbound from Amsterdam. A deviation of 2.53nm (1.98% of route length) is anticipated for inbound transiting vessels to Amsterdam on this route.

265. Based on experience of shipping behaviours around existing offshore renewable projects it is anticipated that a proportion of vessels would pass in closer proximity to the site. This assumes that ships would be able to pre-plan their revised passage in advance of encountering the windfarm, due to effective mitigation, enabling them to make course

adjustments early, minimising the resulting deviations.

266. Re-routeing of vessels would cause a small increase in mileage (3.42nm worst case) for a proportion of vessels on route 19. The development of the proposed East Anglia THREE project would not significantly adversely alter the angle at which route 19 traffic crosses the DWRs.

### **18.6 Route 21 DFDS Seaways Route Harwich to Esbjerg**

267. Route 21 represents traffic transiting in north north-east / south south-west direction between the east coast of the UK and Denmark. This route includes the DFDS Seaways Harwich to Esbjerg route which ceased operations on the 28<sup>th</sup> September 2014. The remaining vessel transits recorded operating on Route 21 are not numerous enough to warrant its inclusion as a main route (< one vessel per day). The following results should therefore be interpreted with a degree of caution and are included to ensure comprehensive assessment of the impact on vessel routeing, given the potential for the usage of Route 21 to increase in the future. Vessel tracks recorded on this route can be seen in Figure 18.16.

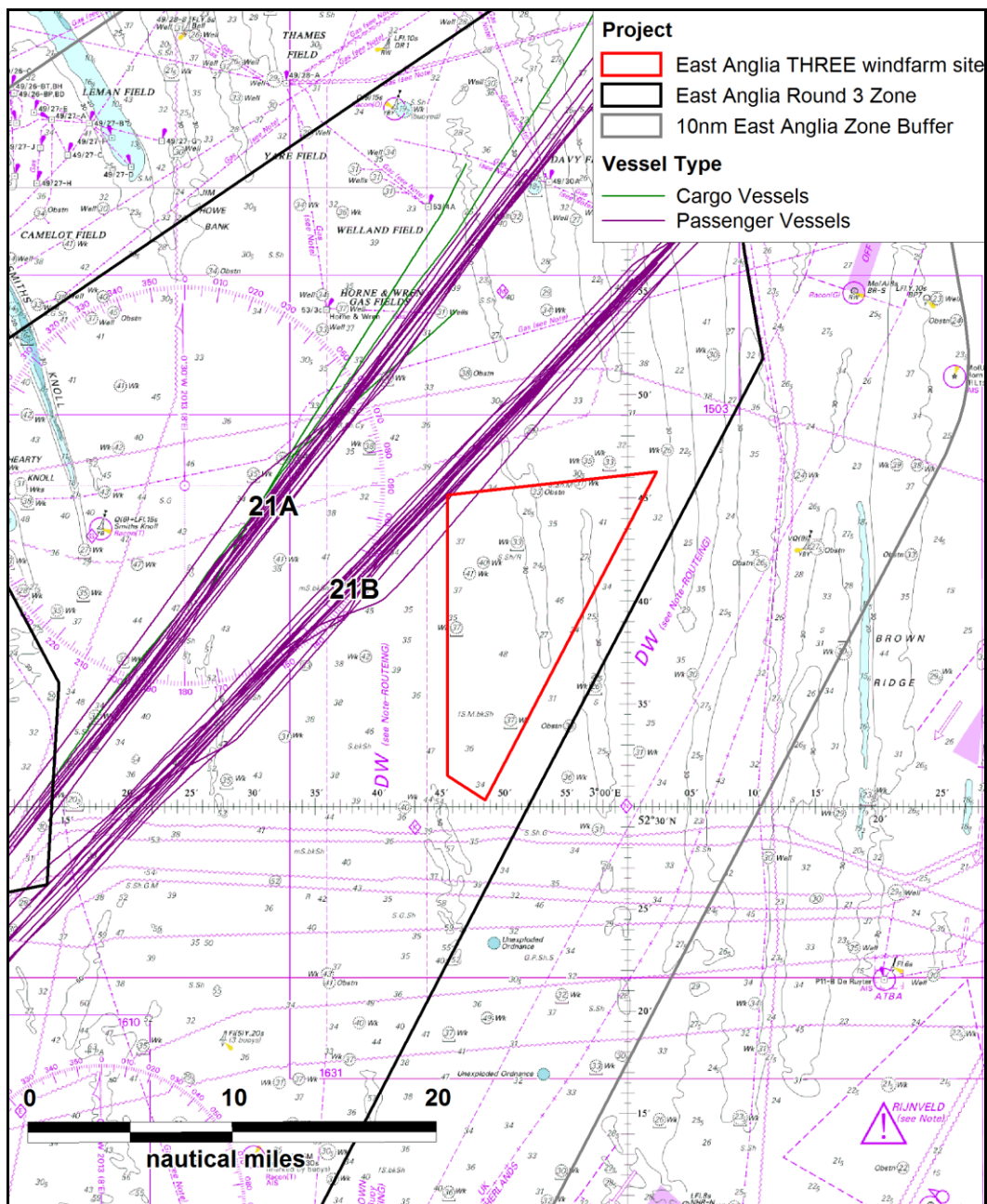
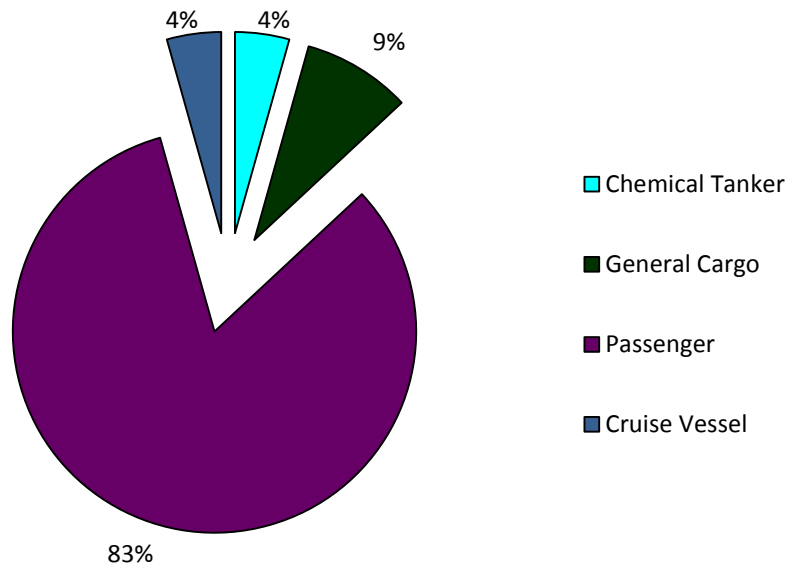


Figure 18.16 Route 21 (40days)

268. Taking into account the combined effective survey period of 40 days, an average of one to two unique vessels were recorded using route 21 per day, of which only 8% (less than one vessel per day) passed through the East Anglia THREE site all of which the passenger vessel *Sirena Seaways*. The vessel type distribution of the traffic on this route is presented in Figure 18.17.





**Figure 18.17 Route 21 Vessel Type Distribution**

269. The majority of vessels transiting route 21 over the combined 40 days survey period were passenger vessels (83%). The most frequently recorded vessel on this route was the DFDS passenger ferry *Sirena Seaways* (previously named *Dana Seaways*), which was recorded on 20 occasions. The cargo vessels *Scott mariner* and *Scot Ranger* and the chemical tanker *Discovery* were each recorded transiting route 21 on one occasion.

270. It is expected that a small minority of the shipping on the north north-east / south south-west route 21 would route further to the northwest following the development of the East Anglia THREE site, in order to achieve a clearance of 2nm from the site boundary.

271. Figure 18.18 presents an alternative routeing for vessels transiting route 21.

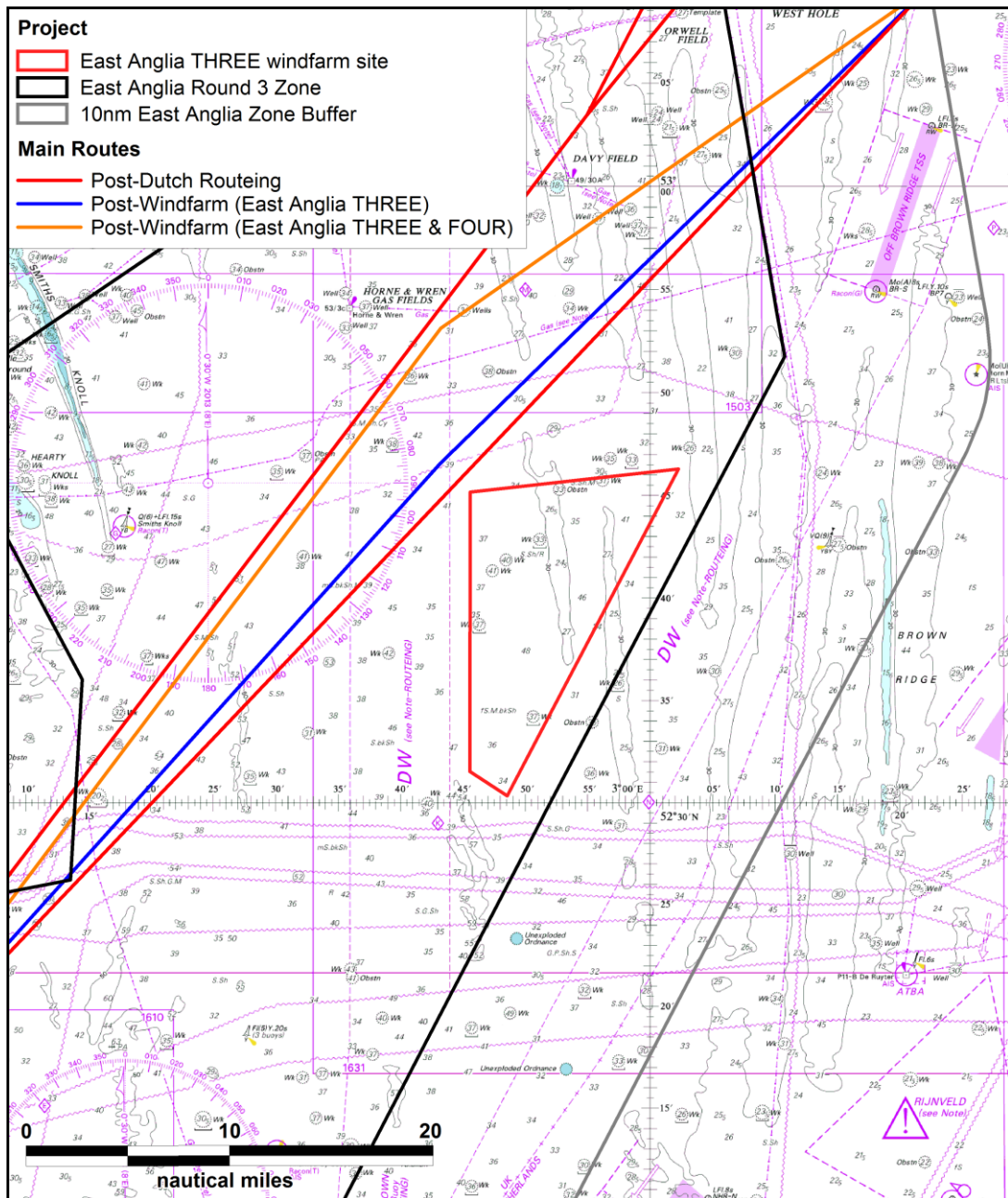


Figure 18.18 Anticipating Routeing for Route 21 Post East Anglia THREE

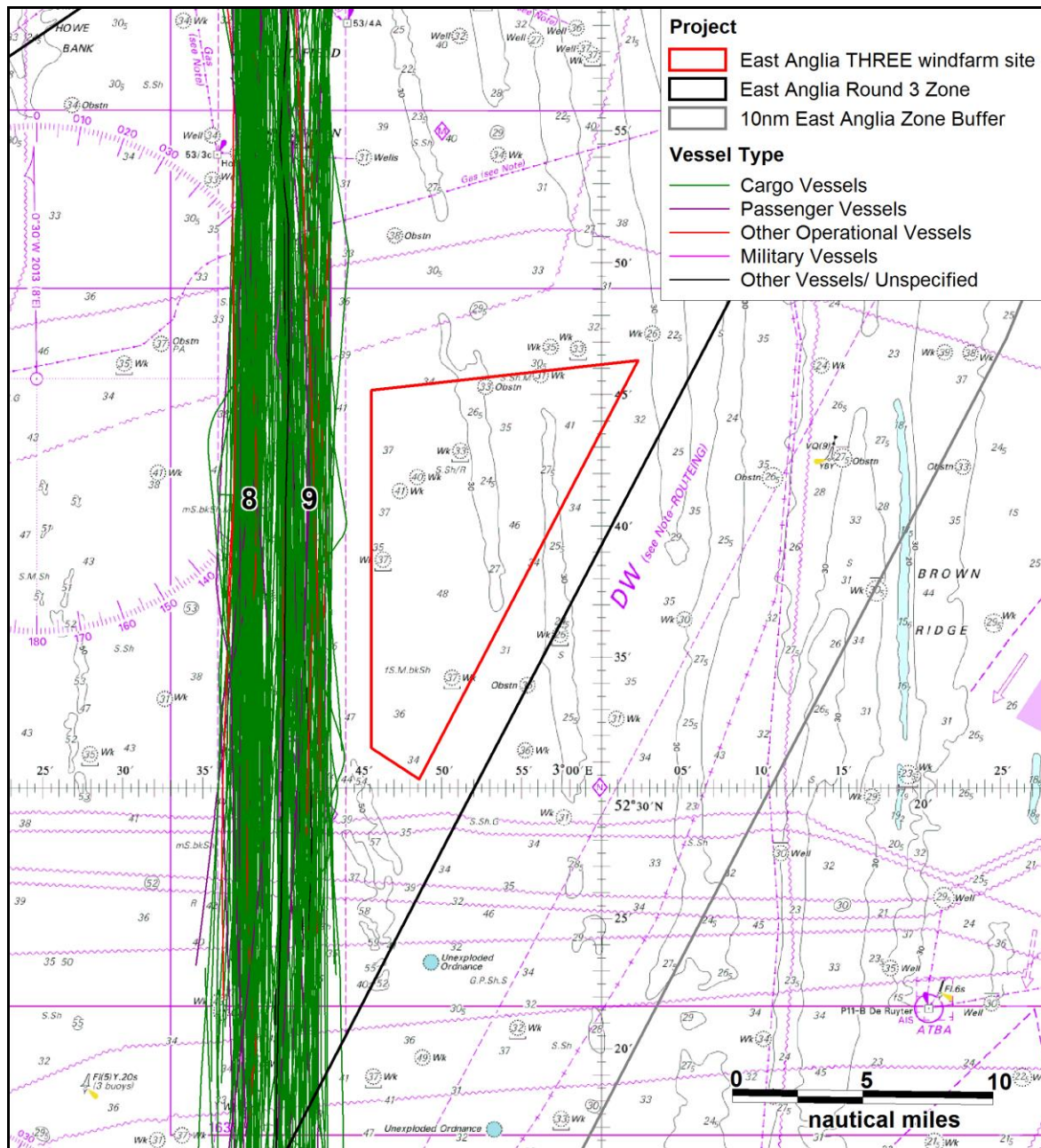
272. A degree of rerouting is likely to be required for the proportion of vessels operating on route 21B only. Vessels transiting route 21A already pass up to 7.6nm northwest of the site.

273. The worst case deviation for vessels on route 21B is estimated to be approximately 0.85nm (0.98% of route length), based on a vessel transiting route 21B, in order to achieve a 2nm minimum passing distance from the windfarm (based on experience of shipping behaviours around existing offshore renewable projects it is anticipated that a proportion of vessels would pass in closer proximity to the site, as shown by the shipping lane position in the figure above).

274. Rerouting of vessels intersecting the site would cause a very minor increase in mileage for a proportion of vessels on route 21 (those operating on route 21B only). The development of the proposed East Anglia THREE project would not alter the angle at which route 21B traffic crosses the DWRs.

### 18.7 Routes 8 and 9- IMO DWRs

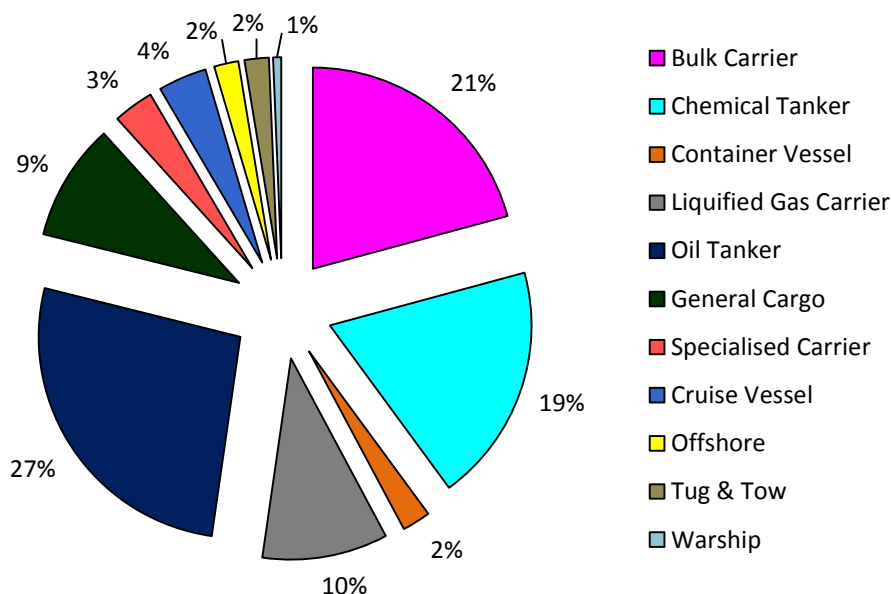
275. The East Anglia THREE site is situated between two busy DWRs, which are presented as routes 6, 7, 8 and 9 in Figure 17.1. Figure 18.19 presents the traffic transiting the DWR to the west of the East Anglia THREE site (route 8 and route 9) during the combined 40 days marine traffic survey period.



**Figure 18.19 Routes 8 and 9 Traffic (40 Days)**

276. The DWR via the Off Botney Ground TSS passes 1nm west of the East Anglia THREE site. Route 9 represents the northbound traffic while route 8 represents southbound traffic. Approximately four to five vessels per day were recorded transiting each route during the combined 40 day survey period.

277. Figure 18.20 presents the vessel types recorded transiting route 8 and route 9 (excluding 2% unspecified).



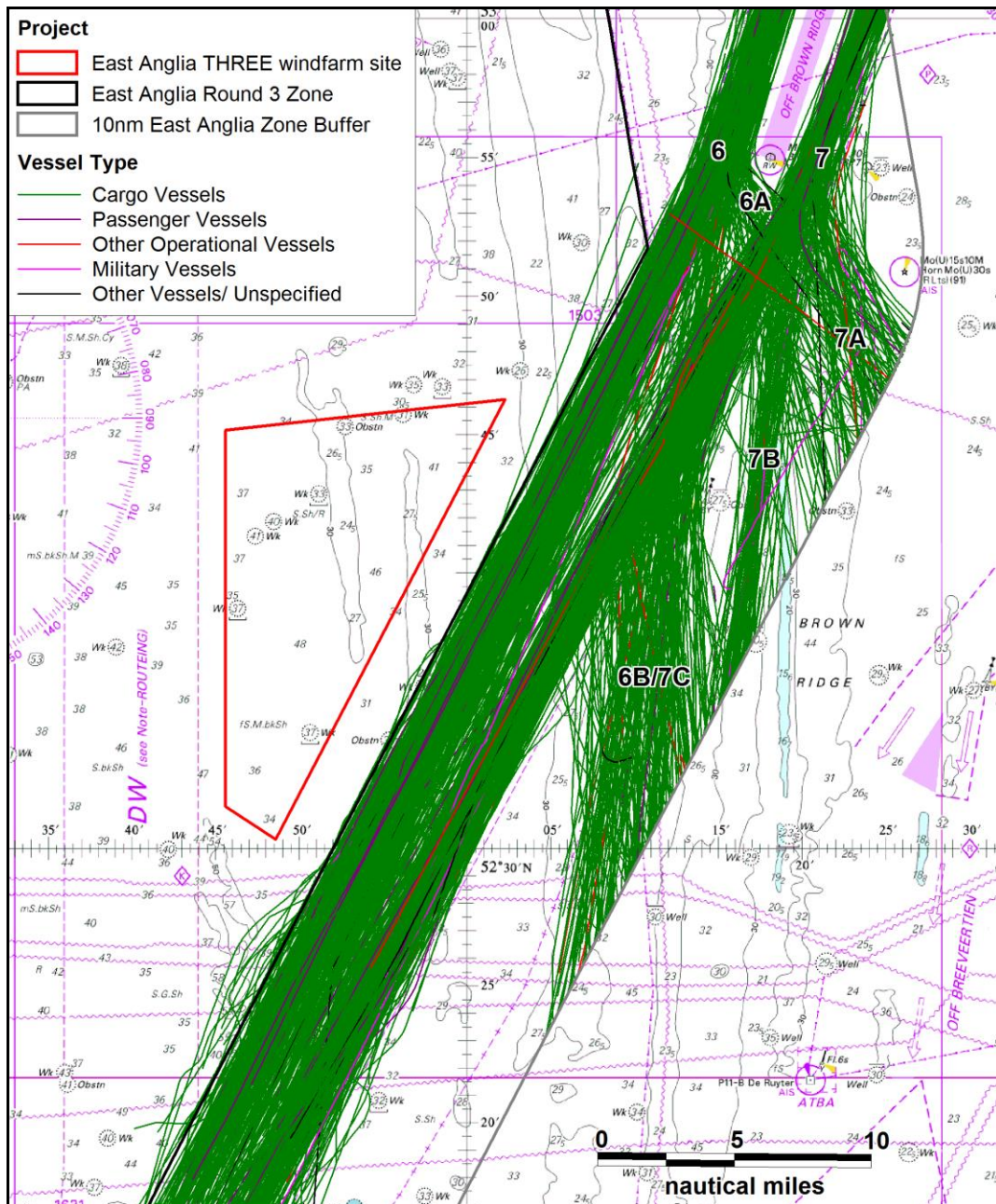
**Figure 18.20 DWRs 8 and 9 Vessel Type Distribution**

278. The majority of vessels recorded were cargo vessels and tankers, with oil tankers representing 27% of marine traffic, chemical tankers 19% and bulk carriers 21%. Liquefied gas carriers represented a significant proportion of marine traffic (10%) as well as general cargo vessels (9%) and passenger cruise vessels (4%).

279. As route 8 and route 9 pass 1nm west of the western boundary of the East Anglia THREE site, the development of the windfarm is anticipated to have no impact on routing of vessels operating on route 8 and route 9.

### 18.8 Route 6 and 7- IMO DWRs

280. The DWRs passing east of the East Anglia THREE site are route 6 and route 7, subdivided to route 6A, route 6B and route 7A, route 7B and route 7C which represent alternative entry/exit points to the OFF Brown Ridge TSS DWR. Figure 18.21 presents vessel tracks, colour-coded by vessel type, recorded operating on the aforementioned routes during the combined 40 day marine traffic survey period.



**Figure 18.21 Routes 6 and 7 Traffic (40 Days)**

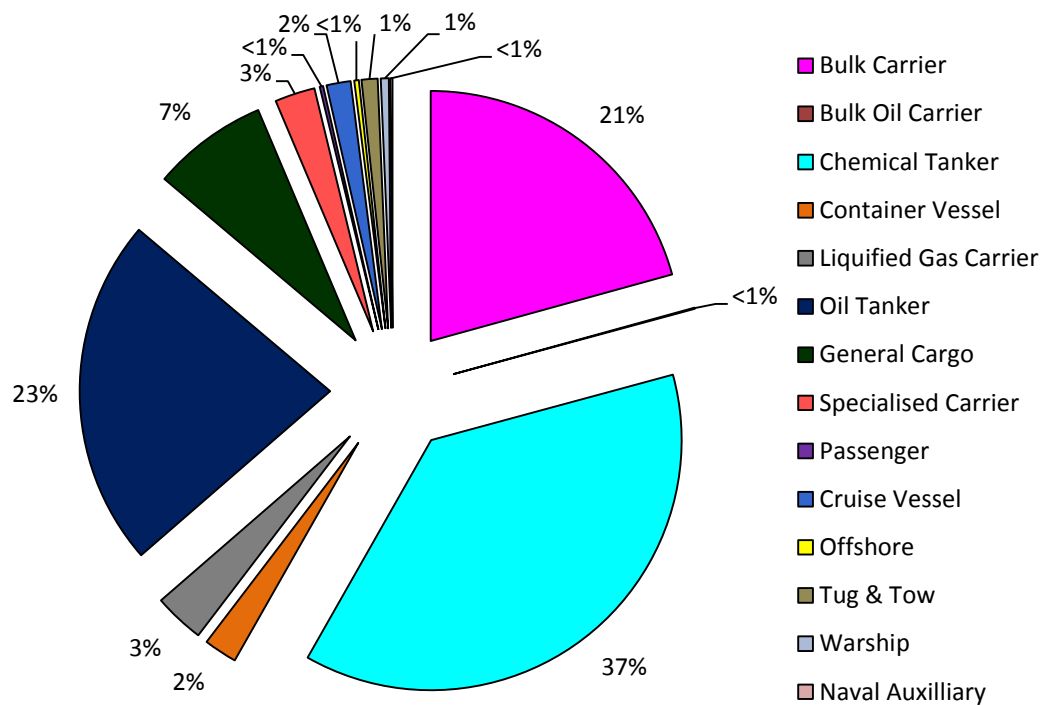
281. The DWR via OFF Brown Ridge TSS passes approximately 2nm east of the East Anglia THREE site boundary. Vessels recorded on route 6 were headed southbound towards the Dover Strait and Benelux ports, while route 7 includes vessels travelling northbound to ports in Germany, Russia and Baltic ports.

282. An average of approximately 13 vessels per day was recorded transiting within the DWR, headed southbound, during the combined 40 day survey period. Of this traffic, approximately two vessels per day were recorded altering their course southeast to leave the DWR, following route 6A, for ports in the Netherlands such as Amsterdam and Rotterdam. A further two vessels per day were recorded leaving the DWR, following

route 6B headed for ports in the Netherlands, Belgium, France and Spain. Vessels transiting southbound and remaining on the DWR (route 6) were recorded travelling to ports of Benelux, France, ports in the south of England and other international destinations through the Dover Strait. Vessels on route 6 only made up approximately ten to eleven vessels per day.

283. An average of approximately eight vessels per day was recorded transiting the DWR headed northbound throughout the combined survey period. Of this traffic, an average of two vessels per day were recorded joining the DWR from route 7A travelling from Belgian, German and Netherlands ports southeast of the East Anglia THREE site. These vessels were most frequently heading to ports in Russia, Norway, Sweden, Denmark and Lithuania. Approximately two vessels per day were tracked transiting route 7B, heading to Russia and Baltic ports. It is estimated that three vessels per day were transiting route 7C, the northbound equivalent of 6B. Vessels recorded operating on route 7C were most frequently recorded on transit to St Petersburg and Murmansk in Russia, Baltic Sea ports and Scandinavian ports.

284. Figure 18.22 presents the distribution of vessel types on route 6 and route 7 (inclusive of all route subdivisions) during the combined 40 day survey period. It should be noted that 1% of unspecified vessel type were excluded from the analysis.



**Figure 18.22 Route 6 and 7 (including subdivisions) Vessel Type Distribution**

285. Tankers represent the vast majority of all recorded vessel type (60%). The most frequently recorded vessel types were chemical tankers (37%) followed by oil tankers (23%). Cargo vessels and bulk carriers were the second large vessel types recorded transiting the DWR via TSS Off Brown Ridge representing 7% and 21% of vessel traffic respectively.

286. The chemical tankers *Eships Bainunah* and *Crystal Skye* were the most frequently recorded vessels (each recorded on six occasions) operating on route 6 and route 7 throughout the survey period. Other frequently recorded vessels include the crude oil tanker *NS Antarctic*, the chemical tanker *Patini*, and the Bulk carrier *AM Quebec* which were all recorded on five separate occasions.
287. As route 6 and route 7 pass 2nm east of the eastern boundary of the East Anglia THREE site, the development of the windfarm is anticipated to have no impact on routing of route 6 and route 7.

## 19 Future Case 90<sup>th</sup> Percentile Route Analysis

288. Table 19.1 provides a summary of anticipated deviations to main routes following construction of the East Anglia THREE site. It should be noted that both the partial and 100% fill build scenarios have been considered.

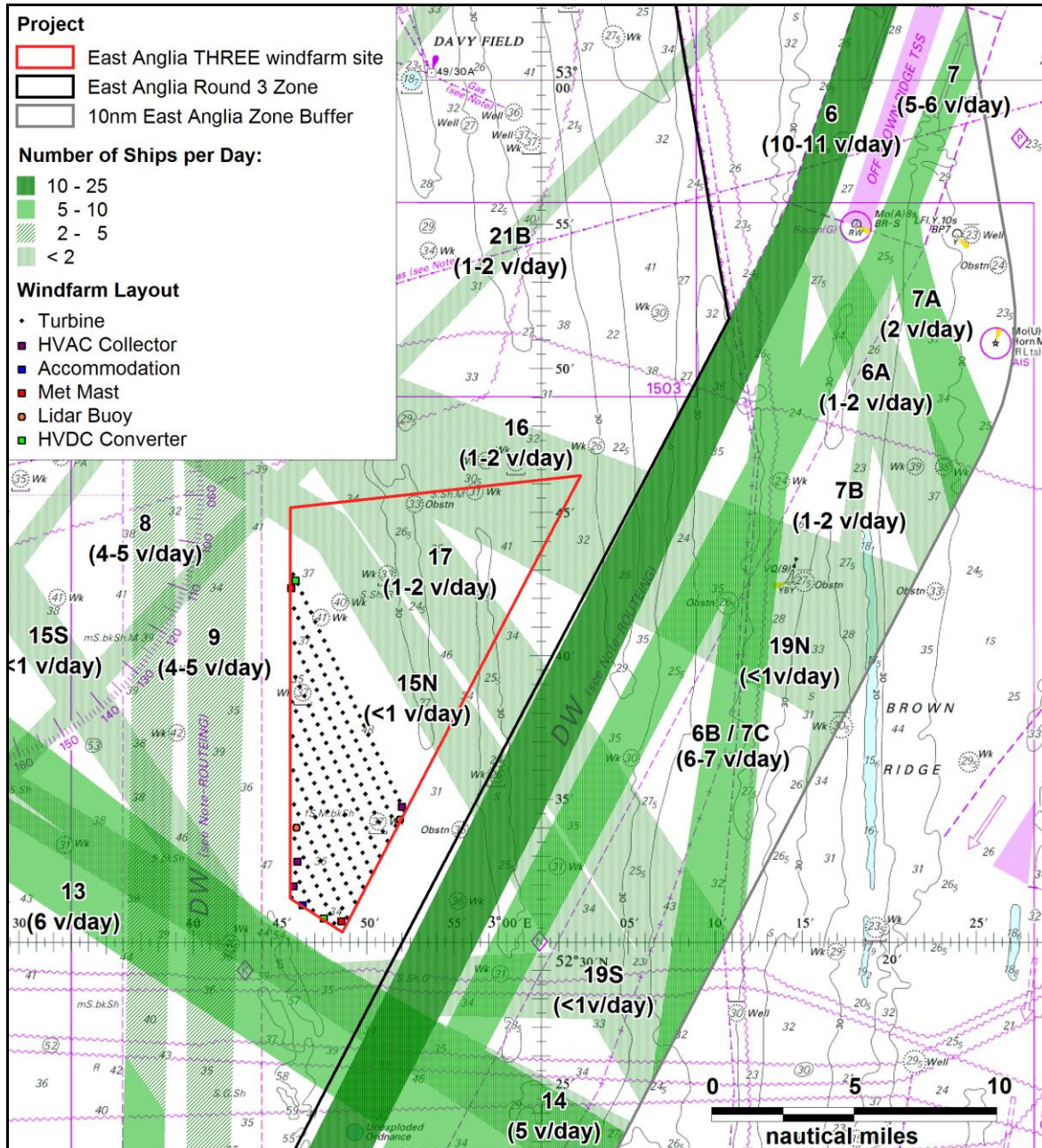
**Table 19.1 Summary of Main Route Deviations**

Route	Partial Fill		100% Fill	
	Increase in Distance (nm)	Increase in Route Length	Increase in Distance (nm)	Increase in Route Length
14 Inbound	0.06	0.06%	0.06	0.06%
14 Outbound	0.01	0.01%	0.01	0.01%
15 Inbound (North)	1.63	1.7%	Vessels unlikely to route north of East Anglia THREE under 100% build scenario.	
15 Inbound (South)	0.8	0.83%	0.8	0.83%
15 Outbound (North)	0.96	1.01%	Vessels unlikely to route north of East Anglia THREE under 100% build scenario.	
15 Outbound (South)	1.06	1.12%	1.06	1.12%
16 Inbound (North)	No impact on vessel routing under partial build scenario.		0.55	0.56%
16 Outbound (North)			0.35	0.36%
16 Inbound (South)			8.25	8.30
16 Outbound (South)			10.30	10.57
17 Inbound			3.02	3.22%
17 Outbound			3.38	3.63%
19 Inbound			2.53	1.98%
19 Outbound			3.42	2.69%
21B			0.03	0.03%

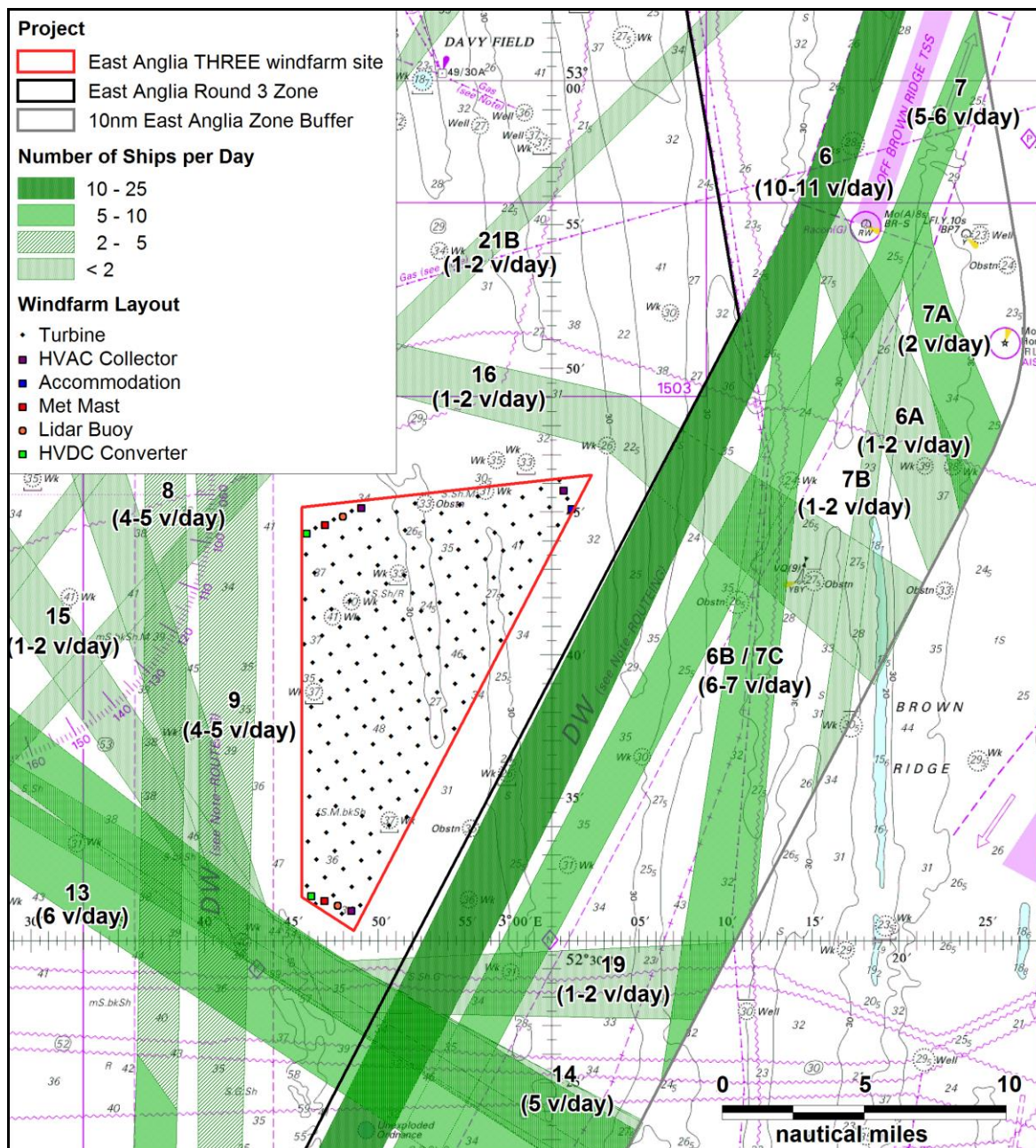
289. An illustration of the anticipated shift in route positions following the development of the proposed East Anglia THREE project, based on the 90% shipping lanes identified in



Section 14 for both the partial fill and 100% fill build scenarios are presented in Figure 19.1 and Figure 19.2 respectively.

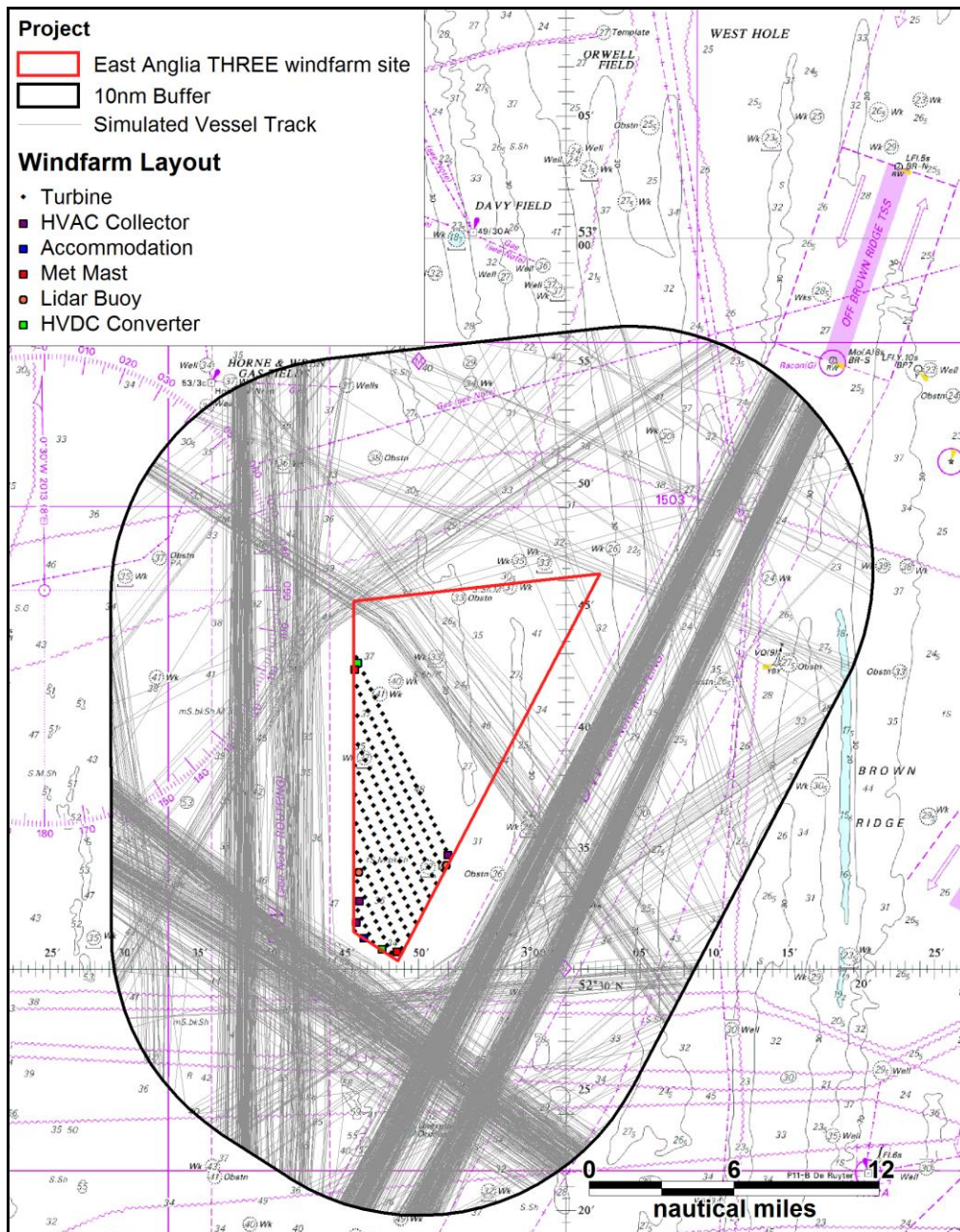


**Figure 19.1 Anticipated 90% Shipping Lanes- Post Construction of the Proposed East Anglia THREE Project (Partial Fill)**



**Figure 19.2 Anticipated 90% Shipping Lanes- Post Construction of the Proposed East Anglia THREE Project (100% Fill)**

290. Based on the baseline routing through the East Anglia THREE site and deviations identified around the site, Anatec’s AIS track simulation program has been used to illustrate what the re-routed traffic would look like post development. The simulated data for the displaced routes has been merged with actual AIS data to show what the future case marine traffic scenario would look like for both the partial fill and 100% fill build scenarios. Ten days of simulated data merged with actual AIS data is presented in Figure 19.3 and Figure 19.4 for each respective build scenario.



**Figure 19.3 10 days of Simulated AIS Data (Partial Fill)**

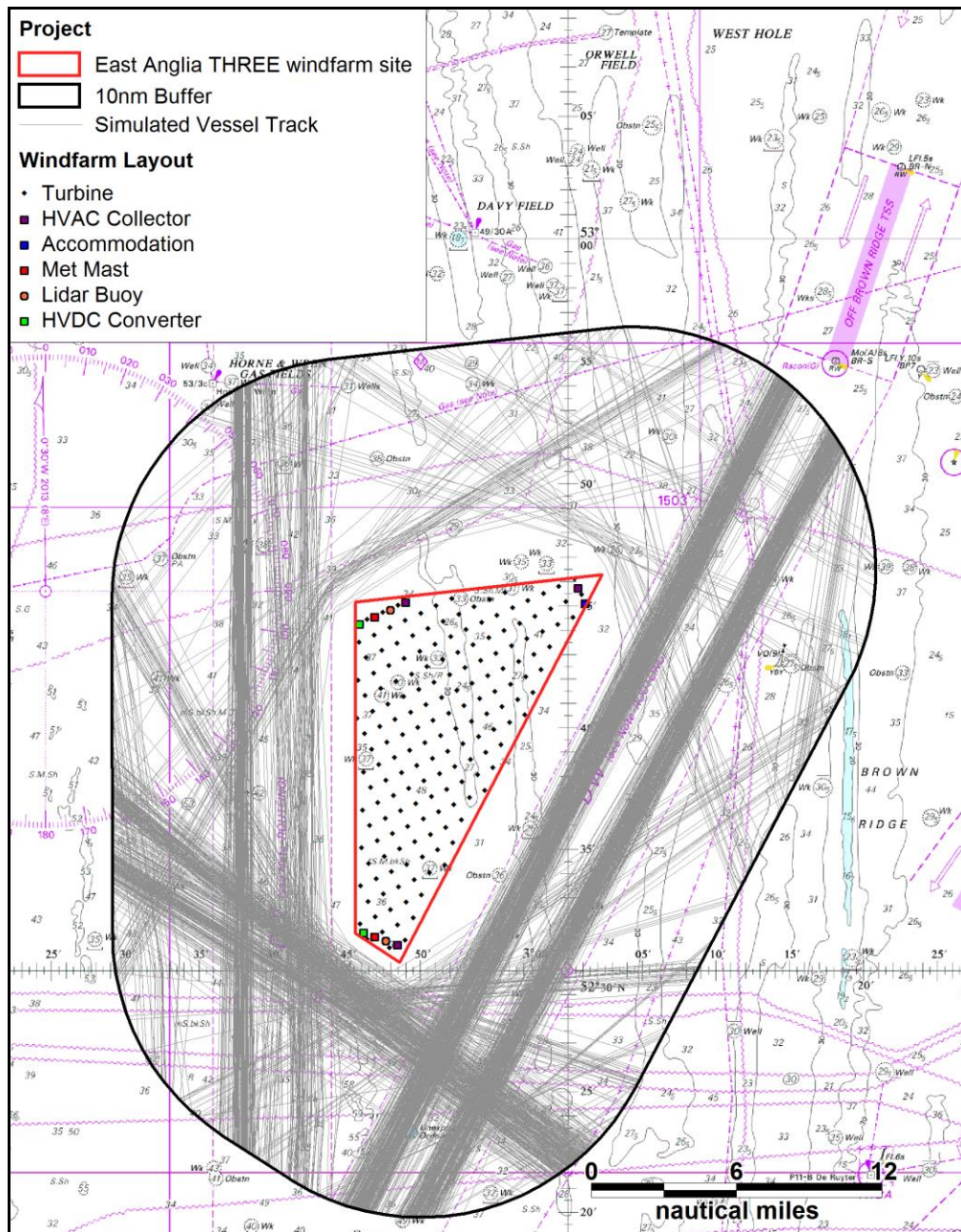


Figure 19.4 10 days of Simulated AIS Data (100% Fill)

### 19.1 Effects on Commercial Vessel Routing

291. This sections shows anticipated re-routes for the routes potentially impacted by the development of the proposed East Anglia THREE project including the changes following the changes to Dutch Routing measures in 2013 which on its own displaced routes 13, 14, and 15 slightly south of their previous mean position (see Section 11). Figure 19.1 and Figure 19.2 show the deviated routes post the development of the proposed East Anglia THREE project with the maximum deviation at 100% fill creating an estimated 3.63% (3.38nm for route 17 outbound) increase on overall journey length compared to

1.7% (1.63nm for route 15 inbound) for a indicative partial fill of the East Anglia THREE site.

292. The increase in route distances for vessels displaced by the windfarm would be minimised by the promulgation of information (including charting) which would enable vessels to passage plan in advance of encountering the development.

### ***19.2 Effects on Commercial Vessel Adverse Weather Routeing***

293. Adverse weather routeing in the southern North Sea is not expected to be impacted by the development of the proposed East Anglia THREE project. In order to mitigate the effects of adverse weather there is ample safe sea room for vessels to safely distance themselves from the East Anglia THREE site without increasing time or deviation distance. However no evidence of adverse weather routeing (meaning routes that significantly alter from their normal transit in adverse weather) through the site has been identified from consultation or baseline data. Commercial ferries, in order to minimise passenger discomfort often route on coastal courses during adverse weather and therefore are not impacted by the proposed East Anglia THREE project.

294. Effects on commercial vessel routeing are assessed in Chapter 15 Shipping and Navigation Section 15.7.2.

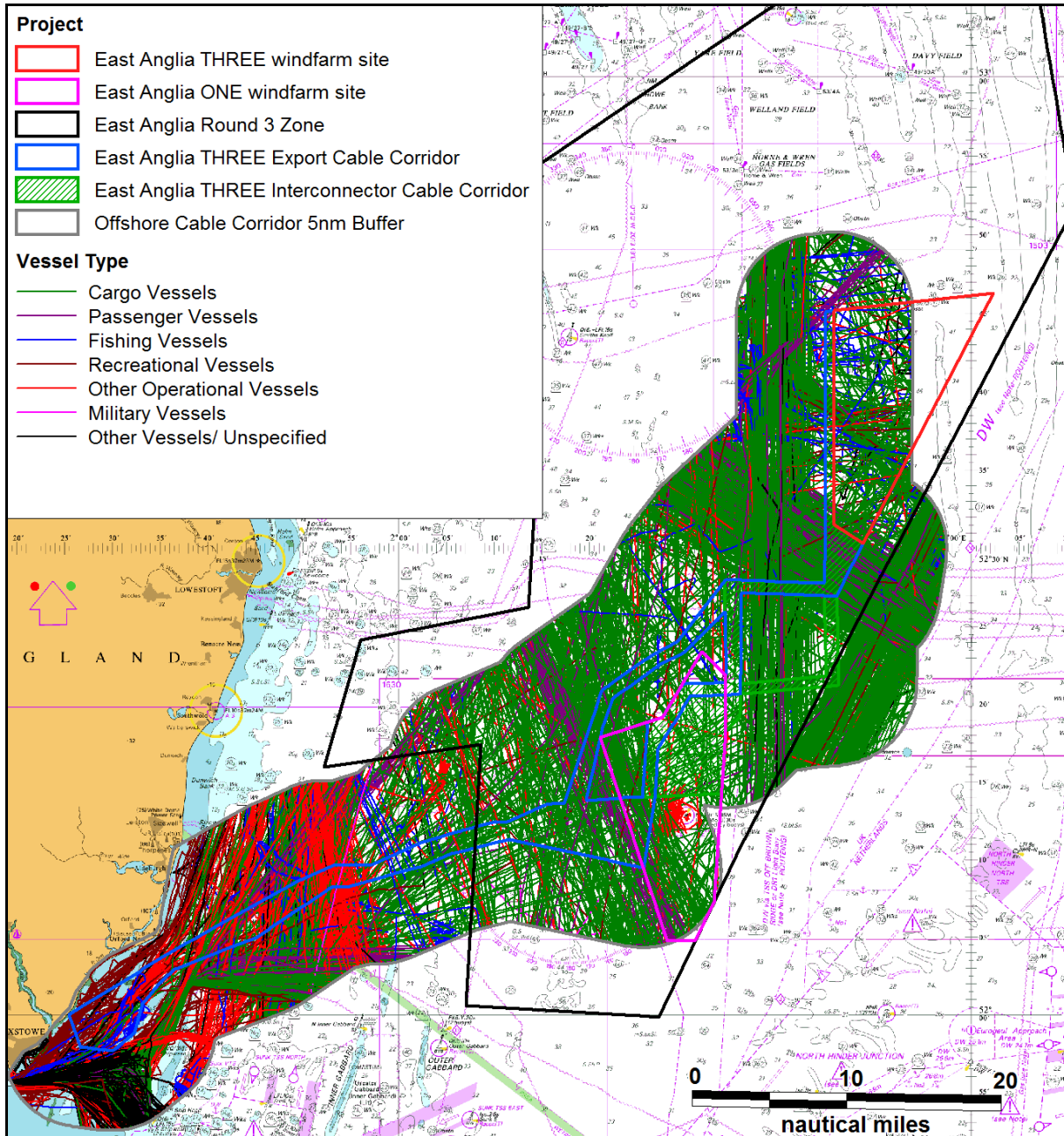
## **20 Offshore Cable Corridor Maritime Traffic Survey**

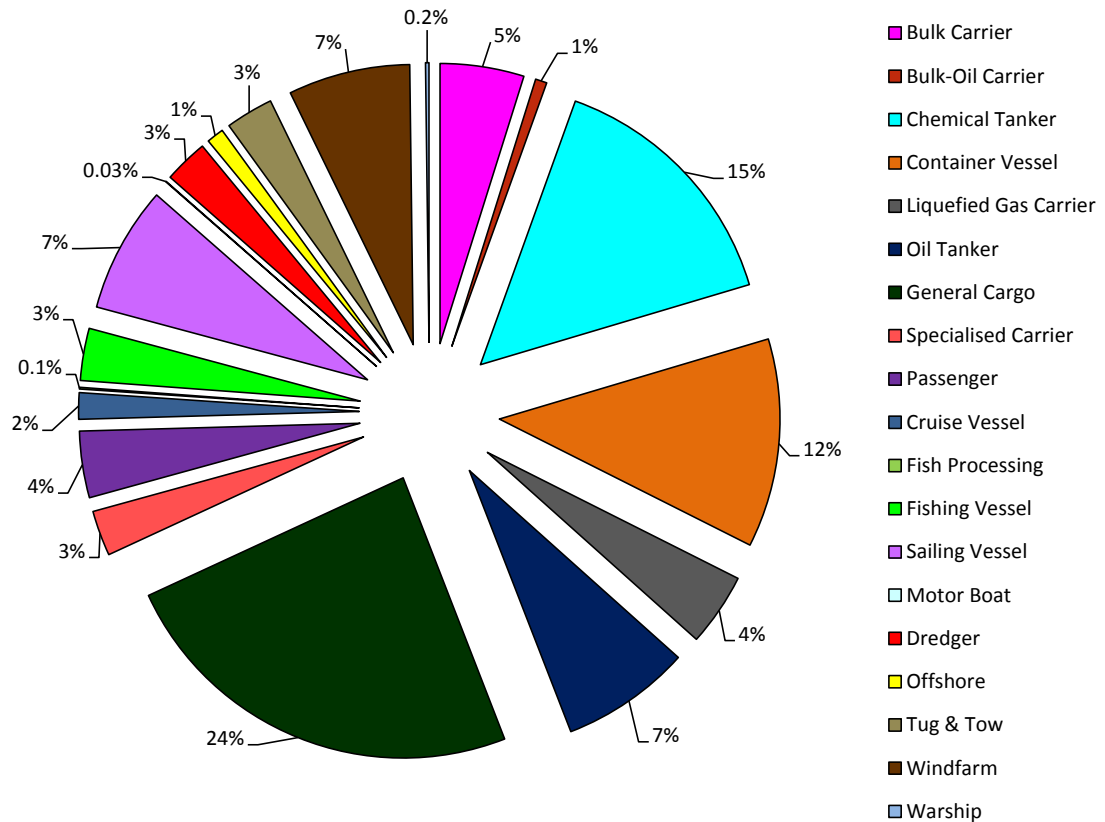
### **20.1 Survey Overview**

295. In order to inform vessel routing in proximity of the offshore cable corridor, 20 days of AIS data collected from coastal survey stations has been analysed. The 20 day survey period is congruent with the second and third surveys carried out by the *Northern Viking* survey vessel and therefore covers a period between the 12<sup>th</sup> to 21<sup>st</sup> of May 2013 and the 24<sup>th</sup> July to 3<sup>rd</sup> August 2013.

### **20.2 Survey Data by Vessel Type**

296. A plot of the tracks recorded during the 20 day survey period, colour-coded by general vessel type categories, is presented in Figure 20.1. Following this, the distribution of vessel types, using the more detailed second-level DECC vessel categories (see Table 11.1) is presented in Figure 20.2





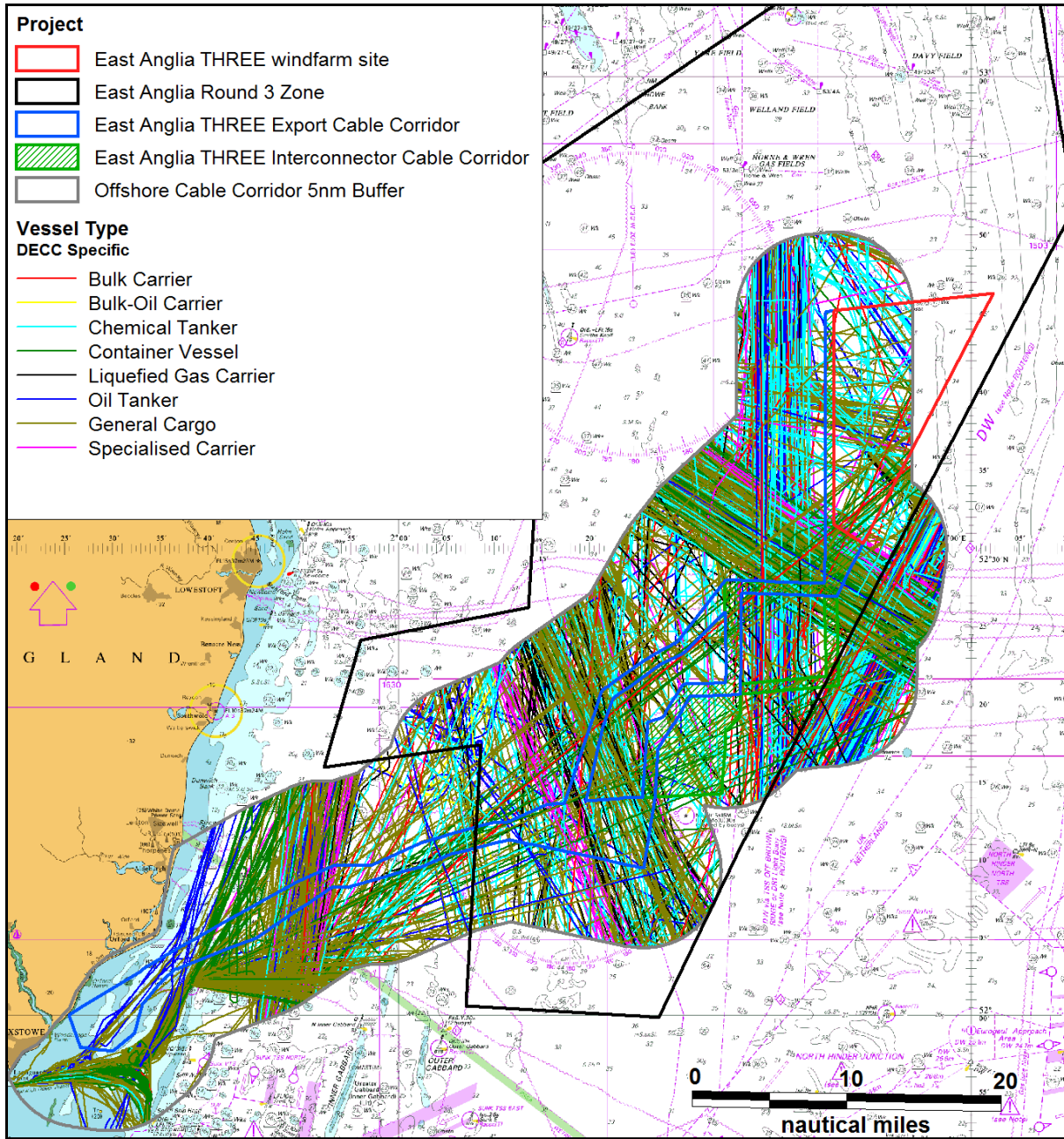
**Figure 20.2 Offshore Cable Corridor Vessel Type Distribution (20 Days May- August 2013)**

297. General cargo vessels were the most frequently recorded vessel type throughout the 20 day survey period, representing 24% of marine traffic. Other significant vessel types recorded include chemical tankers and container vessels, representing 15% and 12% of marine traffic respectively.

298. A higher proportion of recreational vessels (7% sailing vessels and 0.03% motor boats) was recorded throughout the survey period in comparison to surveys carried out in the vicinity of the East Anglia THREE site. This is due to the higher density of recreational vessels typically found closer to shore.

299. The cargo, passenger and other operational vessels tracked within 5nm of the offshore cable corridor are shown in Figure 20.3, Figure 20.4 and Figure 20.5 respectively.





**Figure 20.3 Cargo Vessels Recorded within 5nm of Cable Corridor (20 Days)**

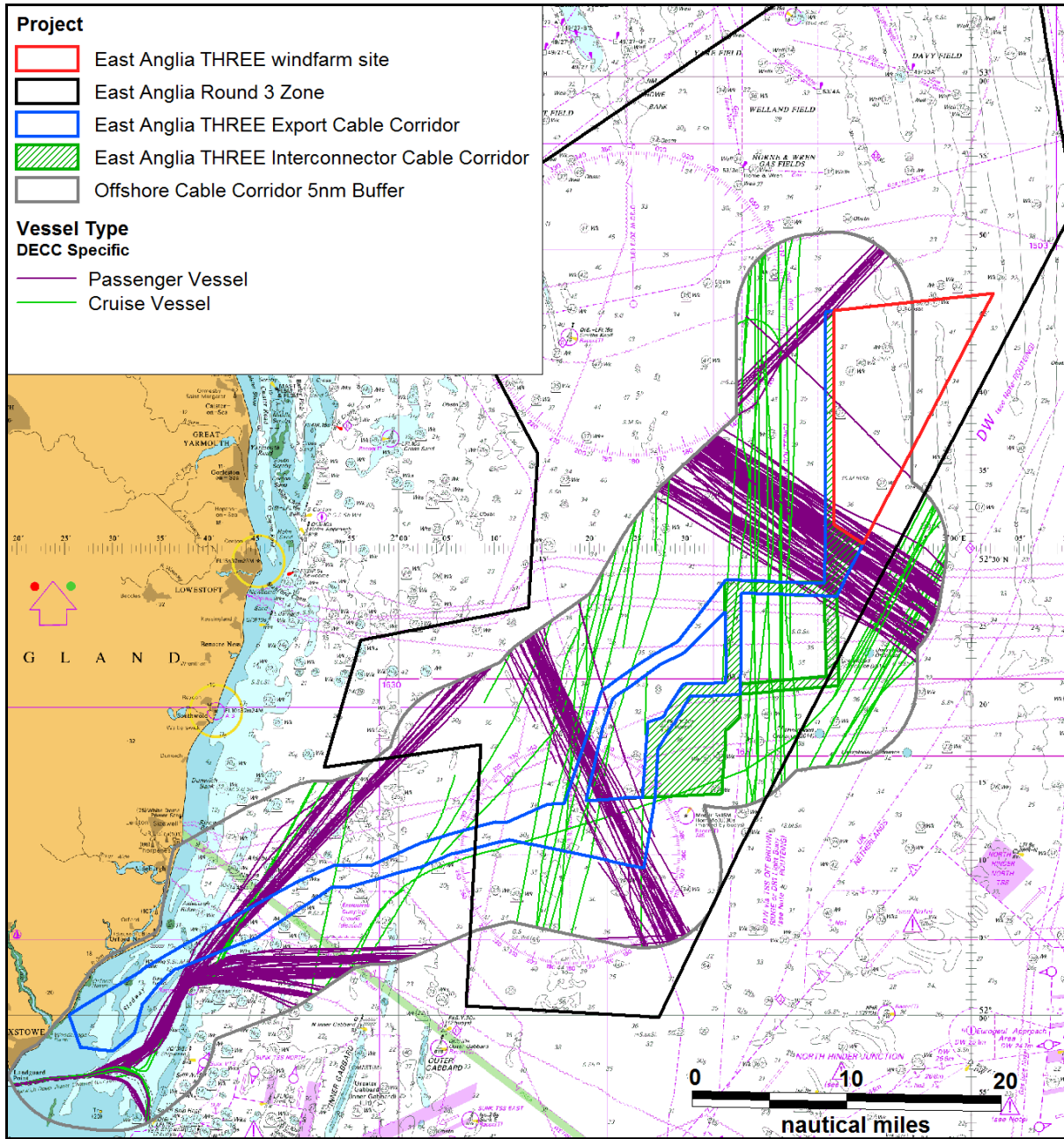


Figure 20.4 Passenger Vessels Recorded within 5nm of Cable Corridor (20 Days)

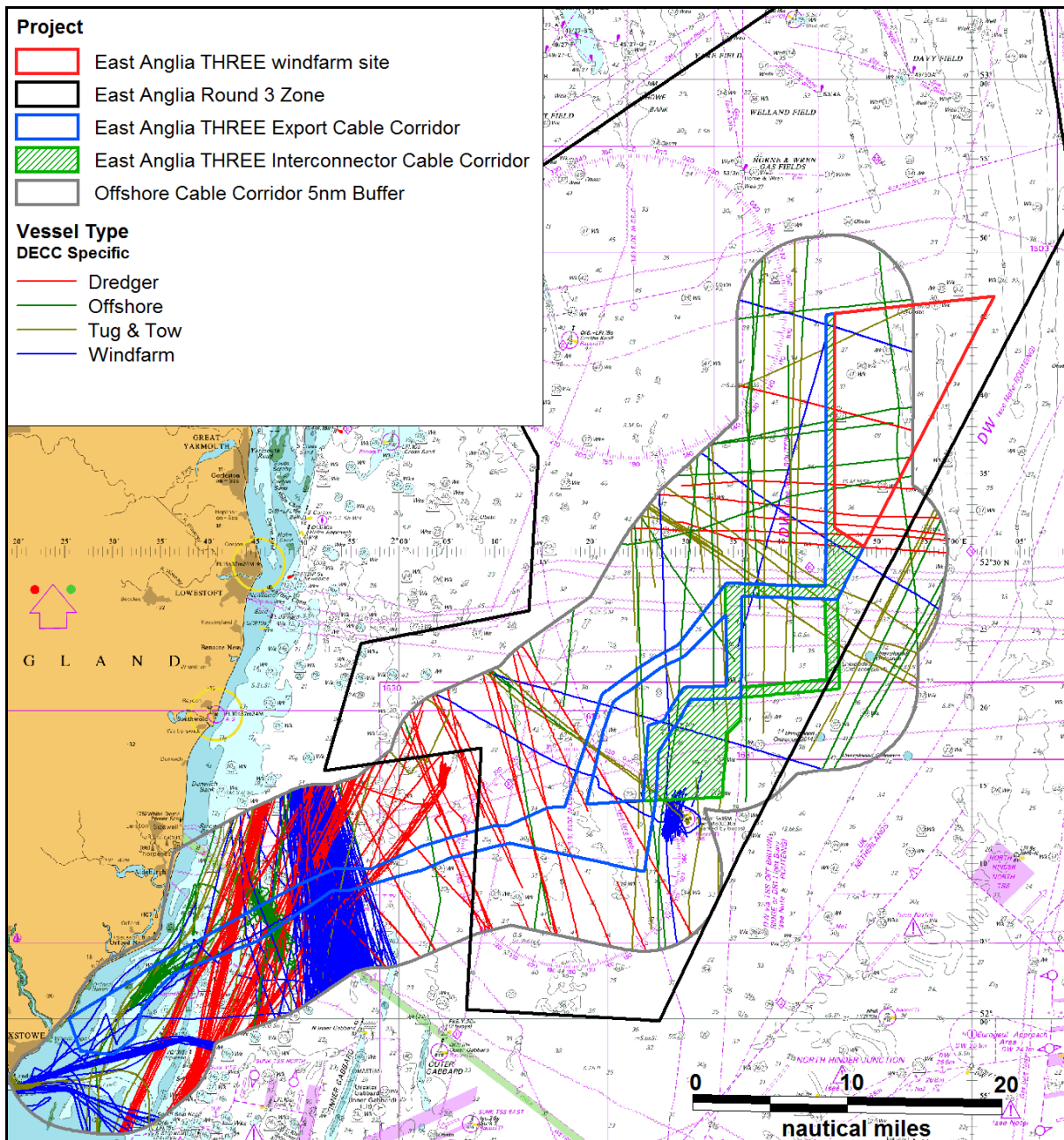
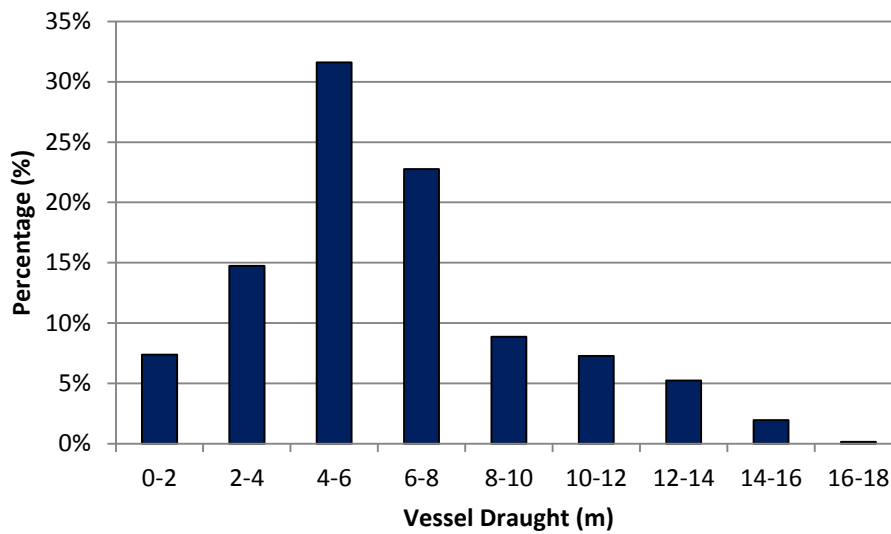


Figure 20.5 Other Operational Vessels within 5nm of Cable Corridor (20 Days)

### 20.3 Vessel Size

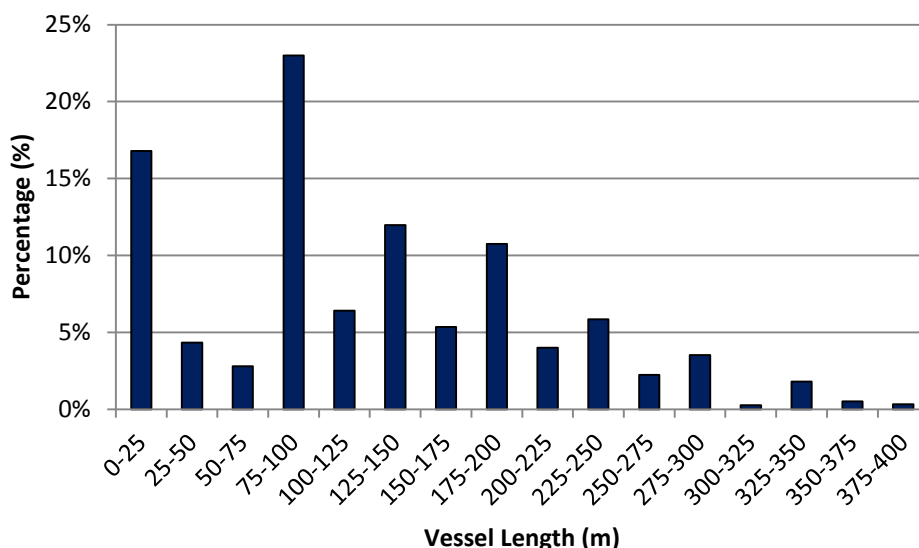
300. Vessel draughts ranged from 0.9m (windfarm support craft *Iceni Pride*) to a maximum of 17.7m (Bulk Carrier *Mineral Noble*). Figure 20.6 illustrates the distribution of vessel draughts for the 20 day survey period.



**Figure 20.6 Offshore Cable Corridor Vessel Draught Distribution (20 days May – August 2013)**

301. The average draught of vessels within 5nm of the offshore cable corridor throughout the survey period was 6.4m excluding 12% of vessels which did not broadcast vessel draught information. The majority (54%) of vessels recorded throughout the survey period had draughts between 4 and 8m.

302. Vessel lengths ranged from 7m (sailing vessel *Ilias* and SAR fast RIB *Volunteer*) to a maximum of 379m (crude oil tanker *TI Europe*). Figure 20.7 illustrates the distribution of vessel lengths for the 20 day survey period.



**Figure 20.7 Offshore Cable Corridor Vessel Length Distribution (20 days May – August 2013)**

303. The average length of vessels within 5nm of the offshore cable corridor throughout

the survey period was 128.3m, excluding 1% of vessels which did not broadcast vessel length information. The majority (23%) of vessels recorded throughout the survey period had lengths between 75 and 100m.

#### **20.4 Offshore Cable Corridor Anchored Vessels**

304. An overview of vessels that broadcast their navigational status as “at anchor” within 5nm of the offshore cable corridor, colour-coded by vessel type is presented in Figure 20.8.
305. Anchoring activity recorded within 5nm of the offshore cable corridor was constrained to designated anchorage areas (Cork and Bawdsey) within the limits of Harwich Haven Port Authority and to an area north of the proposed offshore cable corridor in proximity to the Southwold Oil Cargo Transhipment Area.
306. Throughout the 20 day survey period analysed, no vessels were recorded at anchor directly over the proposed offshore cable route corridor. The closest vessel recorded at anchor to the offshore cable corridor was the 379m long bulk-oil carrier *TI Europe*. This vessel was recorded anchoring 0.3nm north of the proposed offshore cable corridor on the 1<sup>st</sup> August 2013 before transiting to Rotterdam.

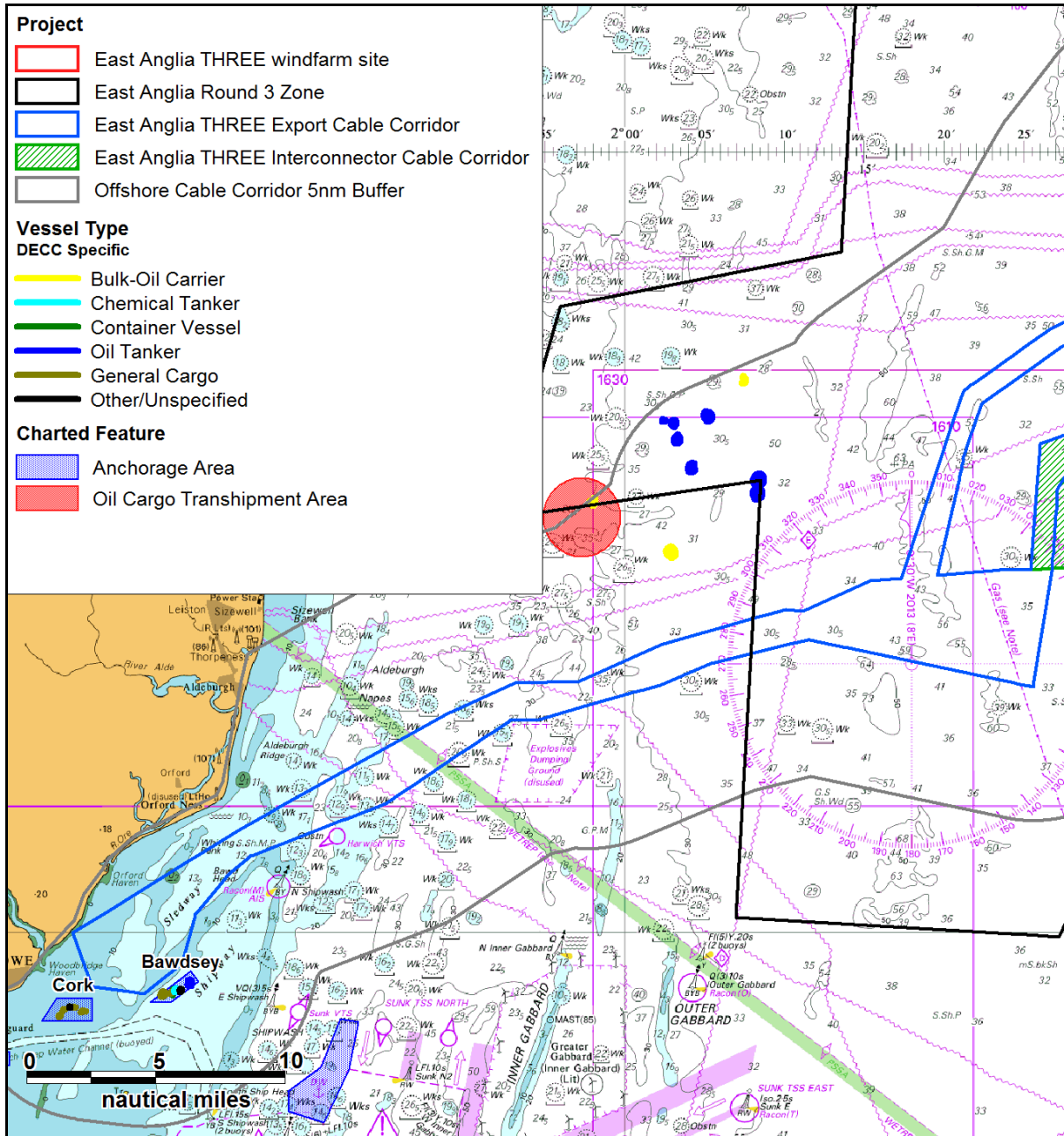
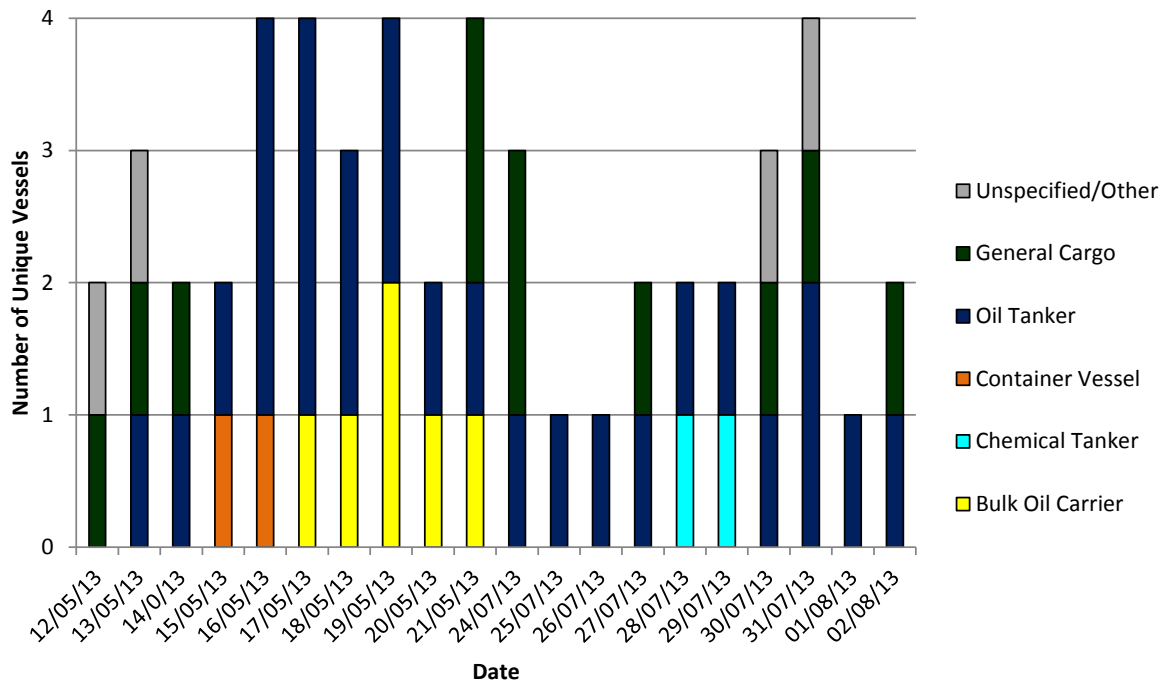


Figure 20.8 Anchored Vessels within 5nm of Offshore Cable Corridor (20 days May – August 2013)



**Figure 20.9 Daily Count and Vessel Type Distribution of Anchored Vessels (20 days May – August 2013)**

307. Oil tankers were the most frequently recorded vessel type, representing 51% of anchored vessel traffic within 5nm of the offshore cable corridor throughout the survey period. General cargo vessels and bulk oil carriers were also frequently recorded at anchor, representing 22% and 12% of marine traffic respectively. A maximum of four vessels at anchor per day and a minimum of one were recorded within 5nm of the offshore cable corridor throughout the survey period.

### 20.5 Effects for Offshore Cable Corridor

308. Throughout the maritime traffic surveys, anchoring activity within 10nm of the East Anglia THREE site was limited, with only three unique vessels recorded anchoring throughout the combined 40 day survey period. Anchoring activity in proximity to the offshore cable corridor was constrained to designated anchorage areas (Cork and Bawdsey) within the limits of Harwich Haven Port Authority and to an area north of the proposed offshore cable corridor in proximity to the Southwold Oil Cargo Transhipment Area. No vessels were recorded at anchor directly over the offshore cable corridor.

309. The Bawdsey and Cork charted anchorage areas are located 500m from the boundary of the proposed offshore cable corridor. In addition, the Admiralty Sailing Directions (UKHO, 2005) recommends Hollesley Bay (to the north of the cable landfall) and Sledway (within the cable corridor, 2.3nm from the coast) as two further anchorages in the area.

310. Therefore, it is assumed the cable would be suitably protected for the seabed conditions (assessed separately) and principally the fishing/anchoring activity in the area through burial and trenching, information promulgation and periodic inspection.

311. The export cables would be buried where possible, in order to provide protection from all forms of hostile seabed interaction, such as fishing activity, dragging of anchors and dropped objects. It is estimated as a minimum 75% of the export and inter-array cable/s would be buried and where protection is required it be assessed in line with a number of factors including marine traffic data to ensure it does not present a risk to anchoring, emergency anchoring or under keel clearance. It is assumed that partially buried cables will be marked and guarded as required to ensure they do not present a risk to anchoring vessels.
312. There would also be periodic inspections/surveys to ensure that they do not become exposed. They would also be marked on Admiralty Charts, although whether all submarine cables are charted depends upon the scale of the chart; in some cases only the export cable may be shown.
313. Effects of the offshore cable corridor on various receptors are considered in Chapter 15 Shipping and Navigation, section 15.7.



## 21 Emergency Response

314. This section summarises the existing emergency response resources in the region and the issues being considered as a gap analysis in relation to the design of the windfarm and the facilities to be provided by the developer.

315. East Anglia Offshore Wind Limited recognise that the proposed East Anglia THREE project, within their Round 3 allocated East Anglia Zone, requires a higher level of Emergency Response planning and co-operation than those developments in which it has previously been involved, due to:

- The larger sea area which the East Anglia THREE site would cover and the potential for EATL expansion into the remaining area of the East Anglia Zone;
- The distance offshore from shore-based emergency response units; and
- The types, number & routes of traffic currently using the site and its environs.

316. As a basic principle, EATL would comply fully with all the requirements of MGN 371, Annex 5 - "Standards and procedures for generator shutdown and other operational requirements in the event of a search and rescue, counter pollution or salvage incident in or around an OREI" – and with all subsequent amendments or new directives from the Maritime & Coastguard Agency (MCA).

317. Additionally EATL would, using its own on-site personnel, vessels, structures and facilities, initiate procedures in which would constitute a rational first and self-help response to all emergencies occurring within, and close to, the proposed East Anglia THREE project.

318. Although details of personnel, structures, work vessels and personnel required for the proposed East Anglia THREE project are not yet determined, the following would serve as a guide to their principles which EATL would follow.

319. Those sectors of Emergency Response in which East Anglia THREE Limited (EATL) considers it could directly co-operate and contribute include:

- Search and rescue as defined in the Search & Rescue (SAR) Convention of 1979 and in subsequent amendments;
- The rendering of assistance to vessels in distress as detailed in the Safety Of Life At Sea (SOLAS) Convention 1988 and in subsequent amendments;
- First response as described in the Salvage Convention of 1989; and
- First response in respect of the National Contingency Plan for Marine Pollution from Shipping & Offshore Installations (2006).

### 21.1 Search and Rescue

320. EATL recognises that it has an obligation to take a major role in the evacuation of its own personnel from within and around its development and to assist in the search for and rescue of other casualties that may occur within its wind farm or in its environs.

321. This would be carried out in the spirit of the Department for Transport's "SAR

Framework for the United Kingdom” (2008) and consultations would be held with the relevant Maritime Rescue Co-ordination Centres (MRCC) and the MCA’s newly devised Maritime Operations Centre (MOC).

### *21.1.1 SAR Helicopters*

322. The use of helicopters for search and rescue within offshore windfarms would normally be restricted to the detection of casualties and then the direction of surface craft towards that casualty, rather than sea surface rescue by the helicopter itself. This may however not be the case where in-extremis situations occur (MCA 2005).
323. A review of the assets in proximity to the East Anglia THREE site indicated that the closest SAR helicopter base is located at Lydd, operated by the Bristow Group, approximately 125nm from the southwest boundary of the East Anglia THREE site. It is planned that two Augusta Westland 189 helicopters shall operate from Lydd airbase. The base will be operational 24 hours a day but details of readiness times are not currently known.
324. The response time from Lydd airbase to the East Anglia THREE site boundary would be approximately 55 minutes (based on a flight speed of 145 knots) plus the readiness time. It is noted that these calculations are based on still air and would vary depending on the prevailing conditions.

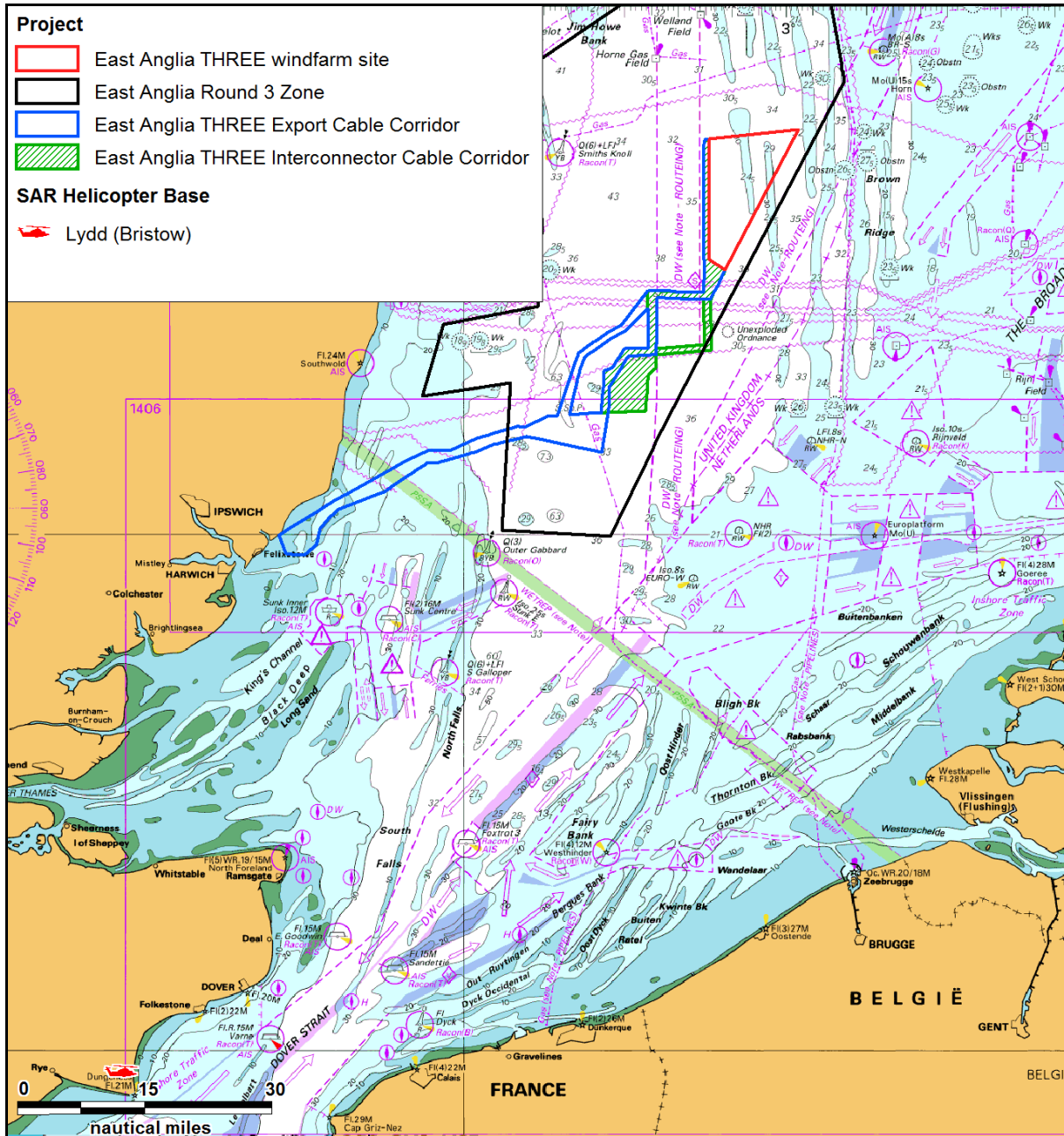


Figure 21.1 SAR Helicopter Bases relative to the East Anglia THREE Site

### 21.1.2 RNLI Lifeboats

325. The RNLI maintains a fleet of over 400 lifeboats of various types at 235 stations round the coast of the UK and Ireland.

326. The RNLI stations in the vicinity of East Anglia THREE are presented in Figure 21.2.

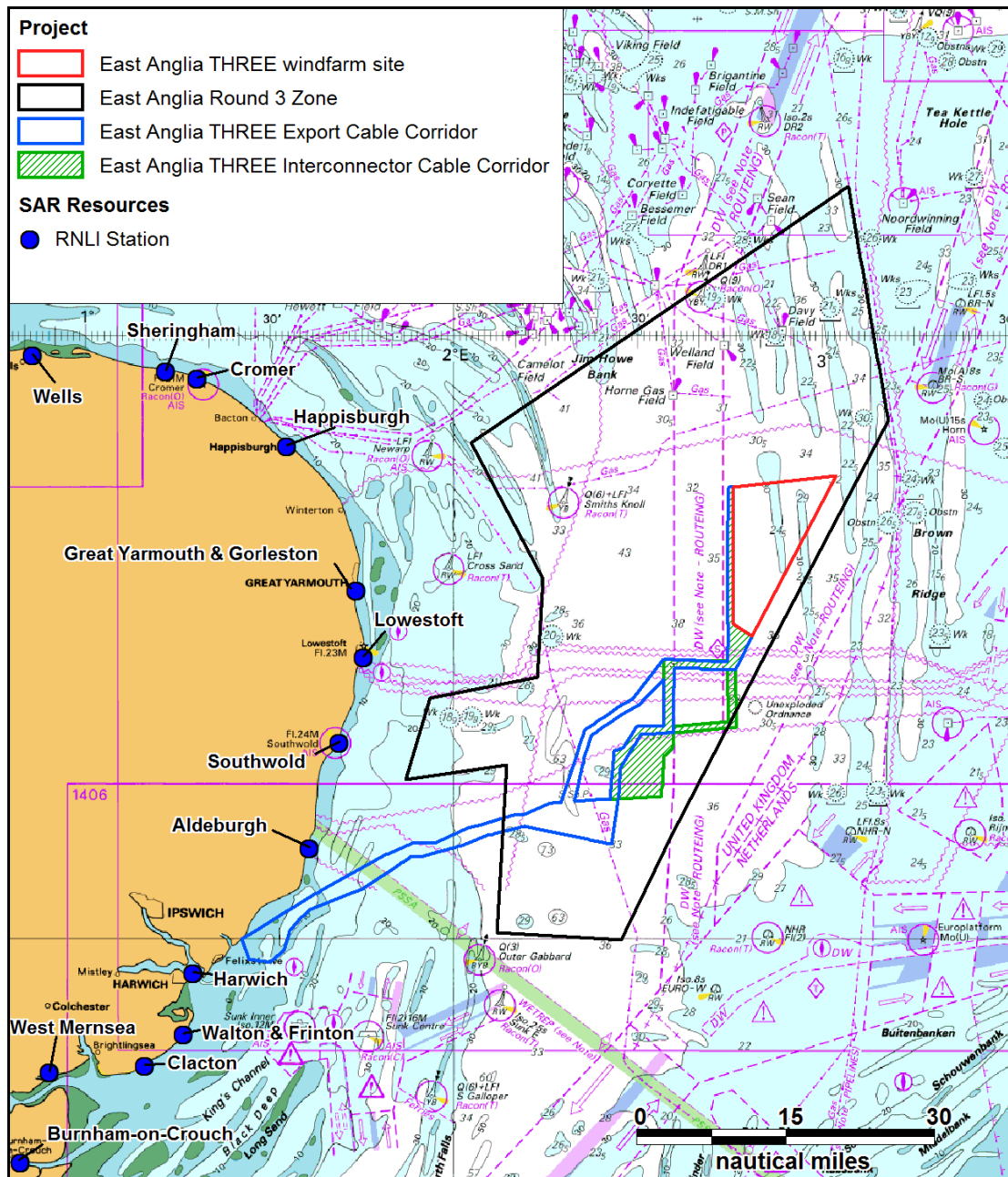


Figure 21.2 RNLI Bases relative to the East Anglia THREE site

327. At each of these stations crew and lifeboats are available on a 24-hour basis throughout the year. Table 21.1 provides a summary of the facilities at the stations closest to the East Anglia THREE site.

**Table 21.1 Lifeboats held at nearby RNLI stations**

Station	Lifeboats	ALB Class	ILB Class	Distance to centre of East Anglia THREE (nm)
Happisburgh	ILB (x2)	n.a.	B Class & D Class	48.8
Great Yarmouth & Gorleston	ALB & ILB	Trent	B Class	41.3
Lowestoft	ALB	Tyne	n.a.	41.8
Southwold	ILB	n.a.	B Class	47.0
Aldeburgh	ALB & ILB	Mersey	B Class	54.8
Harwich	ALB & ILB	Severn	B Class	71.7

328. Based on the offshore position of the East Anglia THREE site it is likely that ALBs would respond to an incident within the site from Lowestoft, Aldeburgh or Great Yarmouth and Gorleston. This is confirmed when reviewing the historical incident data, with ALBs responding to all incidents within 10nm of the East Anglia THREE site from 2001 to 2010 (see Section 9.3).

329. The Trent class lifeboat has a maximum speed of 25 knots, range of 250nm and can operate in all weather. The Tyne and Mersey class lifeboats are also all-weather lifeboats. The Tyne class having a maximum speed of 17 knots and a range of 240nm, whilst the Mersey class has a speed of 17 knots and a 140nm range. All-weather lifeboats are fitted with the latest in navigation, location and communication equipment, including electronic chart plotter, VHF radio with direction finder, radar and GPS.

330. Readiness times vary but the average declared by RNLI is 14 minutes for all-weather lifeboats and seven minutes for inshore lifeboats. This is the time from callout, i.e., first contact from the Coastguard to the lifeboat station to launch.

331. Based on the above information, the response time to the centre of the windfarm from Great Yarmouth & Gorleston would be in the order of one hour and 40 minutes (excluding readiness time), assuming a maximum 25 knot speed in good sea conditions of the Trent class ALB.

## **21.2 Salvage and Towing**

332. For the benefit and safety of its own installations and for third party assistance, East Anglia THREE Limited would attempt to provide salvage and towage, where immediate assistance is necessary, within the limits of its own vessel and crew capabilities.

333. Such capabilities would be determined in consultation with MCA and HSE. The relevant MRCC would hold details of all other available tugs in the area.

334. Each MRCC holds comprehensive databases of harbour tugs available locally. Procedures are also in place with Brokers and Lloyd's Casualty Reporting Service to quickly obtain information on towing vessels that may be able to respond to an incident.

335. It is noted that the Coastguard Agreement on Salvage & Towing (CAST) is a tool available to the MCA which may be invoked (by the MCA) in situations where there is a significant risk of major pollution.

### **21.3 Emergency Response Co-operation Plan (ERCoP)**

336. As stated previously, as a basic principle, EATL would comply fully with all the requirements of Annex 5 of MGN (MCA 2008b), in terms of standards and procedures for generator shutdown and other operational requirements in the event of a search and rescue, counter pollution or salvage incident in or around the site, and would comply with all subsequent amendments or new directives from the Maritime & Coastguard Agency (MCA).

337. This includes the development of an Emergency Response Co-operation Plan (ERCoP) for the windfarm, which would in place pre-construction.

338. Examples of features to be incorporated are as follows.

#### **21.3.1 Design:**

- All wind turbines and other offshore renewable energy installation (OREI) individual structures would each be marked with clearly visible unique identification characters which can be seen by both vessels at sea level and aircraft (helicopters and fixed wing) from above.
- The identification characters shall each be illuminated by a low-intensity light visible from a vessel thus enabling the structure to be detected at a suitable distance to avoid an allusion with it. The size of the identification characters in combination with the lighting would be such that, under normal conditions of visibility and all known tidal conditions, they are clearly readable by an observer, stationed three metres above sea levels, and at a distance of at least 150m from the turbine.

#### **21.3.2 Operation:**

- The MRCC, or mutually agreed single contact point, would be manned 24 hours a day.
- All MRCCs would be advised of the contact telephone number of the Central Control Room, or single contact point (and vice versa)
- The control room operator, or single contact point, would immediately initiate the shut-down procedure for wind turbines as requested by the MRCC, and maintain the wind turbines in the appropriate shut-down position, as requested by the MRCC until receiving notification from the MRCC that it is safe to restart the wind turbines.

### **21.4 Marine Pollution and Counter Pollution**

339. East Anglia THREE Limited recognises that small levels of pollution may occur from its own operations within the windfarm and that greater spillages may occur through

incidents involving third party vessels both inside the windfarm and outside its boundaries. In the latter case, pollutants may drift into the windfarm through the actions of wind and tide.

340. East Anglia THREE Limited would carry out its full responsibilities within the spirit of the National Contingency Plan for Marine Pollution from Shipping and Offshore Installations (NCP of 2006) together with the provisions of subsequent modifications.

341. In these respects East Anglia THREE Limited recognises its responsibility for “Tier 1 preparedness and response” as described in chapter eight of the Bonn Agreement on Counter Pollution (modified February 2012) with particular reference to pollution drifting through offshore renewable energy installations.

342. To ensure that agreed recommendations and best practice are considered and implemented in a timely fashion as deemed appropriate, East Anglia THREE Limited would engage in consultation with MCA.

343. East Anglia THREE Limited would ensure that the Secretary of State’s Representative (SOSREP) and the Operations Control Unit (OCU) has readily available information pertaining to the installation to enable a counter pollution response strategy to be developed without delay.

### ***21.5 Engagement with all Relevant Government Departments and Agencies***

344. East Anglia THREE Limited would engage with MCA and other relevant departments and agencies to determine how best to fulfil its obligations and responsibilities in all of the foregoing respects.

## 22 Hazard Workshop

345. In order to provide expert opinion and local knowledge, a hazard workshop was undertaken in order to create a hazard log that was project and site specific. The hazard log identifies hazards caused or changed by the introduction of structures within the proposed East Anglia THREE project. It also details the risk associated with the hazard and the controls put in place to reduce the risk. The log includes both industry standard and additional mitigation measures required to show that the hazards associated with the windfarm are Broadly Acceptable or Tolerable on the basis of As Low As Reasonably Practicable (ALARP) declarations.

### 22.1 Hazard Workshop Attendance

346. The East Anglia THREE hazard workshop was held on the 3<sup>rd</sup> February 2014 to identify the navigational hazards associated with the development. This workshop was attended by the maritime stakeholders, as outlined in Table 22.1. Stakeholders who were invited to the workshop but did not attend are also listed in Table 22.1.

**Table 22.1 Hazard Workshop Invitees**

Invitee	Company/Organisation	Title	Attendance
Rick Campbell	EATL	Project Manager	Yes
Colin Brown	EATL	Zonal Marine Navigation Advisor	Yes
Sam Westwood	Anatec Ltd.	Principle Risk Analyst	Yes
Sandy Bendall	Anatec Ltd.	Risk Analyst	Yes
Joanna Sowulewska	Anatec Ltd.	Risk Analyst	Yes
Sander Meyns	Rederscentrale (Belgian Fisheries)	Representative	Yes
Antoine Fry	Brown & May Marine Ltd.	Fisheries Consultant	Yes
Peter Bury	Cruising Association	Representative	Yes
Ted Osborne		Representative	Yes
Stephen Fairlie	DFDS Ferries	Marine Standards Superintend	Yes
Grant Laversuch	P&O Ferries	Head of Safety Management / Designated Person Ashore	Yes
Nigel Griffiths	Hanson Marine Aggregates	Principal Resource Manager	Yes
Andreas de Boer	VisNed (Netherlands Fisheries)	Representative	Yes
Michael Oakes	RNLI	Divisional Operations Manager	Yes
Stuart	Royal Yachting	Cruising Manager	No



Carruthers	Association		
Richard Nevinson	Chamber of Shipping	Policy Assistant Safety & Environment	No
Phil Pannett	CLdN Ro-Ro UK Ltd. (Cobelfret)	Owners Representative	No
Anders Dirdal	Teekay Shipping (UK) Ltd.	Scheduling & Operations Manager	No
James Manson	Europilots	Chairman	No
Don Cockrill	UK Pilots Association	Technical Advisor	No
Graeme Proctor	Maritime Coastguard Agency	Navigation Safety Policy Manager	No
Roly McKie		SAR Operations Specialist	No
Roger Barker	Trinity House Lighthouse Services	Navigation Manager	No
Michael Read-Leah	Department for Transport	Shipping Policy	No
Samantha Willenbacher	Bristow Group	Director (UK SAR)	No
Natalie Dillon		UK SAR Infrastructure Co-Ordinator	No

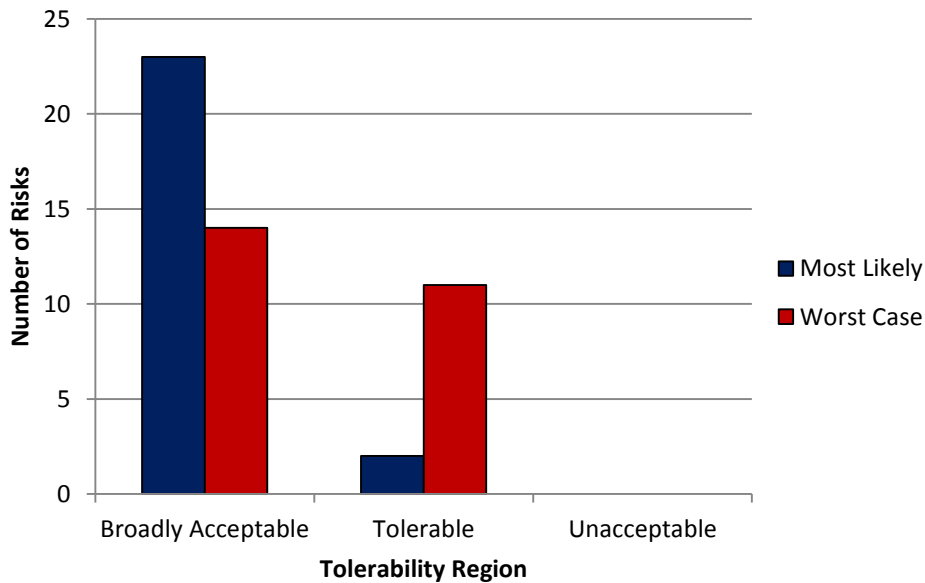
## 22.2 Results

347. Following the workshop a Hazard Log was developed and issued for consultation with those that attended as well as those organisations that were invited and could not attended. The following impacts were identified.

- Commercial vessel (powered) allision with windfarm structure (Construction (C), Operations (O) and Decommissioning (D))
- Commercial vessel (drifting) allision with windfarm structure (C, O, D)
- Recreational craft allision with windfarm structure (C,O, D)
- Recreational craft collision with another vessel within windfarm array (O, D)
- Vessel-to-vessel collision due to avoidance of site or support vessels (C, O, D)
- Vessel anchoring on or dragging over subsea equipment (C, O, D)
- Vessel allision with partially constructed or deconstructed turbine (C, D)
- Unauthorised mooring to and/or deliberate damage to device (C, O, D)
- Unauthorised access to and/or deliberate damage to device (C, O, D)
- Access to structure in an emergency situation (C, O, D)
- Restricted emergency response in the windfarm in an emergency situation (C, O, D)
- Fishing vessel allision with windfarm structure (C, O, D)
- Fishing gear interaction with inter-array cabling (C, O, D)
- Fishing gear interaction with export cable (C, O, D)

- Fishing gear interaction with subsurface windfarm structure (C, O, D)
- Support vessel allision with windfarm structure (C, O, D)
- Man Overboard (C, O, D)

The following overall breakdown by tolerability region was assessed for the identified hazards.



**Figure 22.1 East Anglia THREE Hazard Ranking Results**

348. No risks were assessed to be unacceptable. As shown in the above figure, two hazards were ranked within the Tolerable (ALARP) region based on the most likely outcome whilst eleven were ranked as Tolerable (ALARP) based on a realistic worst case outcome.

349. Full details of the logged and ranked hazards are summarised in Chapter 15 Appendix A Annex A – Hazard Log.

## 23 Allision and Collision Risk Modelling Overview

350. This section assesses the major hazards associated with the development of the proposed East Anglia THREE project. This is divided into a base case and a future case assessment with and without the development and includes major hazards associated with:

- Increased vessel to vessel collision risk;
- Additional vessel to structure allision risk;
- Additional fishing vessel to structure allision risk;
- Additional recreational craft (sailing/cruisers) collision risk;
- Additional risk associated with vessels Not Under Command (NUC); and
- Anchor/cable interaction.

351. The base case assessment used the present day vessel activity identified from the maritime traffic surveys, consultation and other data sources. The future case assessment made conservative assumptions on shipping traffic growth over the life of the proposed East Anglia THREE project.

352. The modelling was undertaken using the worst case assessment of 172 turbines, one accommodation platform, three HVAC collector substations, two HVDC converter stations, two meteorological masts and two buoys. Additional information regarding the structures within the windfarm can be found in Section 4. It should be noted that the allision and collision risk modelling has been undertaken assuming construction of the five offshore electrical platforms throughout the single phase construction approach.

353. Given EATL's commitment to not place additional structures (accommodation platforms, HVAC collector substations, HVDC converters, meteorological masts and buoys) on the periphery of the wind farm in proximity to areas of high density shipping, it is anticipated that the additional offshore electrical platform considered throughout the two phase construction approach would result in a small increase to the overall allision risk for East Anglia THREE. It can therefore be concluded that the powered vessel allision risk (Section 25.3) and the drifting vessel allision risk (Section 25.4) are broadly representative of the worst case.

354. The additional offshore electrical platform considered throughout the two phase construction approach would also result in a small increase to the overall fishing vessel allision risk (Section 25.5). However, the increase in fishing vessel allision risk is not deemed to be significant and it can therefore be concluded that the fishing vessel allision risk modelling results reported are broadly representative of the worst case.

355. It is anticipated that the vessel to vessel collision risk would not significantly alter (overall development spread and hence degree of vessel re-routeing required would not increase significantly) given the additional offshore electrical platform considered throughout the two phase construction approach. It can therefore be concluded that the vessel to vessel collision frequency results reported (Section 24.2) are broadly representative of the worst case.

356. The two scenarios modelled are as follows:

- East Anglia THREE site Partial fill build scenario.
- East Anglia THREE site 100% fill build scenario.

357. Further information on modelling can be found in Annex 15.1.4 Risk Models Overview.

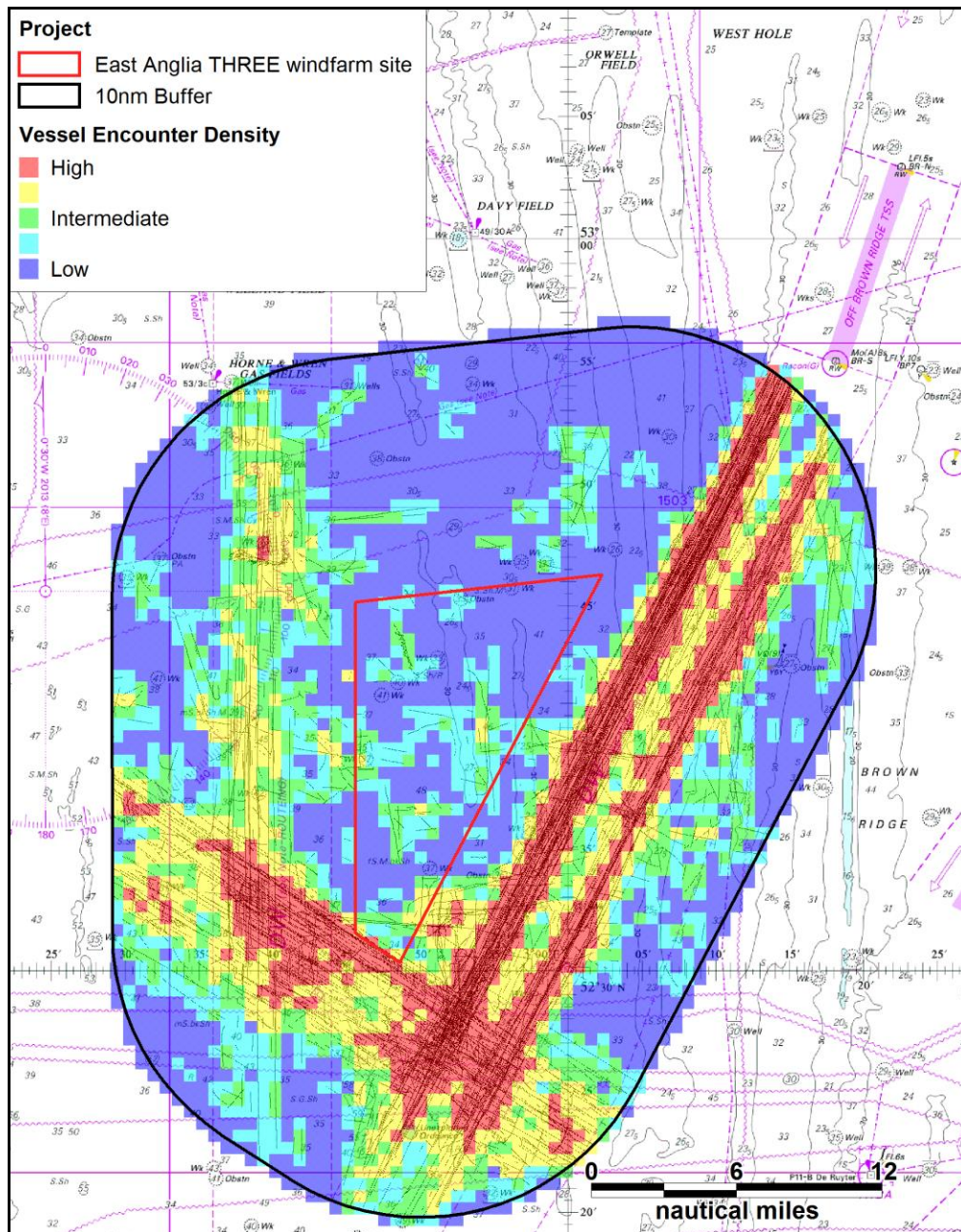
## **24 Base Case No Windfarm Model Results**

### **24.1 Encounters**

358. An assessment of current vessel-to-vessel encounters has been carried out by replaying at high speed 40 days of AIS and Radar data from the four maritime traffic surveys.

359. An encounter distance of 1nm has been considered, i.e. two vessels passing within 1nm of each other has been classed as an encounter. This helps to illustrate where existing shipping congestion is highest and therefore where offshore developments, such as windfarms, could potentially increase congestion and therefore also increase the risk of encounters/collisions.

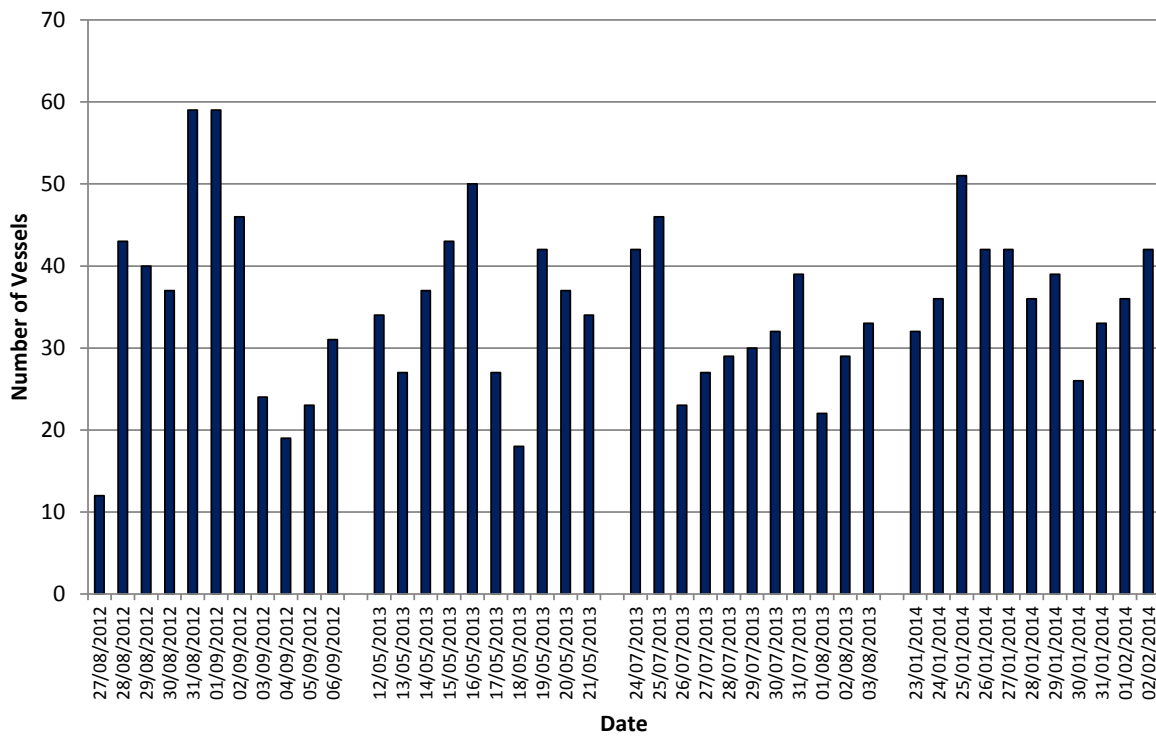
360. The tracks recorded for vessels during encounters throughout the 40 days of analysis, and a vessel density grid based on the geographical distribution of encounters within a 0.5nm x 0.5nm grid of cells, are presented in Figure 24.1.



**Figure 24.1 Vessel Encounters Density**

361. The majority of encounters in the area occurred to the east and south of the East Anglia THREE site within the DWR via Off Brown Ridge TSS and at the meeting point of north-west / south-east traffic crossing the DWR via Off Brown Ridge TSS and the DWR via DR1 Light Buoy. In comparison, there were relatively few encounters within the East Anglia THREE site. The majority of encounters recorded within the site were fishing vessels actively engaged in fishing encountering transiting vessels.

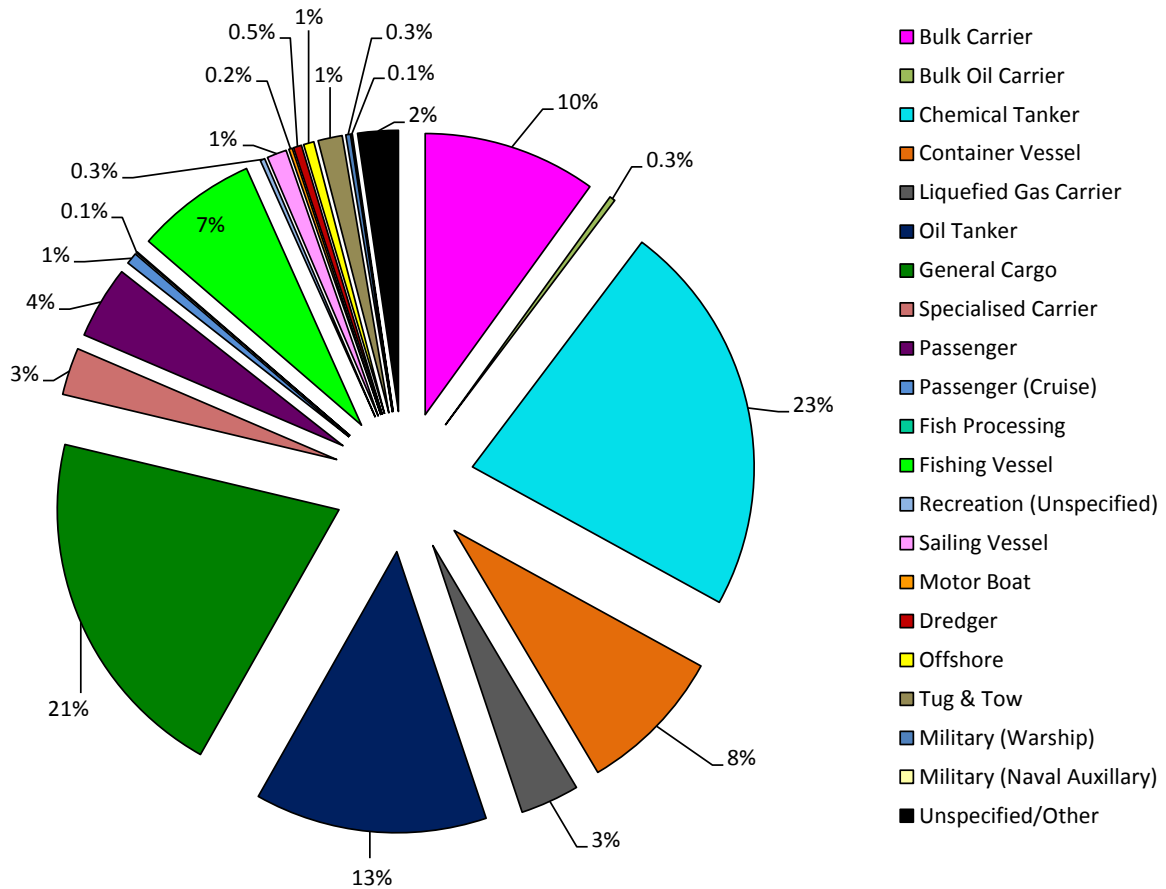
362. There were 1,189 encounters recorded within 10nm of the East Anglia THREE site during the 40 day period. Figure 24.2 presents the number of encounters within 10nm of the site per day.



**Figure 24.2 Encounters per day within 10nm of the East Anglia THREE Site**

363. The average number of encounters within 10nm of the East Anglia THREE site was 35 per day, with the highest number of 59 encounters observed on the 31<sup>st</sup> August and 1<sup>st</sup> September 2012.

364. Figure 24.3 presents the distribution of vessel types involved in encounters within 10nm of the East Anglia THREE site.



**Figure 24.3 Encounter Vessel Type Distribution**

365. The majority of vessels involved in encounters were cargo vessels, with chemical tankers, general cargo vessels, oil tankers and container vessels representing 23%, 21%, 13% and 8% of vessel encounter traffic respectively

366. The locations of encounters colour-coded by vessel type recorded during the 40 day period are presented in Figure 24.4.



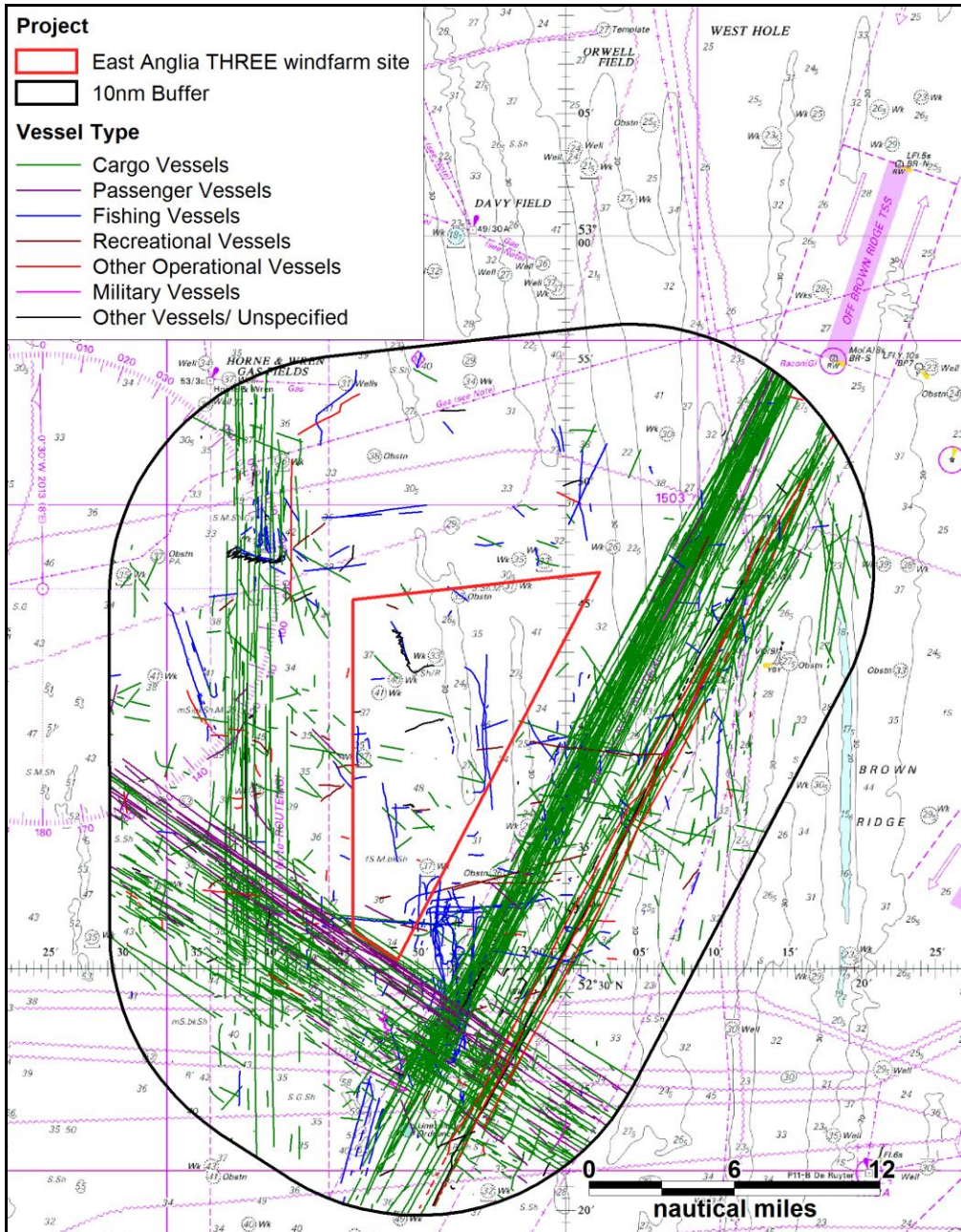
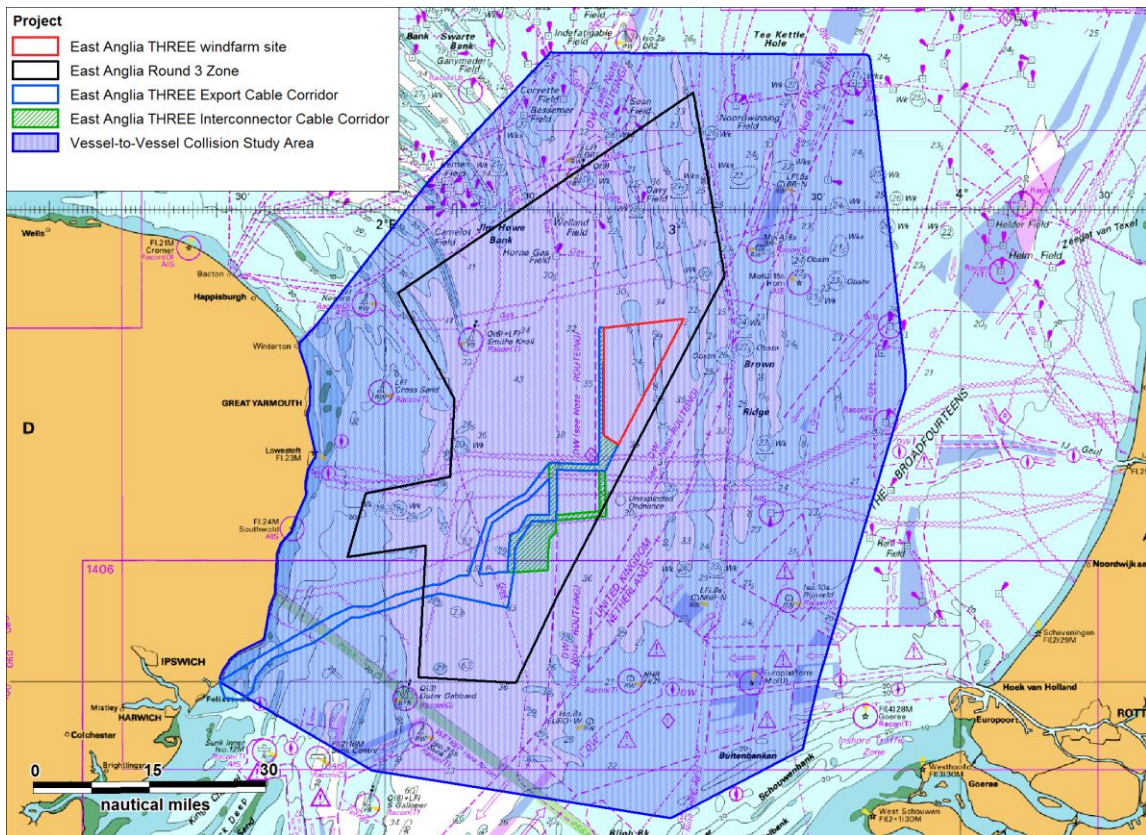


Figure 24.4 Overview of 1nm encounters during 40 days (AIS & Radar)

## 24.2 Vessel-to-Vessel Collisions

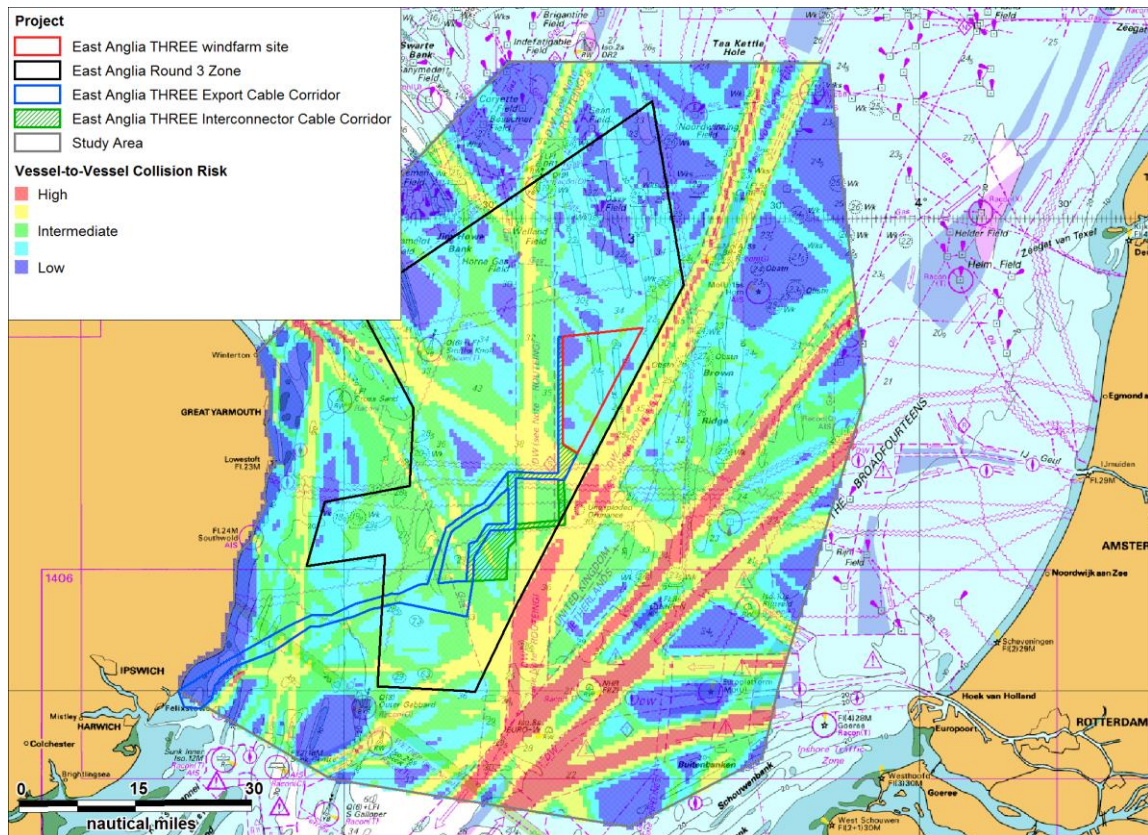
367. Based on the existing routing and encounter levels in the area, Anatec’s COLLRISK model has been run to estimate the existing vessel-to-vessel collision risks in the area illustrated in Figure 24.5. This is the area in which it is considered that the East Anglia THREE site could alter vessel routing, and was modelled in order to give full account of the impact of the development.



**Figure 24.5 Vessel-to-Vessel Collision Study Area**

368. The route positions and widths are based on the maritime traffic surveys with the annual densities based on port logs and Anatec’s ShipRoutes database, which takes seasonal variations into consideration.

369. The baseline vessel-to-vessel collision risk level pre-windfarm is in the order of 2.5 major collisions per year in the area shown. Figure 24.6 illustrates the vessel-to-vessel collision risk results as heat map. The highest risk areas, in terms of vessel-to-vessel collision risk are associated with busy shipping areas e.g. the North Hinder Junction and on approach to the Ijmuiden Crossing. There are isolated patches of high risk vessel-to-vessel collision risk areas in proximity to the East Anglia THREE site: Both within the DWR via Off Brown Ridge TSS to the east of the site and to the southeast of the site at the meeting point of north-west / south-east traffic crossing the DWR via Off Brown Ridge TSS.



**Figure 24.6 Base Case Vessel-to-Vessel Collision Risk**

370. It is emphasised that the model is calibrated based on major incident data at sea which allows for benchmarking but does not cover all incidents, such as minor impacts. Other incident data, which includes minor incidents, is presented in Section 9.

## 25 Future Case No Windfarm

### 25.1.1 Vessel-to-Vessel Collisions – Change in Risk

371. The revised routeing pattern following construction of the windfarm has been estimated based on the future commercial vessel routeing analysis (see Section 18). It is assumed that vessels would be able to pre-plan their revised passage in advance of encountering the windfarm due to effective mitigation.

372. Based on vessel-to-vessel collision risk modelling of the revised traffic pattern for each of the two scenarios, the changes in collision frequency due to the windfarm development is estimated to be  $1.56 \times 10^{-02}$  per year for the partial fill build scenario and  $2.14 \times 10^{-03}$  for the 100% fill build scenario. This represents a 0.63% increase (partial fill build scenario) and 0.21% increase (100% fill build scenario) from the pre windfarm vessel-to-vessel collision risk for the area considered.

### 25.2 Vessel Allision with Structure

373. The two main scenarios for passing vessels alliding with offshore structures (such as windfarm turbines, accommodation platforms, HVAC collector substations, HVDC converter substations, meteorological masts and buoys) are:

- Powered Collision: where the vessel is under power but errant.
- NUC (Drifting) Collision: Where a vessel on a passing route experiences propulsion failure and drifts under the influence of the prevailing conditions.

374. Each scenario is assessed below.

### 25.3 Powered Vessel Allision

375. Based on the vessel routeing identified for the area, the anticipated change in routeing due to the development(s), and assumptions that effective mitigation measures are in place, the frequency of an errant vessel under power deviating from its route to the extent that it comes into proximity with a structure is not considered to be a probable outcome.

376. From consultation with the shipping industry it is also assumed that merchant vessels would not navigate between turbine rows due to the restricted sea room and would be directed by the navigational aids in the area.

377. Based on modelling of the revised routeing, proposed layouts, local metocean data, the frequency of a passing powered vessel allision was estimated and the results are presented in Table 25.1

378.

379. Table 25.1.

**Table 25.1 Powered Vessel-to-Structure Allisions – Base Case with Windfarm**

<b>Turbine Layout</b>	<b>Annual Allision Frequency</b>	<b>Allision Return Period</b>
Partial Fill Build Scenario	$2.97 \times 10^{-02}$	34 years
100% Fill Build Scenario	$1.67 \times 10^{-02}$	60 years

380. The individual turbine allision frequencies ranged from  $3.97 \times 10^{-03}$ , with the greatest allision frequencies being for the structures on the southern boundary of the array for both layouts, to negligible for turbines in the centre of the East Anglia THREE site. The higher allision frequency for the partial fill build scenario reflects the greater number of structures with smaller spacing, and therefore the greater concentration of structures, in the higher risk areas.

381. Plots showing the passing powered allision frequency for each structure within the partial fill build scenario and 100% fill build scenario are presented in Figure 25.1 and Figure 25.2 respectively.

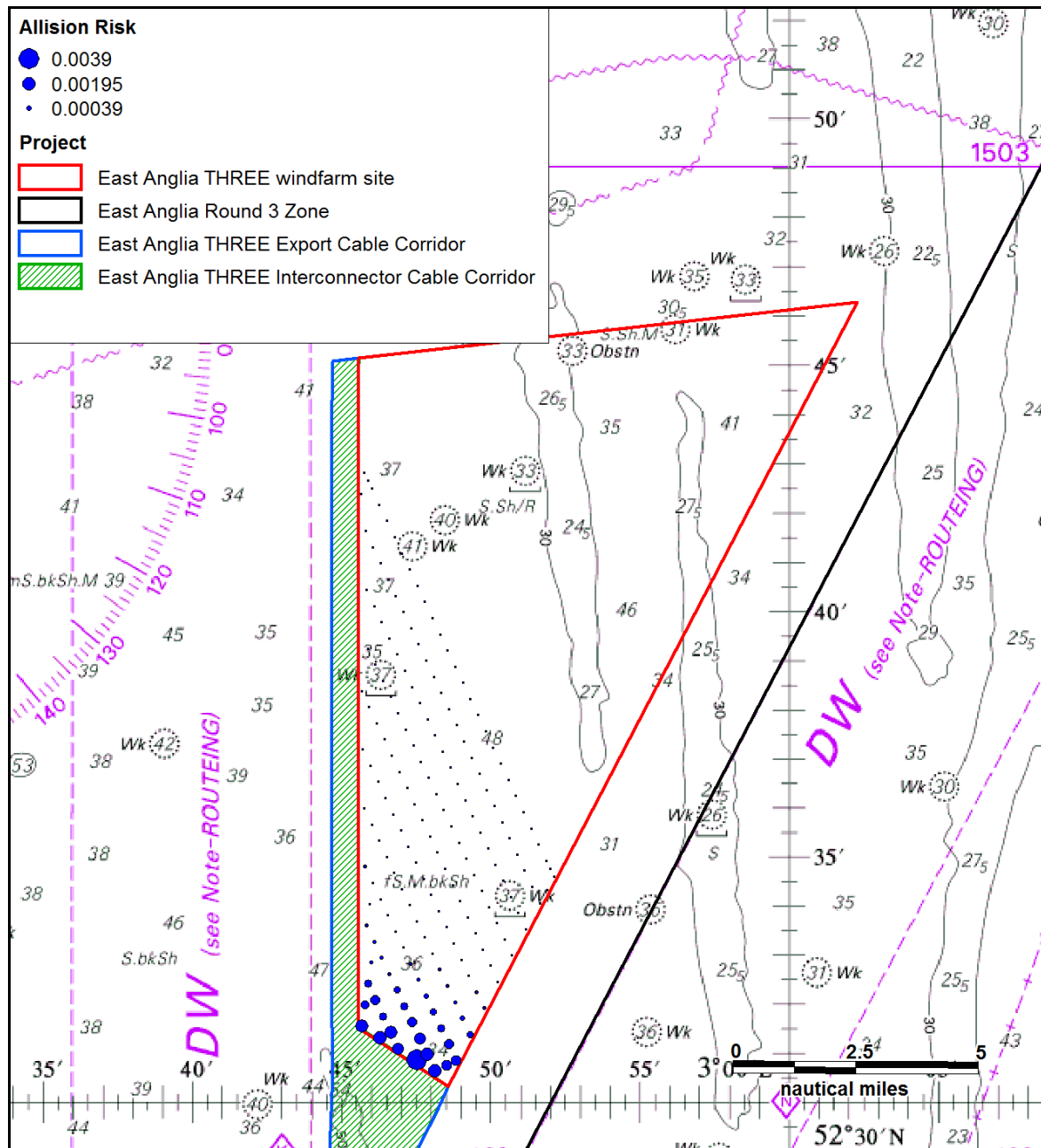


Figure 25.1 Annual Passing Powered Allision Frequency (Partial Fill Build Scenario)

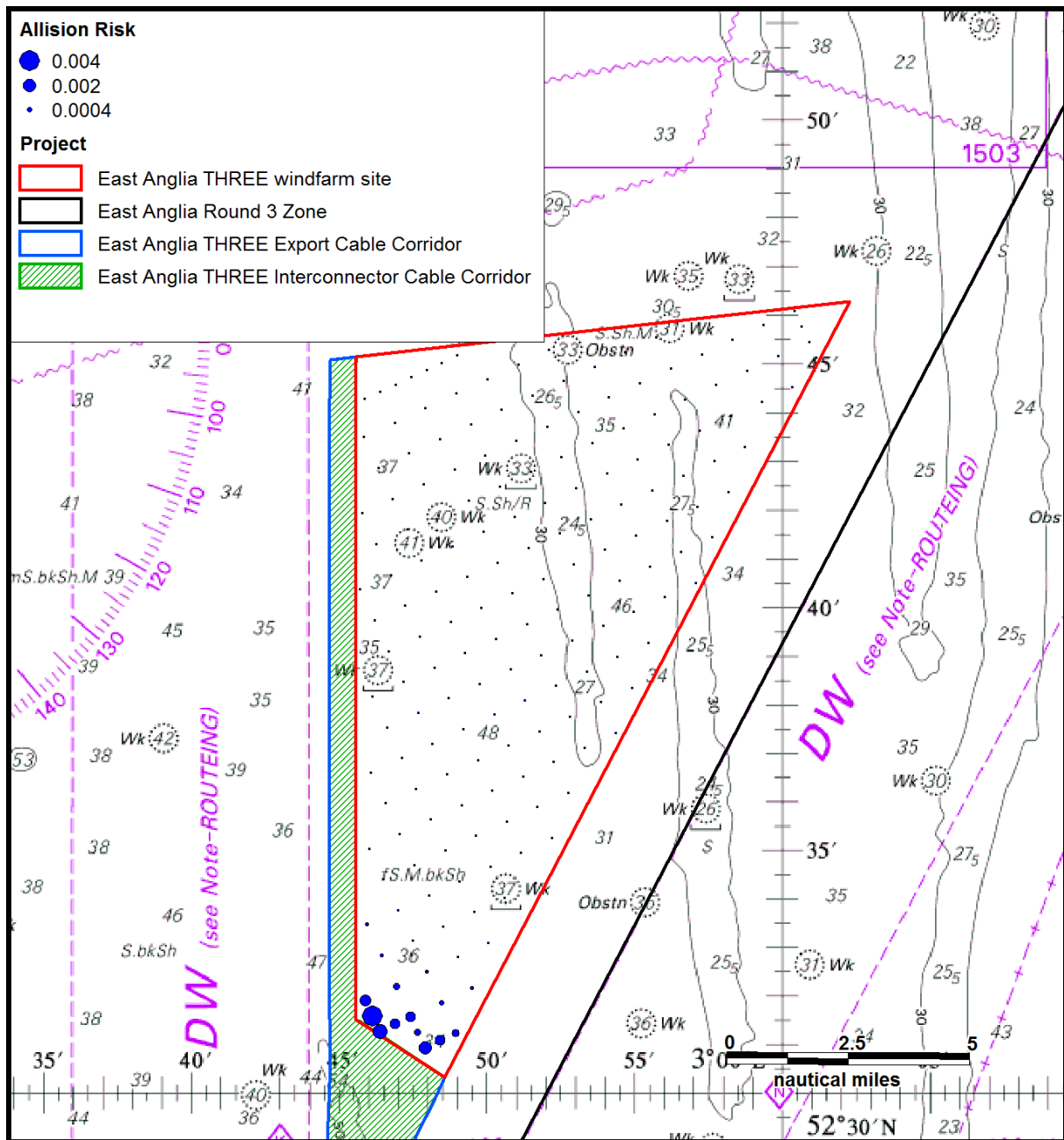


Figure 25.2 Annual Passing Powered Allision Frequency (100% Fill Build Scenario)

382. The additional structures (accommodation platforms, HVAC collector substations, HVDC converters, meteorological masts and buoys), which were placed on the southern boundary of the East Anglia THREE site in order to create a worst case layout, represent approximately 27.1% of the total allision frequency for the partial fill build scenario. Therefore when these additional structures are excluded, the return period for the partial fill build scenario increases to one major allision every 46 years.

383. Similarly, the additional structures represent 41.6% of the total allision frequency for the 100% fill build scenario. When these additional structures are excluded, the return

period for the 100% fill build scenario increases to one major collision every 103 years.

384. It has therefore been agreed that additional structures (accommodation platforms, HVAC collector substations, HVDC converters, meteorological masts and buoys) shall not be placed on the periphery of the windfarm in proximity to areas of high density shipping. It is therefore likely that additional structures shall be placed internally within the windfarm.

#### **25.4 Drifting Vessel Allision**

385. The risk of a vessel losing power and drifting into the proposed windfarm structures was assessed using Anatec’s COLLRISK model. This model is based on the premise that propulsion on a vessel must fail before a vessel would drift. The model takes account of the type and size of the vessel, number of engines and average time to repair in different conditions.

386. The exposure times for a drifting scenario are based on the ship-hours spent in proximity to the proposed windfarms (up to 10nm from perimeter). These have been estimated based on the traffic levels, speeds and revised routeing pattern. The exposure is divided by vessel type and size to ensure these factors, which based on analysis of historical accident data have been shown to influence accident rates, are taken into account within the modelling.

387. Using this information the overall rate of breakdown within the area surrounding the windfarm was estimated. The probability of a vessel drifting towards a structure and the drift speed are dependent on the prevailing wind, wave and tide conditions at the time of the accident.

388. The following drift scenarios were modelled:

- Wind
- Peak Spring Flood Tide
- Peak Spring Ebb Tide

389. The probability of vessel recovery from drift is estimated based on the speed of drift and hence the time available before reaching the windfarm structure. Vessels that do not recover within this time are assumed to allide.

390. After modelling the two different layouts it was established that the ebb tide-dominated drift produced the worst case results for both layouts. These results are presented in Table 25.2.

**Table 25.2 Drifting Vessel-to-Structure Allision Frequency (Base Case with Windfarm)**

<b>Turbine Layout</b>	<b>Annual Allision</b>	<b>Allision Return Period</b>
-----------------------	------------------------	-------------------------------



	<b>Frequency</b>	
Partial Fill Build Scenario	$2.07 \times 10^{-03}$	483 years
100% Fill Build Scenario	$1.14 \times 10^{-03}$	879 years

391. The worst case drifting allision risk has been identified as one every 483 years (partial fill build scenario). Drifting allisions are assessed to be less frequent than powered allisions for both of the turbine layouts assessed, which is reflective of historical data. There have been no reported ‘passing’ drifting NUC vessels allisions with offshore installations on the UK Continental Shelf (UKCS) in over 6,000 operational-years. Whilst a large number of drifting ships have occurred each year in UK waters, most vessels have been recovered in time, e.g., anchored, restarted engines or taken in tow. There have also been a small number of ‘near-misses’.

392. The majority of the drifting vessel allision frequency is associated with the more westerly structures and those at the sites southern boundary, since the currents in the area run in a generally south-west to north-east direction on the ebb.

393. Emergency Response procedures are required for all foreseeable marine events, including the scenario of a drifting vessel within or in proximity to the windfarm. This would form part of Emergency Response planning as per the ERCoP.

### **25.5 Fishing Vessel Allision**

394. Anatec’s COLLRISK fishing vessel risk model has been calibrated using fishing vessel activity data along with offshore installation operating experience in the UK (oil and gas) and the experience of allisions between fishing vessels and UKCS offshore installations (published by the Health and Safety Executive (HSE)).

395. The two main inputs to the model are the fishing vessel density for the area and the structure details including the number and dimensions of the structures. The fishing vessel density in the area of the East Anglia THREE site was based on fishing vessel satellite data (2009).

396. Using site-specific data as input to the model, the annual fishing vessel allision frequency, based on this density of fishing activity and the maximum number of windfarm structures in situ, the following return period was estimated. It should be noted that the model does not give consideration to vessel transit but to densities of vessels within the area.

**Table 25.3 Fishing Vessel-to-Structure Allision Frequency (Base Case with Windfarm)**

<b>Number of Structures</b>	<b>Annual Allision Frequency</b>	<b>Allision Return Period</b>
172 turbines, 5 substations, 2 met masts, 1 accommodation platform	$6.76 \times 10^{-02}$	15 years

and 2 Buoys		
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397. The estimated collision frequencies are high and reflect the maximum target area assumed for all the structures based on the largest jacket suction bucket foundations. It also assumes the fishing vessel density following the development would remain the same as current levels.

398. In terms of the consequences of these impacts it is expected that the majority will be relatively minor impacts during fishing itself and there will be low levels of risk to crew and of pollution (see Annex 15.1.2).

## **26 Future Case with Windfarm**

### **26.1 Commercial Shipping Estimated Future Case**

399. Over recent years the vessel arrivals and tonnages at the ports closest to the East Anglia THREE site have decreased (see Section 7.5).
400. No proposals have been identified which are likely to significantly impact the volume of shipping in the vicinity of the windfarm, other than that associated with the offshore windfarm developments in the area.
401. However, given the uncertainty associated with long-term predictions of this nature including the potential for any major new developments in UK or Transboundary ports, a conservative (i.e., high) potential growth in shipping movements of 10% was estimated over the life of the windfarm.

### **26.2 Commercial Fishing Estimated Future Case**

402. The Commercial Fisheries Assessment (Chapter 14 Commercial Fisheries) considered the potential changes to the fishing baseline over the life of the development. It is recognised that this is a speculative exercise due to the numerous unpredictable direct and indirect factors which could materially affect fisheries. A 10% increase in fishing activity has been assumed.

### **26.3 Recreational Vessel Estimated Future Case**

403. In terms of recreational vessel activity, there are no major developments known of that would increase the activity of these vessels in the area. Based on the discussion presented, the future level of activity has been assumed to increase by 10% compared to the current levels.

### **26.4 Collision and Allision Probabilities**

404. The potential increase in vessel activity levels would increase the probability of ship-to-structure allisions (both powered and drifting). Whilst in reality the risk would vary by vessel type, size and route, it is roughly estimated this would lead to a linear 10% increase in the base case allision risks.
405. The increased activity would also increase the probability of vessel-to-vessel encounters and hence collisions. Whilst this is not a direct result of the proposed windfarm, the increased congestion caused by the site and potential displacement of traffic in the area may have an influence. Again, a 10% overall increase is assumed.

### **26.5 Risk Results Summary**

406. The base case and future case annual levels of risk without and with the proposed East Anglia THREE project are summarised in Table 26.1 and Table 26.2. The change in risk is also shown, i.e., the estimated collision or allision risk with the windfarm minus the estimated baseline collision or allision risk without the windfarm (which is zero except for

vessel-to-vessel collisions which has been considered as a future case with and without the windfarm in situ).

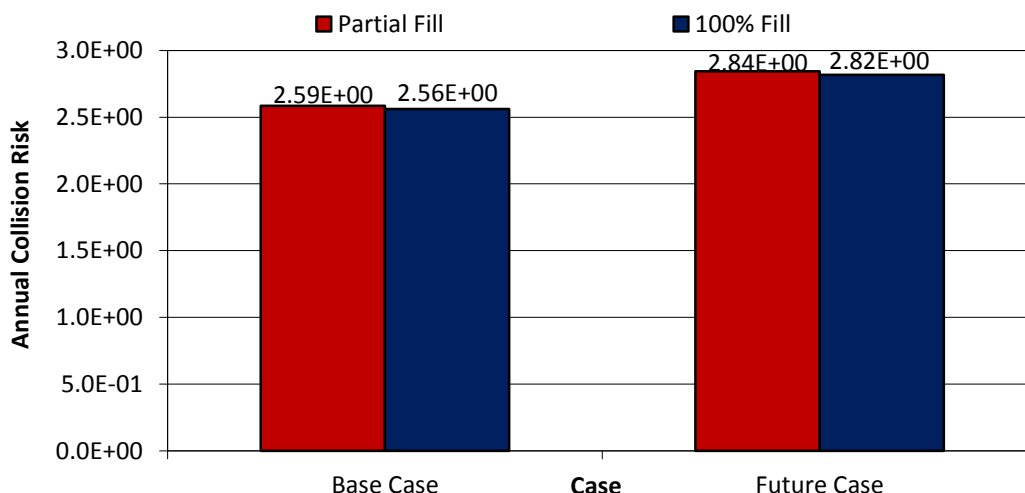
**Table 26.1 Summary of Annual Collision and Allision Frequency Results (Partial Fill Build Scenario)**

Scenario	Base Case			Future Case		
	Without	With	Change	Without	With	Change
Passing Powered	--	2.97E-02	2.97E-02	--	3.27E-02	3.27E-02
Passing Drifting	--	2.07E-03	2.07E-03	--	2.28E-03	2.28E-03
Vessel-to-Vessel	2.47	2.49	1.56E-02	2.72	2.73E-03	1.72E-02
Fishing	--	6.76E-02	6.76E-02	--	7.43E-02	7.43E-02
<b>Total</b>	2.47	2.59	1.15E-01	2.72	2.84	1.26E-01

**Table 26.2 Summary of Annual Collision and Allision Frequency Results (100% Fill Build Scenario)**

Scenario	Base Case			Future Case		
	Without	With	Change	Without	With	Change
Passing Powered	--	1.67E-02	1.67E-02	--	1.83E-02	1.83E-02
Passing Drifting	--	1.14E-03	1.14E-03	--	1.25E-03	1.25E-03
Vessel-to-Vessel	2.47	2.48	5.30E-03	2.72	2.72	5.82E-03
Fishing	--	6.76E-02	6.76E-02	--	7.43E-02	7.43E-02
<b>Total</b>	2.47	2.56	9.07E-02	2.72	2.82	9.97E-02

407. A summary of the annual combined collision and allision frequency for the two indicative layouts analysed is presented in Figure 26.1.



**Figure 26.1 Summary of Change in Annual Collision and Allision Risk Result**

408. In the worst case (partial fill build scenario) the overall annual level of combined collision and allision risk is estimated to increase due to the proposed windfarm by approximately one in every nine years (base case) and one in every eight years (future case). The vast majority of this increase in risk is from fishing vessel allisions.

## 26.6 Consequences

409. The probable outcomes for the majority of hazards are expected to be minor. However, the worst case outcomes could be severe, including events with potentially multiple fatalities.

410. An allision involving a larger vessel is likely to result in collapse of a turbine with limited damage to the vessel. Breach of a ship’s fuel tank is considered unlikely and in the case of vessels carrying hazardous cargoes, e.g., tanker or gas carrier, the additional safety features associated with these vessels would further mitigate the risk of pollution (for example double hulls). Similarly, in a drifting allision the proposed windfarm structures are likely to absorb the majority of the impact energy, with some energy also being retained by the vessel in terms of rotational movement (glancing blow).

411. In terms of smaller vessels such as fishing and recreational craft, the worst case scenario would be risk of vessel damage leading to foundering of the vessel and potential loss of life.

412. A quantitative assessment of the potential consequences of collision/allision for each of the scenarios is presented in Annex 15.1.2. This applies the site-specific collision/allision frequency results presented above with estimated outcomes in terms of fatalities on-board and oil pollution from the vessel based on research into historical collision incidents (MAIB, Internal Tanker Owners Pollution Federation (ITOPF), etc.). The results are summarised in Table 26.3.

**Table 26.3 Annual Predicted change in Potential Loss of Life (PLL) due to the proposed East Anglia THREE project.**

	Partial Fill Build Scenario	100% Fill Build Scenario
--	-----------------------------	--------------------------

Base case PLL (fatalities per year)	2.73E-03	2.54E-03
Future Case PLL (fatalities per year)	3.01E-03	2.79E-03

413. For the worst case turbine layout (partial fill build scenario) the overall increase in PLL is estimated due to the proposed East Anglia THREE project is  $2.7 \times 10^{-3}$  fatalities per year (base case), which equates to one additional fatality in 366 years. This is a small change compared to the MAIB statistics which indicate an average of 29 fatalities per year in UK territorial waters.

414. In terms of individual risk to people, the incremental increase for commercial ships (in the region of  $10^{-07}$ ) is very low compared to the background risk level for the UK sea transport industry of  $2.9 \times 10^{-4}$  per year.

415. Similarly for fishing vessels, whilst the change in individual risk attributed to the development is higher than for commercial vessels (in the region of  $10^{-05}$ ), it is relatively low compared to the background risk level for the UK sea fishing industry of  $1.2 \times 10^{-3}$  per year.

416. The estimated amount of oil spilled per year due to the impact of the proposed East Anglia THREE project is presented in Table 26.4.

**Table 26.4 Annual Oil Spilled due to the proposed East Anglia THREE project**

	Partial Fill Build Scenario	100% Fill Build Scenario
Base case PLL (tonnes of oil per year)	2.69	1.50
Future Case PLL (tonnes of oil per year)	2.96	1.65

417. For the worst case turbine layout (partial fill build scenario) the overall increase in oil spilled due to the East Anglia THREE project is 2.69 tonnes of oil (base case). From research undertaken as part of the DfT MEHRA project (DfT, 2005) the average annual tonnes of oil spilled in the waters around the British Isles due to marine accidents in the 10-year period from 1989 to 1998 was 16,111. Therefore, the overall increase in pollution estimated for East Anglia THREE is very low compared to the historical average pollution quantities from marine accidents in the UK waters.

418. Therefore, the incremental increase in risk to both people and the environment caused by the proposed East Anglia THREE project is estimated to be low.

## **26.7 Effects Associated with Collision and Allision Modelling**

419. Vessel to vessel collisions may increase in the high density areas noted to the north or south of the East Anglia THREE site due to routes altering from their base case routes, which currently intersect the site, to deviate north or south (relevant to both 100% and

partial fill designs). With consideration for the deviations and accumulation of traffic, increases in collision risk are expected to be negligible overall due to the lower densities of traffic on the deviated routes and mitigated by embedded mitigations and good practice such as continuous compliance with COLREGs including conduct of vessel in restricted visibility, following safe speed principles and compliance for the 'give way' rules including crossing, head on and vessel type.

420. The majority of this risk was noted on the southern boundary and was to some degree due to the inclusion of larger structures (substations) on the peripheral boundary and the convergence of a number of deviated routes (combination of routes 13 and 14 could see approximately 13-14 vessels per day transiting past the southern boundary). Following assessment of these collision modelling results the structures would now be located inter row within the array which would reduce the overall collision risk for the development. It is also noted that in practice it is likely that vessels would increase their passing distance due to the available sea room and not route on the worst case passing distances (2nm) as used within the model.
421. Also, following work already undertaken at a zonal level, the proposed East Anglia THREE project has been designed to take consideration of both DWRs and the traffic using them agreeing with stakeholders a 2nm buffer to the east and 1nm to west of the site. This will allow sufficient sea room for the routes to be safely used, preventing crossing encounters or collisions associated with east – west traffic and the DWRs by allowing sufficient sea room for vessels to acquire targets visually and electronically before crossing the DWR.

## **27 Communication and Position Fixing**

422. The following section summarises the potential impacts of the different communications and position fixing devices used in and around offshore windfarms from the potential effects of the proposed East Anglia THREE project on the physical environment. This section includes a literature review of the industry assessments.

### **27.1 Impact of Marine Radar**

423. In 2004 the MCA conducted trials within and close to the North Hoyle windfarm off North Wales to determine any impact of wind turbines on marine communications and navigations systems (MCA and QinetiQ, 2004).

424. The trials indicated that there is minimal impact on VHF radio, GPS receivers, cellular telephones and AIS. UHF and other microwave systems suffered from the normal masking effect when turbines were in the line of the transmissions.

425. This trial identified areas of concern with regard to the potential impact on vessel borne and shore based radar systems. This is due to the large vertical extent of the wind turbine generators returning radar responses strong enough to produce interfering side lobe, multiple and reflected echoes (ghosts). This has also been raised as a major concern by the maritime industry with further evidence of the problems being identified by the Port of London Authority around the Kentish Flats offshore Windfarm in the Thames Estuary and by Trinity House in other locations. Based on the results of the North Hoyle trial, the MCA produced the shipping route template (MCA 2004) a non-prescriptive tool used to give guidance on the distances which should be established between shipping routes and offshore windfarms.

426. A second trial was conducted at Kentish Flats on behalf of BWEA (BWEA 2008). The project steering group had members from BERR, the MCA and the Port of London Authority (PLA). The trial took place between 30 April and 27 June 2006. This trial was conducted in Pilotage waters and in an area covered by the PLA VTS at distances of one nautical mile and more from the windfarm. It therefore had the benefit of Pilot advice and experience but was also able to assess the impact of the generated effects on VTS radars.

427. The trial concluded that:

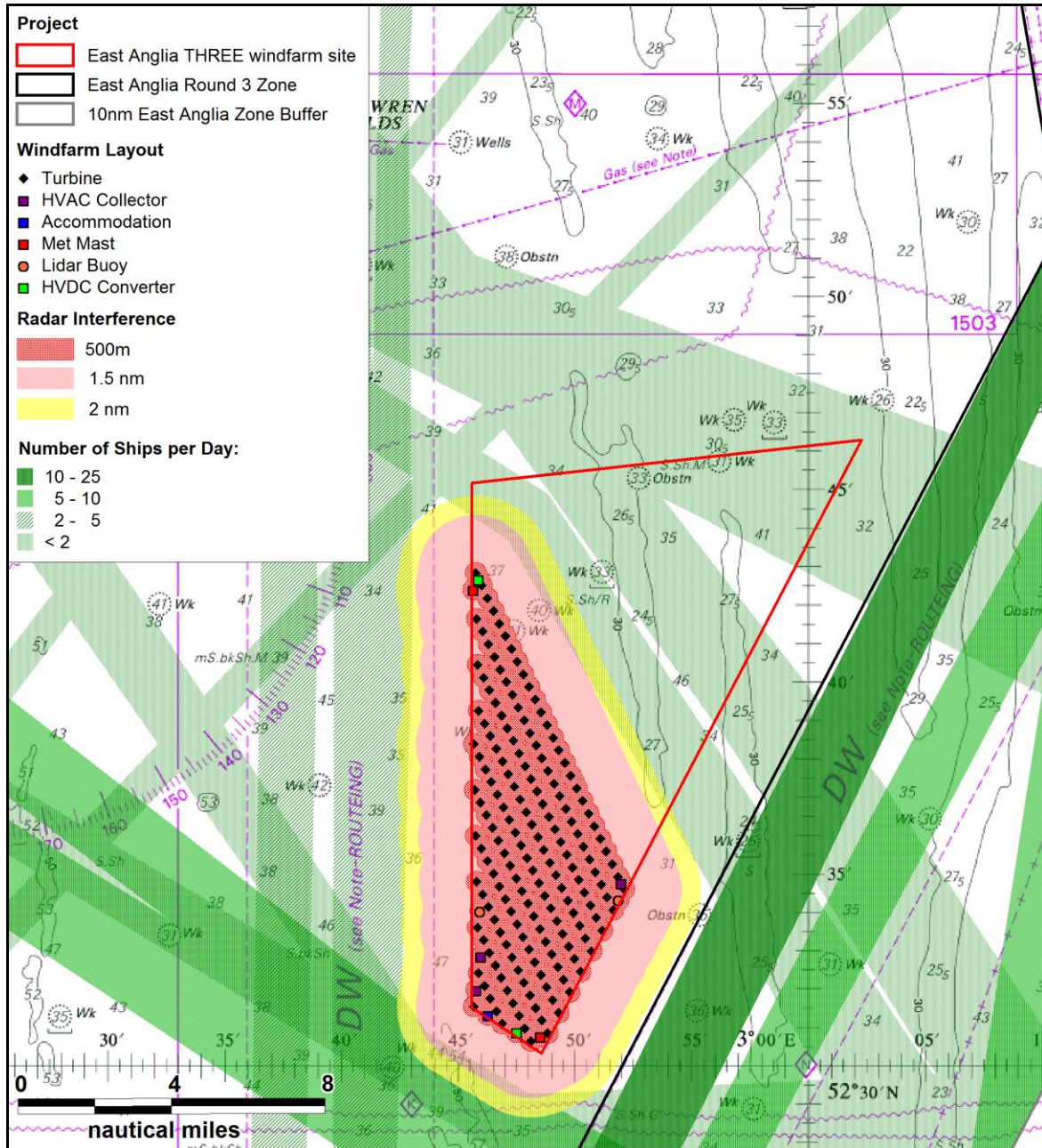
- The phenomena referred to above detected on marine radar displays in the vicinity of windfarms could be produced by other strong echoes close to the observing vessel although not necessarily to the same extent;
- Reflections and distortions by conventional ships structures and fittings created many of the effects and that the effects vary from vessel to vessel and radar to radar;
- VTS scanners static radars could be subject to similar phenomena as above if passing vessels provide a suitable reflecting surface but the effect did not seem to present a significant problem for the PLA VTS; and



- Small vessels operating near the windfarm were usually detectable by radar on ships' operating near the array but were less detectable when the small vessel was operating within the array.
428. The potential radar interference is mainly a problem during periods of bad visibility when ARPA may not detect and track smaller vessels in the vicinity mariners may not be able to visually confirm their presence (i.e. those without AIS installed which are usually fishing and recreational craft).
429. Based on the trials carried out to date the onset range from the turbines of false returns is about 1.5nm, with progressive deterioration in the radar display as the range closes.
430. It should be noted that MCA and MoD trials show that problems are also produced on the radars of SAR helicopters, restricting the detection of small vessels and casualties within windfarms.

#### *27.1.1 Impact on Collision Risk*

431. Figure 27.1 and Figure 27.2 present the future case 90<sup>th</sup> percentiles relative to the East Anglia THREE turbine locations, based on the partial fill and 100% fill layouts with 500m, 1.5nm and 2nm buffers applied around each turbine location in order to illustrate potential radar interference. These buffers are based on guidance contained within MGN 371 (MCA, 2008a).
432. On all sides of the East Anglia THREE site there is sea room available for ships to increase their clearance, should they consider it necessary, with the exception of vessels using the IMO adopted Deep Water Routes which lies 1nm to the East of the site. From the maritime traffic surveys of the area, it is known that shipping tends to treat the DWRs as extensions of the adjacent Off Botney Ground TSS and Off Brown Ridge TSS. In the main this leads to northbound shipping keeping to the East of centre and southbound shipping keeping to the west of centre of the DWR.
433. Impacts on marine Radar are considered further in Chapter 15 Shipping and Navigation.



**Figure 27.1** Partial Fill Layout and Indicative Radar Buffer Zones

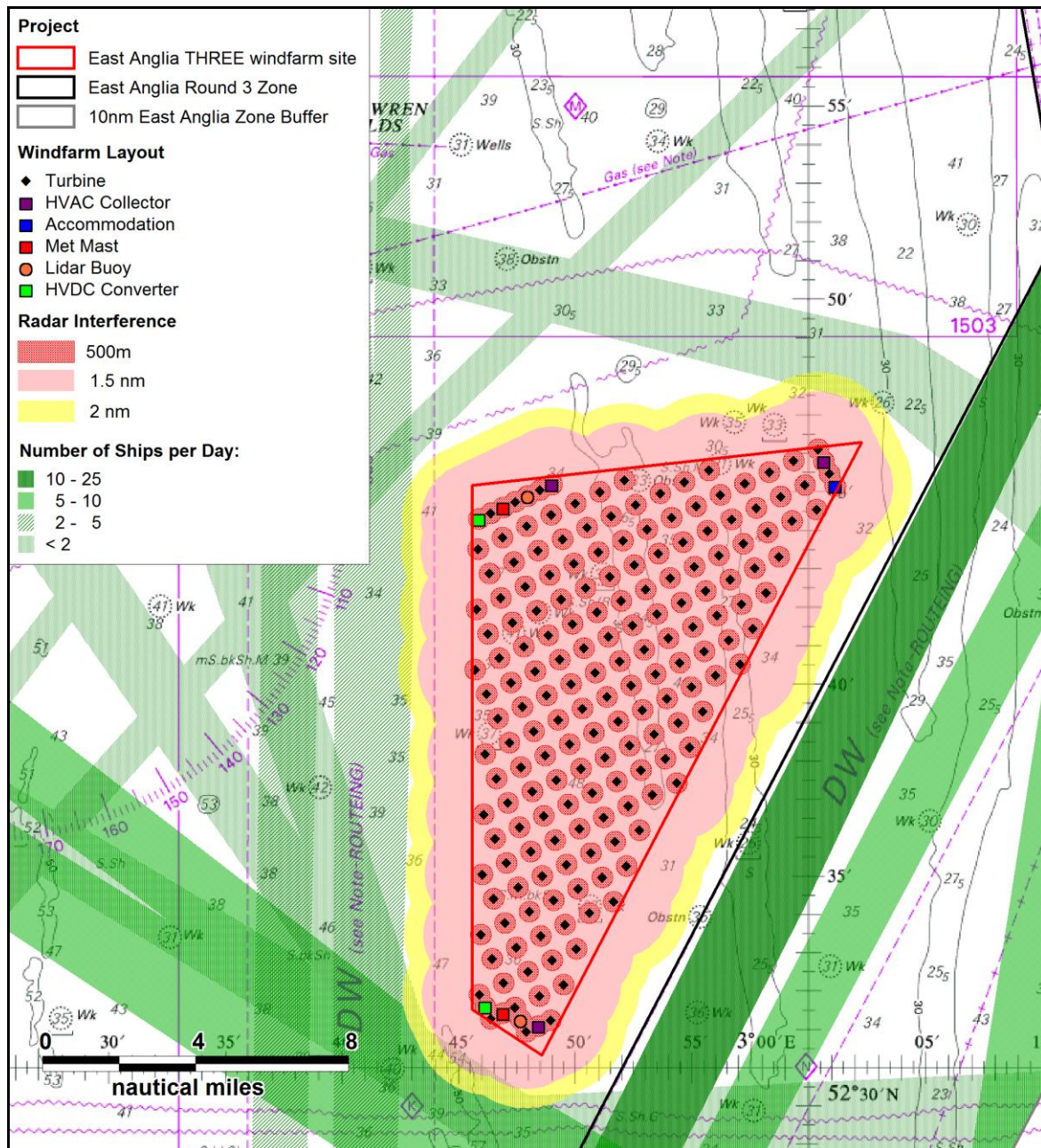


Figure 27.2 100% Fill Layout and Indicative Radar Buffer Zones

## 27.2 Very high Frequency (VHF) Communications (including Digital Selective Calling (DSC))

434. As part of the 2004 trials at North Hoyle Wind Farm tests were undertaken by the MCA and QinetiQ to evaluate the operational use of typical small vessel VHF transceivers when operated close to windfarm structures.

435. The windfarm structures had no noticeable effect on voice communications within the windfarm or ashore. It was noted that if small vessel ship-to-ship and ship-to-shore

communications were not affected significantly by the presence of wind turbines, then it is reasonable to assume that larger vessels, with higher powered and more efficient systems would also be unaffected.

436. During this trial a number of mobile telephone calls were made from ashore, within the windfarm, and on its seawards side. No effects were recorded using any system provider (MCA and QinetiQ 2004).
437. Furthermore, as part of 2005 SAR trials carried out at North Hoyle Wind Farm, radio checks were undertaken between the Sea King helicopter and both Holyhead and Liverpool Coastguards. The aircraft was positioned to the seaward side of the windfarm and communications were reported as very clear, with no apparent degradation of performance. Communications with the service vessel located within the windfarm were also fully satisfactory throughout trial. (MCA 2005)
438. Vessels operating in and around offshore windfarms have not noted any noticeable effects on VHF (including voice and DSC communications). No significant impact is anticipated at the East Anglia THREE windfarm and therefore has been scoped out of the EIA assessment.

### **27.3 VHF Direction Finding**

439. During the 2004 trials at North Hoyle Offshore Wind Farm, the VHF direction equipment carried in the lifeboats did not function correctly when very close to turbines (within about 50 m). This is deemed to be a relatively small scale impact due to the limited use of VHF direction finding equipment and would not impact operational or SAR activities, especially as the effect is now recognised by the MCA (MCA and QinetiQ, 2004).
440. Throughout the 2005 SAR trials carried out at North Hoyle Wind Farm, the Sea King radio homer system was tested. The sea king radio homer system utilises the lateral displacement of a vertical bar on an instrument to indicate the sense of a target relative to the aircraft heading. With the aircraft and the target vessel within the windfarm, at a range of approximately 1nm, the homer system operated as expected with no apparent degradation
441. No significant impact has been noted at other sites and none are expected at the proposed East Anglia THREE project and therefore has been scoped out of the EIA assessment.

### **27.4 Navtex Systems**

442. The Navtex system is used for the automatic broadcast of localised Maritime Safety Information (MSI) and either prints it out in hard copy or displays it on an LCD screen, depending on the model.
443. There are two NAVTEX frequencies. All transmissions on NAVTEX 518 kHz the international channel are in English. NAVTEX 518 kHz provides the Mariner (both recreational and commercial) with weather forecasts, severe weather warnings and navigation warnings such as obstructions or buoys off station. Depending on your location other information options may be available such as ice warnings for high latitude

sailing.

444. The 490 Kilo Hertz (kHz) national NAVTEX service may be transmitted in the local language. In the UK full use is made of this second frequency including useful information for smaller craft, such as the inshore waters forecast and actual weather observations from weather stations around the coast.

445. No significant impact has been noted at other sites and none are expected at the proposed East Anglia THREE project and therefore has been scoped out of the EIA assessment.

### **27.5 AIS**

446. In theory there could be interference when there is a structure located between the transmitting and receiving antennas (i.e. blocking line of sight). This was not evident in the trials carried out at the North Hoyle site and no significant impact is anticipated for AIS signals being transmitted and received at the proposed East Anglia THREE project and therefore has been scoped out of the EIA assessment.

### **27.6 GPS**

447. GPS is a satellite based navigational system. GPS trials were also undertaken at North Hoyle (MCA and QinetiQ, 2004) and stated that 'no problems with basic GPS reception or positional accuracy were reported during the trials'.

448. The additional tests showed that 'even with a very close proximity of a turbine tower the GPS antenna, there were always enough satellites elsewhere in the sky to cover for any that might be shadowed by the turbine tower' (MCA and QinetiQ 2004).

449. No significant impact has been noted at other sites and none are expected at the proposed East Anglia THREE project and therefore has been scoped out of the EIA assessment.

### **27.7 Structures and Generators affecting Sonar Systems in Area**

450. No evidence has been found to date with regard to existing windfarms to suggest that they produce any kind of sonar interference which is detrimental to the fishing industry, or to military systems. No impact is anticipated for the proposed East Anglia THREE project and therefore has been scoped out of the EIA assessment.

### **27.8 Electromagnetic Interference on Navigation Equipment**

451. A compass, magnetic compass or mariner's compass is a navigational instrument for determining direction relative to the earth's magnetic poles. It consists of a magnetised pointer (usually marked on the North end) free to align itself with Earth's magnetic field. A compass could be used to calculate heading, used with a sextant to calculate latitude, and with a marine chronometer to calculate longitude.

452. Like any magnetic device, compasses are affected by nearby ferrous materials as well as by strong local electromagnetic forces, such as magnetic fields emitted from power cables. As the compass still serves as an essential means of navigation in the

advent of power loss or a secondary source, it should not be allowed to be affected to the extent that safe navigation is prohibited.

### *27.8.1 Wind Turbines*

453. No problems with respect to magnetic compasses were reported. However, small vessels with simple magnetic steering and hand bearing compasses should be wary of using these close to wind turbines as with any structure in which there is a large amount of ferrous material (MCA and QinetiQ 2004).

### *27.8.2 Export and Inter Array Cables*

454. Previous consultation with the MCA has indicated that cables should not result in more than five degrees of compass deviation for marine vessels.

- The important factors that affect the resultant deviation are:
- Water and burial depth;
- Current (alternating or direct) running through the cables;
- Spacing or separation of the two cables in a pair (Balanced Monopole and Bipolar designs); and/or
- Cable route alignment relative to earth's magnetic field.

455. It is noted that all equipment and cables would be rated and in compliance with design codes. In addition the cables associated with the windfarm would be buried and any generated fields would be very weak and would have no impact on navigation or electronic equipment. No impact is anticipated for the proposed East Anglia THREE project.

## **27.9 Noise Impact**

### *27.9.1 Acoustic Noise Masking Sound Signals*

456. The concern which must be addressed under MGN 371 is whether acoustic noise from the windfarm could mask prescribed sound signals. The sound level from a windfarm at a distance of 350m has been estimated to be in the range 35-55 decibels (dB) and it should therefore be below a background sound level which is typically 63-68 dB.

457. The 1972 International Regulations for Preventing Collisions at Sea (1972 COLREGS), ANNEX III, entered into force by the IMO, specifies the technical requirements for sound signal appliances on marine vessels. Frequency range and minimum decibel level output is specified for each class of vessel (based on length).

458. A ship's whistle for a vessel of 75m should generate in the order of 138 dB and be audible at a range of 1.5nm, so this should be heard above the background noise of the proposed East Anglia THREE project. Foghorns would also be audible over the background noise of the windfarm.

459. Therefore, there is no indication that the sound level of the proposed East Anglia THREE project would have any significant influence on marine safety.

### 27.9.2 Noise Impacting Sonar

460. Once in operation it is not believed that the subsea acoustic noise generated by the windfarm would have any significant impact on sonar systems. It is noted that these systems are already designed to work in noisy environments.

### 27.10 Effects on Communications and Position Fixing

461. The following summarises the potential impacts of the different communications and position fixing devices used in and around offshore windfarms. The basis for the assessment is the trials carried out by the MCA at North Hoyle (MCA and QinetiQ, 2004) and experience of personnel/vessels operating in and around other offshore windfarm sites.

**Table 27.1 Summary of Communication and Position Fixing Equipment Effects**

Topic		Sensitivity	Screened into Environmental Impact Assessment
Marine radar	Vessel radar	Vessels within DWR could be sensitive but have ability to distance themselves further from the boundary if required and make manual adjustments to mitigate any impacts.	Screened In (Chapter 15 Shipping and Navigation)
	Oil and gas platform radar	Low due to distance from oil and gas platforms and potential Radar Early Warning Systems (REWS).	Screened Out
	Onshore marine radar	Due to distance from shore no anticipated impacts.	Screened Out
Telecommunications	AIS	No anticipated impacts.	Screened Out
	Navtex	No anticipated impacts.	Screened Out

Topic		Sensitivity	Screened into Environmental Impact Assessment
	VHF Radio and Direction Finding	No anticipated impacts.	Screened Out
	GPS	No anticipated impacts.	Screened Out
Noise	Wind turbine generated noise	No anticipated impacts.	Screened Out
	Sonar	No anticipated impacts.	Screened Out

## 27.11 Effects on Visual Collision / Allision Avoidance

### 27.11.1 Visual Impact (Other Vessels)

462. Consideration has been given to the alignment of turbines within the array with regards to visual navigation. Based on the alignment, number of turbines and minimum spacing (675 x 900m) it is not considered there would be any significant effects associated with visual 'blind spots' between vessels on the main commercial shipping routes in the area. As noted in section 15.7.1 this also includes small craft navigating within the array.

463. During the shipping surveys, recreational activity was recorded during the summer and autumn surveys, with fishing identified all year round in the general area. In the event of a small vessel emerging from the windfarm towards shipping traffic, the vessel should be visible for the vast majority of the time, due to the size of the turbines and the spacing between them.

### 27.11.2 Visual Impact (Navigational Aids and/or Landmarks)

464. The East Anglia THREE site itself would form a significant aid to navigation, which would be very visible to shipping with lights on significant peripheral structures as well as selected intermediate structures in accordance with THLS requirements (see Section 5).

465. It is therefore considered that, provided suitable marking and lighting would be developed at the East Anglia THREE site, it would not degrade the ability of vessels to navigate in the area through visual impairment.

466. It is also noted that the windfarm does not impact on any other pre-established navigational aids.



## 28 Cumulative and In Combination Effects

467. Cumulative and in-combination effects have been considered for the East Anglia THREE site including the impacts on shipping and navigation arising from other proposed offshore wind developments and any the impacts arising from other marine activities or users of the sea.

468. Following assessment of the baseline it has been identified that the development of the East Anglia THREE site may have cumulative and/or in-combination effects with the navigational activity of other receptors. The following receptors have been identified which have the potential to create a cumulative effects.

- Other Offshore Wind Farms;
- Recreational Craft ;
- Marine Aggregate Dredgers;
- Commercial Fishing;
- Oil and gas developments
- Port Operations; and
- MOD Defence – Practice and Exercise Areas.

469. Projects and proposed developments were screened in to the assessment only where potential overlap between activities and receptors was identified.

470. Vessel transits were considered in detail as part of the baseline for the NRA therefore vessel traffic associated with marine aggregates dredgers, oil and gas support/standby transits, commercial fishing transits, recreational craft transits and MOD movements are effectively screened out of the cumulative section.

471. It is noted that since undertaking the hazard workshop and the cumulative assessment for East Anglia THREE, future zonal plans within the overall East Anglia zone are now under re-assessment and only the consented East Anglia ONE project is being considered within the cumulative assessment. Any future developments proposed within the East Anglia zone will be considered on a site by site basis; with the cumulative impact assessment being undertaken within the current projects Navigational Risk Assessment.

### 28.1 Cumulative Screening

472. Table 28.1 and Table 28.2 summarises the cumulative screening process and highlights projects and proposed developments within 10nm where a cumulative or in combination activity have been identified.

473. Cumulative impacts have been considered for shipping and navigation receptors, this includes other offshore developments, as well as in combination activities associated with other marine operations. However it should be noted that fishing, recreation and marine aggregate dredging transits have been considered as part of the baseline assessment and not therefore within the screening table.

474. Cumulative impacts are again considered within a 10nm buffer around the East Anglia THREE site but then extended where applicable to encompass vessel routing. This includes consideration of transboundary offshore wind farm projects and shipping routes. However for a cumulative or transboundary wind farm to be considered in the cumulative routing assessment a vessel route needs to be impacted (route through or in proximity to) by both the screened wind farm and the proposed East Anglia THREE project.

**Table 28.1 Cumulative Screening (10nm around the site)**

Development	Distance (nm)	Status	Data Confidence	Screened In
Future East Anglia Zonal Offshore Windfarm Developments (UK)	0	Early Planning	Low	No – Future zonal development uncertain and therefore cannot be fully assessed.
Balgzand Bacton Gas Pipeline	6.8	Fully Commissioned	High	No – No cumulative impact anticipated.
Wissey Gas Production Pipeline	8.8	Fully Commissioned	High	No – No cumulative impact anticipated.
Future Ijmuiden Zone Offshore Wind Farm Developments (Netherlands)	10.0	Early Planning	Low	No – Due to current scoped projects. A large number of projects within the area are currently dormant.
27th Round Oil & Gas Current License Blocks: 53/10, 53/14, 53/15, 53/19a, 53/20a, 53/3a, 53/4a, 53/4b, 53/4d, 53/5c, 53/8, 53/9, 54/11a, 54/1b, 54/6a.	All within 10nm	Licensed	Medium	No- No scoping work yet been carried out and therefore cannot fully be assessed.

Development	Distance (nm)	Status	Data Confidence	Screened In
28 <sup>th</sup> Round Oil & Gas Conditionally Awarded License Blocks: 5/6b, 54/11b, 54/16.	All within 10nm	Early Planning	Medium	No- No cumulative impact anticipated.
28 <sup>th</sup> Round Oil & Gas Offered License Blocks: 53/13, 53/18, 53/19b, 53/20b, 54/1a.	All within 10nm	Early Planning	Medium	No- No cumulative impact anticipated.
Ministry of Defence Marine Activities	Various	On Going	Medium	No – No cumulative impact anticipated.

475. The following section identifies receptors which have been screened in and have the potential to create a cumulative effect with shipping and navigation receptors. This is considered in conjunction with work undertaken as part of The Crown Estates (TCE) into cumulative (and in combination) impacts associated with offshore wind developments in 2012 (TCE, 2012) which considered the screening of marine activities by area.

### 28.1.1 Reduction in available sea room for oil and gas exploration and infrastructure

476. Although it is noted that oil gas blocks (Section 0) have been licensed which overlap with the proposed East Anglia THREE site, no scoping work has yet been carried out by the licence holders so as to allow assessment of cumulative impacts to be undertaken. The proposed East Anglia THREE site is within UKCS Block 53/9, 53/10, 53/14, 53/15, and 54/6a. All of these blocks are currently licensed for oil and gas development by the operator Jetex Petroleum UK Ltd. and were licenced in the 27th round of licencing. There are also two plugged and abandoned wells within the East Anglia THREE site. Should any works be considered pre or post consent as per planning requirements this would be subject to marine licensing or consent requirements and therefore, no cumulative impacts are anticipated.

### 28.2 Increased Deviations Associated with Offshore Wind Farm Developments (including Transboundary)

477. As shipping and navigational receptors could route and therefore be cumulatively impacted by a number of offshore developments the principles of the cumulative assessments have been extended to 100nm. The routes passing through the East Anglia THREE site (and another development for cumulative impact) have been assessed with the results presented in Table 28.2.

478. It is noted that a zonal approach is also being considered within Netherlands territorial waters, the outer edge of which is within 10nm, but as a number of the sites are dormant or unscreened they have not been considered cumulatively apart from Breeveertien II Offshore Wind Farm Development (Netherlands) which is 21.8nm miles away.

**Table 28.2 Cumulative Screening (Routeing)**

Development	Distance (nm)	Status	Screened In
Future East Anglia Zonal Offshore Windfarm Developments (UK)	0	Early Planning	No
Future Ijmuiden Zone Offshore Wind Farm Developments (Netherlands)	10.0	Early Planning	No
East Anglia ONE Offshore Windfarm Development (UK)	12.0	Consent Authorised	Yes
Brown Ridge Oost Offshore Wind Farm Development (Netherlands)	14.6	Dormant	No
Tromp Binnen Offshore Wind Farm Development (Netherlands)	15.0	Dormant	No
Breeveertien II Offshore Wind Farm Development (Netherlands)	21.8	Dormant	Yes- If constructed (in future) potential cumulative impact on vessel routeing.
Den Helder I Offshore Wind Farm Development (Netherlands)	21.9	Dormant	No
Future Hollandse kust Zone Offshore Wind Farm Developments (Netherlands)	23.9	Early Planning	No
West-Rijn Offshore Wind Farm Development (Netherlands)	32.0	Dormant	No

Development	Distance (nm)	Status	Screened In
Scroby Sands Offshore Wind Farm Development (UK)	35.0	Fully Commissioned	No
Galoper Offshore Wind Farm Development (UK)	39.9	Consent Authorised	No
Beaufort (formerly Katwijk) Offshore Wind Farm Development (Netherlands)	40.7	Dormant	No
Q4 West Offshore Wind Farm Development (Netherlands)	41.5	Dormant	No
Greater Gabbard Offshore Wind Farm Development (UK)	43.1	Fully Commissioned	No
Prinses Amaliawindpark	43.3	Fully Commissioned	No
Future Borssele Zone Offshore Wind Farm Developments (Netherlands)	43.4	Early Planning	No
Q4 Offshore Wind Farm Development (Netherlands)	43.8	Dormant	No
Eneco Luchterduinen Offshore Wind Farm Development (Netherlands)	45.6	Under Construction	No
Belwind Phase 2 Offshore Wind Farm Development (Belgium)	47.6	Consent Authorised	No
Belwind Phase 1 Offshore Wind Farm Development (Belgium)	48.0	Fully Commissioned	No
Egmond aan Zee Offshore Wind Farm Development (Netherlands)	48.6	Fully Commissioned	No

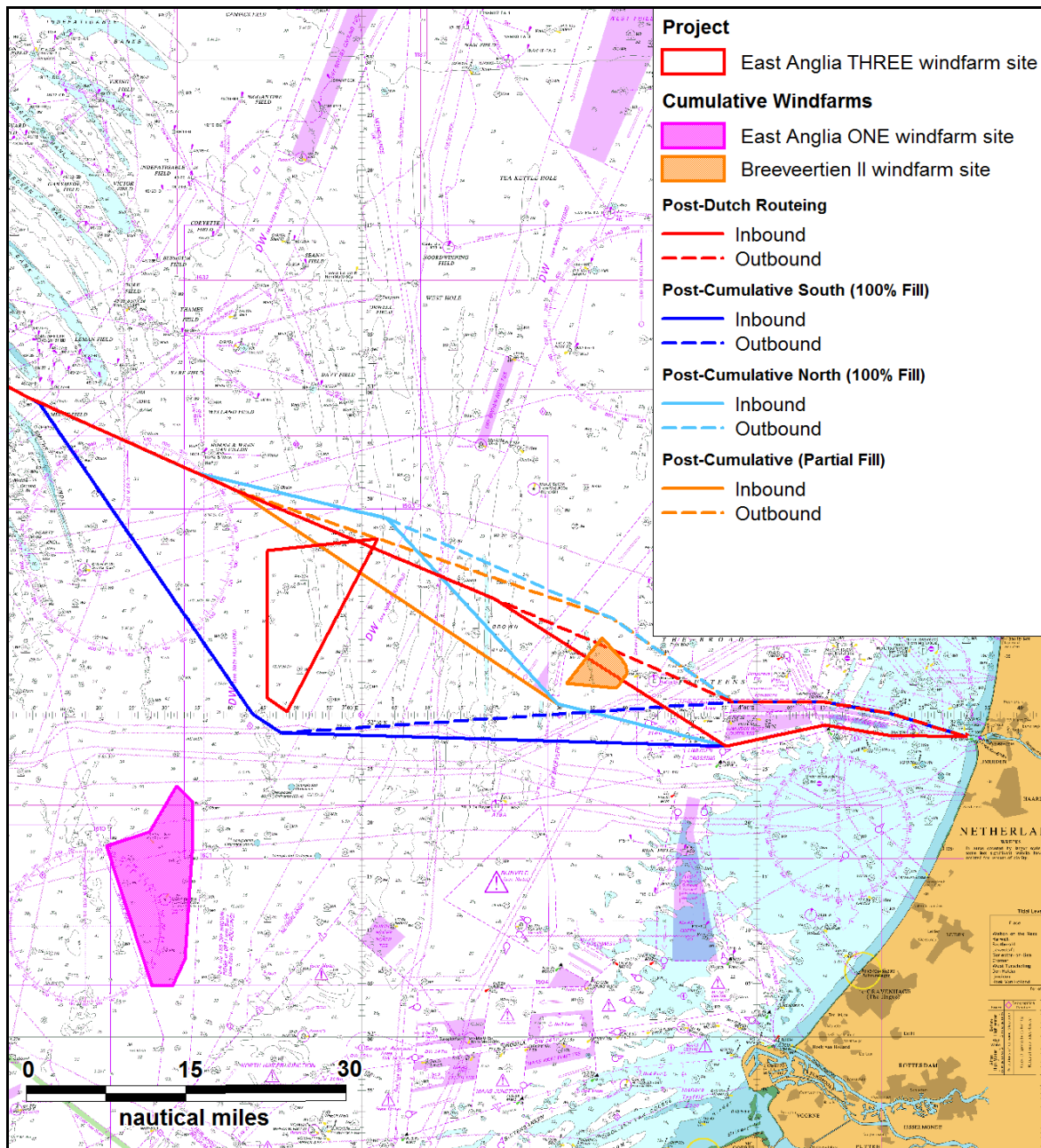
Development	Distance (nm)	Status	Screened In
Belwind Alstom Haliade Demonstration Offshore Wind Farm Development (Belgium)	48.9	Fully Commissioned	No
Seastar Offshore Wind Farm Development (Belgium)	50.5	Consent Authorised	No
Northwind Offshore Wind Farm Development (Belgium)	51.8	Fully Commissioned	No
Future Hornsea Zonal Offshore Wind Farm Developments (UK)	51.9	Early Planning	No
RENTEL Offshore Wind Farm Development (Belgium)	53.6	Consent Authorised	No
Dudgeon Offshore Wind Farm Development (UK)	54.2	Consent Authorised	Yes
Norther Offshore Wind Farm Development (Belgium)	56.4	Consent Authorised	No
Thornton Bank Phases I Offshore Wind Farm Development (Belgium)	57.3	Fully Commissioned	No
Sheringham Shoal Offshore Wind Farm Development (UK)	59.5	Fully Commissioned	Yes
Hornsea Project One Offshore Wind Farm Development (UK)	67.3	Consent Authorised	No
Race Bank Offshore Wind Farm Development (UK)	72.7	Consent Authorised	Yes
Triton Knoll Offshore Wind Farm Development (UK)	74.9	Consent Authorised	Yes
Hornsea Project Two Offshore Wind Farm Development (UK)	76.2	Application	No

Development	Distance (nm)	Status	Screened In
Lincs Offshore Wind Farm Development (UK)	84.4	Fully Commissioned	No
Lynn Offshore Wind Farm Development (UK)	85.1	Fully Commissioned	No
Inner Dowsing Offshore Wind Farm Development (UK)	86.7	Fully Commissioned	No

479. The only routes that are impacted by other windfarms (including Transboundary developments) are routes 16 and 19 which are cumulatively impacted by the proposed East Anglia THREE project and by Breeveertien II. Cumulative rerouteing taking account of UK and Transboundary windfarms is discussed in the following subsections. It should be noted that the development of the Breeveertien II wind farm is currently dormant. However, given the future potential for the development to be constructed and potential cumulative impact on vessel routeing, the development has been considered throughout the following subsections.

#### 28.2.1 Route 16 (Cumulative)

480. Figure 28.1 presents the mean route positions for vessels operating on route 16 post Dutch routeing measure changes and alternative routeing options post construction of cumulatively scoped windfarms. Consideration has been given to both partial fill and 100% fill of the East Anglia THREE site throughout analysis of alternative routeing options. It is noted that the layouts used are indicative and should any navigational corridor be developed between the sites they will comply with MCA and THLS requirements with regards to corridor design including width.



**Figure 28.1 Anticipated Routeing for Route 16 Post Cumulative Scenario**

481. Throughout the 100% fill build scenario of the East Anglia THREE site, it is likely that vessels would transit to the south of the East Anglia THREE site resulting in a worst case deviation of approximately 10.30nm (10.57% of route length) for vessels on passage outbound from Amsterdam. A deviation of 8.25nm (8.30% of route length) is anticipated for inbound transiting vessels passing south of the East Anglia THREE site throughout the 100% fill build scenario. It is also possible that vessels on this route may pass to the north of the East Anglia THREE site resulting in a deviation of approximately 0.50nm (0.52% of route length) for vessels transiting outbound from Amsterdam and 2.18nm (2.19% of route length) for vessels transiting inbound to Amsterdam.

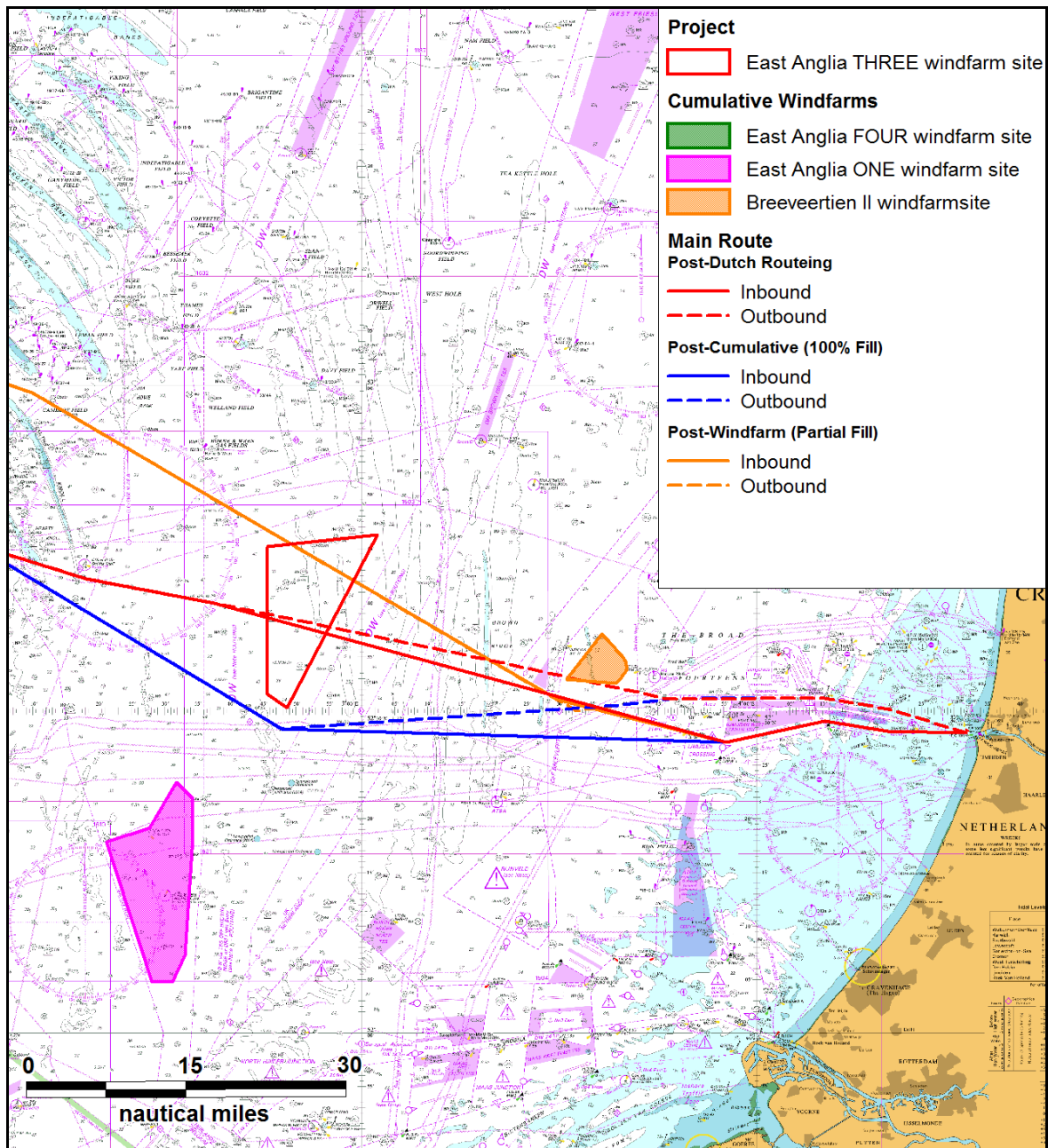


482. Throughout the partial fill build scenario of the East Anglia THREE site, it is likely that vessels transiting from Amsterdam would pass north of the Breeveertien II windfarm whilst vessels transiting to Amsterdam would pass to the south. This results in a deviation of approximately 0.37nm (0.38% of route length) for vessels transiting from Amsterdam and a 0.50nm (0.50% of route length) for vessels transiting to Amsterdam throughout the partial fill build scenario of the East Anglia THREE site.

483. Route deviations are based on vessels seeking a minimum passing distance of 2nm from the windfarm (as previously noted, based on analysis of shipping data around offshore windfarms, a proportion of vessels are likely to pass in closer proximity to the site). It is assumed that vessels would be able to pre-plan their revised passage in advance of encountering the windfarm, due to effective mitigation, enabling them to make course adjustments early, minimising the resultant deviations.

### *28.2.2 Route 19 (Cumulative)*

484. Figure 28.2 presents the mean route positions for vessels operating on route 19 post Dutch routing measure changes and alternative routing options post construction of cumulatively scoped windfarms. Consideration has been given to both partial fill and 100% fill of the East Anglia THREE site throughout analysis of alternative routing options.



**Figure 28.2 Anticipated Routing for Route 19 - Cumulative Scenario**

485. Throughout the 100% fill build scenario of the East Anglia THREE site it is likely that vessels would transit to the south of the East Anglia THREE site resulting in a worst case deviation of approximately 3.43nm (2.70% of route length) for vessels on passage outbound from Amsterdam. This is a minor (0.01nm) increase from the East Anglia THREE site 100% fill scenario considered in Section 18.5 due to the need to remain 2nm from the Breeveertien II windfarm. A deviation of 2.53nm (1.98% of route length) is anticipated for inbound transiting vessels passing south of the East Anglia THREE site throughout the 100% fill build scenario.

486. Throughout the partial fill build scenario of the East Anglia THREE site it is likely that

vessels would transit south of the Breeveertien II windfarm. Route deviations are based on vessels seeking a minimum passing distance of 2nm from the windfarm (as previously noted, based on analysis of shipping data around offshore windfarms, a proportion of vessels are likely to pass in closer proximity to the site). It is assumed that ships would be able to pre-plan their revised passage in advance of encountering the windfarm, due to effective mitigation, enabling them to make course adjustments early, minimising the resultant deviations.

487. Table 28.3 and Table 28.4 summarises the cumulative main route deviations taking account of scoped UK and Transboundary windfarms.

**Table 28.3 Summary of Cumulative Main Route Deviations (100% Fill)**

Route	Impacted By		100% Fill	
	EA 3	BRE*	Increase in Distance (nm)	Increase in Route Length
16 Inbound	X	X	2.18	2.19%
16 Outbound	X	X	0.50	0.52%
19 Inbound	X		2.53	1.98%
19 Outbound	X	X	3.43	2.70%

\* *Breeveertien II*

**Table 28.4 Summary of Cumulative Main Route Deviations (Partial Fill)**

Route	Impacted By		Partial Fill	
	EATL	BRE*	Increase in Distance (nm)	Increase in Route Length
16 Inbound		X	0.50	0.50%
16 Outbound		X	0.37	0.38%
19 Inbound	X	X	0.53	0.43%
19 Outbound	X	X	1.63	1.31%

\* *Breeveertien II*

## 29 Next Steps EIA and Additional Mitigations

488. The requirement for an EIA is set out in the Infrastructure Planning EIA Regulations 2009 which implement EC directive 85/337/EEC as amended by Directive 97/11/EC as detailed within Chapter 3 Policy and Legislative Context of the Environmental Statement.

489. Following identification of both future case impacts and the outcomes of the Formal Safety Assessment an impact assessment in line with EIA guidance has been undertaken. The impact assessment screens the identified impacts from the NRA with effective pathways.

490. THE EIA requires data review including compiling and reviewing available data. For shipping and navigation this includes the marine traffic surveys, base case assessment and Navigational Risk Assessment. The likely and significant effects of the East Anglia THREE project during pre- construction, construction, operation and decommissioning stages of the project are assessed and feedback provided to the design and engineering teams to mitigate or modify the development in order to avoid, prevent, reduce and, where possible, offset any significant adverse effects on the environment. Following this is the identification of any residual effects and any further mitigation measures that may be required.

491. Table 29.1 shows the additional mitigation required to reduce the impacts noted in Chapter 15 Shipping and Navigation of the Environmental Statement.

**Table 29.1 Additional Mitigation**

Mitigation	Description
<b>Works Vessel Coordination</b>	Development, implementation and operation of Works Vessel Coordination which could include the development of construction corridors and / entry exit points for support craft to ensure that they are effectively managed and are not displaced into areas used by commercial craft.
<b>Final Site Design Consultation</b>	Consultation on the final site design (including cable burial and the locations of larger offshore structures) shall be carried out with regulatory stakeholders in order to ensure the final site design is signed-off as per the DCO (under the requirements of MGN 371),
<b>Additional Aids to Navigation</b>	Additional aids to navigation such as buoyage could be required following consultation with THLS and MCA to aid the displacement of traffic and prevent the creation of a high risk

	<p>crossing point on the southern boundary.</p> <p>There may also be a requirement for additional aids to navigation to assist fishing vessels transiting within or in proximity to the windfarm but this would depend on final site design and requirement agreement with THLS and MCA.</p> <p>Furthermore, a through life aids to navigation management plan shall be agreed by the Marine Management Organisation, in consultation with Trinity House prior to construction as per updated Development Consent Order conditions.</p>
<b>Additional and Specific Promulgation of Information</b>	<p>Promulgation of Information to ensure vessels are aware of ongoing construction or decommissioning activities and could passage plan effectively.</p>

## **30 Future Monitoring**

### **30.1 Safety Management Systems (SMS)**

492. Health and safety documentation, including a policy statement and SMS would be in place for the project. This would be continually updated throughout the development process. The following sections provide an overview of documentation and how it would be maintained and reviewed with reference where required to specific marine documentation.

493. Monitoring, reviewing and auditing would be carried out on all procedures and activities and feedback actively sought. Any Designated Person, managers and supervisors are to maintain continuous monitoring of all marine operations and determine if all required procedures and processes are being correctly implemented.

494. The operator has a commitment to manage the risks associated with the activities undertaken at the East Anglia THREE site and associated works. It has established an integrated management system which ensures that the safety and environmental impacts of those activities are tolerable. This includes the use of remote monitoring and switching for Aids to Navigation to ensure that if a light is faulty a quick fix could be instigated from the marine control centre.

495. The ERCoP would also form part of the safety management systems.

### **30.2 Future Monitoring of Marine Traffic**

496. Following change to the MCAs Development Consent Order Conditions East Anglia THREE Limited would comply with the following conditions.

- The undertaker shall complete a post construction traffic monitoring survey submitted annually for the first three years post construction, and thence every second year, for the life of the project, or until such time as the MCA formally rescind the biennial survey requirement in writing.
- The survey would consist of a minimum of 28 days annual AIS traffic data covering seasonal variations in traffic patterns and fishing operations within a 10nm buffer of the 'as built' site. The associated report would review comparisons of 90th percentile routes from the NRA, points of closest approach, incidents recorded by MCA, MAIB, RNLI and internally reported, comparing this data against the original NRA submission.

### **30.3 Subsea Cables**

497. The subsea cable routes will be subject to periodic inspection to monitor cable burial depths.

498. As required by MGN 371 in order to establish a baseline, confirm the safe navigable depth, monitor seabed mobility and to identify underwater hazards, detailed and accurate hydrographic surveys are required at agreed intervals. These will cover the site and its immediate environs extending to 500m outside the East Anglia THREE site.

### **30.4 Decommissioning Plan**

499. A decommissioning plan will be developed. With regards to impacts on shipping and navigation this will also include consideration of the scenario where on decommissioning and on completion of removal operations, an obstruction is left on site (attributable to the windfarm) which is considered to be a danger to navigation and which it has not proved possible to remove. Such an obstruction may require to be marked until such time as it is either removed or no longer considered a danger to navigation, the continuing cost of which would need to be met by the developer/operator.

## 31 Summary

500. Following a review of the base case environment, a Navigational Risk Assessment, for the East Anglia THREE site has been undertaken. The assessment has included the collision risk modelling and a formal safety assessment for all phases of the development as well as an assessment of cumulative (and in combination) impacts.

### 31.1 Marine Traffic

501. An analysis of marine traffic types passing within a 10nm buffer of the East Anglia THREE site during the traffic surveys has been undertaken. The first three surveys (30 days) showed a distribution of cargo vessels (recorded most frequently) of 63%, fishing vessels which made up 15% of the traffic and then followed by recreational vessels (9%). Of the cargo vessel category, general cargo and chemical tankers were the most frequently seen. For the validation survey undertaken in 2014 (post changes to the Dutch routing measures) vessel types were noted as cargo vessels (67.5%), fishing vessels (19%) and other operational vessels (9.5%) with the most frequent cargo types again being general cargo and chemical tankers. It was noted that this survey was a winter survey in which extreme adverse weather was noted hence the lower numbers of recreational craft.

502. Currently three main routes fully pass through the area (routes 15, 17 and 19) and have approximately one to two vessels per day on each route. Route 14 and 16 also partially intersect the East Anglia THREE site with route 16 showing one to two vessels per day and route 14 being a denser route with five vessels per day which includes north-west to south-east traffic bound from the north-east UK and ports to the Netherlands including Stena Lines Ro-Ro (Roll on Roll Off) route between Killingholme and Hoek Van Holland. The majority of the traffic on these routes is cargo (including liquid and gas tankers) with DECC vessel types showing the majority to be general cargo (34%) and chemical tankers (14%).

503. Route 17 is also transited by Ro-Ro vessels bound between Teesport and Rotterdam and operated by P&O Ferries. The most common vessel type to transit East Anglia THREE on route 17 were chemical tankers (47%) followed by general cargo vessels (36%). The Ro-Ro cargo vessel Norsky, operating on the P&O Teesport to Europort, was the most frequently recorded vessel.

504. Route 21 was formerly used by the DFDS Harwich – Esbjerg ferry (operations ceased on 28<sup>th</sup> September 2014). However, the impact of East Anglia THREE on this route was still assessed in order to ensure comprehensive assessment of the impact on vessel routing, given the potential for the usage of Route 21 to increase in the future.

505. Fishing vessel activity was recorded on AIS (93%) and Radar (7%). Overall 67 unique fishing vessels were tracked during the combined survey period. Averages of six unique fishing vessels per day were recorded within 10nm of East Anglia THREE throughout the combined 40 day survey period. The level of fishing vessel activity recorded in the area was higher during August and September 2012 and July and August 2013 surveys when an average of seven to eight unique fishing vessels were tracked per day, compared with the May 2013 survey when an average of two fishing vessels were recorded per day. From the tracks it was noted that there was both a combination of



vessels engaged in fishing and vessels transiting to and from fishing grounds and ports.

506. When considering the RYA Cruising Atlas (2010), it could be seen that there were three routes (one low and two medium) running in an approximate east – west direction and transiting from the UK coast to mainland Europe. The combined 40 days of AIS and radar data from the marine traffic surveys showed similar results but low levels of 1 to 2 per day. The vast majority of recreational craft were sailing vessels on transit.

### **31.2 Modelling**

507. The following scenarios have been considered as part of the NRA process;

- Base case without windfarm;
- Base case with windfarm;
- Future case without windfarm (assuming 10% increase in traffic); and
- Future case with windfarm (assuming 10% increase in traffic) Vessel to Vessel only.

508. Results showed the change in vessel-to-vessel collision frequency due to the windfarm development was estimated to be  $1.18 \times 10^{-2}$  per year for the partial fill build scenario and  $4.01 \times 10^{-3}$  for the 100% fill build scenario. This represents a 0.63% increase (partial fill build scenario) and 0.21% increase (100% fill build scenario) from the pre wind farm vessel-to-vessel collision risk for the area considered.

509. For allision risk (based on modelling of the revised routeing following the complete installation and commissioning of the proposed East Anglia THREE project) the frequency of a passing powered vessel allision is estimated to be  $2.97 \times 10^{-2}$  per year for the partial fill build scenario (one allision every 34 years) and  $1.67 \times 10^{-2}$  for the 100% fill build scenario (one allision every 60 years). The frequency of a drifting vessel allision is estimated to be  $2.07 \times 10^{-3}$  per year for the partial fill build scenario (one allision every 483 years) and  $1.14 \times 10^{-3}$  for the 100% fill build scenario (one allision every 879 years).

### **31.3 Hazard Worksop**

510. In order to provide expert opinion and local knowledge a hazard workshop was undertaken to create a hazard log that was specific to the proposed project. The hazard log identified the hazards caused or changed by the introduction of the proposed East Anglia THREE project. It looked at the risk associated with the hazard, the controls that could be put in place and the tolerability of the residual risk. The log also included embedded mitigations (required and best practice) required to show that the hazards associated with the proposed project are Broadly Acceptable or Tolerable on the basis of ALARP declarations. No risks were assessed to be unacceptable. Two hazards were ranked within the Tolerable (ALARP) region based on the most likely outcome whilst eleven were ranked as Tolerable (ALARP) based on a realistic worst case outcome.

### **31.4 Emergency Response**

511. Under national and international law the operators of the proposed East Anglia THREE project would be required to comply with existing emergency response requirements as well as giving consideration to other response groups within the area. Owing to the increased level of activity in and around the proposed project there are

expected to be some increased demands on search and rescue facilities within the area. The proposed project could also increase traffic and activity to a level that self-help emergency response would be required and consideration in the ERCoP should be given to what resources would be required to provide a level of response that would ensure that response time and resources aren't impacted.

### **31.5 Cumulative Impacts**

512. Cumulative and in-combination effects have been considered for the East Anglia THREE including the impacts on shipping and navigation arising from other proposed offshore wind developments and any the impacts arising from other marine activities or users of the sea. This included consideration for projects and developments within 10nm of the East Anglia THREE site and then to a wider area to consider cumulatively routeing.

### **31.6 Receptors for the Environmental Impact Assessment**

513. Following consideration of the results of the NRA including baseline data, consultation and modelling the NRA has identified six receptors for consideration in the EIA. This includes:

- Commercial Vessel Safe Navigation (including marine Radar);
- Commercial Vessel Routeing;
- Fishing Vessel Safe Navigation
- Recreational Craft;
- Port Operations; and
- Emergency Response.

514. Impacts on other types of communication and navigation equipment have been screened out at this stage.

515. Following a cumulative screening process the following projects and activities have been taken forward to the EIA:

- Triton Knoll;
- Sheringham Shoal;
- Race Bank;
- Breeveertien II Offshore Wind Farm; and
- Oil and Gas Licences and Developments.

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Appendix 15 (a) ends here