FOREWIND

DOGGER BANK
TEESSIDE A & B

March 2014

Environmental Statement Chapter 16 Appendix A Navigational Risk Assessment

Application Reference: 6.16.1

Navigational Risk Assessment

Dogger Bank Teesside A & B

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TABLE OF CONTENTS

1. EXECUTIVE SUMMARY 16

2. INTRODUCTION 18

2.1 BACKGROUND 18
2.2 NAVIGATIONAL RISK ASSESSMENT PURPOSE 18

3. GUIDANCE AND LEGISLATION 19

3.1 PRIMARY GUIDANCE 19
3.2 OTHER GUIDANCE 19

4. FORMAL SAFETY ASSESSMENT PROCESS 20

4.1 FLOW CHART FOR NRA METHODOLOGY 21
4.2 METHODOLOGY FOR CUMULATIVE ASSESSMENT 22
4.3 OFFSHORE RENEWABLE ENERGY INSTALLATIONS – SOUTHERN NORTH SEA OFFSHORE WIND FORUM 22
4.4 ASSUMPTIONS 24

5. CONSULTATION 24

5.1 EQUITY TO STAKEHOLDERS 24
5.2 STAKEHOLDERS CONSULTED AS PART OF NRA PROCESS 24
5.3 REGULAR OPERATORS CONSULTED AS PART OF NRA PROCESS 24
5.4 EUROPEAN SHIPPING ASSOCIATIONS CONSULTED AS PART OF ZONAL PROCESS IN 2011 26
5.5 INTERNATIONAL STAKEHOLDERS CONSULTED AS PART OF SNSOWF WORK IN 2011 26

6. DATA SOURCES 28

7. LESSONS LEARNT 29

8. MARINE TRAFFIC SURVEY METHODOLOGY 30

8.1 BASELINE SURVEY METHODOLOGY 30
8.2 AIS AND RADAR COVERAGE 32
8.3 COMMERCIAL VESSELS DATASET 32
8.4 RECREATIONAL ACTIVITY 32
8.5 FISHING ACTIVITY 32

9. OTHER OFFSHORE USERS 33

9.1 OIL AND GAS INSTALLATIONS 33
9.2 MARINE AGGREGATES AREA 33
9.3 NAVIGATIONAL FEATURES 33

10. DESIGN ENVELOPE 34

10.1 DOGGER BANK TEESSIDE A & B DEVELOPMENT BOUNDARIES 34
10.2 FOREWIND PROPOSED DESIGN ENVELOPE PROCESS 35
10.3 LAYOUT RULES 35

10.4 Wind Turbine Numbers 37
10.5 Foundations 37
10.6 Wind Turbine Design 38
10.7 Other Structures within Dogger Bank Teesside A & B 38
10.8 Export Cable 39
10.9 Definition of Worst Case Scenario 40
10.10 Mooring Buoys 41
10.11 Bridge Links 41

11. BASELINE ENVIRONMENT 43

11.1 Baseline Environment with Potential In-combination Effects 43
11.2 Ports and Auxiliary Functions 43
11.3 Existing Aids to Navigation (AtoN) 44
11.4 Oil and Gas Infrastructure 45
11.5 Aggregates Dredging Areas and Transit Routes 48
11.6 Other Wind Farm Developments 49
11.7 Marine Environmental High Risk Areas 50
11.8 Wrecks 52

12. METOCEAN DATA 54

12.1 Introduction 54
12.2 Wind 54
12.3 Visibility 54
12.4 Tides and tidal streams 54
12.5 Wave 58

13. EMERGENCY RESPONSE OVERVIEW AND ASSESSMENT 58

13.1 MCA including HM Coastguard (HMCG) 59
13.2 SAR Helicopters 60
13.3 Emergency Towing Vessels, Fires and Salvage 62
13.4 CAST Agreement (Coastguard Agreement on Salvage and Towage) 62
13.5 Pollution Control and Clean-up 62
13.6 MCA Tiered response for Pollution 63
13.7 RNLI Lifeboats 63
13.8 Salvage 66

14. MARITIME INCIDENTS 67

14.1 Marine Accident Investigation Branch 68
14.2 Royal National Lifeboat Institution 71

15. OVERVIEW OF KEY CONSULTATION 78

15.1 Introduction 78

16. REGULAR OPERATORS CONSULTATION 90

16.1 Regular Operators Identification 90

17. EUROPEAN SHIPPING ASSOCIATION CONSULTATION 2011 93
18. MARITIME TRAFFIC SURVEY DOGGER BANK TEESSIDE A & B........... 95
18.1 INTRODUCTION 95
18.2 SURVEY ANALYSIS 95
18.3 SPRING 2013 SURVEY ANALYSIS 112
18.4 ANCHORED VESSELS........ 122
18.5 DEFINITION OF A ROUTE 122
18.6 ZONE – COMMERCIAL TRAFFIC 122
18.7 BASE CASE MAIN ROUTES........ 123
18.8 MAIN ROUTE VALIDATION 126
18.9 RECREATIONAL VESSEL ACTIVITY........ 129
18.10 FISHING VESSEL ACTIVITY 133
19. MARITIME TRAFFIC SURVEY – EXPORT CABLE ROUTE...................... 138
19.1 INTRODUCTION 138
19.2 SURVEY ANALYSIS 138
19.3 VESSEL DRAUGHT 145
19.4 ANCHORED VESSELS........ 147
19.5 RECREATIONAL VESSEL ACTIVITY 153
19.6 FISHING VESSEL ACTIVITY 154
20. CONSTRUCTION, SIGNIFICANT MAINTENANCE AND DECOMMISSIONING VESSELS........ 159
20.1 HAZARDS DURING CONSTRUCTION / DECOMMISSIONING........ 159
21. FUTURE CASE MARINE TRAFFIC 161
21.1 INCREASES IN TRAFFIC ASSOCIATED WITH PORTS 161
21.2 INCREASES IN FISHING VESSEL ACTIVITY........ 161
21.3 INCREASES IN RECREATIONAL VESSEL ACTIVITY 161
21.4 INCREASE IN TRAFFIC ASSOCIATED WITH DOGGER BANK TEESSIDE A & B 161
21.5 COLLISION PROBABILITIES........ 161
21.6 COMMERCIAL TRAFFIC ROUTEING........ 162
22. COLLISION RISK MODELLING AND ASSESSMENT........ 166
22.1 BASE CASE WITHOUT WIND FARM DEVELOPMENTS 167
22.2 BASE CASE WITH WIND FARM DEVELOPMENTS 174
22.3 CABLE INTERACTION – ANCHORING AND TRAWLING 181
22.4 RISK RESULTS SUMMARY 182
22.5 CONSEQUENCES 183
23. EXPORT CABLE RISK ASSESSMENT........ 185
23.1 FISHING GEAR INTERACTION 185
23.2 VESSEL FOUNDERING 187
23.3 ANCHORING........ 187

23.4 EXPORT CABLE ROUTE RISK ASSESSMENT ... 188

24. HAZARD WORKSHOP ... 190

24.1 HAZARD WORKSHOP ... 190
24.2 HAZARD WORKSHOP PROCESS ... 192
24.3 HAZARD LOG ... 192
24.4 TOLERABILITY OF RISKS IDENTIFIED AT THE HAZARD WORKSHOP ... 192

25. EMBEDDED MITIGATION MEASURES ... 193

25.1 MARINE AIDS TO NAVIGATION (ATON) ... 197
25.2 OREI DESIGN SPECIFICATIONS NOTED AS PER MGN 371 ... 201

26. ADDITIONAL MITIGATION MEASURES ... 205

27. EMERGENCY RESPONSE STUDY ... 209

28. COMMUNICATION AND ON BOARD NAVIGATION ... 210

28.1 COMMUNICATIONS AND POSITION FIXING ... 210
28.2 IMPACT ON MARINE RADAR SYSTEMS ... 213
28.3 STRUCTURES AND GENERATORS AFFECTING SONAR SYSTEMS IN AREA ... 216
28.4 NOISE IMPACT ... 216
28.5 HUMAN ELEMENT ... 216
28.6 VISUAL NAVIGATION AND COLLISION AVOIDANCE ... 217

29. CUMULATIVE EFFECTS ... 219

29.1 OTHER OFFSHORE WIND FARMS ... 219
29.2 VISUAL CONFUSION DUE TO ALIGNMENT OF STRUCTURES ... 243
29.3 ADVERSE WEATHER ... 245
29.4 REDUCTION IN AVAILABLE SEA ROOM FOR DEFENCE ACTIVITIES ... 245
29.5 INCREASE IN FISHING ACTIVITIES ASSOCIATED WITH THE AGGREGATION OF FISHING AROUND STRUCTURES ... 246
29.6 INCREASING OR DIMINISHING EMERGENCY RESPONSE. ... 246

30. COST BENEFIT ANALYSIS ... 248

31. THROUGH LIFE SAFETY MANAGEMENT ... 249

31.1 SAFETY POLICY AND SAFETY MANAGEMENT SYSTEMS (SMS) ... 249
31.2 INCIDENT REPORTING ... 249
31.3 REVIEW OF DOCUMENTATION ... 249
31.4 INSPECTION OF RESOURCES ... 250
31.5 AUDIT PERFORMANCE ... 250
31.6 FUTURE MONITORING ... 250
31.7 FUTURE MONITORING OF MARINE TRAFFIC ... 250
31.8 DECOMMISSIONING PLAN ... 250

32. SUMMARY ... 251

32.1 CONSULTATION ... 251

32.2 MARINE TRAFFIC 251
32.3 COLLISION RISK MODELLING 252
32.4 FORMAL SAFETY ASSESSMENT 253
32.5 MITIGATION MEASURES 253

33. CONCLUSION 254

34. NEXT STEPS - IMPACT ASSESSMENT FOR EIA 255

34.1 ASSESSMENT METHODOLOGY 255
34.2 HAZARD WORKSHOP 255
34.3 FORMAL SAFETY ASSESSMENT PROCESS 256
34.4 IMPACT ASSESSMENT 256
34.5 IDENTIFICATION OF RECEPTORS 257

35. REFERENCES 258

APPENDICES

APPENDIX A ..... REGULAR OPERATOR CONSULTATION
APPENDIX B ..... CONSEQUENCES ASSESSMENT
APPENDIX C ..... HAZARD LOG
APPENDIX D ..... MGN 371 CHECKLIST

Table of Figures

Figure 4.1 Formal Safety Assessment Process 20
Figure 4.2 Overview of Methodology for Navigational Assessment 22
Figure 4.3 Round 3 Zones in Southern North Sea Offshore Wind Forum (SNSOWF) 23
Figure 8.1 Survey Vessel AIS Tracks (28 Days Autumn / Winter 2011 / 2012) 30
Figure 8.2 Survey Vessel AIS Tracks (14 Days Spring / Summer 2012) 31
Figure 8.3 Survey Vessel AIS Tracks (14 Days Spring 2013) 32
Figure 10.1 Chart Overview of Dogger Bank Teesside A & B 34
Figure 10.2 Worst Case Layout 37
Figure 10.3 Multileg 1 Foundation Type 38
Figure 10.4 Example Collector Station 39
Figure 10.5 Example Convertor Station 39
Figure 10.6 Overview of Export Cable Route 40
Figure 10.7 Example Mooring Buoys 41
Figure 11.1 Baseline Environment in Proximity to Dogger Bank Teesside A & B and Export Cable Route Corridor 43
Figure 11.2 Ports in Proximity to Dogger Bank Teesside A & B 44
Figure 11.3 Aids to Navigation 45
Figure 11.4 Oil and Gas Infrastructure 46
Figure 11.5 Cavendish, Munro, Tyne and Katy Platforms 47
Figure 11.6 Location of Well Associated with the Proposed Cygnus Platform 48

Figure 11.7 Application Dredge Region and BMAPA Proposed Transit Routes 49
Figure 11.8 Other Offshore Wind Farm Developments within UK REZ 50
Figure 11.9 MEHRAs... 51
Figure 11.10 Tees MEHRA.. 52
Figure 11.11 Wrecks 53
Figure 12.1 Annual Wind Direction Distribution 54
Figure 12.2 Location of South West Patch.. 55
Figure 12.3 Tidal Diamond Information 57
Figure 13.1 SAR Helicopter bases relative to Dogger Bank Teesside A & B 60
Figure 13.2 Future SAR Helicopter bases relative to Dogger Bank Teesside A & B......... 61
Figure 13.3 RNLI Bases relative to Dogger Bank Teesside A & B................................... 64
Figure 14.1 MAIB Incidents by Type within 10nm of Dogger Bank Teesside A & B 68
Figure 14.2 MAIB Incidents (2002-2011) by Type within 5nm of Export Cable Corridor 69
Figure 14.3 Distribution of MAIB Incidents (2002-2011) by Type within 5nm of Export Cable Corridor 70
Figure 14.4 MAIB Incidents by Year within 5nm of Export Cable Corridor 71
Figure 14.5 RNLI Incidents (2001-2010) by Casualty Type within 5nm of Export Cable Corridor 72
Figure 14.6 Distribution of RNLI Incidents (2001-2010) by Casualty Type within 5nm of Export Cable Corridor.. 73
Figure 14.7 RNLI Incidents (2001-2010) by Cause within 5nm of Export Cable Corridor 74
Figure 14.8 Distribution of RNLI Incidents (2001-2010) by Cause within 5nm of Export Cable Corridor 75
Figure 14.9 RNLI Incidents by Year within 5nm of Export Cable Corridor 76
Figure 14.10 RNLI Incidents by Station within 5nm of Export Cable Corridor............... 77
Figure 16.1 Figure in Regular Operator Consultation Letter March 2013.......................... 90
Figure 18.1 AIS and Radar Data of All Tracks (28 Days Winter 2011 / 2012)................. 96
Figure 18.2 AIS and Radar Data of All Tracks (14 Days Spring / Summer 2012)............ 97
Figure 18.3 AIS and Radar Data Excluding Temporary Traffic (28 Days Winter 2011 / 2012) 98
Figure 18.4 AIS and Radar Data Excluding Temporary Traffic (14 Days Spring / Summer 2012) 99
Figure 18.5 Number of Unique Vessels Per Day (28 Days Winter 2011 / 2012) 100
Figure 18.6 Number of Unique Vessels Per Day (14 Days Spring / Summer 2012)........ 100
Figure 18.7 Busiest Day Winter 2011 – 11th November 2011 101
Figure 18.8 Busiest Day Summer 2012 – 06th June 2012 102
Figure 18.9 Unique Fishing Vessels per Day (28 Days Winter 2011 / 2012)................... 103
Figure 18.10 Unique Fishing Vessels per Day (14 Days Spring / Summer 2012).......... 103
Figure 18.11 Fishing Vessels Busiest Day – 11th November 2011 104
Figure 18.12 Vessel Types Within 10nm Buffer (28 Days Winter 2011 / 2012) 105
Figure 18.13 Vessel Types Within 10nm Buffer (14 Days Spring / Summer 2012) 106
Figure 18.14 Cargo Vessels (28 Days Winter 2011 / 2012) 107
Figure 18.15 Cargo Vessels (14 Days Spring / Summer 2012) 108
Figure 18.16 Fishing Vessels (28 Days Winter 2011 / 2012) 109
Figure 18.17 Fishing Vessels (14 Days Spring / Summer 2012) 110

Figure 18.18 Tankers (28 Days Winter 2011 / 2012) 111
Figure 18.19 Tankers (14 Days Spring / Summer 2012) 112
Figure 18.20 AIS and Radar Data of All Tracks (14 Days Spring 2013) 113
Figure 18.21 Detailed overview of AIS and Radar Data of All Tracks (14 Days Spring 2013) 114
Figure 18.22 AIS and Radar Data Excluding Temporary Traffic (14 Days Spring 2013) 114
Figure 18.23 Detailed overview of AIS and Radar Data Excluding Temporary Traffic (14 Days Spring 2013) 115
Figure 18.24 Number of Unique Vessels per Day (14 Days Spring 2013) 116
Figure 18.25 Joint Busiest Day Spring 2013 – 23rd April 2013 117
Figure 18.26 Unique Fishing Vessels per Day (14 Days Spring 2013) 118
Figure 18.27 Fishing Vessels Busiest Day – 23rd April 2013 119
Figure 18.28 Vessel Types Within 10nm Buffer (14 Days Spring 2013) 120
Figure 18.29 Fishing Vessels (14 Days Spring 2013) 120
Figure 18.30 Cargo Vessels (14 Days Spring 2013) 121
Figure 18.31 Tankers (14 Days Spring 2013) 121
Figure 18.32 Illustration of Route Calculation 122
Figure 18.33 Main Routes and 90th Percentile Lanes in Proximity to Dogger Bank Zone 123
Figure 18.34 Main Routes 124
Figure 18.35 90th Percentile Lanes 125
Figure 18.36 16 Weeks (November 2011 – June 2012) AIS Data thematically mapped by Vessel Type. 127
Figure 18.37 Dogger Bank Zone Vessel Density Grid 128
Figure 18.38 Dogger Bank Zone Main Commercial Vessel Routes 128
Figure 18.39 Recreational Vessels (14 Days Spring / Summer 2012) 130
Figure 18.40 RYA Cruising Routes and Facilities 131
Figure 18.41 Route for North Sea Triangle Challenge 132
Figure 18.42 Recreational Vessels taking part in North Sea Triangle Challenge 132
Figure 18.43 Fishing Vessels (56 Days) 134
Figure 18.44 Fishing Vessels During Sand Eel Fishing Season 135
Figure 18.45 Fishing Vessel Density (from Satellite Data 2009) 136
Figure 18.46 Nationality Distribution (from Satellite Data 2009) 137
Figure 19.1 All Vessels within 5nm of Export Cable Corridor (7 Days June 2011) 139
Figure 19.2 All Vessels within 5nm of Export Cable Corridor (7 Days June 2012) 140
Figure 19.3 All Vessels within 5nm of Export Cable Corridor excluding Temporary Traffic (7 Days June 2011) 141
Figure 19.4 All Vessels within 5nm of Export Cable Corridor excluding Temporary Traffic (7 Days in June 2012) 142
Figure 19.5 Unique Vessels per Day (14 Days Summer 2011 and Summer 2012) 143
Figure 19.6 Vessel Types Within 5nm of Export Cable Corridor (14 Days Summer 2011 and Summer 2012) 143
Figure 19.7 Cargo Vessels (14 Days Summer 2011 and Summer 2012) 144
Figure 19.8 Tankers (14 Days Summer 2011 and Summer 2012) 145

Figure 19.9 Vessel Draught (14 Days Summer 2011 and Summer 2012) 146
Figure 19.10 Large Scale plot of Vessel Draught (14 Days Summer 2011 and Summer 2012) 147
Figure 19.11 Anchored Vessels within 5nm of Export Cable Corridor (7 Days Spring 2013) 148
Figure 19.12 Detailed Plot of Anchored Vessels (7 Day Spring 2013) 149
Figure 19.13 Duration at Anchor (hours) 150
Figure 19.14 Anchored Vessel Types Within 5nm of Export Cable Corridor (7 days Spring 2013) 151
Figure 19.15 Daily Count of Anchored Vessels 151
Figure 19.16 Closest Point of Approach Analysis 152
Figure 19.17 Size Distribution of Anchoring Vessels 153
Figure 19.18 RYA Cruising Routes and Facilities in proximity to Export Cable Corridor 154
Figure 19.19 Fishing Vessels (14 Days Summer 2011 and 2012) AIS & Radar Data ... 155
Figure 19.20 Fishing Vessel Density (from Satellite Data 2009) 156
Figure 19.21 Nationality Distribution (from Satellite Data 2009) 157
Figure 19.22 Gear Type Distribution (from Satellite Data 2009) 158
Figure 20.1 Sample Jack Up Barge 159
Figure 20.2 Sample Crew Transfer/ Maintenance Wind Cat 159
Figure 21.1 Alternative Routes for Dogger Bank Teesside A 163
Figure 21.2 Alternative Routes for Dogger Bank Teesside B 164
Figure 21.3 Alternative Routes for Dogger Bank Teesside A & B 165
Figure 22.1 Vessel encounters within 10nm of Dogger Bank Teesside A 168
Figure 22.2 Number of Encounters per Day within 10nm of Dogger Bank Teesside A .. 168
Figure 22.3 Vessel Types involved in Encounters within 10nm of Dogger Bank Teesside A 169
Figure 22.4 Vessel encounters within 10nm of Dogger Bank Teesside B 170
Figure 22.5 Number of Encounters per Day within 10nm of Dogger Bank Teesside B... 170
Figure 22.6 Vessel Types involved in Encounters within 10nm of Dogger Bank Teesside B 171
Figure 22.7 Vessel encounters within 10nm of Dogger Bank Teesside A & B 172
Figure 22.8 Number of Encounters per Day within 10nm of Dogger Bank Teesside B... 172
Figure 22.9 Vessel Types involved in Encounters within 10nm of Dogger Bank Teesside B 173
Figure 22.10 Annual Passing Powered Allision Frequency for Dogger Bank Teesside A 176
Figure 22.11 Annual Passing Powered Allision Frequency for Dogger Bank Teesside B 177
Figure 22.12 Annual Passing Powered Allision Frequency for Dogger Bank Teesside A & B 178
Figure 22.13 Air draught data – IRC fleet (data collected from 2009-2011) (RYA, 2012) 181
Figure 23.1 Example of Bottom (Otter) Trawl Gear (FAO, 2012) 186
Figure 23.2 Beam Trawl Gear (FAO, 2012) 186

Figure 23.3 Overview of Cable Risk Ranking for 5nm around Export Cable Corridor ... 189
Figure 24.1 Risk Ranking Results ... 192
Figure 25.1 Sample Marking of a Wind Farm ... 200
Figure 28.1 Dogger Bank Teesside A Deviated Main Routes and Passing Distances ... 214
Figure 28.2 Dogger Bank Teesside B Deviated Main Routes and Passing Distances ... 215
Figure 28.3 Radar Image Showing Small Craft Tracked Within Kentish Flats (BWEA, 2007) 218
Figure 29.1 Cumulative Scenario – Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B ... 220
Figure 29.2 Cumulative Scenario – Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B Worst Case Layout. ... 221
Figure 29.3 Cumulative Scenario – Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B and Dogger Bank Teesside C & D. ... 222
Figure 29.4 Cumulative Scenario – Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B and Dogger Bank Teesside C & D Worst Case Layout. ... 223
Figure 29.5 Alternative Routes for Cumulative Scenario – Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B ... 224
Figure 29.6 Alternative Routes for Cumulative Scenario – Dogger Bank Creyke Beck A & B and Dogger Bank Teesside A, B, C & D ... 226
Figure 29.7 Annual Passing Powered Allision Frequency for Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B ... 228
Figure 29.8 Annual Passing Powered Allision Frequency for Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B and Dogger Bank Teesside C & D. ... 229
Figure 29.9 Overview of wind farm developments including Round 3 Zones and German Shipping Priority Lanes (Anatec, 2013) ... 231
Figure 29.10 Overview of wind farm developments (including Round 3 Zones) colour-coded by development phase (Anatec, 2013) ... 232
Figure 29.11 Existing Routeing within the Southern North Sea (Anatec, 2013) ... 233
Figure 29.12 Existing Routeing within the Southern North Sea (Dogger Bank Zone Overview) (Anatec, 2013) ... 234
Figure 29.13 Deviated Routeing with Consideration for the SNSOWF Projects (Anatec, 2013) 235
Figure 29.14 Deviated Routeing with Consideration for the SNSOWF Projects (Dogger Bank Zone Overview) (Anatec, 2013) ... 236
Figure 29.15 Aggregate Areas Relative to the Dogger Bank Development Zone (Anatec, 2013) 237
Figure 29.16 Oil and Gas Pipelines in proximity to the Dogger Bank Zone (Anatec, 2013) 238
Figure 29.17 Oil and Gas Platforms in proximity to the Dogger Bank Zone (Anatec, 2013) 239
Figure 29.18 Oil and Gas Wells in proximity to the Dogger Bank Zone (Anatec, 2013) 240
Figure 29.19 Conditional Award Licence Blocks in proximity to the Dogger Bank Zone (Anatec, 2013) 241

Figure 29.20 Changes in Anticipated Re-routeing of Shipping Routes in Vicinity of the Dogger Bank Zone: Comparison of 2011 and 2013 90th Percentile Lines. (Anatec, 2013) .. 242
Figure 29.21 Defence Activities Relative to Dogger Bank 244
Figure 29.22 Defence Activities Relative to Dogger Bank 246
Figure 29.23 Dogger Bank Zone Distance from Shore 247

Table of Tables

Table 5.1 Regular Operators 25
Table 10.1 Corner Co-ordinates of Dogger Bank Teesside A & B (WGS 84 UTM 31N) 35
Table 10.2 Wind Turbine Measurements 38
Table 10.3 Structure Dimensions and Numbers 40
Table 10.4 Mooring Buoy Dimensions 41
Table 12.1 Tidal Information for Location 54.87° N, 01.79° E 56
Table 12.2 Tidal Diamond "T" 57
Table 13.1 RNLI Lifeboat Stations in Proximity to Dogger Bank Teesside A & B 64
Table 15.1 Stakeholder Consultation Responses 78
Table 16.1 Regular Operator Consultation Responses 91
Table 17.1 European Shipping Association Consultation Responses 93
Table 18.1 Description of Main Routes 125
Table 19.1 Anchored Vessel Details (7 Days Spring 2013) 149
Table 19.2 Size Classes and DWT 152
Table 21.1 Route Deviations Dogger Bank Teesside A 163
Table 21.2 Route Deviations Dogger Bank Teesside B 164
Table 21.3 Route Deviations Dogger Bank Teesside A & B 165
Table 22.1 Vessel-to-Vessel Collisions – Without Wind Farm Developments (Base Case) 174
Table 22.2 Vessel-to-Vessel Collisions - With Wind Farm Developments (Base Case) 174
Table 22.3 Powered Vessel-to-Structure Allisions - With Wind Farm Developments (Base Case) 175
Table 22.4 NUC Vessel-to-Structure Allisions - With Wind Farm Developments (Base Case) 179
Table 22.5 Fishing Vessel Allisions - With Wind Farm Developments (Base Case) 180
Table 22.6 Summary of Results: Annual Risk - Dogger Bank Teesside A 182
Table 22.7 Summary of Results: Annual Risk - Dogger Bank Teesside B 182
Table 22.8 Summary of Results: Annual Risk - Dogger Bank Teesside A & B 183
Table 22.9 Annual predicted change in Potential Loss of life (PLL) due to Dogger Bank Teesside A & B 183
Table 22.10 Annual predicted oil spilled due to Dogger Bank Teesside A & B 184
Table 24.1 Hazard Workshop Invitees 190
Table 25.1 Industry Standard Mitigations 193
Table 25.2 Navigational Lighting Requirements for Structures 198
Table 25.3 OREI Design Specifications (from MGN 371) 202

Table 26.1 Additional Mitigation Measures 205
Table 29.1 Increase in Route Distances for Cumulative Scenario 224
Table 29.2 Increase in Route Distances for Cumulative Scenario 226
Table 29.3 Vessel-to-Vessel Collisions (commercial vessels only) – Dogger Bank Teesside A & B 227
Table 29.4 Vessel-to-Vessel Collisions - Cumulative 227
Table 29.5 Powered Vessel-to-Structure Allisions - Cumulative 227
Table 29.6 NUC Vessel-to-Structure Allisions – Cumulative 229
Table 29.7 Existing Vessel Routeing in proximity to Dogger Bank Zone. 234

Abbreviations

ABP	-	Associated British Ports
AIS	-	Automatic Identification System
ALARP	-	As Low as Reasonably Practicable
ALB	-	All-Weather Lifeboat
ARPA	-	Automatic Radar Plotting Aid
ASMS	-	Active Safety Management System
AtoN	-	Aid to Navigation
BERR	-	Department for Business Enterprise & Regulatory Reform
BIS	-	UK Department for Business, Innovation and Skills
BMAPA	-	British Marine Aggregates Producers Association
BWEA	-	British Wind Energy Association (now RenewableUK)
CA	-	Cruising Association
CAA	-	Civil Aviation Authority
CAST	-	Coastguard Agreement on Salvage and Towage
CBA	-	Cost Benefit Analysis
CNIS	-	Channel Navigation Information Service
COLREGS	-	International Regulations for Preventing Collisions at Sea
CoS	-	Chamber of Shipping
CPA	-	Closest Point of Approach
CRT	-	Coastguard Rescue Teams
DECC	-	Department of Energy and Climate Change
DfT	-	Department for Transport
DSA	-	Danish Shipowners' Association
DSC	-	Digital Selective Calling
DTI	-	Department of Trade and Industry
EIA	-	Environmental Impact Assessment
EMF	-	Electromagnetic Field
ERCoP	-	Emergency Response Cooperation Plan
ES	-	Environmental Statement
EU	-	European Union
FAO	-	Food and Agricultural Organization of the United Nations
FSA	-	Formal Safety Assessment
GCAF	-	Gross Cost of Averting a Fatality

GIS	-	Geographical Information System
GPS	-	Global Positioning System
GRP	-	Glass Reinforced Plastic
GRT	-	Gross Registered Tonnes
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
ILB	-	Inshore Lifeboat
IMO	-	International Maritime Organisation
IPC	-	Infrastructure Planning Commission
ITOPF	-	International Tanker Owners Pollution Federation Limited
km	-	Kilometre
LAT	-	Lowest Astronomical Tide
LORAN	-	Long Range Navigation
m	-	Metre
MAIB	-	Marine Accident Investigation Branch
MCA	-	Maritime and Coastguard Agency
MEHRA	-	Marine Environmental High Risk Area
MGN	-	Marine Guidance Notice
MHWS	-	Mean High Water Springs
MLWS	-	Mean Low Water Springs
MMO	-	Marine Management Organisation
MOC	-	Maritime Operations Centre
MOD	-	Ministry of Defence
MRCC	-	Maritime Rescue Co-ordination Centre
MRSC	-	Maritime Rescue Sub-Centre
MSI	-	Maritime Safety Information
MSL	-	Mean Sea Level
MW	-	Mega-Watt
nm	-	Nautical Miles
NFFO	-	National Federation of Fishermen's Organisations
NOREL	-	Nautical and Offshore Renewable Energy Liaison
NRA	-	Navigation Risk Assessment
NUC	-	Not Under Command
O&M	-	Operation and Maintenance
OREI	-	Offshore Renewable Energy Installations
PEXA	-	Practice and Exercise Area
PLA	-	Port of London Authority
PLL	-	Potential Loss of Life
QHSE	-	Quality, Health, Security and Environment
RAF	-	Royal Air Force

REWS	-	Radar Early Warning System
REZ	-	Renewable Energy Zones
RNLI	-	Royal National Lifeboat Institution
RUK	-	Renewable UK
RYA	-	Royal Yachting Association
SAR	-	Search and Rescue
SEAL	-	Shearwater Elgin Area Line
SMS	-	Safety Management System
SPS	-	Significant Peripheral Structure
SNSOWF	-	Southern North Sea Offshore Wind Forum
TCE	-	The Crown Estate
THLS	-	Trinity House Lighthouse Service
UHF	-	Ultra High Frequency
UK	-	United Kingdom
UKCS	-	United Kingdom Continental Shelf
UKHO	-	United Kingdom Hydrographic Office
VHF	-	Very High Frequency
VTS	-	Vessel Traffic Services
ZAP	-	Zone Appraisal and Planning

Glossary

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.
Emergency Response Facilities	Emergency response includes search and rescue, dealing with medical emergencies and pollution clean-up and control.
Flotel	A portmanteau of the terms floating hotel, refers to the installation of living quarters on top of rafts or semi-submersible platforms.
Marine Environmental High Risk Area	Areas in UK coastal waters where ships' masters are advised of the need to exercise more caution than usual i.e. crossing areas of high environmental sensitivity where there is a risk of pollution from merchant shipping.
Marine Guidance Note	A system of guidance notes issued by the Maritime and Coastguard Agency which provide advice relating to the improvement of the safety of shipping and of life at sea, and to prevent or minimise pollution from shipping.

Mitigation	Actions which may include process or design to avoid/reduce/remedy or compensate for adverse impacts of a development. Avoids or reduces an effect.
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.
Precautionary Area	An International Maritime Organisation term where a ship is advised to navigate with particular caution.
Offshore Renewable Energy Infrastructure (OREI)	*Offshore Renewable Energy Installations (OREIs) as defined by Guidance on UK Navigational Practice, Safety and Emergency Response Issues,* Marine Guidance Note (MGN) 371. For the purpose of this report and in keeping with the consistency of the Environmental Impact Assessment, OREI can mean offshore wind turbines and the associated electrical infrastructures such as offshore collector stations, offshore converter stations, inter-array and export cables and offshore reactive stations.
Radar	Radio Detection And Ranging - an object-detection system which uses radio waves to determine the range, altitude, direction, or speed of objects.
Radar Early Warning	Radar early warning is a system used primarily for the long-range detection of approaching objects.
Receptor	An individual, habitat or feature (e.g. ferry operator) receiving (or exposed to) an effect.
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.
Sensitivity	The extent to which a study subject can accept a change of a particular type and scale without unacceptable adverse effects.
Temporary	Not a permanent receptor with the base line data as they are associated with short offshore activities.
Single Point Mooring Buoy	Steel or plastic floating buoy, permanently moored to the seabed using a variety of mooring solutions.

1. Executive Summary

Using regulator guidance, this Navigational Risk Assessment (NRA) identifies and analyses both the base case and future case risk associated with the development of Dogger Bank Teesside A & B. Analysis and collision risk modelling was undertaken based on three scenarios as follows: Dogger Bank Teesside A in isolation, Dogger Bank Teesside B in isolation and Dogger Bank Teesside A & B together.

The NRA includes an assessment of existing navigational features including metocean data, maritime incidents and a marine traffic survey (AIS and Radar) to identify the baseline environment. The elements of the Rochdale Envelope have then been assessed against the base case to identify areas or activities that may see a change in risk following development of Dogger Bank Teesside A & B.

Consultation was undertaken with stakeholders, regular operators identified from the marine traffic survey and European Shipping Associations. In order to address the cumulative issue in the Southern North Sea, Forewind joined Hornsea and East Anglia developers in forming the Southern North Sea Offshore Wind Forum (SNSOWF) and further consultations were undertaken as part of this work.

The marine traffic survey identified seven main routes operating within a 10 nautical mile (nm) buffer around Dogger Bank Teesside A & B with the majority of vessel types transiting on these routes being tankers and cargo vessels. Fishing activity was recorded across much of the sites with a high density of vessels to the north of Dogger Bank Teesside B. The level of recreational vessel activity was noted as being very low.

Deviations for the main routes were identified where required. The maximum time increases calculated for each of the scenarios were as follows:

- Dogger Bank Teesside A – maximum of 14.5 minute increase or 0.75%
- Dogger Bank Teesside B – maximum of 14.5 minute increase or 0.52%
- Dogger Bank Teesside A & B – maximum of 14.5 minute increase or 0.75%

For Dogger Bank Teesside A the collision risk modelling showed an increase of 23.41% (1 every 2435 years) for vessel to vessel collisions and an additional vessel to structure allision risk of 1 every 692 years. For Dogger Bank Teesside B the collision risk modelling showed an increase of 78.31% (1 every 1420 years) for vessel to vessel collisions and an additional vessel to structure allision risk of 1 every 2728 years. For Dogger Bank Teesside A & B the collision risk modelling showed an increase of 29.07% (1 every 1074 years) for vessel to vessel collisions and an additional vessel to structure allision risk of 1 every 636 years. This report identifies mitigations which will enable these risks to be brought within ALARP (As Low As Reasonably Practicable) regions.

Collision risk was also addressed as part of the Hazard Workshop which included stakeholders and regulators assessing navigational hazards that would be associated with the construction, operation, maintenance and decommissioning of Dogger Bank Teesside A & B. For the most likely consequences identified at the workshop, 23 of the risks were broadly acceptable and 13 were in the tolerable region. When the worst case consequences were assessed, there were 36 risks which were tolerable. Using mitigations, all risks could be brought within ALARP principles.

In line with MGN 371, impacts on navigation, collision risk and communication were identified and assessed in line with principles laid out in the Formal Safety Assessment and were found to be within tolerable regions.

Mitigation and safety measures have been identified as suitable for application within the Dogger Bank Teesside A & B and export cable route developments appropriate to the level and type of risk that will be determined within the Environmental Impact Assessment (EIA). The specific measures to be employed will be selected in consultation with the Maritime and Coastguard Agency (MCA) Navigation Safety Branch and other relevant statutory stakeholders where required.

From this assessment, it is noted that additional navigational risk associated with the development of Dogger Bank Teesside A & B and the export cable route can be brought within ALARP regions following additional consultation and refinement of the Rochdale Envelope.

2. Introduction

2.1 *Background*

Anatec was commissioned by Forewind to undertake a Navigational Risk Assessment (NRA) for the proposed Dogger Bank Teesside A & B offshore wind farm and Export Cable Corridor, which are being developed as the single project within the Round Three Zone 3 – Dogger Bank.

This report presents information on the development relative to the existing and future case navigational activity for the proposed Dogger Bank Teesside Developments and forms part of the EIA.

2.2 *Navigational Risk Assessment Purpose*

An EIA is a process which identifies the environmental affects, both negative and positive, in accordance with EU Directives. A key requirement of the EIA is the Navigational Risk Assessment. Following the Department of Energy and Climate Change (DECC) Methodology and MGN 371, an NRA for the Project Design Statement has been undertaken and includes:

- Overview of base case environment;
- Marine Traffic Survey;
- Implications of Offshore Renewable Energy Installations (OREIs);
- Assessment of navigational risk pre and post development of the proposed Dogger Bank Teesside A & B developments;
- Formal Safety Assessment (FSA);
- Implications on marine navigation and communication equipment;
- Identification of mitigation measures;
- Search and Rescue (SAR) planning; and
- Through life safety management.

Assessments will be reviewed by phase:

- Construction;
- Operation and maintenance; and
- Decommissioning.

The assessment is based on a Project Design Statement defined by Forewind and assessed against worst case parameters relevant to impacts for shipping and navigation.

3. Guidance and Legislation

3.1 *Primary Guidance*

The primary guidance documents used during the assessment are listed below:

- Maritime and Coastguard Agency (MCA) Marine Guidance Notice 371 (MGN 371 Merchant + Fishing) Offshore Renewable Energy Installations (OREIs) Guidance on UK Navigational Practice, Safety and Emergency Response Issues (MCA 2008a);
- Department of Energy and Climate Change (DECC 2005). in Association with MCA Guidance on the Assessment of Offshore Wind Farms - Methodology for Assessing Marine Navigational Safety Risks of Offshore Wind Farms (2005); and
- Guidelines for Formal Safety Assessment (FSA) – MSC/Circ. 1023 (IMO 2002).

MGN 371 highlights issues to be taken into consideration when assessing the effect on navigational safety from offshore renewable energy developments, proposed within United Kingdom internal waters, territorial sea or Renewable Energy Zones (REZ).

The MCA require that the DECC methodology is used as an overview template for preparing navigation risk assessments. It is centred on risk management and requires a submission that shows that sufficient controls are, or will be, in place for the assessed risk (base case and future case) to be judged as broadly acceptable or tolerable. It is noted that the Methodology was developed in 2005 and the structure of NRAs has developed to allow comparison and integration with Environment Impact Assessments.

3.2 *Other Guidance*

Other guidance documents used during the assessment are listed below:

- MCA Marine Guidance Notice 372 (MGN 372 M+F) Offshore Renewable Energy Installations (OREIs) Guidance to Mariners Operating in the Vicinity of UK OREIs (MCA 2008b);
- International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) – 0139 the Marking of Man-Made Offshore Structures, Edition 1 IALA (2008);
- Royal Yachting Association (RYA) – The RYA's Position on Offshore Renewable Energy Developments: Paper 1 – Wind Energy (RYA 2012);
- DECC Standard Marking Schedule for Offshore Installations (2011); and
  The Recreational Craft Directives 94/25/EC and 2003/44/EC - implemented into UK law by the Recreational Craft Regulations 2004 (SI No. 2004/1464), apply to recreational craft and are intended to ensure the free movement of goods on the EEA market.

4. Formal Safety Assessment Process

The International Maritime Organization (IMO) Formal Safety Assessment process (IMO 2002) approved by the IMO in 2002 under SC/Circ.1023/MEPC/Circ392 has been applied within this study. This is a structured and systematic methodology based on risk analysis and cost benefit analysis (if applicable).

There are five basic steps within this process:

1. Identification of hazards (a list of all relevant accident scenarios with potential causes and outcomes);
2. Assessment of risks (evaluation of risk factors);
3. Risk control options (devising regulatory measures to control and reduce the identified risks);
4. Cost benefit analysis (determining cost effectiveness of risk control measures); and
5. Recommendations for decision-making (information about the hazards, their associated risks and the cost effectiveness of alternative risk control measures).

Figure 4.1 is a flow diagram of the FSA methodology applied.

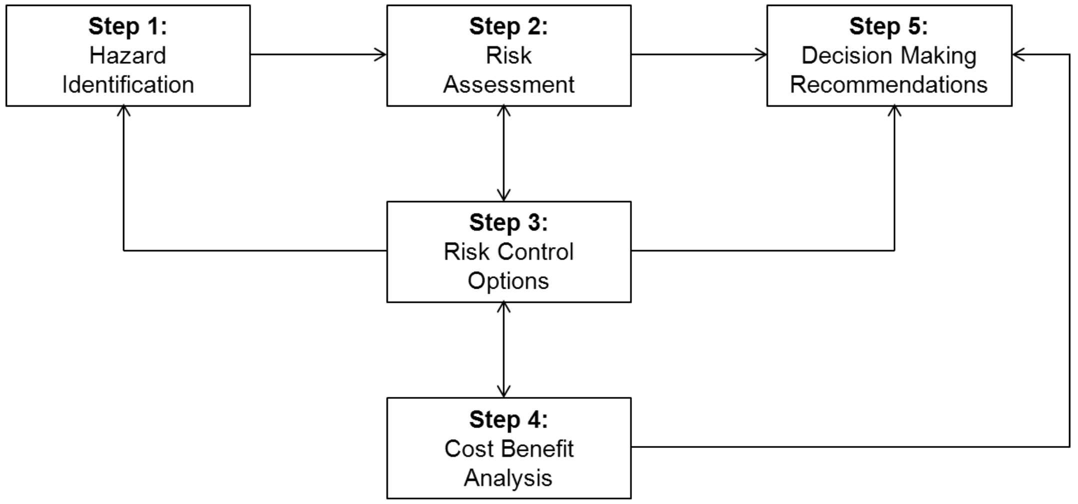

Figure 4.1 Formal Safety Assessment Process

The impact assessment uses information within the baseline assessment to assess impacts as per the Formal Safety Assessment process.

- Hazard log and risk ranking;
- Quantified navigational risk assessment for selected hazards;
- Base case and future case risk levels assessed for selected hazards;

- Emergency response review; and
- Assessment of mitigation measures.

The main part of the impact assessment covers the potential impacts to commercial vessels, fishing vessels and recreational vessels from the construction/installation and presence of the proposed offshore wind farm and associated infrastructure including the offshore export cable. The impacts on emergency response, marine radar systems and navigational equipment are assessed for the operational phase only.

4.1 *Flow Chart for NRA Methodology*

Figure 4.2 shows an overview of the NRA methodology which was used in this study.

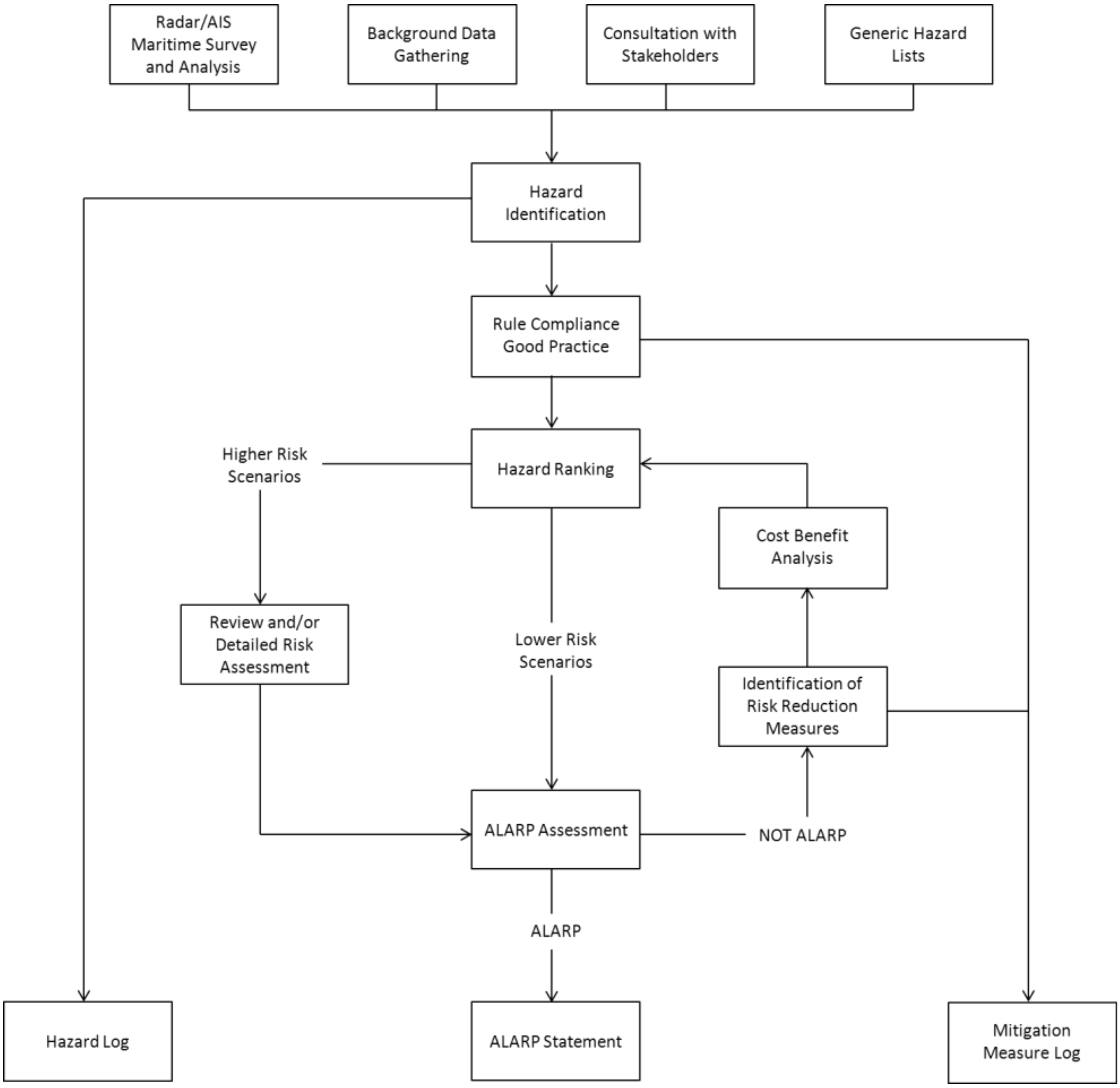

Figure 4.2 Overview of Methodology for Navigational Assessment

4.2 *Methodology for Cumulative Assessment*

The assessment of cumulative effects includes considering the impacts arising from multiple offshore wind farm development activities within the southern North Sea. Forewind has developed and implemented a comprehensive Cumulative Impact Assessment (CIA) strategy for the Dogger Bank Zone. Traditionally CIAs have been undertaken with a 'building block' approach, however it became clear to Forewind that while this approach would allow for an assessment to be undertaken on the basis of known information and data, there were concerns raised by the Planning Inspectorate (formerly Infrastructure Planning Commission) that the approach would not adequately consider the whole development potential of the Zone and the Round 3 plan in general. Forewind has, therefore, sought advice from various sources and developed its own CIA Strategy.

In its simplest form the strategy involves consideration of:

- Whether impacts on a receptor can occur on a cumulative basis between the wind farm project(s) subject to the application(s) and other wind farm projects, activities and plans in the Dogger Bank Zone (either consented or forthcoming);
- Whether impacts on a receptor can occur on a cumulative basis with other activities, projects and plans out with the Dogger Bank Zone (e.g. other offshore wind farm developments), for which sufficient information regarding location and scale exist.

The strategy recognises that data and information sufficient to undertake an assessment will not be available for all potential projects, activities, plans and/or parameters, and seeks to establish the 'confidence' we can have in the data and information available.

Mitigation is also to be considered at the project level to remove, or reduce to an acceptable level, the impacts that occur within the Zone.

4.3 *Offshore Renewable Energy Installations – Southern North Sea Offshore Wind Forum*

Due to the potential for wide spread cumulative impacts relevant to shipping and navigation issues, these were assessed by the Southern North Sea Offshore Wind Forum (SNSOWF), a group made up of representatives from the three Round 3 Zones in the Southern North Sea (Dogger Bank, Hornsea and East Anglia). It has been recognised that due to the scale and location of Round 3 Zones in the southern North Sea (Dogger Bank, Hornsea and East Anglia), coordination is required between zones in order for developers of these zones to successfully undertake their respective Zone Appraisal and Planning (ZAP) process. Therefore, the three zones established the SNSOWF to extend the principles of ZAP beyond the boundaries of their respective zones to help manage wider cumulative effects between these zones. The three zones are presented in Figure 4.3. An overview of this work is detailed in Section 29 of the NRA and includes both revisions of the SNSOWF report undertaken in 2011 and 2013.

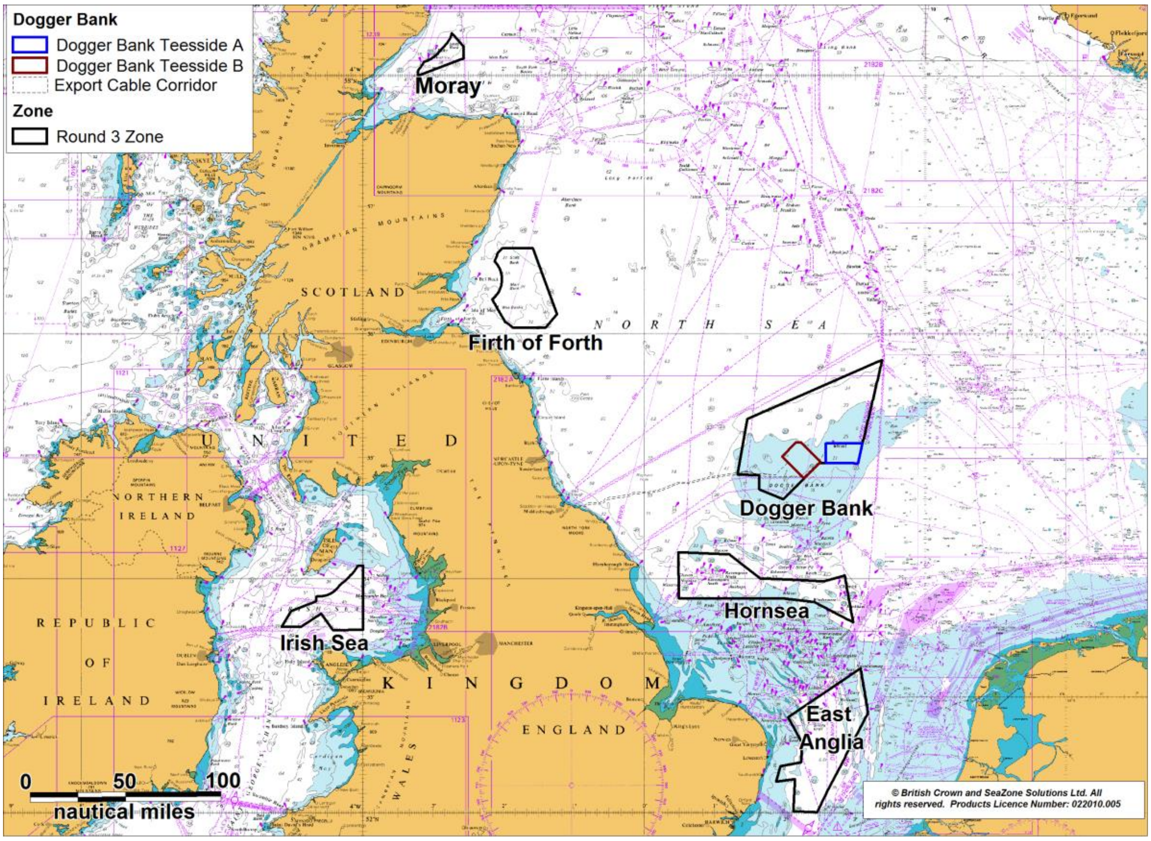

Figure 4.3 Round 3 Zones in Southern North Sea Offshore Wind Forum (SNSOWF)

The impact of Dogger Bank Teesside A, B and the export cable route was considered with other existing and proposed offshore users in the vicinity which have the potential to impact on commercial shipping.

The following methods have been used to assess these effects identified as part of the baseline study:

- Stakeholder consultation and expert opinion;
- Lessons learnt;
- Desk top study;
- Collision risk modelling; and
- Regular operator feedback.

4.4 *Assumptions*

The shipping and navigation baseline and impact assessment has been carried out based on the information available and responses received at the time of preparation. It is assumed that any notable changes will be re-assessed and re-modeled if required.

5. Consultation

5.1 *Equity to Stakeholders*

There are a variety of stakeholder types:

- **Risk Imposer** is whose actions or policies result in risk and need action;
- **Risk Taker** is whose action or inaction results in a risk;
- **Risk Beneficiary** benefits from imposing or taking the risk;
- **Risk Payer** pays for the management of the risk;
- **Risk Sufferer** suffers the consequence of a risk; and
- **Risk Observer** is aware of the risk but it does not affect them directly.

In order to ensure that all stakeholders and their relevant equities were included within the NRA process, a review of the stakeholders' types was undertaken in line with the baseline study. Stakeholders have been represented by organisations which have different roles including:

- Proposers who are proposing the development;
- Approvers who are responsible for giving a development its consent;
- Advisors who are formally consulted by the approvers;
- Commentators who are not formally consulted by the approvers but who may provide input to them; and
- Observers.

5.2 *Stakeholders consulted as part of NRA process*

As well as the hazard workshop the following key marine and navigational stakeholders have been consulted as part of the navigational risk assessment:

- Maritime and Coastguard Agency (MCA);
- Trinity House Lighthouse Services (THLS); and
- Chamber of Shipping (CoS).

5.3 *Regular Operators consulted as part of NRA process*

Regular operators transiting through the Dogger Bank zone were identified. The regular operators listed in Table 5.1 were all contacted in June 2011 and July 2012 regarding the proposed development. These operators and any recently identified were contacted a third time showing updates related to Dogger Bank Teesside A & B in March 2013. See section 16 for the responses received.

Table 5.1 Regular Operators

Regular Operator	Initial Contact Made	Follow up Phone Call	Second Contact Made	Follow up Phone Call
Wilson Euro Carriers AS	Email 25/03/2013	09/04/2013	Email 10/04/2013	-
Charterfrakt Baltic Carrier AB	Email 25/03/2013	09/04/2013	-	-
Gerdes Bereederungs	Email 25/03/13	09/04/2013	Email 10/04/2013	-
DFDS Logistics AS	Email 25/03/2013	09/04/2013	Email 10/04/2013	-
Samskip Multimodal Container	Email 25/03/2013	09/04/2013	Email 10/04/2013	-
Finnlines Plc	Email 25/03/2013	09/04/2013	Email 10/04/2013	-
Vroon Offshore Services BV	Email 25/03/2013	09/04/2013	Email 10/04/2013	-
KS AS Tananger	Letter 25/03/2013	09/04/2013 No Answer	-	-
Team Lines GmbH & Co KG	Email 25/03/2013	09/04/2013	Email 10/04/2013	-
Teekay Navion Offshore Loading	Email 25/03/2013	09/04/2013	-	-
Containerships Ltd OY	Email 25/03/2013	09/04/2013	Email 10/04/2013	-
Unigas International Ltd	Email 25/03/2013	09/04/2013	Email 10/04/2013	-
Unifeeder AS	Email 25/03/2013	-	-	-
Nor Lines AS	Email 25/03/2013	09/04/2013	Email 10/04/2013	-
SCF Novoship JSC	Email 25/03/2013	-	-	-
Kawasaki Kisen Kaisha Ltd	Letter 25/03/2013	09/04/2013	-	-
Fehn Bereederungs GmbH & Co KG	Email 25/03/2013	09/04/2013	Email 10/04/2013	-

Regular Operator	Initial Contact Made	Follow up Phone Call	Second Contact Made	Follow up Phone Call
Arklow Shipping Ltd	Email 25/03/2013	09/04/2013	Email 10/04/2013	03/08/12
Scotline Ltd	Email 25/03/2013	09/04/2013	Email 10/04/2013	-
GasChem Services GmbH & Co KG	Email 25/03/2013	09/04/2013	Email 10/04/2013	-
Marida Tankers Inc	Letters 25/03/2013	09/04/2013	-	-
Clipper Wonsild Tankers AS	Email 25/03/2013	09/04/2013	-	-
Veder Gas Carriers BV	Email 25/03/2013	09/04/2013	Email 10/04/2013	-
Maersk Supply Service AS	Email 25/03/2013	09/04/2013	Email 10/04/2013	-
Abou Merhi Lines SAL	Email 25/03/2013	09/04/2013	-	-
Ahlmark Lines AB	Email 25/03/2013	09/04/2013	-	-
Intrada Ship Management	Email 25/03/2013	09/04/2013	Email 10/04/2013	-

5.4 *European Shipping Associations consulted as part of Zonal process in 2011*

European Ship Owner Associations were identified due to their location and/or nationality of the vessels that have been identified crossing the zone. The following were contacted in June 2011:

- Royal Belgian Ship Owners’ Association (Belgium);
- Danmarks Rederiforening (Denmark);
- Finnish Ship Owners’ Association (Finland);
- Armateurs de France (France);
- Verband Deutscher Reeder (Germany);
- Royal Association of Netherlands Ship Owners’ (Netherlands);
- Norges Rederiforbund (Norway);
- Asociación de Navieros Españoles (Spain); and
- Sveriges Redareförening (Sweden).

5.5 *International stakeholders consulted as part of SNSOWF work in 2011*

The following countries were consulted in late 2011 as part of the SNSOWF work regarding the cumulative impact of multiple offshore wind farms in the Southern North Sea. Bodies included government ministries, ship-owners associations and maritime authorities.

- Federal Public Service Mobility and Transport – Belgium;
- Dutch Ministry for Infrastructure and Environment (Rijkswaterstaat Waterdienst);
- Ship-owners associations including Norwegian, Belgian, Dutch, German, French and Danish;
- German Federal Maritime and Hydrographic Agency (Bundesamt fuer Seeschifffahrt und Hydrographie);
- Danish Maritime Authority; and
- Sveriges Redareforening, Swedish Maritime Administration (Sjöfartsverket).

6. Data Sources

This section summarises the main data sources used in assessing the baseline shipping activities relative to Dogger Bank Teesside A & B. The main data sources used in this assessment are listed below:

- Marine Traffic Survey Data - 28 Days winter 2011/12 (November 2011 – January 2012) Vigilant – no dedicated surveyor on-board;
- Marine Traffic Survey Data - 14 Days spring / summer 2012 (May – June 2012) Tridens & Vigilant – no dedicated surveyor on-board;
- Marine Traffic Survey Data - 14 Days spring 2013 (10th – 25th April 2013) Vigilant & Jubilee Spirit;
- Shore based AIS data collection 1st – 7th April 2013;
- Fishing surveillance satellite data from Marine Management Organisation (MMO) (2009 – no newer data was used due to data protection issues) which was converted to fishing vessel density grid;
- Maritime Incident Data from Marine Accident Investigation Branch (MAIB) (2002-2011) and Royal National Lifeboat Institution (RNLI) (2001-2010);
- Marine aggregate dredging data (licence areas and active areas) and transit routes from The Crown Estate and British Marine Aggregate Producers Association (BMAPA);
- Oil and gas platforms (UK Deal, 2013);
- Admiralty Sailing Directions – North Sea (West) Pilot, NP 54 (UKHO, 2009);
- UK Admiralty Chart 2182B, 1191-0, 266, 267 and 1190-0; and
- UK Coastal Atlas of Recreational Boating, 2009 and 2010 Geographic Information Systems (GIS) Shapefiles (RYA, 2010).

7. Lessons Learnt

There is considerable benefit in the sharing of lessons learnt from developers within the offshore industry. This NRA, and in particular the hazard assessment, includes general consideration of lessons learnt and expert opinion from previous offshore wind farm developments and other sea users. Lessons learnt data sources include:

- RYA & CA (Cruising Association). Sharing the Wind – identification of recreational boating interests in the Thames Estuary, Greater Wash and North West (Liverpool Bay). Southampton: (RYA, 2004);
- DfT. Results of the electromagnetic investigations. 2nd ed. Southampton: MCA and QinetiQ (DfT, 2004);
- BWEA. Guidelines for Health & Safety in the Wind Energy Industry – British Wind Energy Association. London: (BWEA (now RUK), 2008);
- MCA. Offshore Wind Farm Helicopter Search and Rescue – Trials Undertaken at the North Hoyle Wind Farm Report of helicopter SAR trials undertaken with Royal Air Force Valley 'C' Flight 22 Squadron on March 22nd 2005. Southampton: (MCA, 2005);
- NOREL. (Unknown). A Report compiled by the Port of London Authority based on experience of the Kentish Flats Wind Farm Development. Norel Work Paper, WP4 (2^{nd} NOREL); and
- The Crown Estate. Strategic assessment of impacts on navigation of shipping and related effects on other marine activities arising from the development of Offshore Wind Farms in the UK REZ. The Crown Estate and Anatec (The Crown Estate, 2012).

8. Marine Traffic Survey Methodology

8.1 *Baseline Survey Methodology*

Baseline shipping activity was assessed using AIS and Radar track data. Data were collected at the Tranche level as wind farm boundaries had not been defined at the time of data collection. The period of data used in the NRA encompassed seasonal fluctuations in shipping activity (spring/summer and autumn/winter), and also accounted for a range of tidal conditions.

The operational areas of the survey vessels used for the AIS and Radar data collection during the periods used in the NRA (within a 10nm buffer) are presented in Figure 8.1 and Figure 8.2. The 10nm buffer was placed around the Dogger Bank Teesside A & B to provide a sample area in which to undertake data analysis relative to the developments.

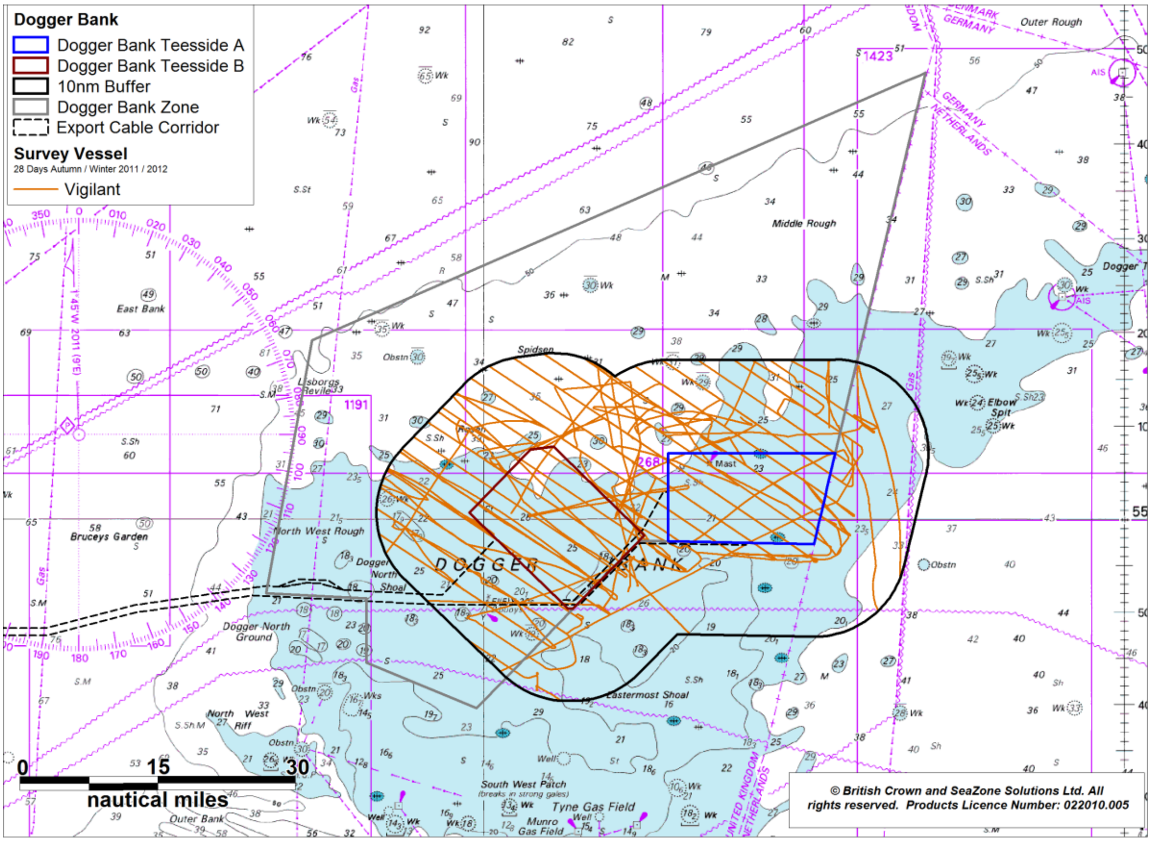

Figure 8.1 Survey Vessel AIS Tracks (28 Days Autumn / Winter 2011 / 2012)

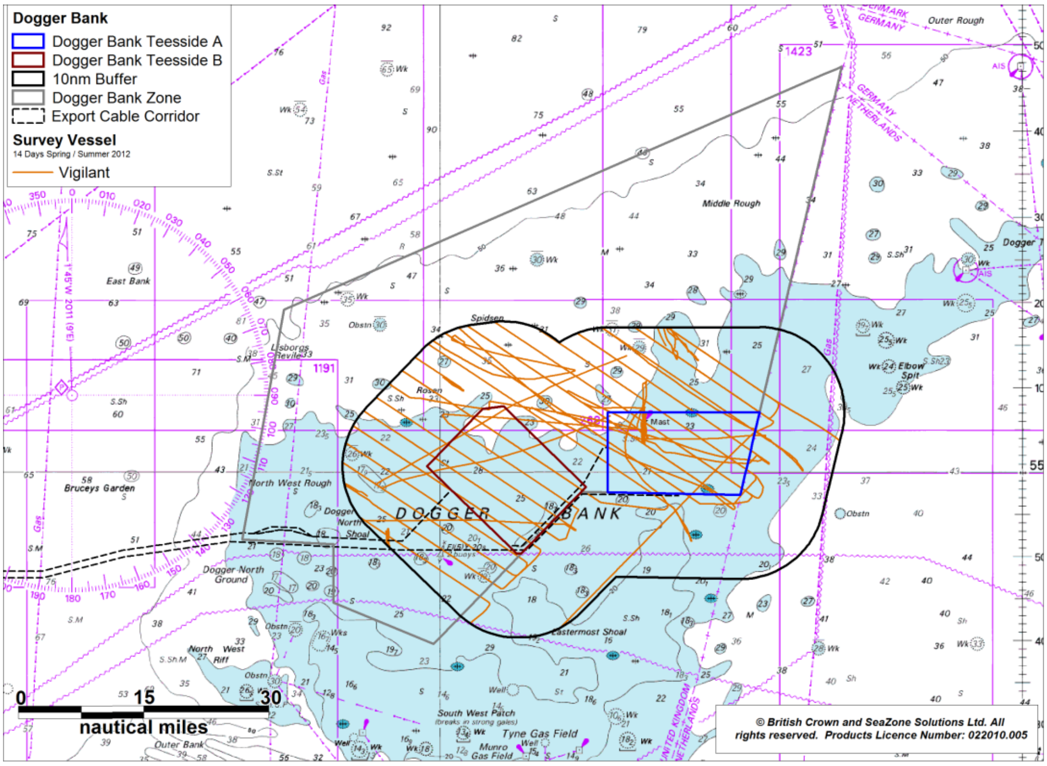

Figure 8.2 Survey Vessel AIS Tracks (14 Days Spring / Summer 2012)

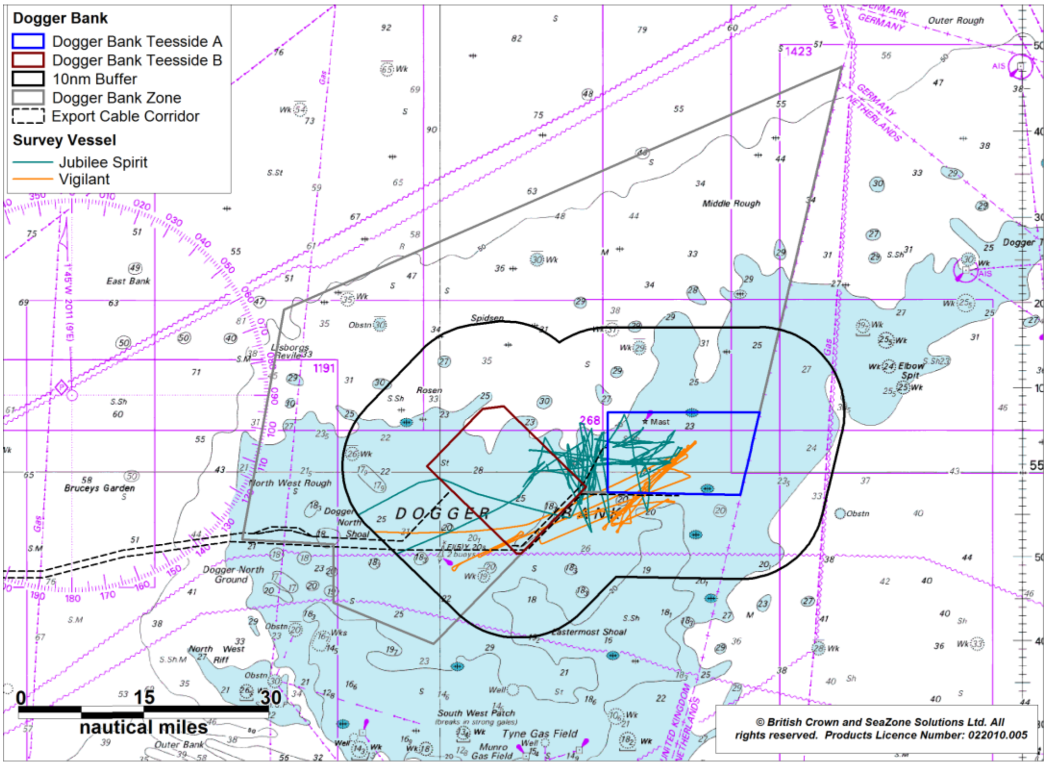

Figure 8.3 Survey Vessel AIS Tracks (14 Days Spring 2013)

It should be noted that data collection is on-going to allow main routes and 90th percentiles assumptions to be continually validated.

8.2 *AIS and Radar Coverage*

AIS is required on board all vessels of more than 300 gross tonnage (GRT) engaged on international voyages, cargo vessels of more than 500 GRT not engaged on international voyages, passenger vessels irrespective of size built on or after 1st July 2002, and fishing vessels over 45 m in length (pre May 2012) and 24 m in length to date. * *Note as of the 31st May 2013 this will be reduced to 18 metres.*

Therefore, larger vessels were recorded on AIS, while smaller vessels without AIS installed were recorded, where possible, on the Automatic Radar Plotting Aid (ARPA) on board the survey vessels. A proportion of smaller vessels also carry AIS voluntarily.

8.3 *Commercial Vessels Dataset*

The marine traffic survey data used for the baseline navigation review of Dogger Bank Teesside A & B was comprised of two datasets of AIS and Radar. These data were recorded from survey vessels working at the site during the given periods.

8.4 *Recreational Activity*

The RYA and the CA represent the interests of recreational users including yachting and motor cruising. In 2005 the RYA , supported by THLS and the CA, compiled and presented a comprehensive set of charts which defined the cruising routes, general sailing and racing areas used by recreational craft around the UK coast. This information was published as the UK Coastal Atlas of Recreational Boating and has been subsequently updated (RYA, 2009). The latest addition of GIS shapefiles from 2010 showing cruising routes, sailing and racing areas has been used in this assessment.

The RYA has also developed a detailed position statement (RYA, 2011) based on analysed data for common recreational craft; this, along with extensive consultation, were used to inform the NRA.

In addition, recreational vessel data were extracted from the AIS tracks recorded during the 56 day survey period in 2011, 2012 and 2013 data.

8.5 *Fishing Activity*

Fishing vessel data were extracted from the AIS and Radar data recorded during the 56 day shipping surveys in 2011, 2012 and 2013.

In addition, fishing vessel satellite monitoring data were obtained from the MMO and presented in density grids to validate the survey data presented in the baseline assessment. Satellites record the positions of fishing vessels of 15m length and over every two hours. Data from 2009 (all nationalities) have been analysed and are presented in a density grid in section 19.6.

9. Other Offshore Users

9.1 *Oil and Gas Installations*

Offshore oil and gas installation data were supplied by UK Deal and include fixed platforms and wellheads. A desk top study was undertaken using these data to identify any possible cumulative effects associated with offshore oil and gas developments.

9.2 *Marine Aggregates Area*

Marine aggregates dredging data (licenced areas and active areas) were supplied by The Crown Estate and passage plans of dredgers were supplied by BMAPA. A desk based study was carried out using this information to identify commercial aggregates dredging activity in the area.

9.3 *Navigational Features*

Other navigational features such as Ministry of Defence (MOD) Practice and Exercise Areas (PEXAs) have been considered based on information from Admiralty charts.

10. Design Envelope

The scope of this NRA will reflect a Design Envelope defined by Forewind. The following section details the worst realistic case parameters of the project against which the effects will be assessed.

10.1 *Dogger Bank Teesside A & B Development Boundaries*

The proposed Dogger Bank Teesside A & B offshore wind farms are located approximately 89nm east of the Yorkshire coast. The total area of Dogger Bank Teesside A is approximately 163.1nm^2 (560.1km^2) and the total area of Dogger Bank Teesside B is approximately 172.7nm^2 (593.2km^2). Water depths within the sites range from around 21m to 32m.

The Dogger Bank Teesside A & B wind farm boundaries are presented in Figure 10.1 and the corner co-ordinates are presented in table 10.1.

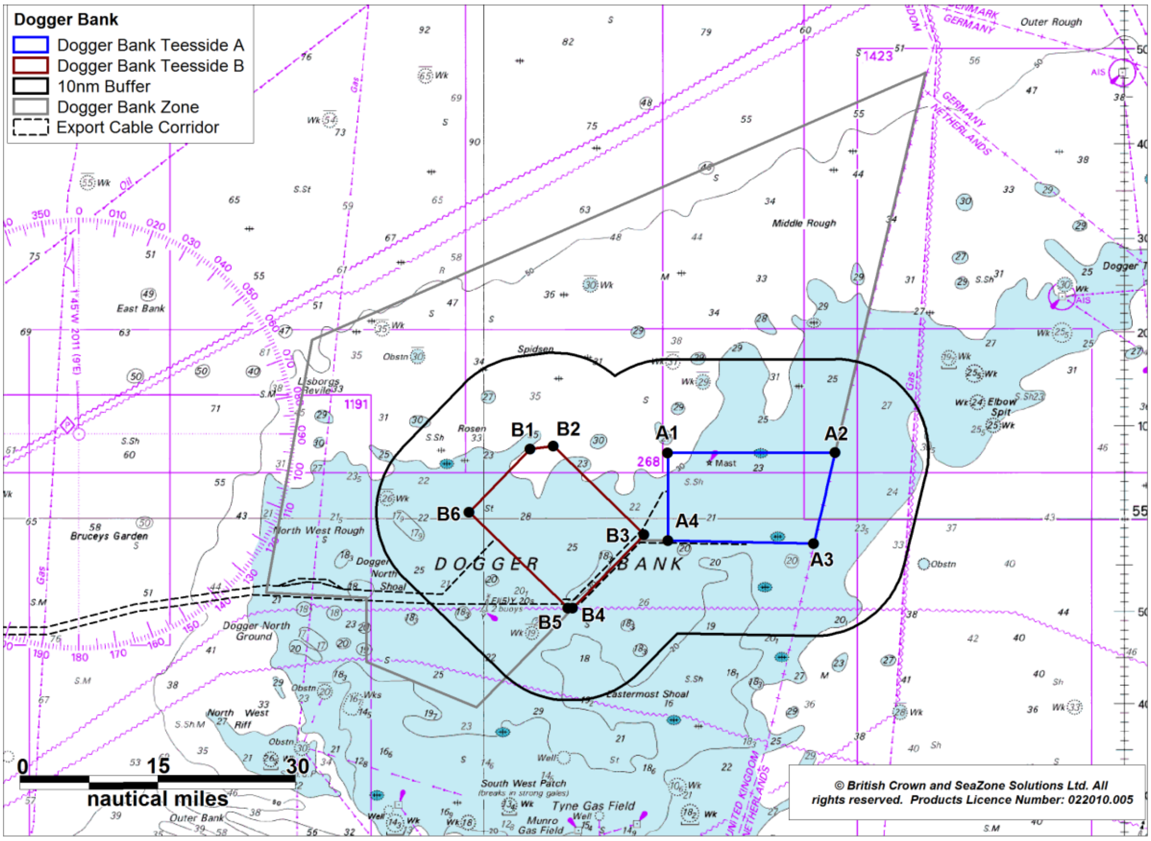

Figure 10.1 **Chart Overview of Dogger Bank Teesside A & B**

Table 10.1 Corner Co-ordinates of Dogger Bank Teesside A & B (WGS 84 UTM 31N)

Corner	Easting (m)	Northing (m)
A1	472908	6107993
A2	506307	6107993
A3	502041	6089767
A4	472908	6090435
B1	445523	6108971
B2	450126	6109539
B3	468113	6091645
B4	453619	6077075
B5	452689	6077082
B6	433143	6096527

10.2 *Forewind Proposed Design Envelope Process*

Due to the extensive potential area for development within the Dogger Bank Zone, Forewind have taken an improved approach to previous developments to allow them to maintain navigational safety but also permit flexibility during the consent process to allow for the large variations in potential shape, size and content of the projects. This method has been noted and approved by both the MCA and THLS. In order to ensure that navigational safety is not only maintained but paramount within this process, Forewind in conjunction with Anatec have established Development Rules. These rules will allow the flexibility that is required but maintain the key elements, such as alignment, to ensure that the final design does not increase navigational safety risk.

It is noted that these rules do not remove the requirement for regulators to sign off the final site design at the end of the development process but do ensure that the route to that point continually considers factors that are important for navigational safety.

10.3 *Layout Rules*

During the development of the project, rules have been developed in consultation with stakeholders that will apply to the final proposed array layout, and which restrict the array patterns employed in order to address particular issues or environmental sensitivities. These are considered further within ES Chapter 16 Navigation and Shipping.

i. <u>Layout Pattern and Regularity</u>
The position of all wind turbines, collector substation platforms, converter substation platforms and accommodation platforms (except those covered by the second rule

below) shall, so far as is practicable, be arranged in straight lines* (to a tolerance of ±150m) in an easily understandable pattern within individual wind farm site layouts, avoiding structures which break this pattern and without any dangerously projecting peripheral structures.
Reason: To facilitate safe navigation, aid location of casualties or incidents during emergency response, and to avoid creating an isolated hazard in or around the wind farm, while allowing the flexibility to optimise wind turbine arrays allowing for issues such as local geology, seabed obstacles, and energy capture.

ii. Perimeter-Type Layouts
The position of all wind turbines, collector substation platforms, convertor substation platforms and accommodation platforms forming a line of perimeter structures around a wind farm area shall, so far as is practicable, be arranged in straight or curved lines (to a tolerance of ±150m) in an easily understandable pattern, avoiding structures which beak this pattern and without any dangerously projecting peripheral structures.
Reason: To facilitate safe navigation, aid location of casualties or incidents during emergency response, and to avoid creating an isolated hazard in or around the wind farm, while allowing the flexibility to optimise wind turbine arrays allowing for issues such as local geology, seabed obstacles, and energy capture.

iii. Layout Clarity
Any changes in wind turbine size and separation distance within a wind farm project will be introduced so as to minimise potential visual confusion for any vessel navigating through the wind farm.
Reason: To facilitate safe navigation for vessels which are working within the Dogger Bank Zone, (noting an assumption of no significant levels of passing traffic within the zone).

iv. Boundary Clarity
Opposing site boundaries which approach closer than 5km to each other shall be aligned broadly parallel with one another and marked to distinguish between separate wind farms.
Reason: To facilitate safe navigation for vessels which are working within the Dogger Bank Zone, (noting an assumption of no significant levels of passing traffic within the zone).

v. Existing Infrastructure
Space will be left for maintenance vessels to access existing active telecommunication cables within the project wind farms (details to be agreed on a case-by-case basis).
Reason: To enable safe operation of existing infrastructure.

vi. Proximity to Project Boundaries
All wind farm surface and sub-surface structures, including rotor swept areas, will be located wholly within the relevant wind farm or cable corridor work area boundaries. No permanent surface infrastructure will be located in the export cable corridor. All

temporary construction works will be within the order limit boundaries (also see DCO Offshore Works Plan).
Reason: To ensure all aspects of the development are within the assessed areas.

10.4 *Wind Turbine Numbers*

In line with these rules, the worst case layout of 200 6MW wind turbines and other structures per project wind farm are presented in Figure 10.2. Section 10.6 describes this in further detail.

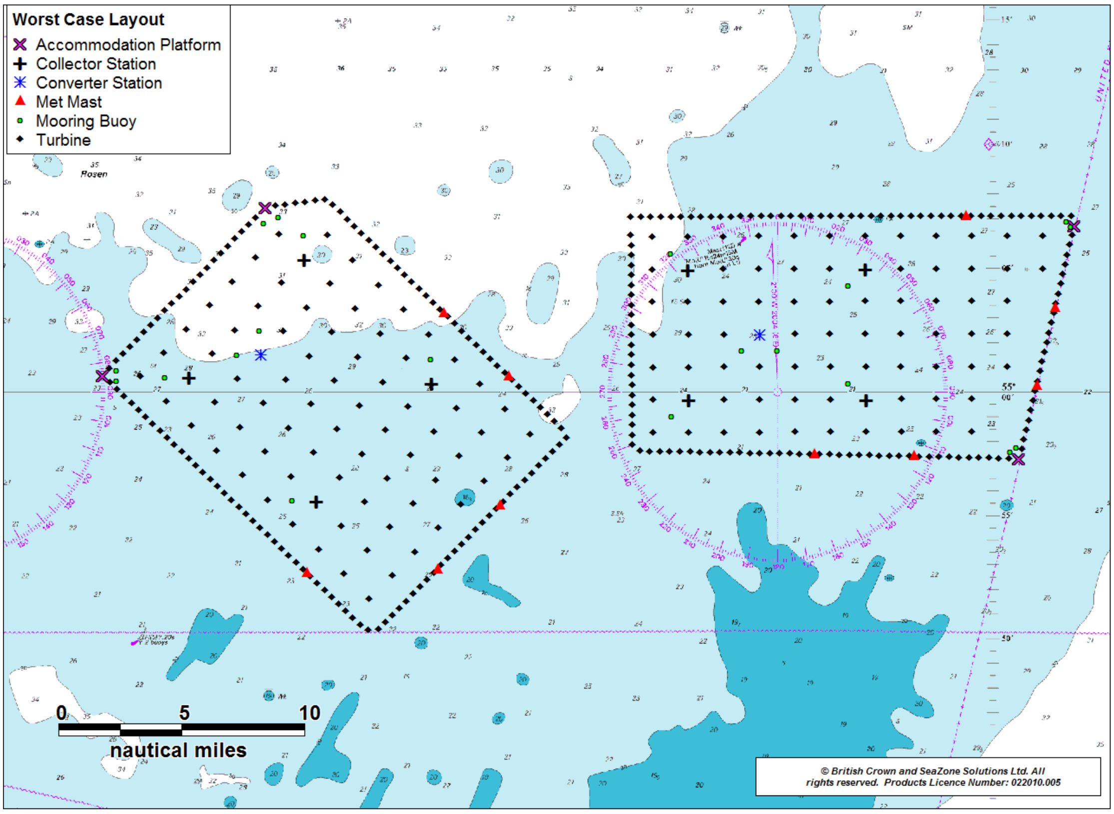

Figure 10.2 **Worst Case Layout**

10.5 *Foundations*

For the collision risk modelling, a worst case assessment of the largest foundation type has been assumed. The worst case foundation for shipping and navigation is a multileg design due to the larger dimensions compared to other scenarios being considered for Dogger Bank Teesside A & B.

10.6 *Wind Turbine Design*

6MW turbines have been considered for the collision risk modelling as using this turbine would result in the greatest number of turbines at the smallest potential spacing. The dimensions of the turbines are presented in the following table.

Table 10.2 Wind Turbine Measurements

Minimum lower blade tip above HAT (m)	22.00
Maximum hub height above HAT (m)	133.5
Maximum upper blade tip above HAT (m)	217.00
Maximum rotor diameter	166.41
Foundation Type	Multileg (foundation based around a single large tubular plus up to 4 large secondary tubulars (legs)). See Figure 10.3 below. *Note: where specific foundation types create effects on individual impacts they have been included within the impact assessment.*
Max width of structure in water column (m)	55

Figure 10.3 Multileg 1 Foundation Type

10.7 *Other Structures within Dogger Bank Teesside A & B*

10.7.1 Collector Station

Offshore collector stations collecting the generation from the inter-array cable system.

Figure 10.4 Example Collector Station

10.7.2 Converter Stations

Converter stations convert the generation from the collector substations for export to shore via High Voltage Direct Current (HVDC) cables.

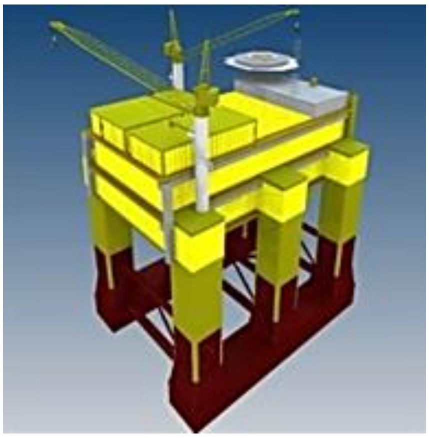

Figure 10.5 Example Convertor Station

10.8 *Export Cable*

The proposed export cable route to shore runs from Dogger Bank Teesside A & B to land at Marske-by-the-Sea. The export cable route is presented in Figure 10.6.

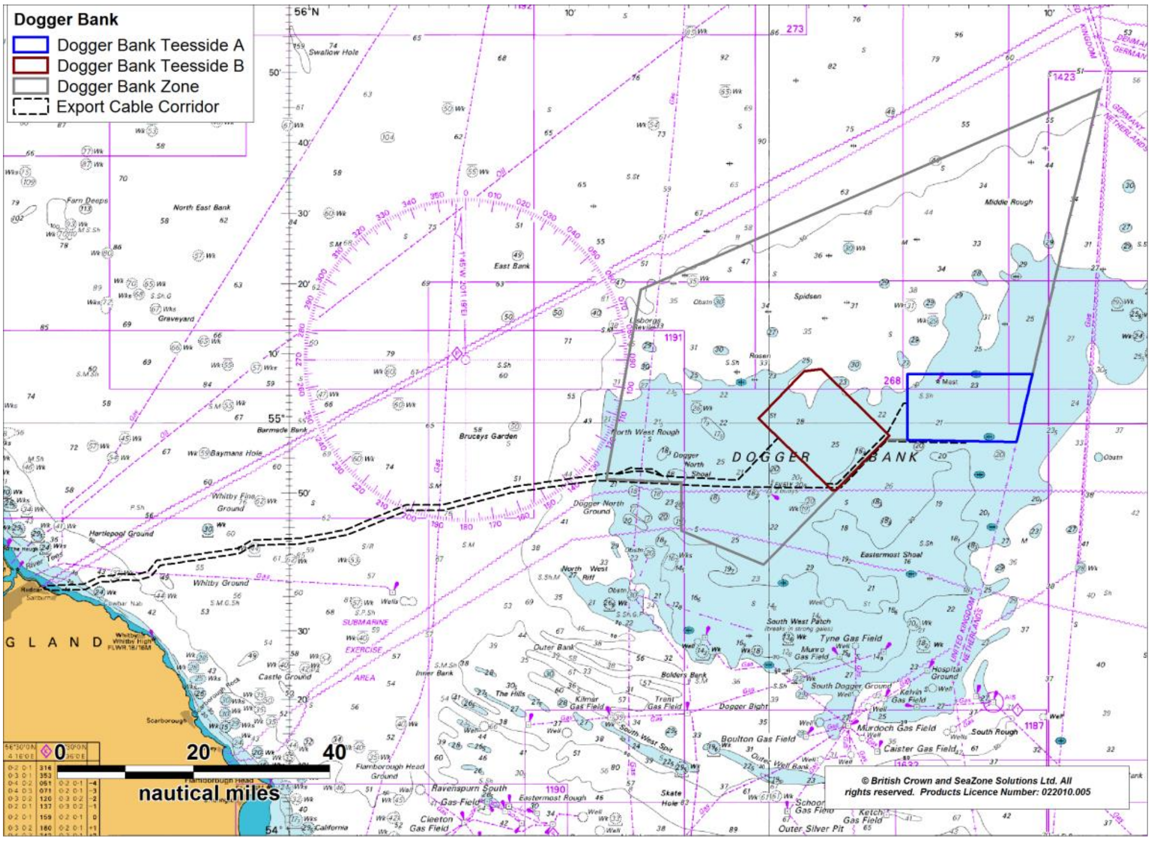

Figure 10.6 Overview of Export Cable Route

For the worst case, it is being assumed that the cables will be 'unbundled' meaning that there would be four cables connecting Dogger Bank Teesside A & B to shore (one pair per wind farm).

Where cables are unbundled, the positive and negative halves of the HVDC connection are installed as separate cables, therefore meaning that the positive and negative magnetic charges do not cancel each other out, unlike with bundled cables where the fields do cancel each other out. Therefore, there is the potential for electromagnetic interference to be produced by the unbundled cables.

10.9 *Definition of Worst Case Scenario*

For the worst case collision risk modelling, the following structures and dimensions have been used:

Table 10.3 Structure Dimensions and Numbers

Structure	Dimensions	Maximum Number (per wind farm)
Turbine (using Multi leg 1 Foundation)	55m x 55m	200 6MW

Met Mast	51.5m x 51.5m	5
Offshore Collector Station	75m x 75m	4
Offshore Converter Station	125m x 100m	1
Accommodation Platform	125m x 100m	2

10.10 *Mooring Buoys*

In addition to the structures described above, there will also be a maximum of 10 mooring buoys per wind farm for Dogger Bank Teesside A & B. These will be steel or plastic floating buoys which are permanently moored to the seabed and will provide a mooring point for wind farm construction and maintenance vessels during lulls in operation. It is assumed that the location of mooring buoys will be charted and they will have a high-visibility yellow colouration as a minimum.

The following table provides indicative dimensions for the mooring buoys.

Table 10.4 Mooring Buoy Dimensions

Indicative buoy diameter (m)	6.0
Buoy surface structure indicative height (m)	2.0
Indicative buoy draft (m)	3.0
Indicative floating line length (m)	10.0

The worst case position for the mooring buoys would be on the periphery of the wind farm boundaries as this represents the greatest collision risk for vessels moored to the buoys.

Figure 10.7 Example Mooring Buoys

10.11 *Bridge Links*

There is the potential to have up to seven offshore platforms per wind farm. These platforms could be installed as isolated structures, neighbouring structures within a cluster or connected via bridge links. If bridge links are used then the platforms will be sited in close proximity to each other in order to maintain alignment with the layout rules, therefore meaning that the bridge links will be relatively short. As a result of this, it has been decided that the realistic worst case assessment for the collision risk modelling should consider isolated platforms rather than those connected with bridge links as this presents the largest number of structures within the wind farm.

11. Baseline Environment

11.1 *Baseline Environment with Potential In-combination Effects*

Figure 11.1 presents an overview of the navigational features in proximity to Dogger Bank Teesside A & B and the export cable route corridor. These features will be discussed in the following section.

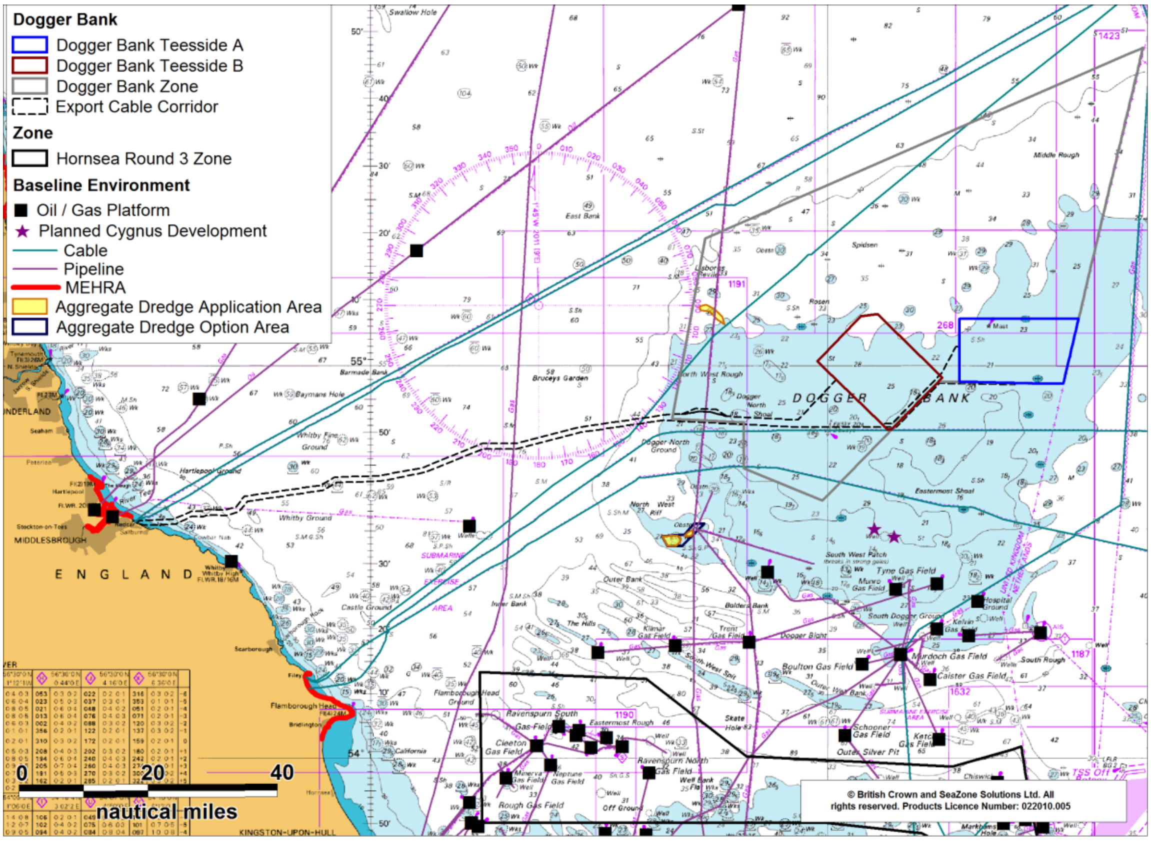

Figure 11.1 Baseline Environment in Proximity to Dogger Bank Teesside A & B and Export Cable Route Corridor

11.2 *Ports and Auxiliary Functions*

11.2.1 Ports in Proximity

The principal ports in the vicinity of Dogger Bank Teesside A & B are presented in Figure 11.2.

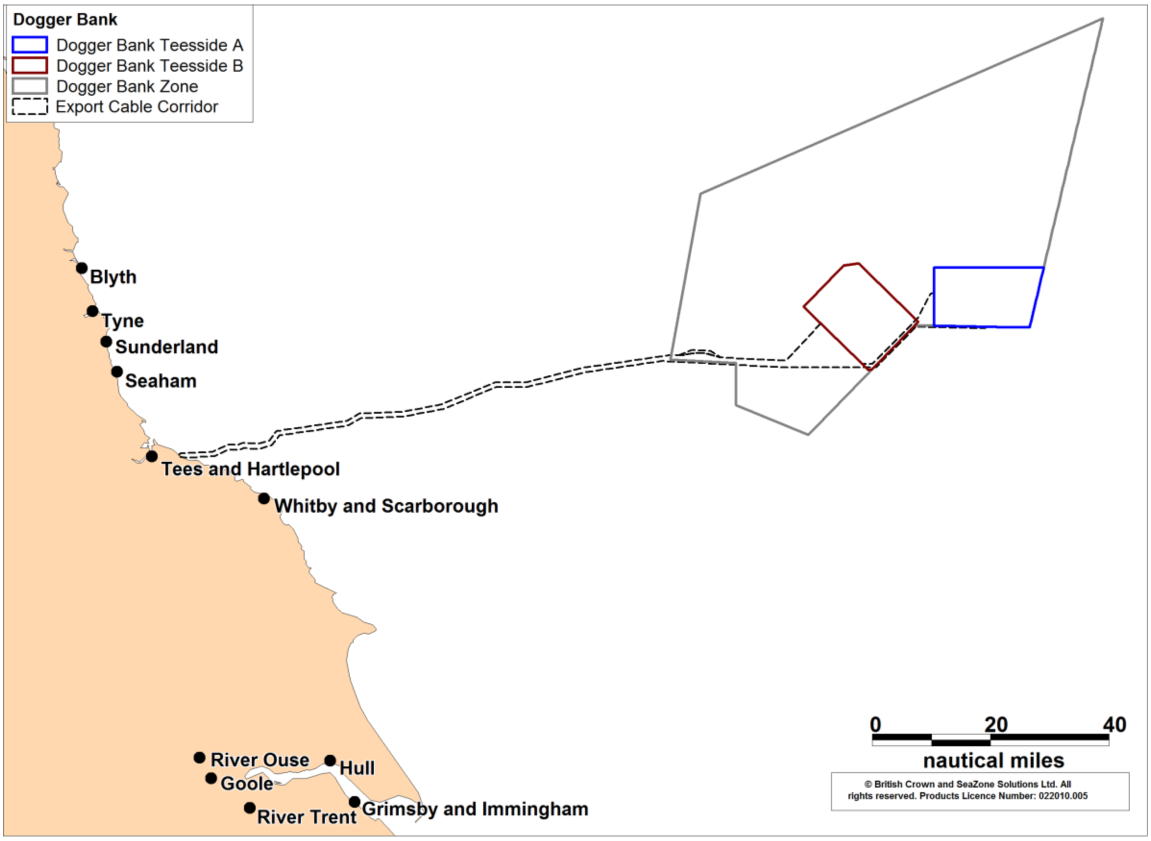

Figure 11.2 Ports in Proximity to Dogger Bank Teesside A & B

The export cable corridor makes landfall approximately 4.7nm southeast of the mouth of the River Tees, along which the port of Tees and Hartlepool is located.

11.3 *Existing Aids to Navigation (AtoN)*

A detailed plot of the existing Aids to Navigation (AtoN) in proximity to Dogger Bank Teesside A & B is presented in Figure 11.3.

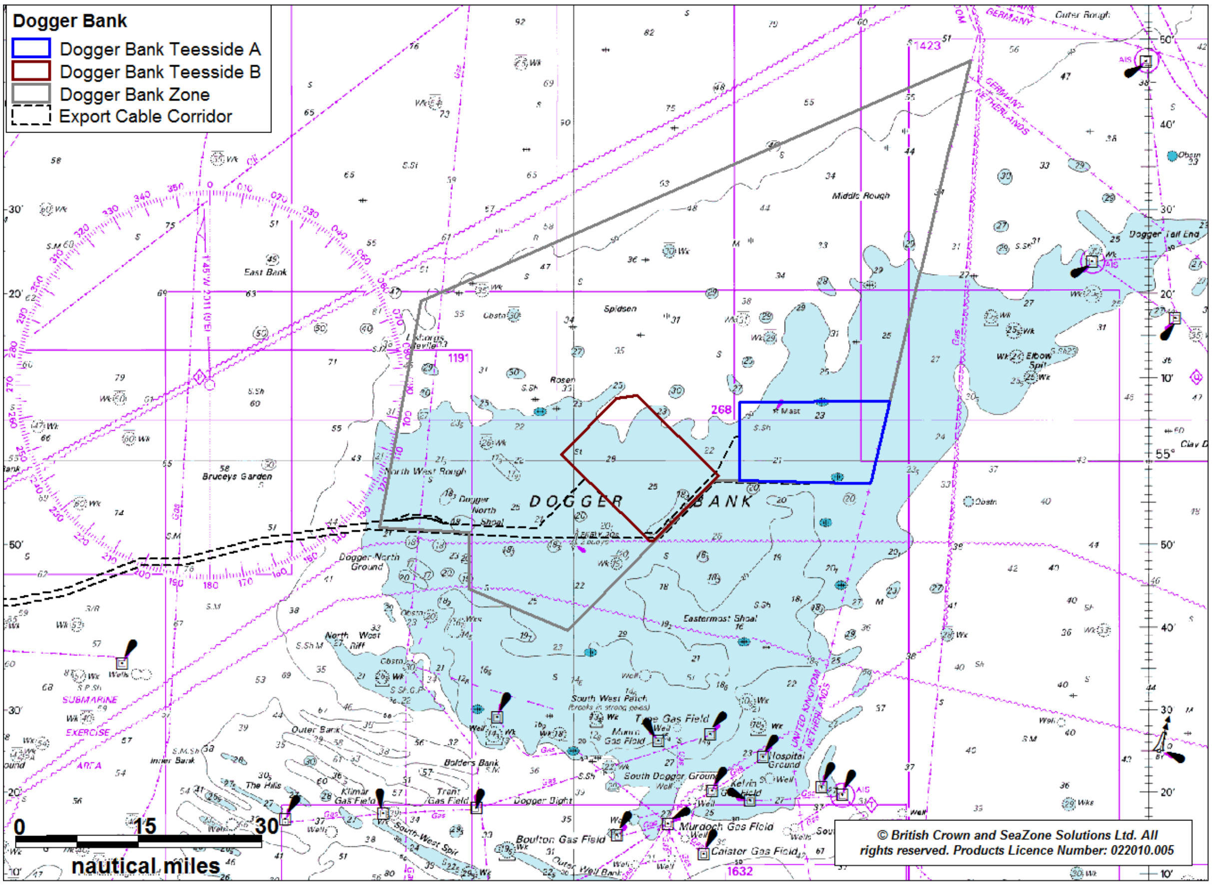

Figure 11.3 Aids to Navigation

As presented above, there are a number of lighted offshore installations to the south of the Dogger Bank Zone.

11.4 *Oil and Gas Infrastructure*

Figure 11.4 presents an overview of the nearby oil and gas platforms and wells relative to Dogger Bank Teesside A & B.

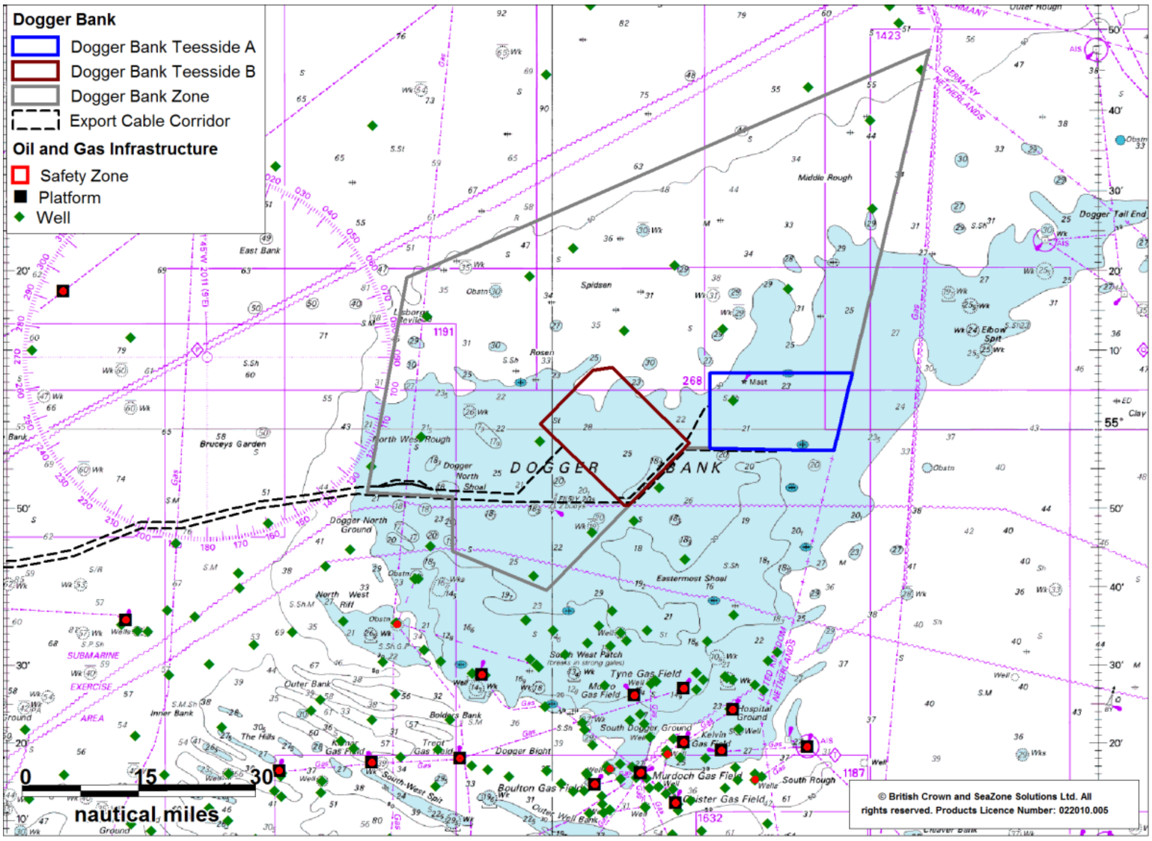

Figure 11.4 Oil and Gas Infrastructure

There are no oil or gas surface platforms located within Dogger Bank Teesside A or B. The nearest platforms are as follows:

- Cavendish platform approximately 28nm southwest of Dogger Bank Teesside B;
- Munro platform approximately 24nm south of Dogger Bank Teesside B;
- Tyne platform approximately 24nm south of Dogger Bank Teesside A & B; and
- Katy platform approximately 33nm south of Dogger Bank Teesside A.

The location of these platforms relative to Dogger Bank Teesside A & B is presented in Figure 11.5.

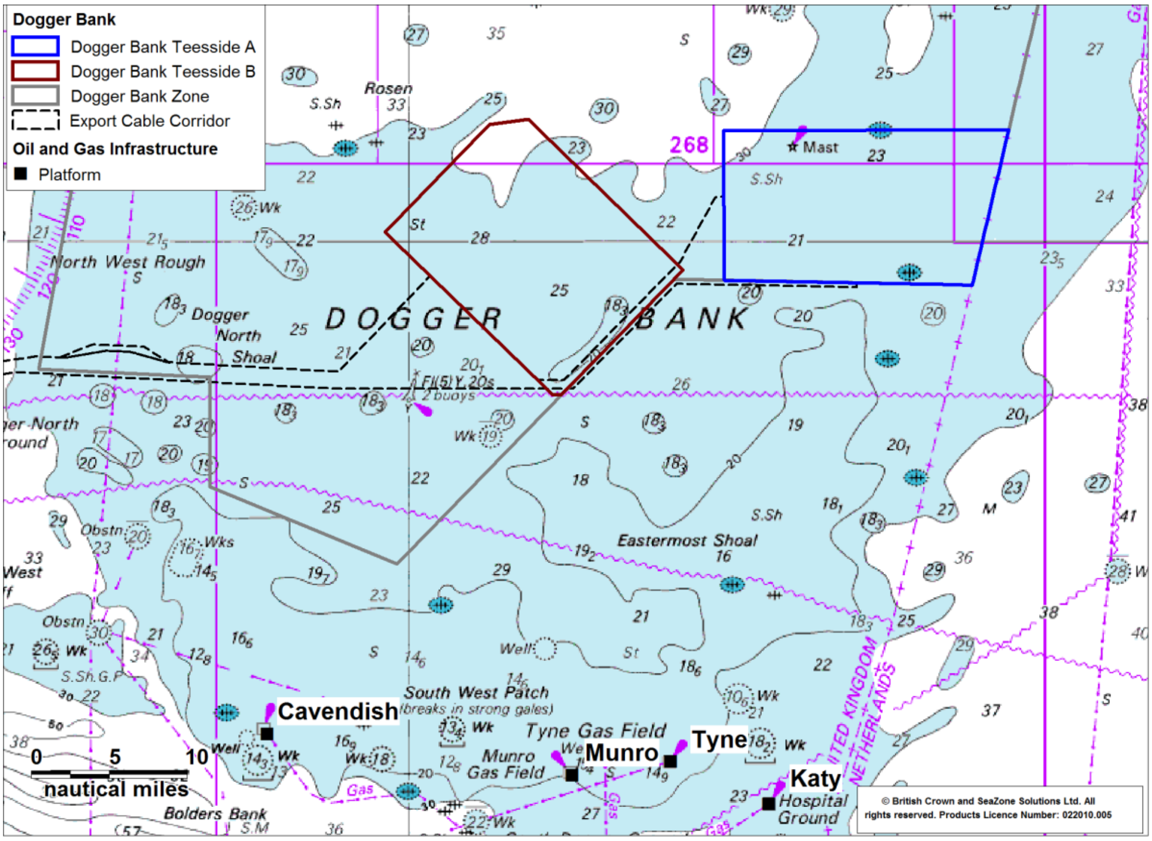

Figure 11.5 Cavendish, Munro, Tyne and Katy Platforms

An additional platform is currently in the planning process, named Cygnus. The coordinates of the platform are not yet available however Figure 11.6 shows the well it will be connected to.

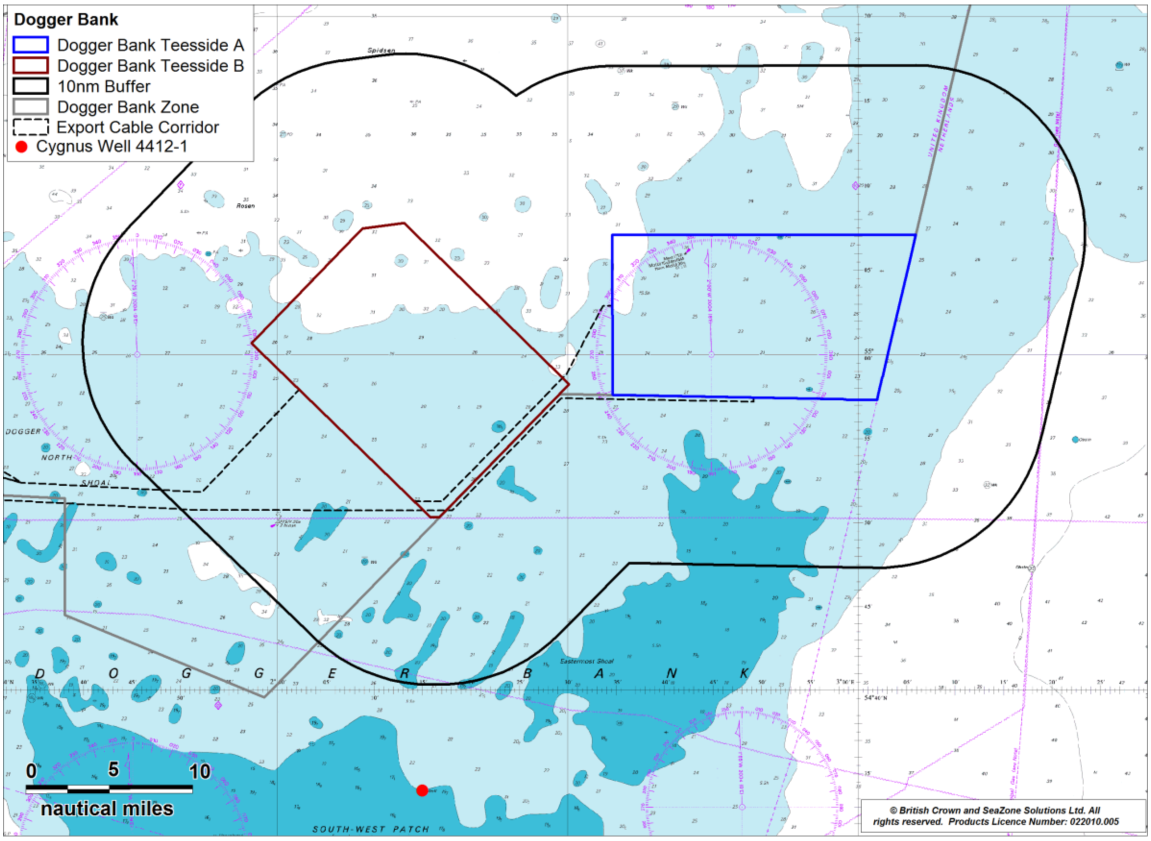

Figure 11.6 Location of Well Associated with the Proposed Cygnus Platform.

Radar Early Warning Systems (REWS) identify vessels on a closest point of approach (CPA) with the platform and alerts the standby vessel to respond. No assessment of the REWS on platforms in proximity to Dogger Bank Teesside A & B has been made at this stage.

11.5 *Aggregates Dredging Areas and Transit Routes*

Figure 11.7 presents the application dredge regions in proximity to Dogger Bank Teesside A & B, the export cable route and BMAPA transit routes.

The BMAPA routes were generated to assist developers with considering the impacts on transit routes to ports from production areas. It should be noted these are estimates and are not actual vessel tracks.

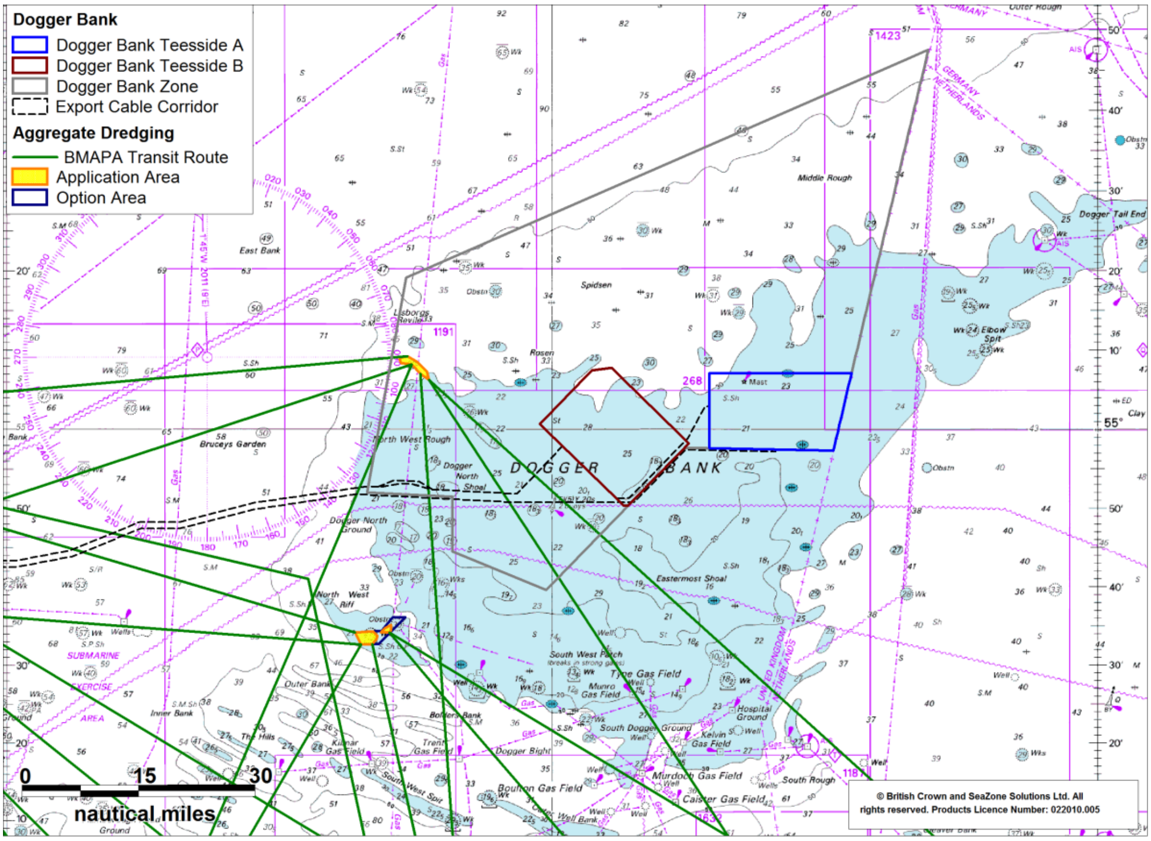

Figure 11.7 Application Dredge Region and BMAPA Proposed Transit Routes

Application Area 466/1 lies approximately 15nm to the northwest of Dogger Bank Teesside B, owned by CEMEX UK Marine Ltd. Option Area 485, owned by CEMEX UK Marine Ltd., in which Application Area 485/1 and 485/2 lie, is situated approximately 17.7nm south of the proposed export cable corridor and approximately 29.1nm southwest of Dogger Bank Teesside B.

BMAPA transit routes show that no potential routes intersect Dogger Bank Teesside A & B when transiting to and from Area 466/1.

11.6 *Other Wind Farm Developments*

The offshore wind farm developments in the vicinity of Dogger Bank Teesside A & B are presented in the following figure.

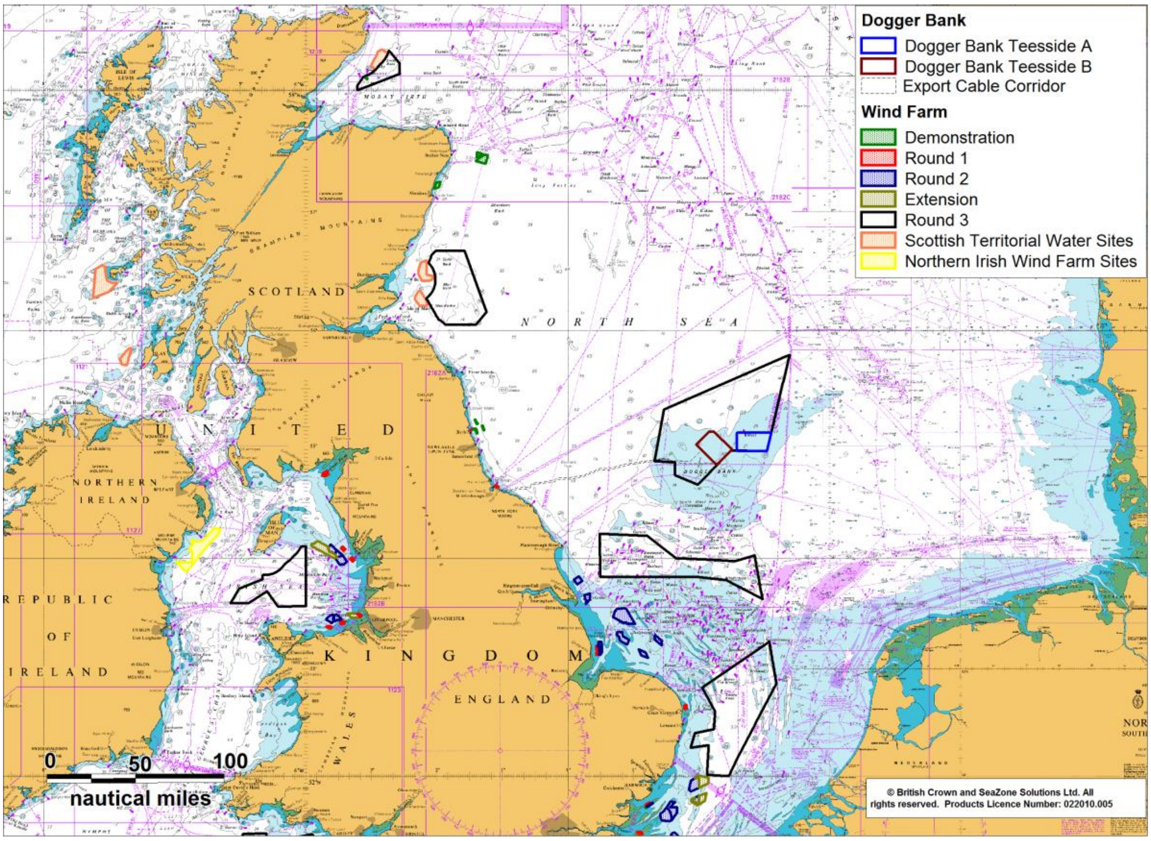

Figure 11.8 Other Offshore Wind Farm Developments within UK REZ

Hornsea and East Anglia Round 3 Zones lie south of the Dogger Bank Zone. There are a number of Round 2 offshore wind farm sites to the south of the Dogger Bank Zone. Teesside Offshore Wind Farm Round 1 site lies west of the Dogger Bank Zone, approximately 2.5nm northwest of the proposed offshore export cable corridor. Blyth Round 1 and Demonstration sites lie west of the Dogger Bank Zone.

Hornsea Round 3 Zone is situated approximately 51nm south of Dogger Bank Teesside B. Teesside Offshore Wind Farm Round 1 site is approximately 107nm west-southwest of Dogger Bank Teesside B, and Blyth Demonstration site is approximately 112nm west-northwest of Dogger Bank Teesside B.

11.7 *Marine Environmental High Risk Areas*

Marine Environmental High Risk Areas (MEHRAs) are areas that have been identified by the UK Government as areas of environmental sensitivity and at high risk of pollution from ships. The UK 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.

MEHRAs in proximity to Dogger Bank Teesside A & B and the export cable route are presented in Figure 11.9. The Tees MEHRA, presented in Figure 11.10, is located approximately 1.1nm northwest of the export cable corridor and has been designated on wildlife, landscape and geological grounds.

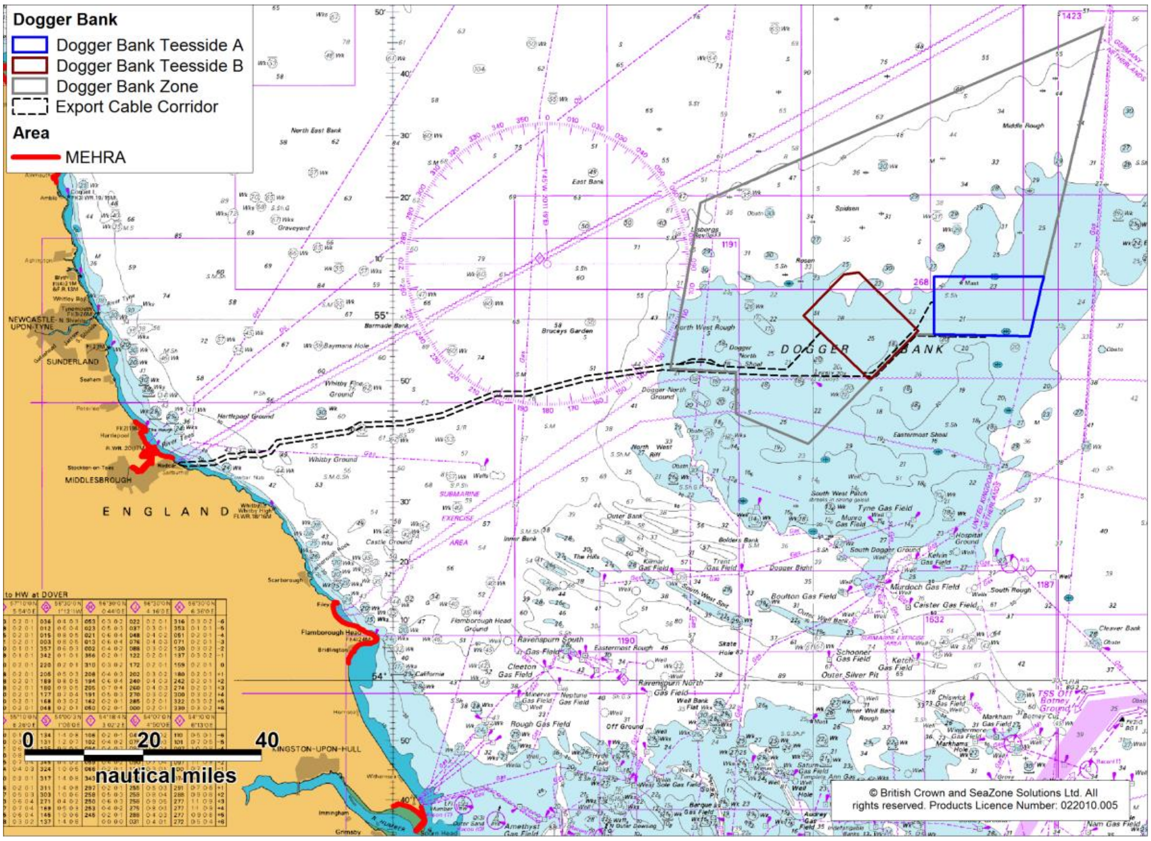

Figure 11.9 MEHRAs

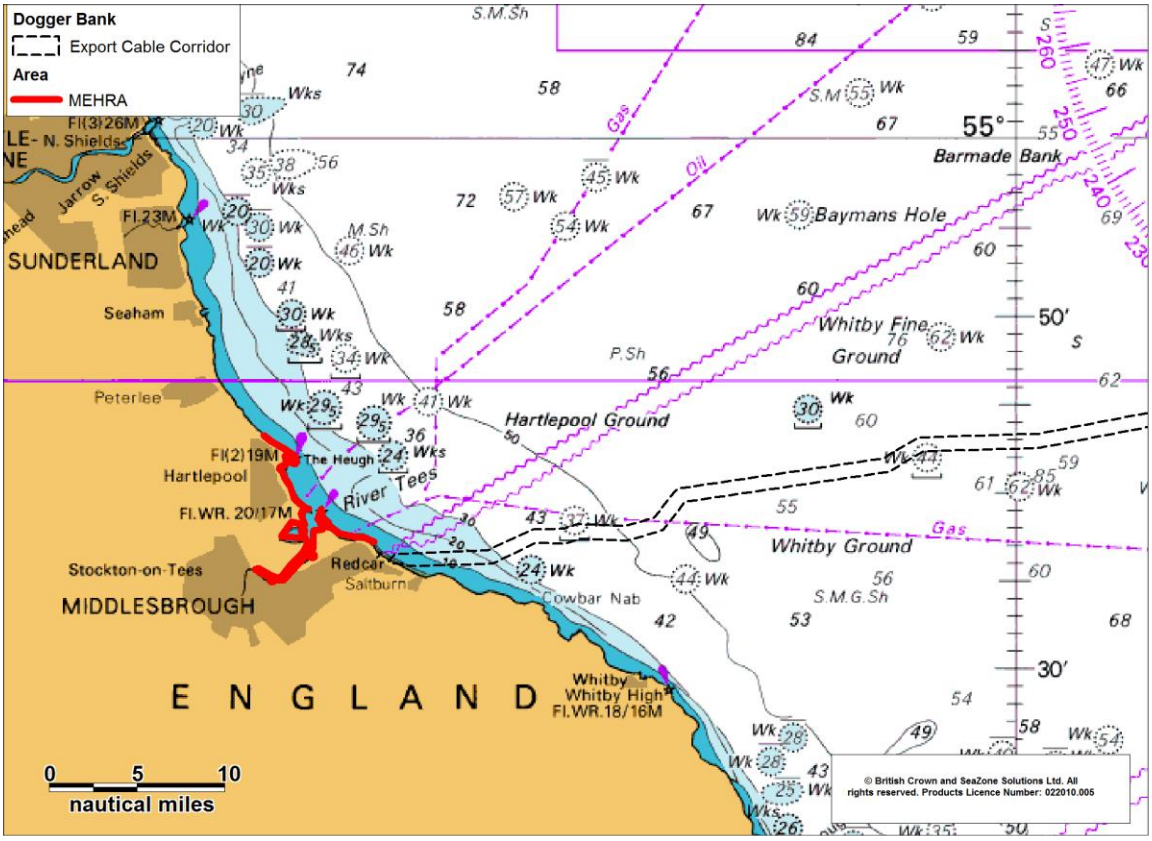

Figure 11.10 Tees MEHRA

11.8 *Wrecks*

Based on Admiralty charts of the area, the locations of wrecks in the vicinity of Dogger Bank Teesside A & B are presented in Figure 11.11.

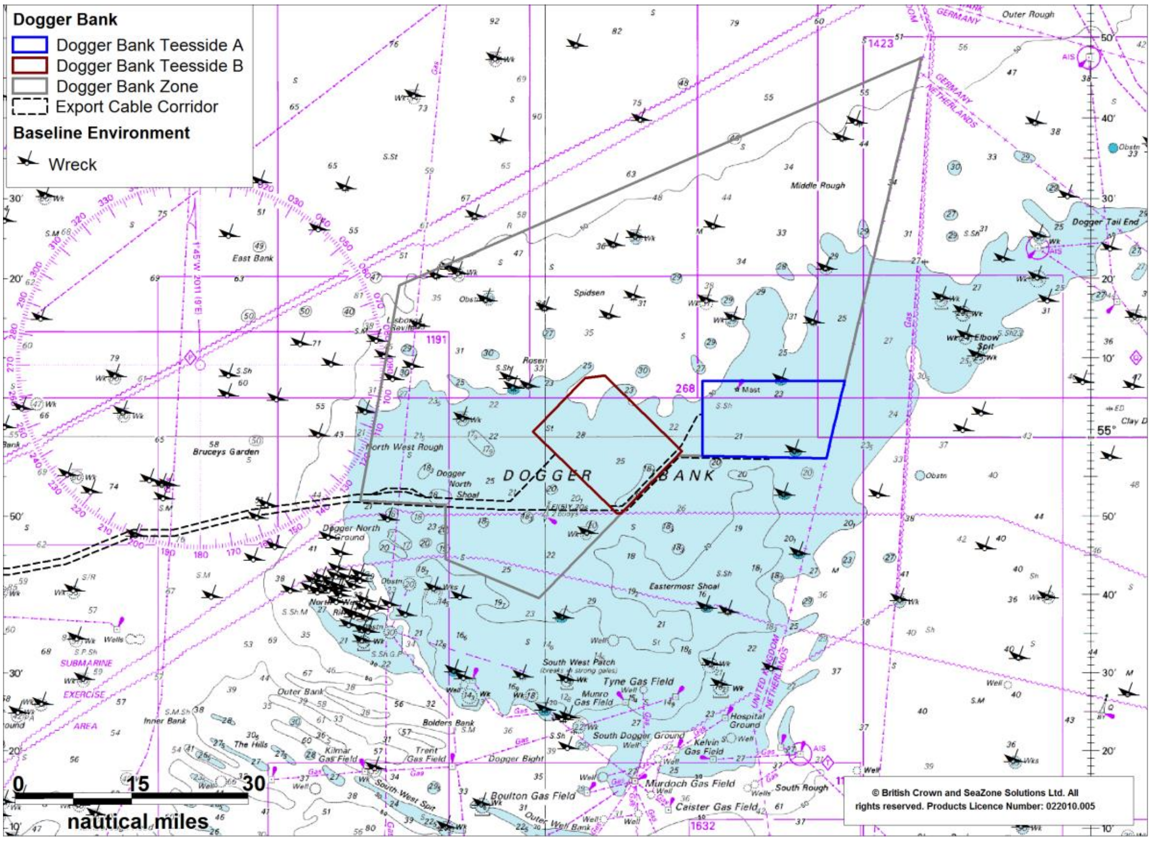

Figure 11.11 Wrecks

There is one charted wreck in Dogger Bank Teesside A and one lying on the northern boundary of Dogger Bank Teesside A. The chart shows a relatively high concentration of wrecks to the south of the area in which the export cable corridor joins the Dogger Bank Zone.

12. Metocean Data

12.1 *Introduction*

This section presents a summary of the metocean data for the area of Dogger Bank Teesside A & B which has been used as an input to the risk assessment.

12.2 *Wind*

The wind direction data for the area has been recorded from location 55.02° N, 02.00° E (Statoil, 2011) and is presented in Figure 12.1. It can be seen that wind is predominantly from a south westerly direction.

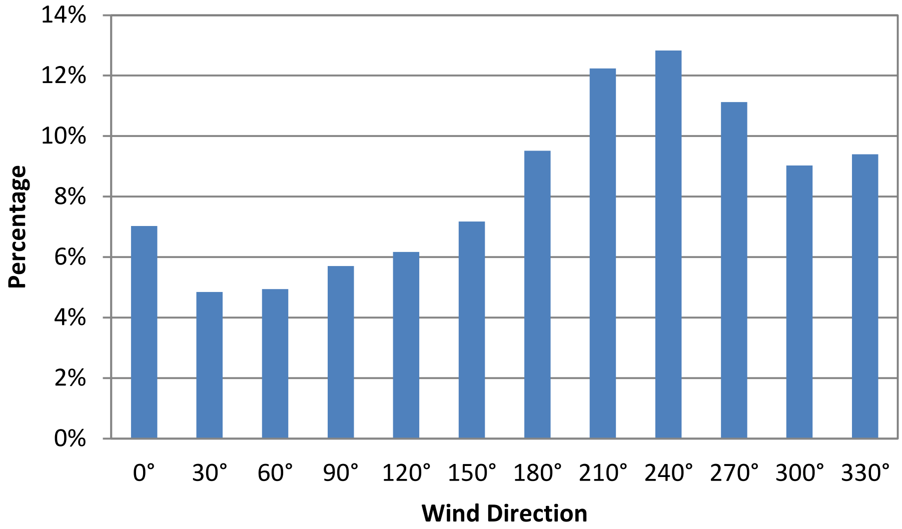

Figure 12.1 Annual Wind Direction Distribution

The mean wind speed at 10m (based on 1 hour averages) for this location is 8.49 m/s whilst the maximum wind speed recorded was 30.8 m/s from the period 1958 - 2010 (Statoil, 2011).

12.3 *Visibility*

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

12.4 *Tides and tidal streams*

There are a number of areas to the south of Dogger Bank Teesside A & B that can prove difficult to navigate in particular tidal conditions. These are shown in Figure 12.2 and marked on the chart as 'South-West Patch (breaks in strong gales)'. It is noted in the Admiralty Sailing Direction for the area that "*South West Patch, having depths of less than 15m, lies on the SW side of Dogger Bank. In bad weather the sea breaks heavily over it*". As the location of Dogger Bank Teesside A & B is directly to the north of this area it will not displace vessels towards them and there is extensive open sea area around the site to allow vessels to route around them. Therefore this is not expected to have any increase on the navigational safety risk to vessels.

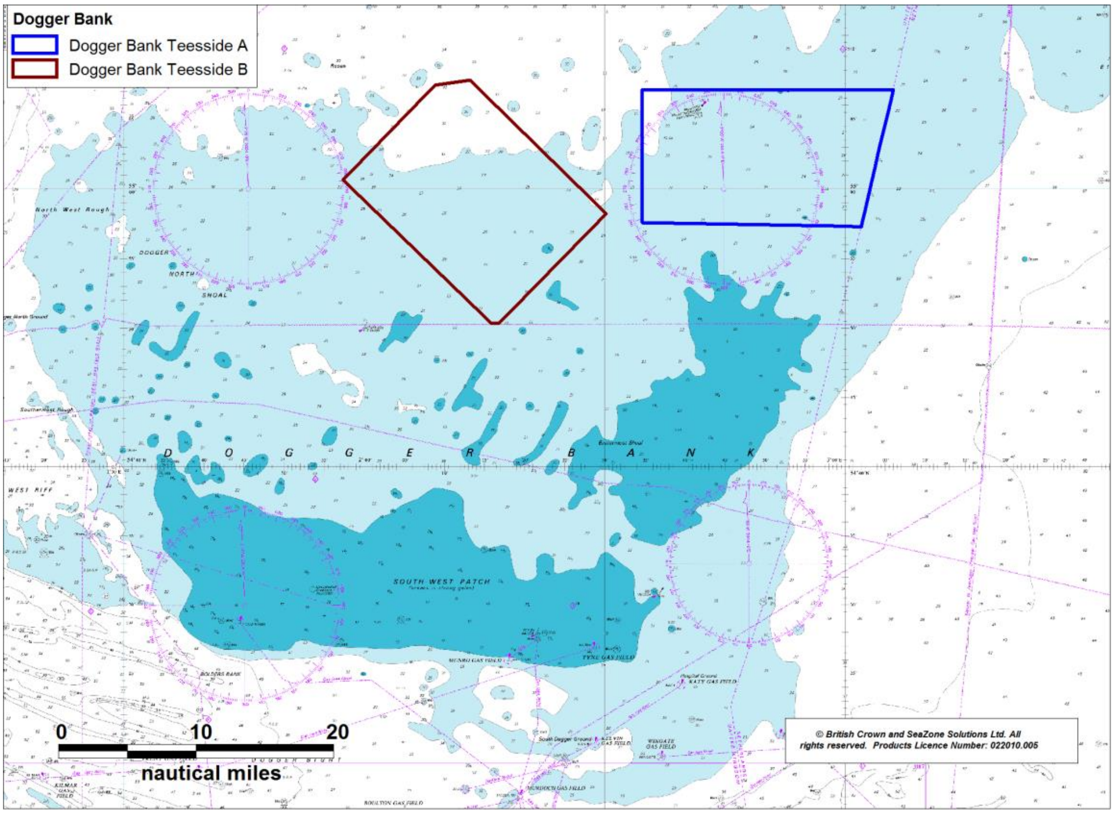

Figure 12.2 Location of South West Patch

Analysis of the base and future case development areas for Dogger Bank Teesside A & B have not identified any impacts existing at high water that do not exist at low water (and vice versa). This is mainly due to the distance offshore that Dogger Bank Teesside A & B is located where the rise and fall of the tide has less impact on navigational safety. The variation in MHWS and MLWS is 2.2m LAT.

Implications for drifting associated with engine failure or other circumstances have been identified in Section 22.2.2.2.

Tidal information (relative to LAT) recorded at location 54.87° N, 01.79° E (Forewind, personal communication) are presented in Table 12.1.

Table 12.1 Tidal Information for Location 54.87° N, 01.79° E

Water Depth (m LAT)	22.5
Highest Astronomical Tide (HAT) (m LAT)	3.0
Mean High Water Springs (MHWS) (m LAT)	2.6
Mean Sea Level (MSL) (m LAT)	1.5
Mean Low Water Springs (MLWS) (m LAT)	0.4
Lowest Astronomical Tide (LAT) (m LAT)	0.0
Mean Spring Range (m)	2.2
(HAT-LAT)/(MHWS-MLWS)	1.4

Admiralty Chart 2182B (Tidal Diamond "T" (54° 18'4 N, 3° 02'2 E), approximately 40nm south of Dogger Bank Teesside A) indicates that currents in the area set in a generally E to NE direction on the flood and NW to SW on the ebb, with a peak spring tidal rate of 0.6 knots and peak neap rate of 0.3 knots. Tidal details for the location are presented in Figure 12.3.

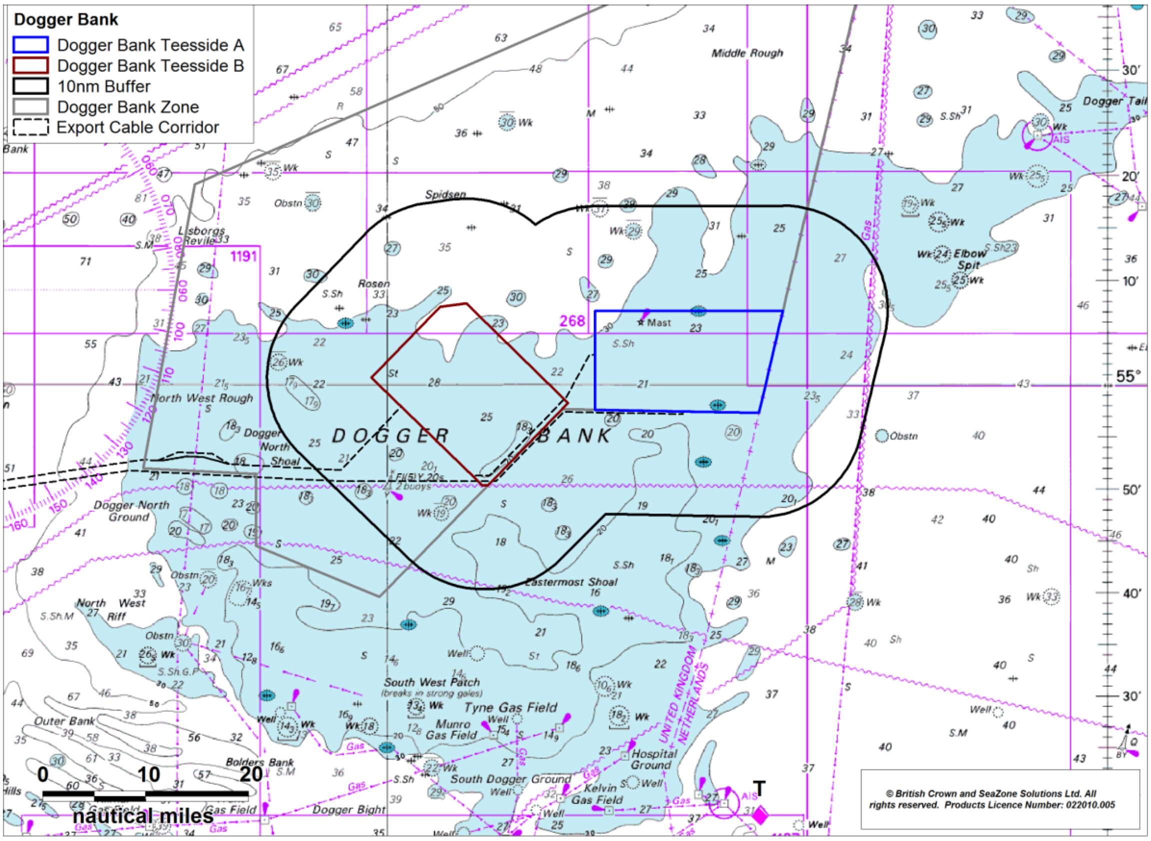

Figure 12.3 Tidal Diamond Information

Table 12.2 Tidal Diamond "T"

Hours		Directions of streams (degrees)	Rates at spring tides (knots)	Rates at neap tides (knots)
Before High Water	6	106	0.2	0.1
	5	102	0.4	0.2
	4	094	0.4	0.2
	3	103	0.4	0.2
	2	059	0.4	0.2
	1	066	0.2	0.1
High Water		343	0.1	0.0
After High Water	1	297	0.2	0.1
	2	258	0.5	0.3
	3	250	0.6	0.3
	4	253	0.4	0.2
	5	245	0.2	0.1
	6		0.0	0.0

The tidal currents in the area are relatively weak with a maximum value of 0-3-0.5 ms^{-1} and are spatially variable in direction.

12.5 *Wave*

The wind farms are situated in an open location exposed to relatively high wave energy. For the location 55.02° N, 02.00°, the predominant wave direction is from the north. The mean and maximum significant wave heights are 1.71m and 10.6m respectively.

13. Emergency Response Overview and Assessment

This section summarises the existing emergency response resources in the region and the issues being considered in relation to the design of the project and the facilities to be provided by the developer.

Forewind recognises that the proposed development requires a higher level of emergency response planning and co-operation than has been required in previous offshore wind farm developments in UK waters due to the large sea area that the development covers and the distance offshore from shore-based emergency response facilities.

Forewind will, using its own on-site personnel, vessels, structures and facilities, initiate procedures for first response to all emergencies within and in proximity to the Dogger Bank Teesside A & B development.

The following sections identify current response capabilities provided by the United Kingdom (UK) emergency response providers and transboundary provision where information has been available.

13.1 *MCA including HM Coastguard (HMCG)*

At the time of writing, the HM Coastguard co-ordinates SAR through a network of 18 Maritime Rescue Co-ordination Centres (MRCCs).

All of the MCA's operations, including SAR, are divided into three geographical regions. Dogger Bank Teesside A & B are located within the East of England region.

Each region is divided into six districts with its own MRCC, which co-ordinates the Search and Rescue response for maritime and coastal emergencies within its district boundaries (East of England Region includes an additional station, London Coastguard, for co-ordinating Search and Rescue on the River Thames). The nearest rescue coordination centre to the Dogger Bank Teesside A & B projects is currently based at Humber.

The MCA published a consultation document in December 2010 to modernise HM Coastguard. The main part of the document proposes the reduction in the number of MRCC stations around the UK coastline.

Revised plans were released by the UK Government mid-way through 2011 (MCA, 2011) with a second consultation period from 14th July 2011 to 6th October 2011. Under the revised proposals the MCA intends to:

- Establish a single 24 hour Maritime Operations Centre (MOC) based in the Fareham (located at the Fire Control Centre) area with 96 operational coastguards. The MOC will act as a national strategic centre to manage Coastguard operations across the entire UK network as well as co-ordinating incidents on a day to day basis. The MOC will also generate a maritime picture using information from a variety of sources;

- Dover will be configured to act as a stand-by MOC for contingency purposes. Dover would have 28 staff and would retain its responsibilities for the Channel Navigation Information Service (CNIS);

- In addition to the MOC and Dover, there will be eight further Maritime Rescue Sub-Centres (MRSC), all of which would be connected to the national network and the MOC. All would be open 24 hours a day with a total staffing of 23 in each. These would be based at the following stations:

    - MRSC Aberdeen
    - MRSC Shetland
    - MRSC Stornoway
    - MRSC Belfast
    - MRSC Holyhead
    - MRSC Milford Haven
    - MRSC Falmouth
    - MRSC Humber

It is noted that the modernisation of the MCA and HMCG is not intended to be a reduction in emergency response facilities but an improved method of coordination and control. Therefore there will be no impacts on the level of response provided within the area; however as per MCA guidance a level of self-help in addition to the national emergency response capability will be required at the proposed Dogger Bank wind farms.

13.2 *SAR Helicopters*

13.2.1 SAR Helicopters

A review of the assets adjacent to Dogger Bank Teesside A & B, presented in Figure 13.1, indicates that the closest SAR helicopter base is located at Leconfield, operated by the RAF, approximately 105nm southwest of the boundary of Dogger Bank Teesside B and approximately 123nm southwest of the boundary of Dogger Bank Teesside A. This base has Sea King helicopters with a maximum endurance of 6 hours and speed of 110mph. This gives a radius of action of approximately 250nm which easily covers Dogger Bank Teesside A & B. One helicopter is available at 15 minutes readiness between 0800 and 2200 hours. Between 2200 and 0800 hours, one helicopter is held at 45 minutes readiness. RAF Boulmer is located approximately 125nm northwest of the boundary of Dogger Bank Teesside B.

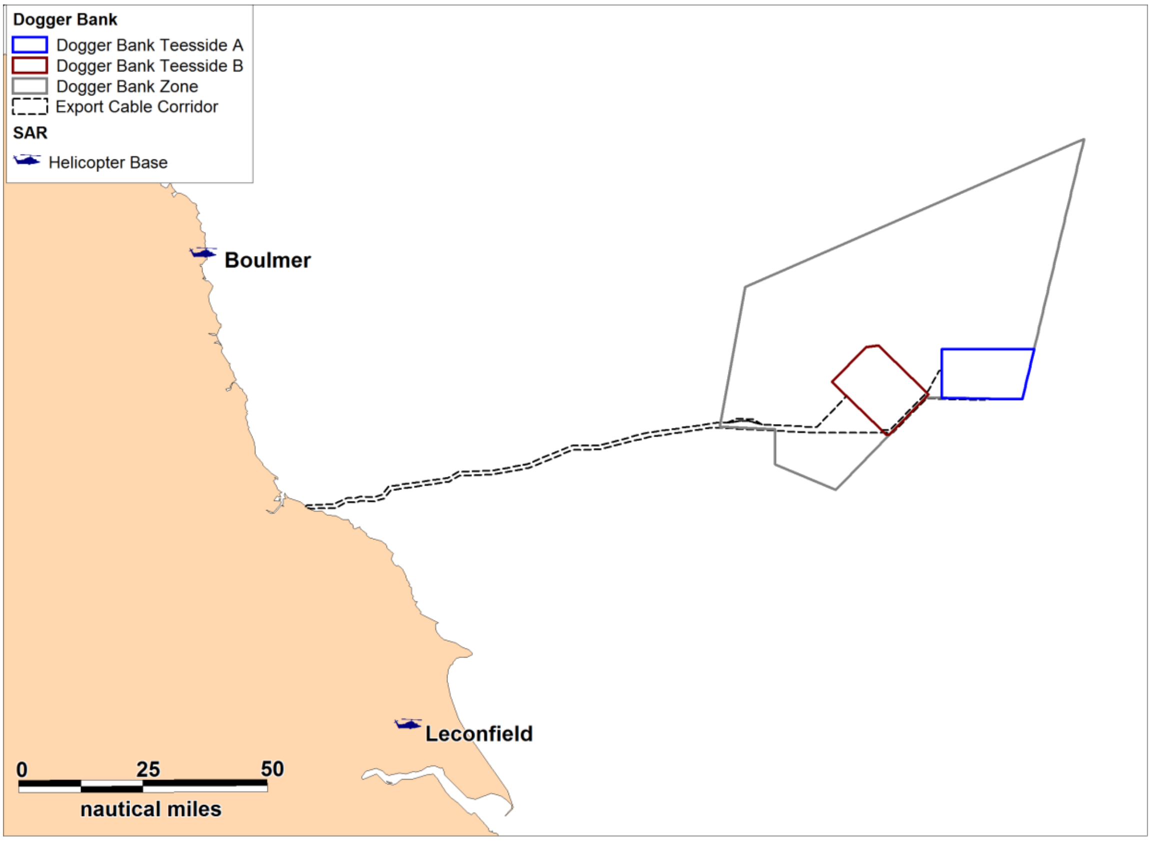

Figure 13.1 SAR Helicopter bases relative to Dogger Bank Teesside A & B

Based on the above information, the day-time response time from RAF Leconfield will be 1 hour 38 minutes to the middle of Dogger Bank Teesside A and 1 hour 27 minutes to the middle of Dogger Bank Teesside B. At night time this will increase by 30 minutes to approximately 2 hour 08 minutes for Dogger Bank Teesside A and 1 hour 57 minutes for Dogger Bank Teesside B due to the additional response time at the base. It is noted that these calculations are based on calm conditions and response times will vary depending on the prevailing conditions.

Under new helicopter search and rescue plans, however, both of these bases are due to close and be replaced with a new service by summer 2017. The Bristow Group will take over helicopter search and rescue operations, with a contract running for ten years from 2015. Figure 13.2 presents the location of future assets adjacent to Dogger Bank Teesside A & B. Humberside is located approximately 120nm southwest of the boundary of Dogger Bank Teesside B and 133nm southwest of the boundary of Dogger Bank Teesside A. This base will operate two Sikorsky S-92s which have a maximum cruise speed of 174mph and range of 539nm. This will cover Dogger Bank Teesside A & B.

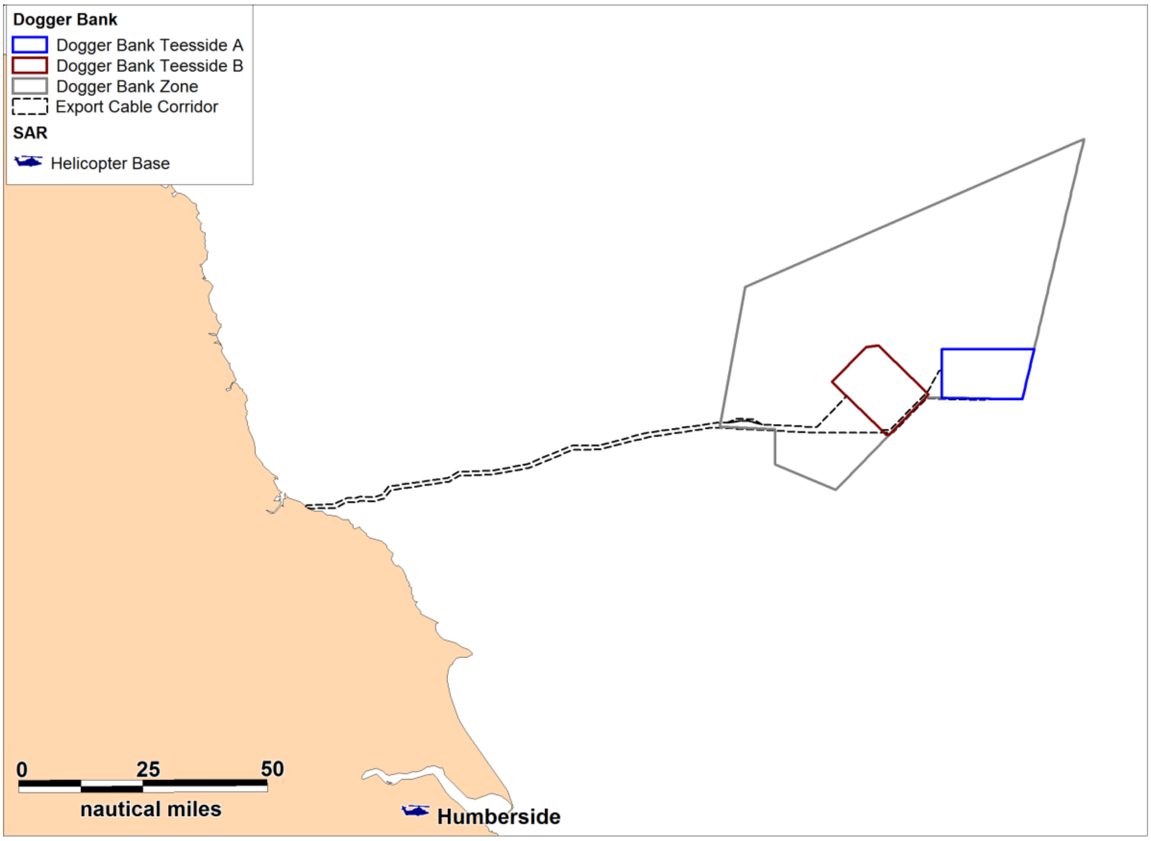

Figure 13.2 Future SAR Helicopter bases relative to Dogger Bank Teesside A & B

The base will be operational 24 hours a day, but details of readiness times are unknown. The response time from the base at Humberside to the middle of Dogger Bank Teesside A will be 50 minutes plus the readiness time, with the response time to the middle of Dogger Bank Teesside B at 43 minutes plus the readiness time.

13.3 *Emergency Towing Vessels, Fires and Salvage*

The MCA has one emergency towing vessel situated in the north of Scotland; this is on temporary contract and will shortly cease operation. Private towing companies may be tasked to assist a drifting vessel.

The responsibility for dealing with fires on vessels lies with the vessel's operating company. The vessel's operating company is obligated to have a safety management system in place. The HMCG will monitor any situation for risk to life or marine pollution. SAR assets will be tasked to assist if the fire has not been dealt with or commercial salvers tasked to assist in saving the vessel and cargo if required.

Private salvage companies may be tasked by the MCA for a variety of tasks including wreck removal, cargo recovery, towage and pollution defence. These private vessels are situated throughout UK waters and ports waiting to be tasked.

13.4 *CAST Agreement (Coastguard Agreement on Salvage and Towage)*

Where there is a serious risk of harm to persons or property, or a significant risk of pollution, it may be necessary to initiate emergency towing arrangements. Such arrangements should be unambiguous, agreed by all parties where possible, and activated as swiftly as practicable.

The MCA has a framework agreement with the British Tugowners Association (BTA) for emergency chartering arrangements for harbour tugs. The agreement covers activation, contractual arrangements, liabilities and operational procedures, should the MCA request assistance from any local harbour tug as part of the response to an incident. Modern harbour tugs are often capable of providing an effective emergency service in all but the worst weather conditions, and to the largest vessels. The UK towage industry has invested heavily over recent years in powerful omni-directional tugs typically of over 50 tonnes bollard pull and with fire-fighting capability. Where weather conditions or size of casualty restrict their use, such tugs can also perform a useful task in providing first response prior to the arrival of other more suitable vessels.

13.5 *Pollution Control and Clean-up*

Any incident of marine pollution or the possibility of pollution must be reported to the nearest MRCC station which will inform the duty counter pollution and salvage officer which determines the level of response - local, regional or national. A local response is a situation that can be dealt with by one authority not requiring assistance from any other authorities. Regional and national responses are required when a significant pollution spill occurs requiring a salvage operation, a spill that requires the deployment of vessels or aircraft to assist in dispersal or during a spill that the local authority does not have the capability to respond to adequately and requires assistance from the MCA.

The initial goal if possible is to prevent pollution, the second step is to stop any further pollution through containment and the third is to minimise environmental hazards.

The MCA may deploy air borne or sea borne equipment to disperse or neutralise the pollution if the installation or the vessel does not have the capability to do so. Commercial salver's can be tasked to perform suitable salvage operations with the goal of minimising pollution.

13.6 *MCA Tiered response for Pollution*

For the purpose of planning, tiers are used to categorise oil pollution incidents. The tiered approach to oil pollution contingency planning identifies resources for responding to spills of increasing magnitude and complexity by extending the geographical area over which the response is coordinated:

- Tier 1 Local (within the capability of one local authority, harbour authority or development)
- Tier 2 Regional (beyond the capability of one local authority or development)
- Tier 3 National (requires national resources)

13.6.1 Secretary of States Representative for Salvage and Intervention (SOSREP)

The role of the SOSREP is to represent the Secretaries of State for the Department for Transport (in relation to ships) and for the Department of Energy and Climate Change (in relations to offshore installations) by removing or reducing the risk to safety, property and the UK environment arising from accidents involving ships, fixed or floating platforms or sub-sea infrastructure. SOSREP's powers extend to UK territorial waters (12 nautical miles from the coast/baseline) for safety issues and to the UK Pollution Control Zone (200 miles or the median line with neighboring states) for pollution

13.7 *RNLI Lifeboats*

The RNLI maintains a fleet of over 400 lifeboats of various types at 235 stations around the coast of the UK and Ireland. The RNLI stations in the vicinity of Dogger Bank Teesside A & B are presented in Figure 13.3.

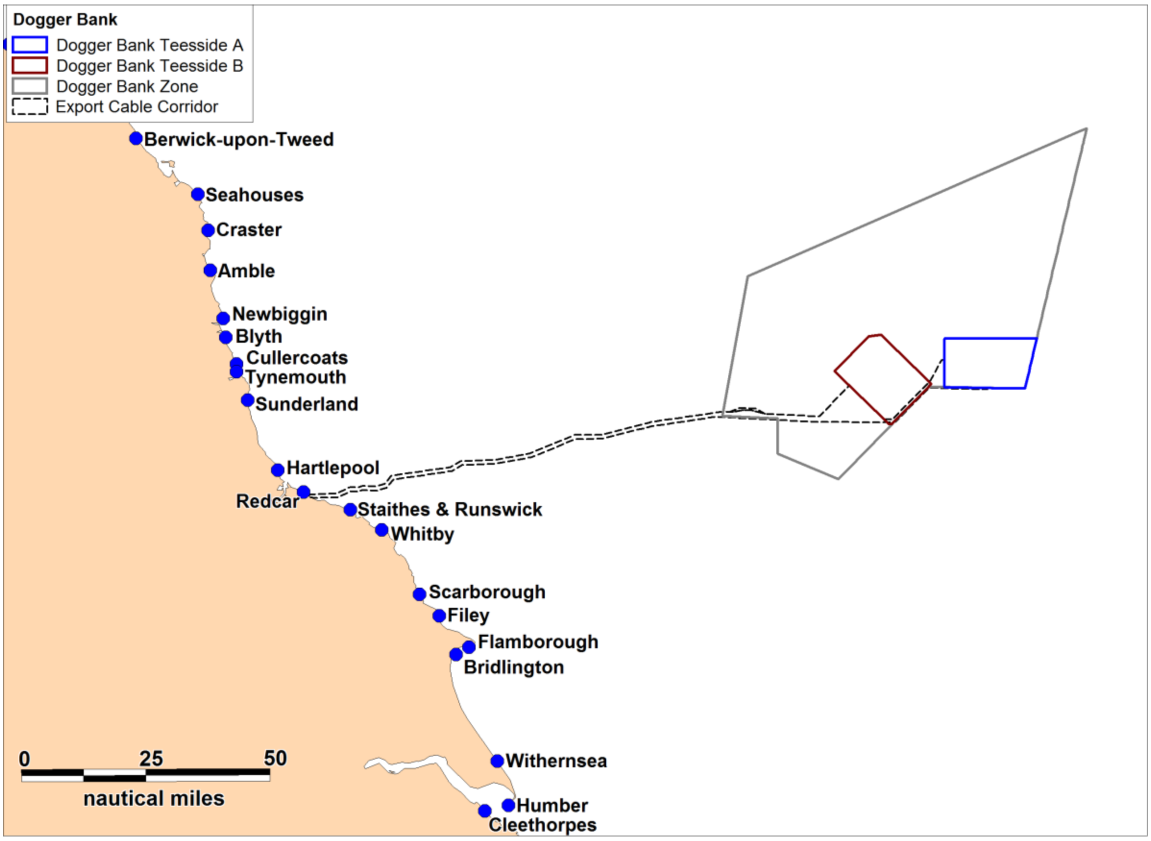

Figure 13.3 RNLI Bases relative to Dogger Bank Teesside A & B

At each of these stations, crew, Inshore Lifeboats (ILB) and/or All Weather Lifeboats (ALB) are available on a 24-hour basis throughout the year. Table 13.1 provides a summary of the facilities at the stations closest to Dogger Bank Teesside A & B.

Table 13.1 RNLI Lifeboat Stations in Proximity to Dogger Bank Teesside A & B

Station	Lifeboats	ALB Class	ILB Class	Distance to Centre of Teesside A	Distance to Centre of Teesside B
Staithes and Runswick	ILB	--	B Class	127nm	108nm
Whitby	ALB/ILB	Trent	D Class	123nm	103nm
Scarborough	ALB/ILB	Mersey	D Class	120nm	101nm
Filey	ALB/ILB	Mersey	D Class	119nm	99nm
Flamborough	ILB	--	B Class	116nm	98nm

Station	Lifeboats	ALB Class	ILB Class	Distance to Centre of Teesside A	Distance to Centre of Teesside B
Bridlington	ALB/ILB	Mersey	D Class	119nm	100nm

The nearest RNLI station with an ALB relative to both Dogger Bank Teesside A & B is Filey where a Mersey class ALB lifeboat is available. The Mersey class lifeboat, the *Keep Fit Association*, is 12m in length and has a maximum speed of 17 knots. The average response time declared by the RNLI for an ALB is 14 minutes. This is the time from callout, i.e., first contact from the Coastguard to the lifeboat station, to launch of the lifeboat.

The time for an ALB from Filey to reach the centre of Dogger Bank Teesside A would be approximately 7 hours, and the time to Dogger Bank Teesside B would be approximately 6 hours (taking into account a 14 minute call out time).

It should be noted that both Dogger Bank Teesside A & B are right on the extremities of the RNLI's 100nm call-out limit.

13.7.1 Coastguard Stations

HM Coastguard, a division of the MCA, is responsible for requesting and tasking SAR resources made available by other authorities and for co-ordinating the subsequent SAR operations (unless they fall within military jurisdiction).

HM Coastguard co-ordinated SAR through a network of 18 Maritime Rescue Co-ordination Centres (MRCC). A corps of over 3,100 volunteer Auxiliary Coastguards around the UK coast form over 380 local Coastguard Rescue Teams (CRT) involved in coastal rescue, searches and surveillance.

All of the MCA's operations, including SAR, are divided into three geographical regions. The East of England Region covers the east and south coasts of England from the Scottish border down to the Dorset/Devon border, and therefore covers the area around Dogger Bank Teesside A & B. The Wales and West of England Region extends from Devon and Cornwall to cover the coast of Wales, North West England and the Solway Firth. The Scotland and Northern Ireland Region covers the remainder of the UK coastline including the Western Isles, Orkney and Shetland.

Each region is divided into six districts with its own Maritime Rescue Co-ordination Centre (MRCC), which co-ordinates the SAR response for maritime and coastal emergencies within its district boundaries (East of England Region includes an additional station, London Coastguard, for co-ordinating Search and Rescue on the River Thames). The nearest rescue coordination centre to both Dogger Bank Teesside A & B is the Humber MRCC (located in Bridlington).

The MCA published a consultation document (MCA, 2010) in December 2010 to modernise HM Coastguard. The main part of the document proposes the reduction in the number of Maritime Rescue Co-ordination stations around the UK coastline. At the time of writing (April 2013), two MRCCs have closed and there are currently 16 MRCCs.

Revised plans were released by the UK Government mid-way through 2011 with a second consultation period from 14th July 2011 to 6th October 2011. Under the revised proposals the MCA intends to:

- Establish a single 24 hour Maritime Operations Centre (MOC) based in the Southampton/Portsmouth area with 96 operational coastguards. The MOC will act as a national strategic centre to manage Coastguard operations across the entire UK network as well as co-ordinating incidents on a day to day basis. The MOC will also generate a maritime picture using information from a variety of sources;

- Dover will be configured to act as a stand-by MOC for contingency purposes. Dover will have 28 staff and would retain its responsibilities for the Channel Navigation Information Service (CNIS);

- In addition to the MOC and Dover, there will be eight further Maritime Rescue Sub-Centres (MRSC), all of which will be connected to the national network and the MOC. All will be open 24 hours a day with a total staffing of 23 in each. These will be based at the following stations:

  - MRSC Aberdeen
  - MRSC Shetland
  - MRSC Stornoway
  - MRSC Belfast
  - MRSC Holyhead
  - MRSC Milford Haven
  - MRSC Falmouth
  - MRSC Humber

Dogger Bank Teesside A & B currently lie within the East of England region with the nearest rescue coordination centre being MRSC Humber. MRSC Humber's area of responsibility provides search and rescue coverage from Haile Sand Fort to the Scottish / English Border.

The proposed changes to the UK MRCC structure will result in MRSC Humber covering a much wider area; however it will continue to respond to any incidents in the vicinity of Dogger Bank Teesside A & B.

13.8 *Salvage*

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.

Emergency tug provision will generally be a contracted agreement between the vessel owners and tug operators. Coastguard Agreement on Salvage and Towage (CAST) will be invoked when owners are either unable or unwilling to engage in a commercial tow contract. MCA will pursue costs through arbitrators on a cost recovery basis.

Tug assistance may also be available from vessels supporting gas fields in the area.

14. Maritime Incidents

This section reviews maritime incidents that have occurred in the vicinity of Dogger Bank Teesside A & B and the export cable corridor in the period 2001 to 2011.

The analysis is intended to provide a general indication as to whether the area of the proposed development is currently low or high risk in terms of maritime incidents. If it was found to be a particularly high risk area for incidents, this may indicate that the development could exacerbate the existing maritime safety risks in the area.

Data from the following sources have been analysed:

- MAIB (2002 to 2011)

- RNLI (2001 to 2010)

It is noted that the same incident may be recorded by both sources.

14.1 *Marine Accident Investigation Branch*

All UK-flagged 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 12 mile territorial waters and carrying passengers to a UK port. Therefore, non-UK registered vessels outside of 12 miles are not included in the MAIB data analysed in this section. There are no requirements for non-commercial recreational craft to report accidents to MAIB.

The locations of accidents, injuries and hazardous incidents reported to MAIB within 10nm of Dogger Bank Teesside A & B for the ten year period between January 2002 and December 2011 are presented in Figure 14.1, thematically mapped by type.

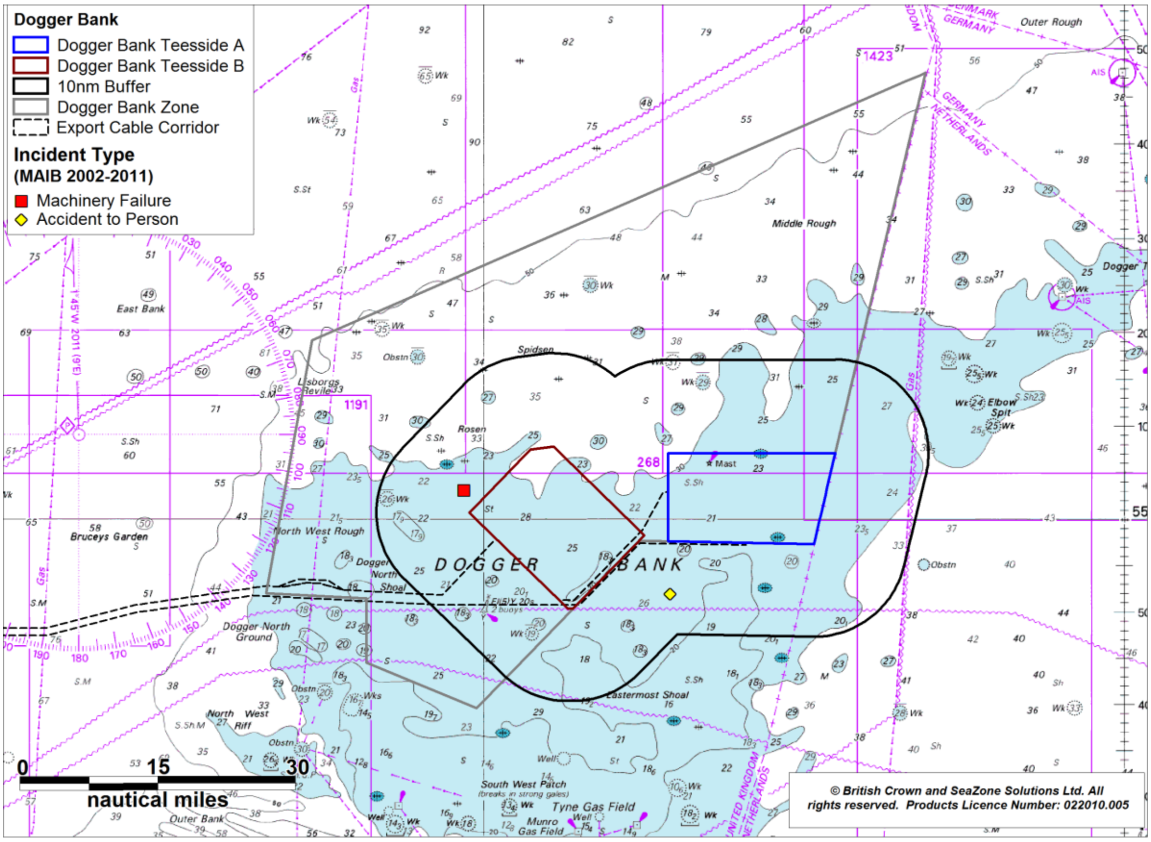

Figure 14.1 MAIB Incidents by Type within 10nm of Dogger Bank Teesside A & B

It should be noted that the MAIB aim for 97% accuracy in reporting the locations of incidents.

Two incidents occurred within 10nm of Dogger Bank Teesside A & B which are described in more detail below:

- On 11 February 2004 a vessel suffered Machinery Failure, which occurred in daylight in high seas. This incident happened approximately 2nm northwest of Dogger Bank Teesside B. The bottom end bolt on the main engine fell out causing the con rod to fail, disabling the engine. The vessel was towed back to port by the RNLI; and
- On 31 July 2008 an Accident to Person on-board a fishing vessel occurred in daylight in high seas. A crewman injured himself approximately 5.6nm south of Dogger Bank Teesside A.

14.1.1 Export Cable Corridor

MAIB incidents within 5nm of the export cable corridor between January 2002 and December 2011 are presented in Figure 14.2 , thematically mapped by type.

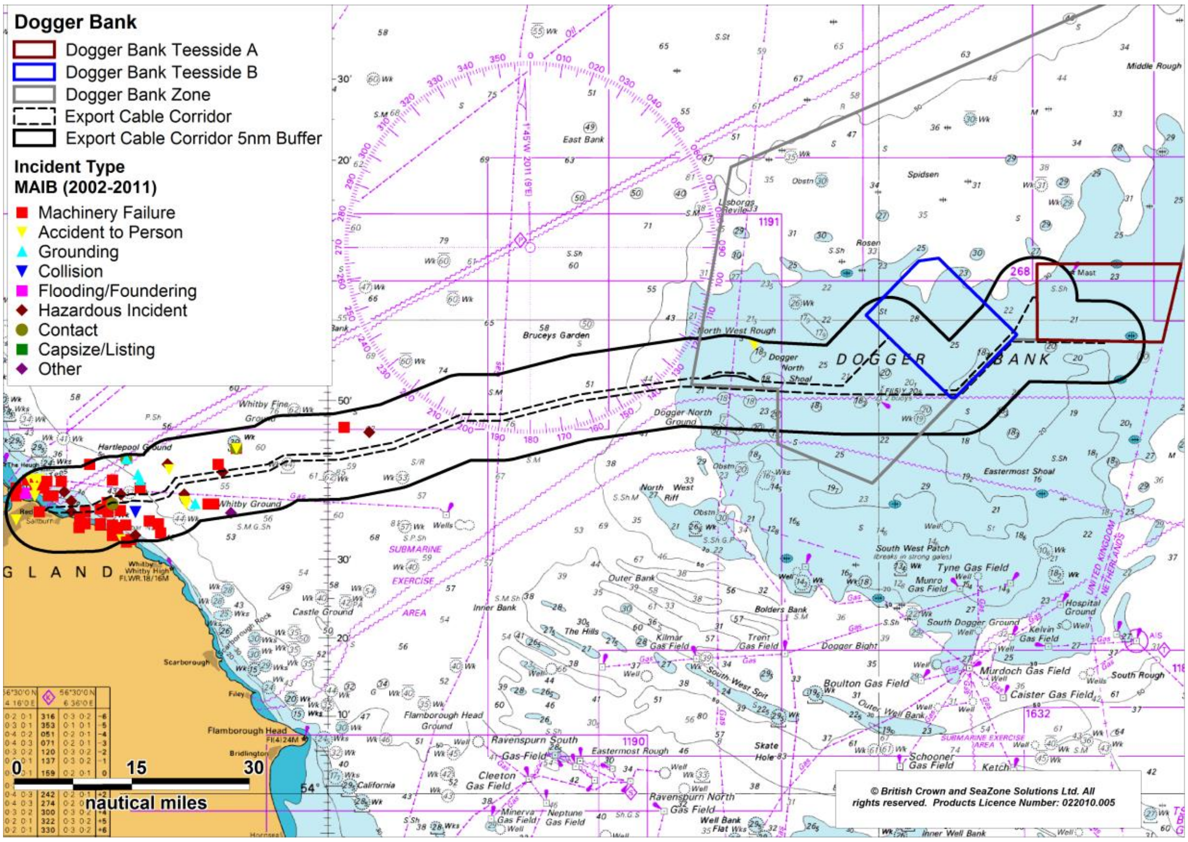

Figure 14.2 MAIB Incidents (2002-2011) by Type within 5nm of Export Cable Corridor

A total of 67 incidents were recorded within 5nm of the export cable corridor over the ten years analysed, involving 72 vessels (or persons), corresponding to an average of just under seven incidents per year.

Two incidents were recorded within the export cable corridor. A summary of these incidents is provided below:

- On 23 January 2004 two vessels were involved in a Hazardous Incident, which occurred in darkness with moderate (2-5nm) visibility and wind force 4-6 in coastal waters. One vessel was a 161m long 27,565 GT vehicle carrier from Vanuatu, and the other was a 39m long 390 GT British fishing vessel. This incident occurred approximately 23nm into the export cable corridor from the coast;
- On 01 January 2011 a Machinery Failure occurred in daylight with wind force 4-6 in coastal waters. The vessel was a 100m long 4,100 GT Danish chemical tanker. This incident occurred approximately 4.5nm into the export cable from the coast.

The distribution of incidents within 5nm of the export cable corridor, by incident type, is presented in Figure 14.3.

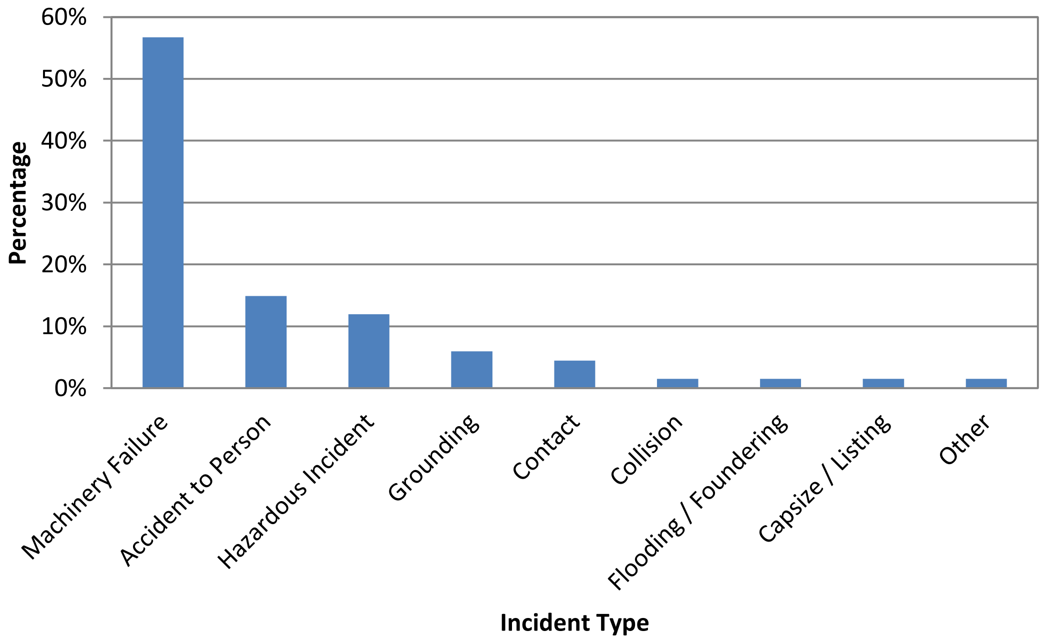

Figure 14.3 Distribution of MAIB Incidents (2002-2011) by Type within 5nm of Export Cable Corridor

The most common incident type recorded within 5nm of the export cable corridor was Machinery Failure, representing 57% of all incidents over the ten year period. Emergency anchoring can occur during a machinery failure (e.g. engine failure, steering gear problems or fouled propeller), which could pose an anchor snagging risk.

Figure 14.4 presents the distribution of MAIB incidents per year in the area.

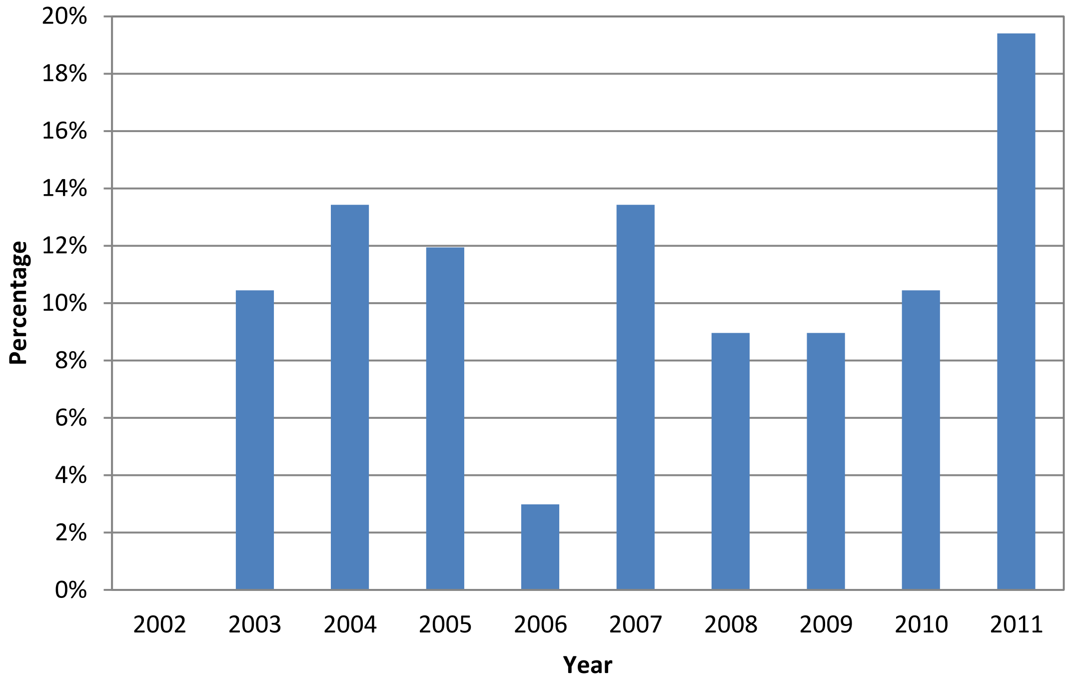

Figure 14.4 MAIB Incidents by Year within 5nm of Export Cable Corridor

The highest number of incidents was recorded in 2011 when 19% of the incidents were recorded.

14.2 *Royal National Lifeboat Institution*

14.2.1 Dogger Bank Teesside A & B

Data on RNLI lifeboat responses within 10nm of Dogger Bank Teesside A & B in the ten-year period between 2001 and 2010 have been analysed. It was found that there were no incidents responded to by the RNLI for the area analysed due to the distance of the sites from shore.

14.2.2 Export Cable Corridor

Data on RNLI responses within 5nm of the export cable corridor in the ten-year period between 2001 and 2010 have been analysed.

A total of 406 unique incidents were recorded within 5nm of the export cable corridor over the ten years analysed, corresponding to an average of approximately 40 incidents per year.

Figure 14.5 presents the geographical location of incidents thematically mapped by casualty type. A total of 18 unique incidents were recorded within the export cable corridor. It can be seen that the vast majority of incidents occurred near the coast with relatively few further out to sea.

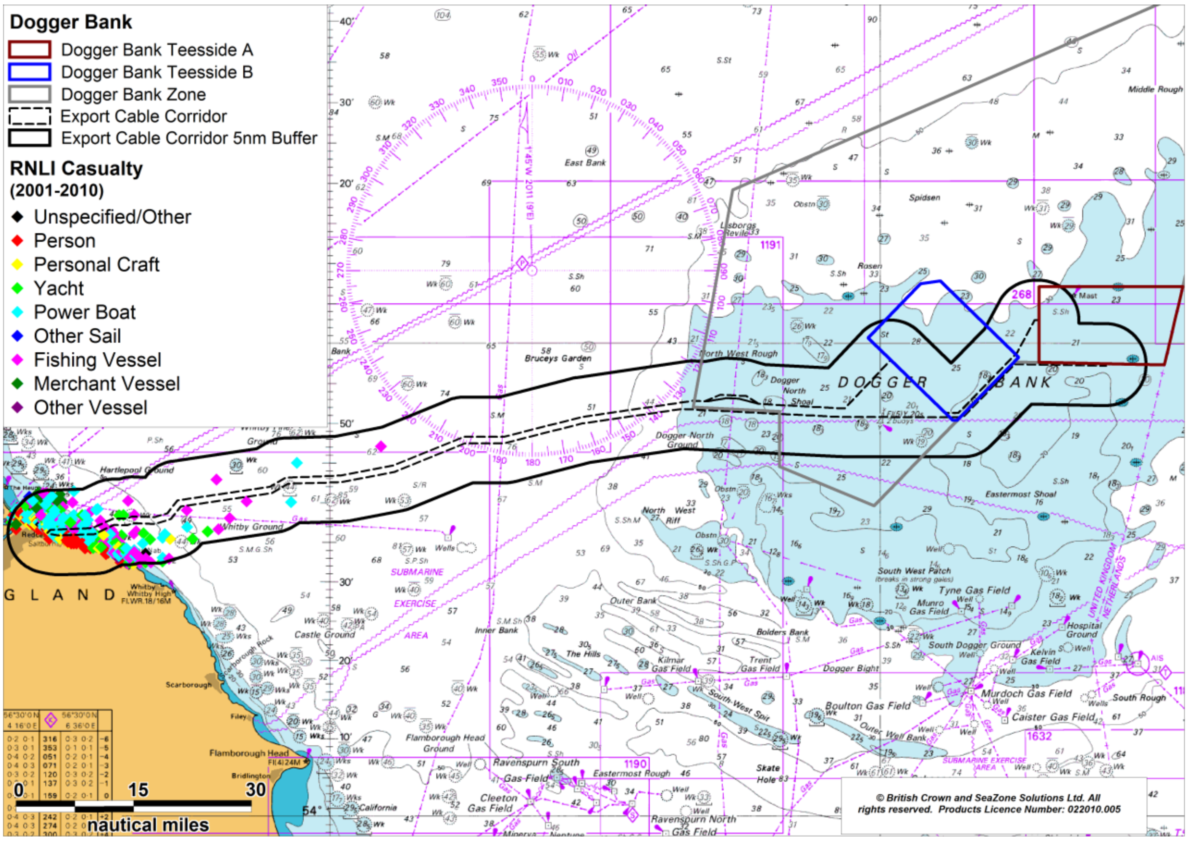

Figure 14.5 RNLI Incidents (2001-2010) by Casualty Type within 5nm of Export Cable Corridor

The overall distribution of incidents within 5nm of the export cable corridor, thematically mapped by casualty type, is summarised in Figure 14.6.

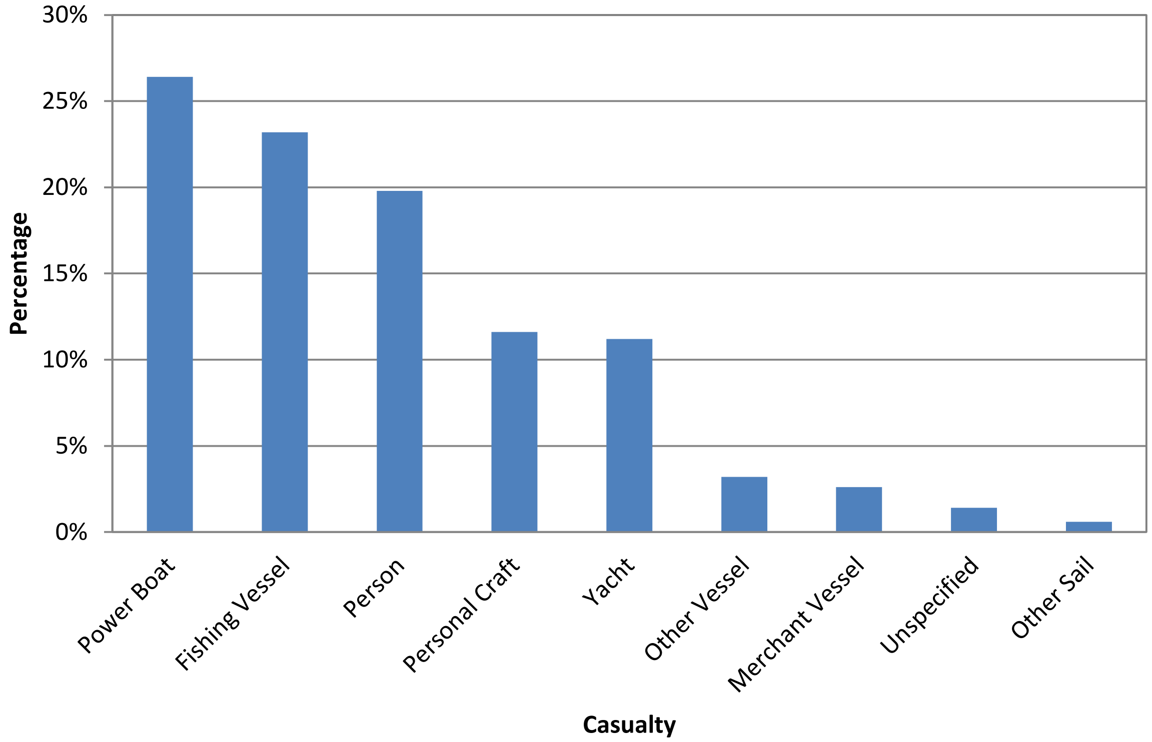

Figure 14.6 Distribution of RNLI Incidents (2001-2010) by Casualty Type within 5nm of Export Cable Corridor

The most common vessel type involved was power boats (26%). The remainder of incidents involved mainly fishing vessels (23%), accidents to people (20%) and personal craft (12%).

A plot of the incidents thematically mapped by cause is presented in Figure 14.7.

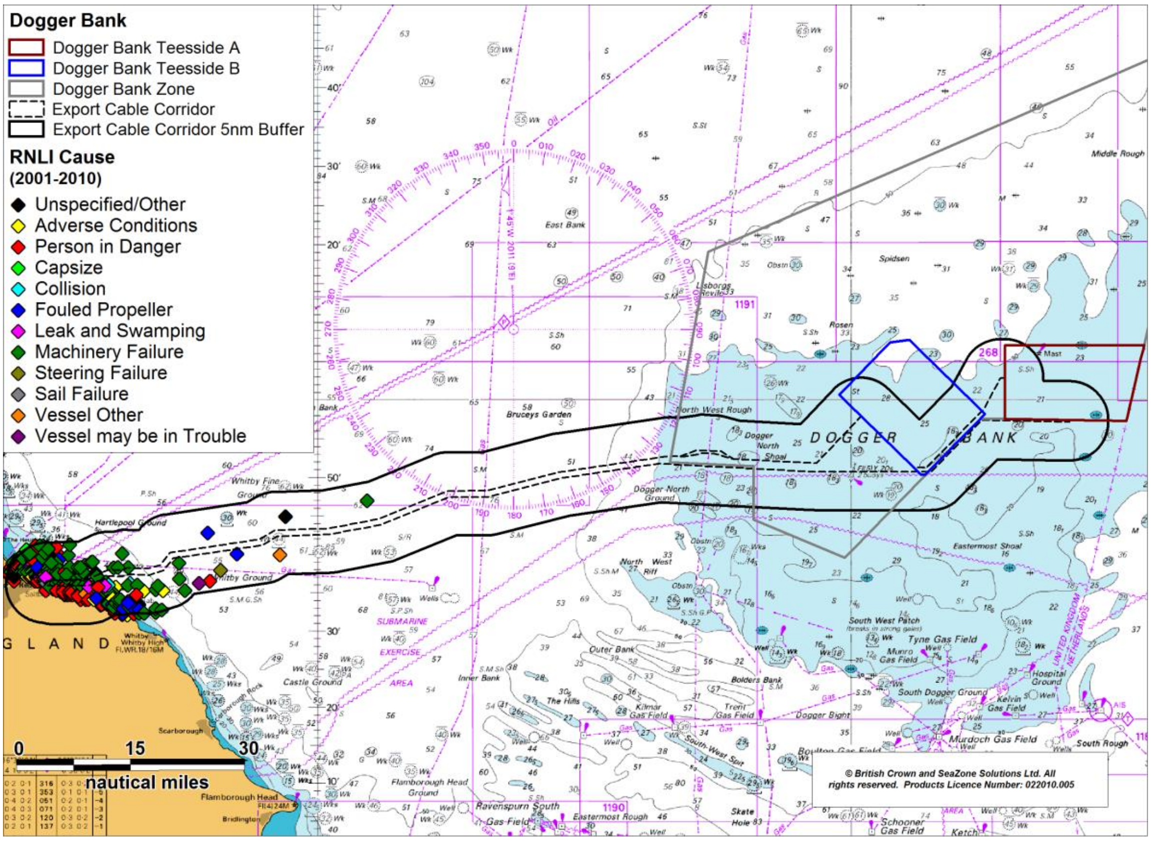

Figure 14.7 RNLI Incidents (2001-2010) by Cause within 5nm of Export Cable Corridor

The overall distribution of causes is summarised in Figure 14.8.

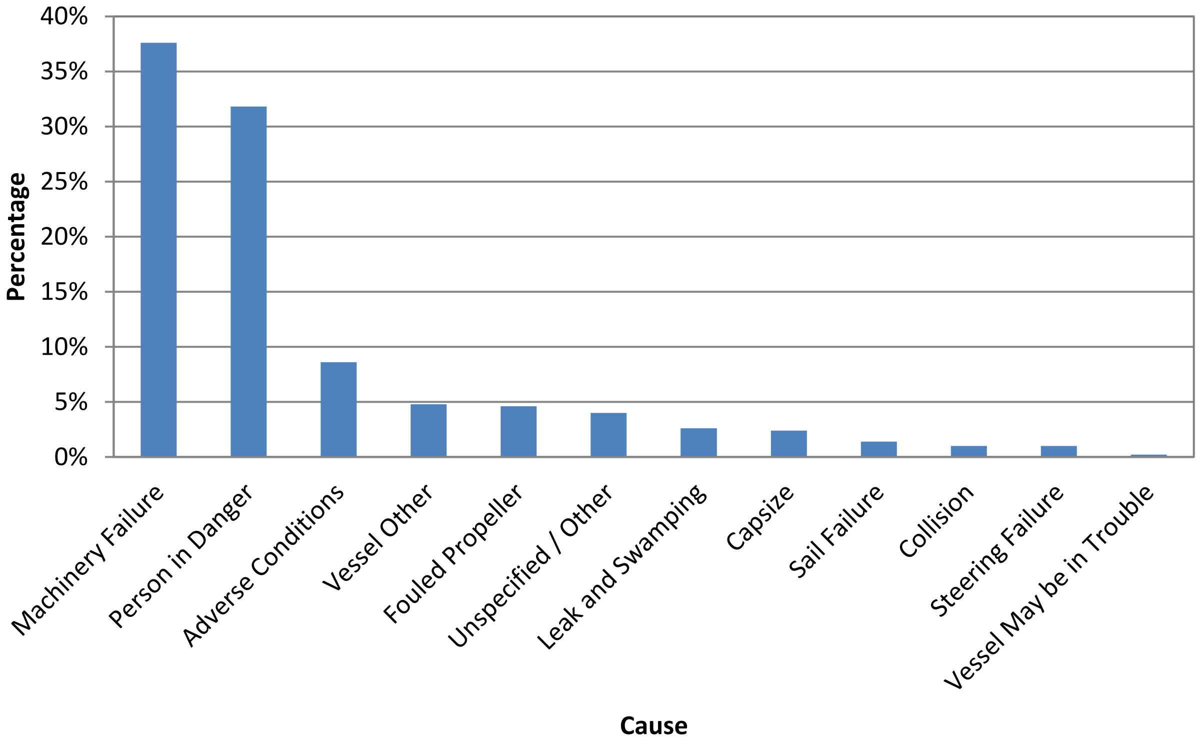

Figure 14.8 Distribution of RNLI Incidents (2001-2010) by Cause within 5nm of Export Cable Corridor

It can be seen that the two main causes were machinery failure (38%) and person in danger (32%).

The annual rate of incidents responded to by the RNLI from 2001 to 2010 is summarised in Figure 14.9.

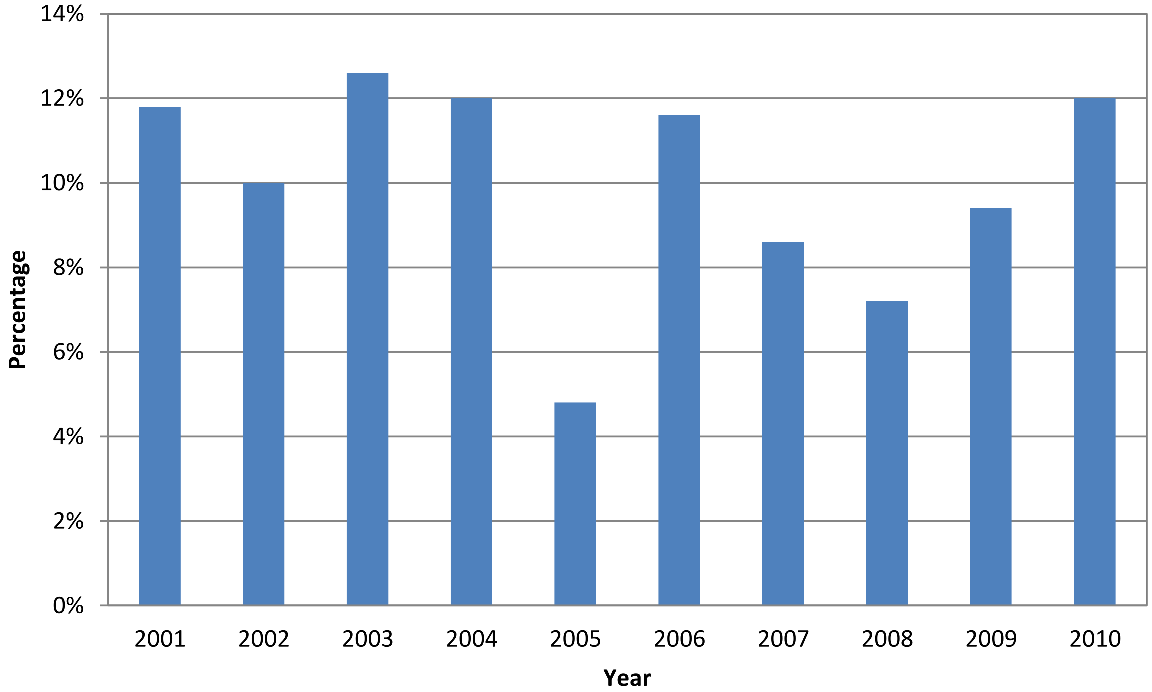

Figure 14.9 RNLI Incidents by Year within 5nm of Export Cable Corridor

The highest number of incidents recorded was in 2003 when 13 % of the incidents were responded to.

There are two types of RNLI lifeboats that can respond to incidents (All Weather Lifeboats (ALB) and Inshore Lifeboats (ILB)). The stations and types of lifeboat responding to incidents within 5nm of the export cable corridor are illustrated in Figure 14.10.

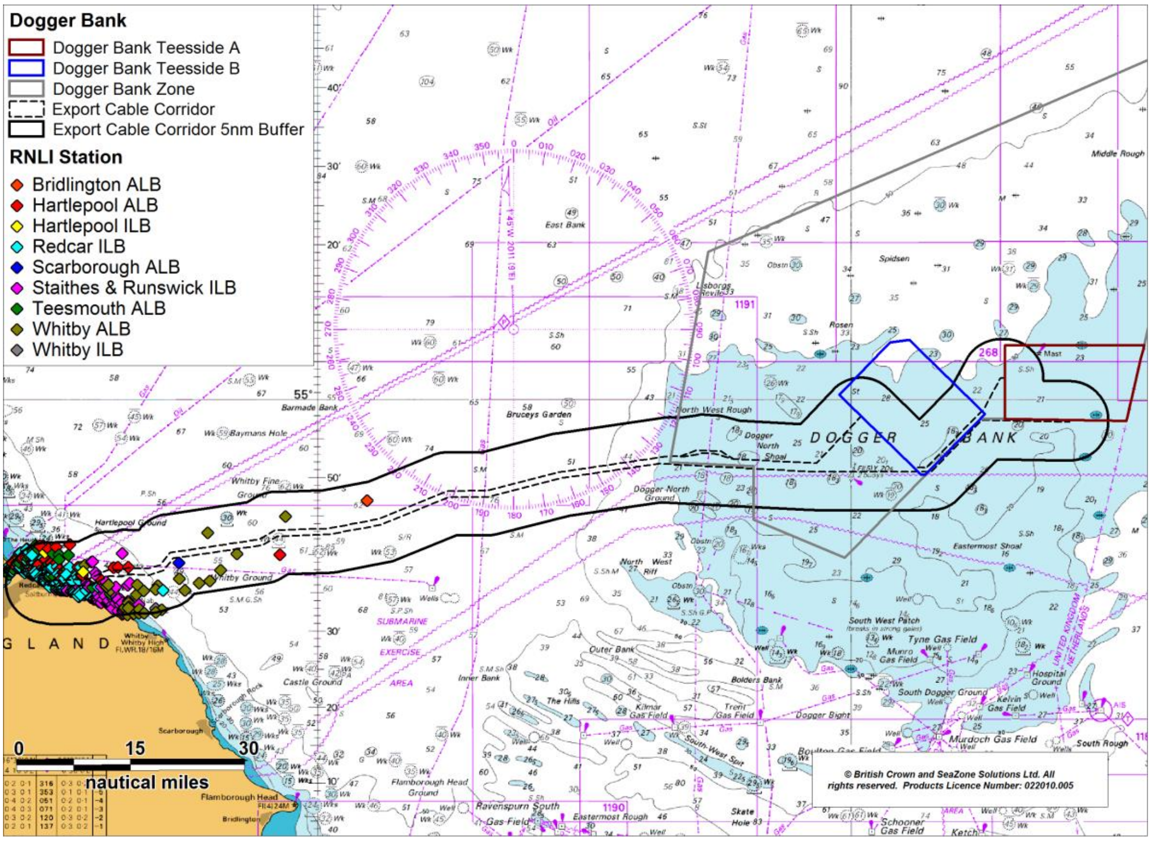

Figure 14.10 RNLI Incidents by Station within 5nm of Export Cable Corridor

Incidents within 5nm of the export cable corridor were responded to mainly by Redcar ILB (52%), Staithes and Runswick ILB (16%), Teesmouth ALB (10%) and Hartlepool ALB (10%).

15. Overview of Key Consultation

15.1 *Introduction*

Consultation for navigational issues has been carried out with stakeholders throughout the appraisal process. This section summarises the key points from consultations and from the Planning Inspectorate Scoping Opinion 2012.

Table 15.1 Stakeholder Consultation Responses

Stakeholder	Overview of Key Points	Section
MCA 27/10/2010 (Scoping Opinion)	• The ES should detail the impact on navigational issues for both commercial and recreational craft. • NRA should be submitted in accordance with MGN 371 (and 372) and the DTI/DfT/MCA Methodology for Assessing Wind Farms. • Particular attention should be paid to cabling routes and burial depth. • Reference should be made to MEHRAs. • Cumulative and in-combination effects require serious consideration. • Recommended minimum separation of 3.5nm between turbines on opposite sides of a route. • Radar and manual observations should be included in addition to AIS data. • Consideration must be given to SAR resources.	• Section 18: Maritime Traffic Survey Dogger Bank Teesside A & B, Section 19: Maritime Traffic Survey – Export Cable Route, Section 21: Future Case Marine Traffic, Section 22: Collision Risk Modelling and Assessment. • NRA submitted in accordance with MGN 371 (and 372) and the DTI/DfT/MCA Methodology for Assessing Wind Farms. • Section 23: Export Cable Risk Assessment. • Section 11: Baseline Environment. • Section 29: Cumulative Effects. • Section 10.3: Layout Rules. • Section 18: Maritime Traffic Survey Dogger Bank Teesside A & B, Section 19: Maritime Traffic Survey – Export Cable Route. • Section 13: Emergency Response Overview and Assessment.

ABP Grimsby, Immingham, Hull and Goole 27/10/2010 (Scoping Opinion)	• Pleased with the thorough approach being taken when considering effects and would like to be kept informed of any updates as the proposal develops.	• N/A
E.ON Climate and Renewables 08/11/2010 (Scoping Opinion)	• There were concerns that the offshore export cable corridor may run through or in close proximity to the Humber Gateway Offshore Wind Farm.	• Not the case.
MMO 10/11/2010 (Scoping Opinion)	• Seasonal variations should be taken into account when quantifying impacts in the EIA.	• Section 18: Maritime Traffic Survey Dogger Bank Teesside A & B, Section 19: Maritime Traffic Survey – Export Cable Route.
Trinity House 11/11/2010 (Scoping Opinion)	• Wind farm will need to be marked by the developer/operator in accordance with general principles outlined in IALA Recommendation O-139. • Cumulative and in-combination effects should be taken into account. • When considering impacts with decommissioning, it should extend to a situation where it is not possible to remove all the obstructions.	• Section 3: Guidance and Legislation. • Section 29: Cumulative Effects. • Section 31.8: Decommissioning Plan.
MCA and THLS 07/04/2011	• They would be concerned if there were an excessive amount of cables between the zone and coast particularly near anchorage/port areas. • Concerns raised over emergency response issues.	• Section 23: Export Cable Risk Assessment. • Section 13: Emergency Response Overview and Assessment.
CoS 05/05/2011	• National Ship Owners' Association should be consulted with. • Consideration should be given to the planned offshore wind farm developments in other countries such as The Netherlands, Belgium and Germany which could have an impact on the overall routes being considered.	• Section 17: European Shipping Association Consultation 2011. • Section 29: Cumulative Effects.

MCA 21/02/2012	• Concern regarding emergency response should a vessel get into difficulty inside an offshore wind farm. • A discussion was held regarding the consideration given to channels and why no channels are being proposed for the Dogger Bank Zone. • Guidance to be issued on the naming conventions to be used in an offshore wind farm for SAR issues. • If the change from 22m above MHWS to 22m above HAT goes ahead this will make very little difference to projects within the Dogger Bank Zone due to the small tidal range. • Agreement that the collated data looks comprehensive and dedicated surveys are not required. Content with on-going data collection from survey vessels and met masts.	• Section 13: Emergency Response Overview and Assessment.
MCA and THLS 03/04/2012	• THLS raised concerns over excessive rock dumping on export cable and the navigational safety issues for vessels restricted by their draughts. • Consideration should be given to the future life of developments especially SAR, Emergency Response Co-operation Plans (ERCoP), HSE documents and Aids to Navigation. • Concerns over different sizing of turbines within developments. • Lighting, numbering and marking should be synchronised between each site. • Structures should not be out of line on the periphery. • There is the potential for the use of floating Aids to Navigation. Sites should be clearly defined to aid SAR.	• Section 23: Export Cable Risk Assessment. • Section 31: Through Life Safety Management. • Section 10.3: Layout Rules. • Section 10: Design Envelope.
Shell (Pipeline) 24/04/2012	• Had no navigational concerns related to the wind farm development	• N/A

	*Note other cable operators were consulted with and their comments are addressed in Other Offshore Users Environmental Statement Chapter.	
RYA 04/05/2012	• The change from MHWS to HAT would have no impact on the proposed projects within the Dogger Bank zone. • From a recreational vessel perspective, the RYA does not see the need for safety zones during operation. • More information needs to be presented on cable burial and the potential impact of rock dumping/mattressing on water depths. • It was stated that due to the distance offshore, recreational sailors around Dogger Bank are expected to be competent and on well-equipped vessels. • A key issue for the developer will be to try and avoid differing sizes of turbines within a site as well as having different spacing.	• Section 10.3: Layout Rules. • Section 10: Design Envelope.
CoS 15/05/2012	• CoS would be concerned if a shipping channel was to be developed within the Dogger Bank Zone given the length of any such channel and the inherent risks associated with it. • The only way they may have an issue with Dogger Bank is if traffic from the Hornsea Zone was rerouted through Dogger Bank.	• Section 29: Cumulative Effects.
MCA and THLS 23/07/2012	• THLS discussed the difficulties in knowing how and when to mark up the individual wind farms, or whether the wind farms would be marked as one. • Both MCA and THLS raised concerns over variations in design between different wind farms and stated that they should be aligned to	• Section 10.3: Layout Rules. • Section 10: Design Envelope. • Section 29: Cumulative Effects.

	aid the mariner. • Concerns over how leisure users would understand the marking system, although the level of leisure activity is extremely low. • No concerns raised over mooring buoys at this stage. • MCA and THLS commented that operational safety zones would not usually be approved. The idea of marking 'precautionary safety zones' on charts was discussed.	
MCA and THLS 11/12/2012	• Confirmed that it is possible that the areas will not be completely filled with turbines and hence the gaps between turbines and wind farms could be larger than the gaps shown in the NRA. • THLS have concerns about marking the multiple site layout. But agreed to work with Forewind to look at options in future meetings. • Agreed that navigation activity in the area is low but that it is individual vessels not used to the area that were the concern. • MCA agreed that this site will require managing shipping in a different way to other sites. • MCA questioned variations in foundation types and that they would prefer foundations to be consistent across a wind farm. Forewind stated that this may not always be possible for engineering reasons as foundations are largely governed by the underlying geology. • Noted that a SAR document has been produced to show how will be mitigated, MCA confirmed this approach as they know their own procedures, it is what the operator is going to do that is of interest to them.	• Section 10.3: Layout Rules. • Section 10: Design Envelope. • Section 13: Emergency Response Overview and Assessment.
Dogger Bank	• The Cygnus project has new	• Section 10.3: Layout

Teesside Hazard Workshop – Revelvant Comments 01/05/2013	coordinates. The Cygnus B platform has moved location, which has moved the route for the infield pipeline. Coordinates for this move have been provided. • Potential mitigation could be agreement with fishing and commercial stakeholders of a vessel route for construction vessels to use. Due to the distance offshore and the variety of routes which could be taken to reach the wind farms, it was not thought that this would be necessary. However, construction vessel entry and exit points to the wind farm could be defined by Forewind. • Potential for accommodation platforms to have 500m safety zones during operation. If accommodation method is a vessel, there is the possibility that it could be located outside of the zone if it is not moored. • Curved layout recognised as being worst case due to difficulty with visual navigation and SAR. • Order of installation of turbines was mentioned as potential mitigation. The preference, to reduce allision risk, will be that structures on the periphery will be installed first.	Rules. • Section 10: Design Envelope. • Section 25: Embedded mitigation measures.
THLS 12/06/2013	• Considered curved layouts to be unacceptable. • A linear design with no standalone structures would help reduce the risk to mariners ALARP. • Reservations regarding the dense perimeter as this could cause navigational confusion. Request consultation as soon as construction plan has been finalised in order to determine the necessary construction phase marking requirements.	• Section 10.3: Layout Rules. • Section 10: Design Envelope.

	CIA – Forewind must remain mindful of the Hornsea OWF project to the south and continue to monitor the cumulative impacts. Site boundaries – The boundaries of these sites are of concern in relation to that of future sites. • Project naming – Name of Teesside wind farms should be changed to reflect the geographical location.	
CoS 12/06/2013	• CIA – Forewind should continue to exchange shipping and navigation data and information between Hornsea and East Anglia. • Curved Layouts – Strong concerns over curved layouts on SAR operations. • Dense Perimeters – No objections to perimeter weighted layouts (which may act as an aid to navigation), however strongly believe that these should be straight and combined with a regular grid layout for internal turbines. • Steps should be taken to ensure that layouts are aligned to assist both normal navigation and SAR operations.	• Section 10.3: Layout Rules. • Section 10: Design Envelope.
Royal Norwgian Ministry of the Environment 12/06/2013	• Safety Zones – It is the Coastal Administration's understanding that 500m safety zones can be established around wind farm installations in accordance with Article 60 in the UN Convention on the Law of the Sea. Further there are measures such as 'Area to be Avoided' that can be implemented in accordance with the IMO general provisions on shipping routes. The concept proposed for use within the Dogger Bank Zone, "Charted Advisory Safety Areas" is probably less known to mariners than measures in the IMO provisions and their legal basis may be unclear. An	• Section 25: Embedded mitigation measures. • Section 26: Additional Mitigation Measures

	advantage by having a measure adopted by IMO may be that these are promulgated by an IMO circular and binding for all nations.	
MCA , THLS and CoS 10/06/2013	• Discussions on Zonal development plans and individual wind farms for the Dogger Bank Zone. • Overview of traffic and traffic densities in the Dogger Bank area, traffic noted as lower levels compared to other development areas. • Review of dense perimeters and curved layouts. • Feedback from MCA SAR representative on issues with curved grids and helicopter/vessel search patterns. • ATBAs and operational safety zones noted not required, although safety zones could be considered post-construction if safety case is present. • CIA issues noted.	• Ongoing Zonal consultation.
MCA , THLS and CoS 02/07/2013	• Agreed traffic levels were low and that individual users were not a significant concern in the Dogger Bank Area. • Project naming discussed highlighting MCAs requirement for geographical reference within the name. • Confirmed MCA and THLS opinions on curved grids. • MCA would like to see a visualisation of dense parameter and curved parameter grids. • Noted that traffic levels were low and that individual users were not a significant concern in the Dogger Bank Area. • MCA noted that they will want to see a central control centre for emergency response that will cover all sites within Dogger Bank. • MCA and THLS confirmed that they	• Ongoing Zonal consultation.

	do not consider curved internal layouts a feasible option due to implication on SAR helicopters.	
RYA 20/11/13 (Post PEI3)	• The RYA is content that the issues raised in its PEI3 response are adequately described in chapter 16 of the Draft Environmental Statement. • The RYA notes that rules have been developed that will apply to the final proposed array layout which restrict the array patterns employed and that these rules will be implemented into the final Development Consent Order.	• Section 10.3: Layout Rules
EPIC Regeneration (representing the Hartlepool Fishermen's Society) Dec 2013	• There is a high likelihood that this development will have significant cumulative impacts when taken in conjunction with those already created by the Teesside Offshore Wind Farm and the Breagh pipeline. • There is concern that this development will lead to yet further displacement of anchorages for Teesport-bound shipping onto traditional fishing grounds. • Should Hartlepool be selected as the construction port it would have a significant impact on the fishermen of Hartlepool, as they could anticipate having their access into and out of port hampered by the need to accommodate shipping movements for over three and a half years. • It is essential that Forewind consider the cumulative impact of any development and growth plans for Teesport, particularly where these will lead to either an increase in the volume of shipping or the average tonnage of vessels using the port.	• Section 19.4: Cable Route Anchored Vessels • Section 21: Future Case Marine Traffic • Section 25: Embedded mitigation measures • Section 0: Additional Mitigation Measures • Section 29: Cumulative Effects.
MCA 12/12/13 (Post PEI3)	• The MCA is satisfied that all aspects of the NRA have been properly addressed. • The MCA welcome the layout rules	• Section 10: Design Envelope • Section 10.3: Layout Rules

	that have been identified and are comfortable that a layout plan can be agreed within these parameters, which appear to take account of concern that have been raised over curved layout proposals. • MCA reiterate concern of the naming choice and use of the word "Teesside" noting there is already a Teesside Wind Farm, and how both development names Creyke Beck and Teesside can be geographically referenced and are therefore potentially confusing. MCA acknowledge and welcome Forewinds agreement to address this concern (post application). • MCA highlight the need to achieve uniformity of layout across the individual wind farms within the Dogger Bank Zone, layout rules, principles and agreement will be a key issue in taking this forward. • MCA wish to see some form of linear progression of the construction programme avoiding disparate sites across the development area. • MCA stress the need for agreed layout and construction programming to be embedded within the DML. • The cumulative impacts associated with the site are considered to have been adequately addressed. • The requirement and use of safety zones as detailed in the application is noted and supported. • MCA state that an approved ERCoP will need to be in place prior to construction being undertaken, this will be included as a formal condition of the DCO. • MCA state that the scale of the development and distance offshore will require a high level of 'self-help'	• Section 25: Embedded mitigation measures. • Section 0: Additional Mitigation Measures • Section 29: Cumulative Effects.

	capability to be developed, outline proposals, or at least support to this statement should be made very clear to application within the ES. • MCA require that a single marine controller is established that ensures a multi-disciplined activity, has an effective overall maritime coordination process in place, again this should be highlighted within the ES.	
THLS 19/12/13 (Post PEI3)	• THLS have significant concerns regarding the layout of turbines at the Dogger Bank site in general but particularly in Dogger Bank Teesside B. THLS advise that a linear turbine layout design with no standalone structures would help reduce the risk to the mariner to ALARP. • THLS stated that offshore site construction plans should be carefully considered to ensure the wind farm "grows" from a single location rather than fragments into multiple work sites that join up at a later date. • THLS reiterated the need to consider the cumulative impact of other wind farms within the southern North Sea, particularly development of the Hornsea Zone to the south, on the Dogger Bank Zone. • Given the proximity, size and shape of Dogger Bank Teesside B in relation to surrounding wind farms within the Dogger Bank Zone, THLS are concerned with the proposed Dogger Bank Teesside B wind farm area as the risk to the mariner may be particularly difficult to mitigate sufficiently with the use of aids to navigation. • THLS request that the name "Teesside" be changed to reflect the geographical location of this wind	• Section 10: Design Envelope • Section 10.3: Layout Rules • Section 29: Cumulative Effects

	farm.	
CoS 08/01/14 (Post PEI3)	• The chamber is generally satisfied that the development will impact minimally upon shipping and navigation in the area due to the relatively low levels of commercial traffic present. • The chamber are concerned that when the wind farms are assessed in combination with other proposed projects in the area, both within the Dogger Bank Zone and elsewhere, the potential impacts may be higher than those assessed in isolation. • The chamber view the update to the SNSOWF work, and addition co-operation between developers, as vital to ensuring that the cumulative impacts on shipping and navigation are assessed in a holistic manner. • The chamber remains concerned over the proposed layouts of the wind farms in the Dogger Bank Zone, both in terms of the site boundaries and potential inconsistencies in turbine layouts. • The chamber recommends that any export cables are buried to a minimum of one metre below the seabed as recommended by the MCA. Where burial is not possible and protection is required, navigable water depth should not be reduced by more than 5% of chart datum. • The chamber shares the concerns of the MCA and THLS over the proposal to name the wind farms "Teesside". The chamber would support any action by Forewind to change the name of the wind farms.	• Section 10: Design Envelope • Section 10.3: Layout Rules • Section 25: Embedded mitigation measures. • Section 29: Cumulative Effects

16. Regular Operators Consultation

16.1 *Regular Operators Identification*

Regular operator identification was undertaken at a zonal level.

27 regular operators that would be required to deviate following the development of Dogger Bank Zone were identified and consulted via electronic or hardcopy mail. The email/letter gave an overview of the work to date and an opportunity to request further information or individual consultation meetings if required. Figure 16.1 was presented to the regular operators in the consultation letter sent out in March 2013.

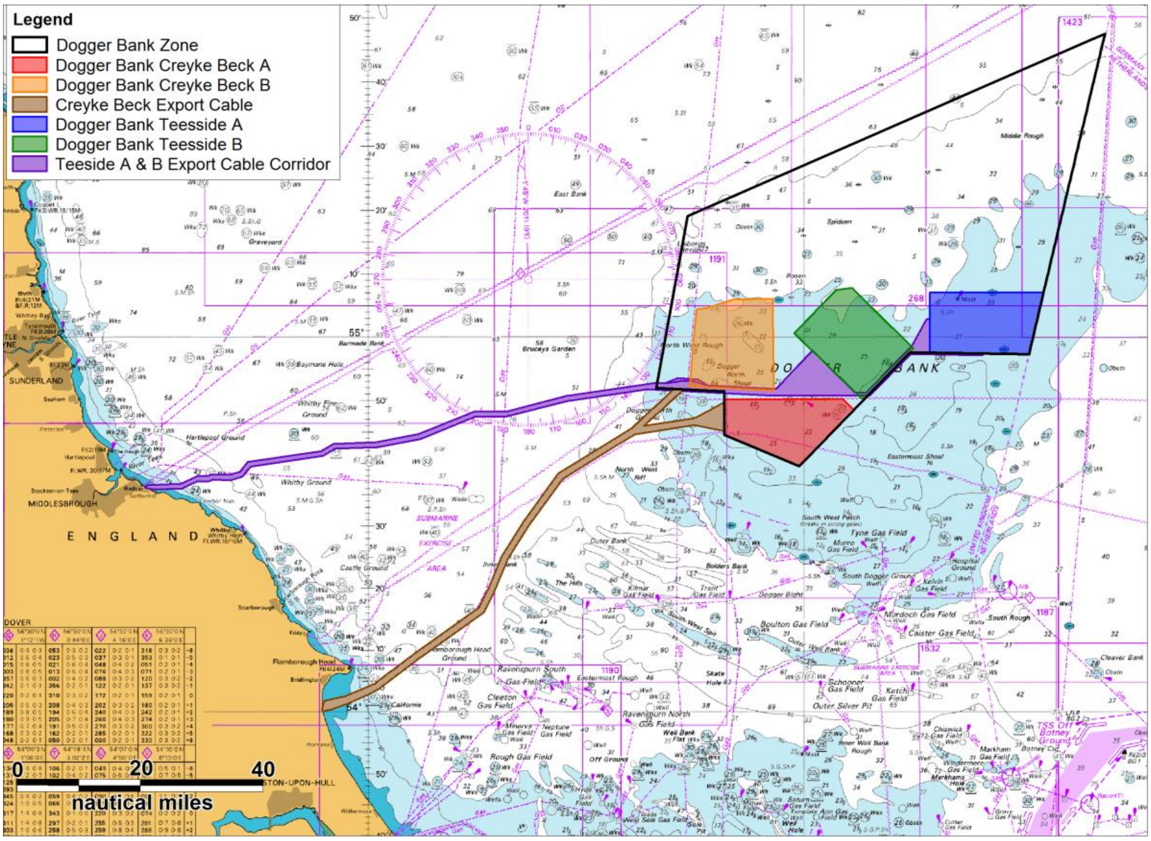

Figure 16.1 Figure in Regular Operator Consultation Letter March 2013

Section 5.3 lists the regular operators consulted and the table below presents the responses received, 6 in total. Comments received demonstrated minimal interest in the development overall and a general opinion that vessels would adapt to the routeing required. Full details of consultation can be found in Appendix A. It should be noted that several attempts were made to contact the users by both email and telephone.

The following questions were asked within the letter;

a) Whether the proposals to construct wind turbines and associated infrastructure within Dogger Bank Teesside A or B is likely to impact the routeing of any specific vessels;
b) If the development could pose any safety concerns for your organisation or members including any adverse weather routeing; and
c) If you would like to be retained on our list of Marine Stakeholders and consulted throughout this process.

Table 16.1 Regular Operator Consultation Responses

Regular Operator	Response on Tranche A and B Development
Containerships (UK) Ltd	Of the opinion that the wind farm would have no significant impact on our business. Their vessels would not have to make any deviation on route Teesport as the passage they take is further North of this area. Their ships prefer to avoid the high waves caused by the shallow waters at Dogger Bank.
DFDS	Any re-routing due to the Dogger Bank wind farm would have to take into consideration any channels that are introduced at the Hornsea site which is closer to the Humber Ports. The Hornsea Project has far greater impact on the shipping routes in that it also affects the ports to and from Northern UK & the busy Benelux Ports.
Finnlines	Their present route is south of the Tyne Gas Field and so does not come within the 10nm buffer zone around the proposed construction areas.
Intrada	Their trading routes is between the River Humber and Sweden (passing over the north of Denmark) and the normal track taken would cross the southern part of Dogger Bank. To keep clear of the next proposed part of the Dogger Bank Project would require our vessels to take a more southerly track which would add approximately 10 miles to the distance which at our speeds is approximately 1 hours steaming time. Therefore, this will not only cause us lost time but will also incur additional costs by way of additional fuel burned.
Kawasaki Kisen Kaisha Ltd	Confirm that the proposed offshore wind farms at Dagger Bank Teesside will have no navigational impact on our IBESCO services which currently calls at TCT2 in Teesport.
Unifeeder	As previous advised do not have many vessels in area and will only have a minor diversion in routing on the Grangemouth - Hamburg route which will pass north of Dogger Bank Teesside A - hence having no impact and does not pose any safety concern for our organisation
Unigas	Returned with no comment to make.
Wilsonship	'*As we could see at the navigational charts, this area of constructing lies a little bit away from the main ships' routes (from Norway and Baltic ports down to the Netherlands, Belgium, France and further to*

	the English Channel). But for some specific voyages of our ships between the UK and the Continent, it can of course affect a choice of the route. For example if we need to sail from one port to another one and we have this area exactly on our way, then we will have to deviate from straight course, which will increase the distance of full route. But I think we are talking now about possible increasing for few miles only and only for the ships with these few particular voyages. *If to talk about safety, then of course any construction in the middle of the open sea will be an obstruction for sailing and as a result will affect the safety of navigation. If these constructions are duly charted and of course properly lighted or marked with lights on the scene, it should not be a big problem.* *Of course there can be a situation when vessel needs to sail with a safe courses directly to this area, for example in stormy weather, but this is very particular case. Otherwise we have already had a lot of obstructions everywhere in the North sea: oil and gas rigs, fields of windmills, sea farms, moored tankers, research buoys, etc.). If we get one more, it should not be a big problem, as long as all necessary action with regards to marking/duly charted and proper information is distributed, are taken.''*

17. European Shipping Association Consultation 2011

Nine European Ship Owner Associations were contacted due to their location and/or nationality of the vessels that have been identified crossing the zone. These are listed in Section 5.4. The responses received are outlined in the following table.

Table 17.1 European Shipping Association Consultation Responses

European Shipping Association	Response
Royal Belgian Ship Owners' Association	*"We did not receive any comments from our members yet. However we would appreciate if we could remain on the list for future stakeholder consultations regarding the project."*
Danish Ship Owners' Association	*"Thank you for giving the Danish Shipowners' Association (DSA) the opportunity to provide you with our initial feedback on the proposed Dogger Bank Wind Farm.* *We have consulted our members, shipping companies who on a daily basis operate in the North Sea area, using their inputs as a basis for DSA's feedback. However due to the short deadline, the feedback at this time will be in very general terms – and if we receive additional comments from the members, we would like the possibility to revert to you.* *As we understand the project, is it in a preliminary stages and is seems a bit difficult for us with the provided data of the shipping movement to see the exact picture within the awarded zone. We estimate that the overall project at least would require minor deviation of the shipping in order to avoid the area. Furthermore regarding the design of the wind farm with developing in tranches may be difficult for shipping to predict the overall shape of the development, and therefore it may be essential that there is symmetry in the overall design. And with a clearer picture of shipping in the region and the assessment of the potential for establishing shipping clearways and/or propose rerouting measures the proposal might be acceptable to the shipping industry.* *We would suggest for the safety of the ships and the wind farms, that the wind farms should be situated in such a way that corridors are not necessary. We have concerns over creating lengthy routing options with turbines present on either side. If possible the Tranche A should be developed in such a way that it allows vessels to reroute through this area and avoid having turbines on either side. Furthermore any proposed rerouting should not increase overall voyage times*

	unreasonably. *Finally we should be pleased to be retained on your list of Marine Stakeholders and consulted throughout this process."*
Armateurs de France – The French Ship Owners' Association	*"I thank you for your message.* *After consultation of our members, it appears that no comments have to be formulated by French Shipowner's Association on this project. Thus, it is no necessary to maintain us in your mailing list concerning this project.* *On the other hand, the French Committee of Fishing would probably remained interested in this information (ltoulhoat@comite-peches.fr)."*
Royal Association of Netherlands Ship Owners' Noted that this consultation focussed mainly of shipping corridors present in other proposed Round 3 sites.	*"In reaction to your stakeholder consultation the following response.* *KVNR and Dutch shipping industry are not opposing wind farms as such, but are of the opinion this should be regulated EU-wide regarding the North sea.* *As several countries implement the demand for energy by appointing several areas to Wind farming no one seems to have the overall picture anymore in North sea spatial planning.* *First and foremost Shipping routes should be visualized to secure safe shipping and preventing costs because of rerouting shipping. In your paper none remark has been made regarding the changing of shipping routes, safety of Navigation. Regarding the immense surface you tend to reserve for wind farming rerouting of shipping seems unavoidable, increasing danger for shipping as traffic is concentrating. CO2 emissions for shipping are to increase significant.* *Dogger Bank is used for fishing. What would be the changes regarding fishing?* *We would like to see a more worked out scheme for the Doggerbank area including safety and rerouting of shipping and calculations on increase of CO2 emissions for ships because of rerouting."*

18. Maritime Traffic Survey Dogger Bank Teesside A & B

18.1 *Introduction*

This section presents marine traffic survey data within 10nm of Dogger Bank Teesside A & B recorded by AIS and Radar (28 days in winter 2011 / 2012 and 14 days in spring / summer 2012). The survey vessel operating during these periods was *Vigilant*.

The majority of vessels were recorded on AIS. AIS is now fitted on all commercial ships operating in UK waters over 300 GRT engaged on international voyages, over 500 GRT on domestic voyages, passenger vessels carrying 12 or more persons and fishing vessels over 45m. Small vessels not carrying AIS have been captured by Radar and visual observations where possible.

The proceeding charts show vessel tracks within 10nm of Dogger Bank Teesside A & B.

18.2 *Survey Analysis*

Plots of the AIS and Radar vessel tracks recorded during a 28 day survey period in winter 2011 / 2012 and a 14 day survey period in spring / summer 2012, thematically mapped by vessel type, are presented in Figure 18.1 and Figure 18.2 respectively.

These figures include tracks of the survey vessel *Vigilant* and other temporary traffic.

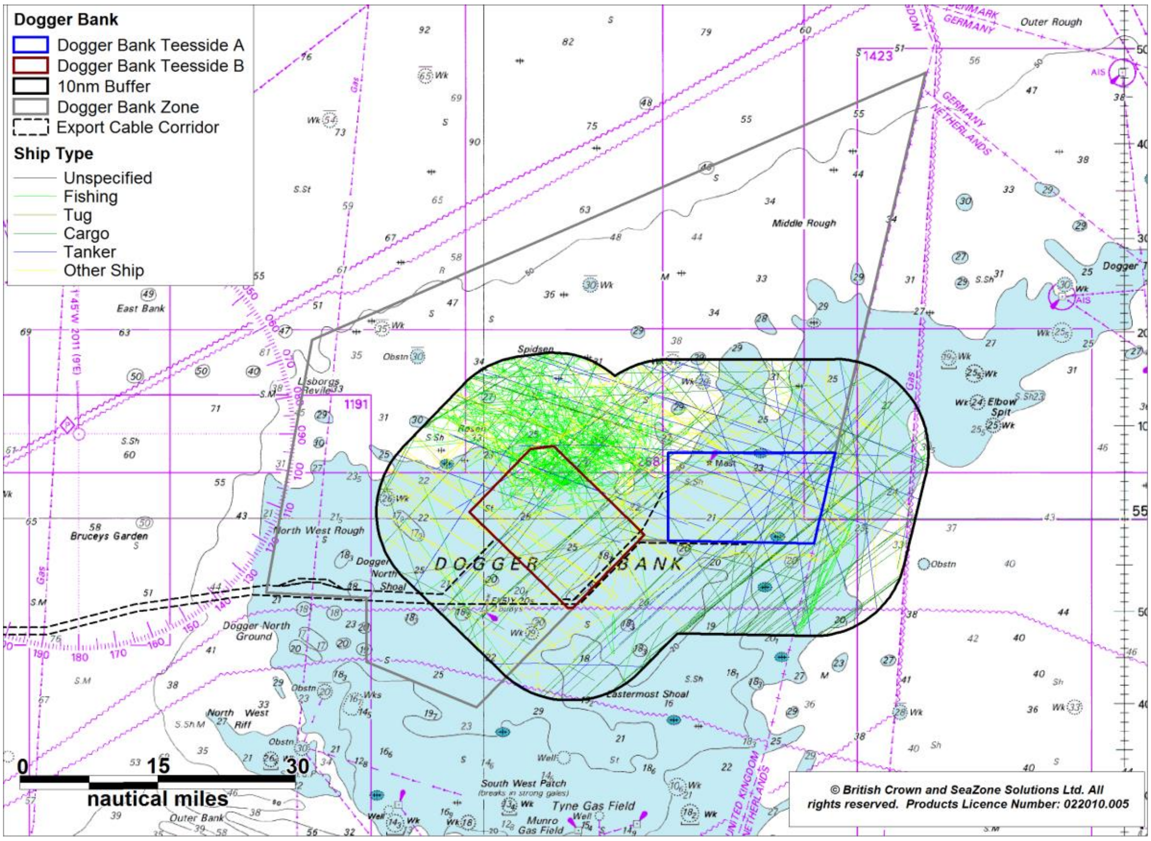

Figure 18.1 AIS and Radar Data of All Tracks (28 Days Winter 2011 / 2012)

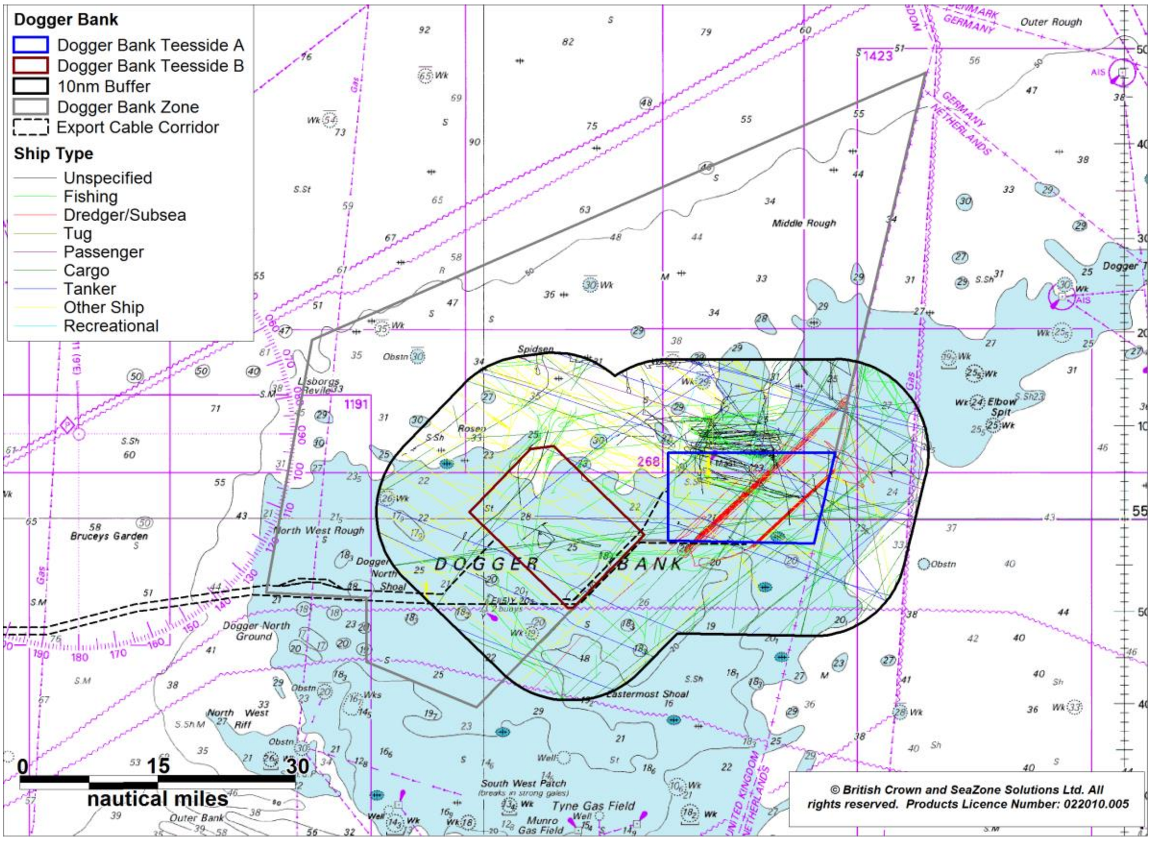

Figure 18.2 AIS and Radar Data of All Tracks (14 Days Spring / Summer 2012)

A number of tracks recorded during the survey periods were classified as temporary (non-routine), such as the tracks of the survey vessels and other vessels engaged in survey work. These tracks have therefore been excluded from further analysis. Oil & gas vessels supporting permanent installations were retained in the analysis.

Plots of the AIS and Radar vessel tracks recorded during the survey periods, thematically mapped by vessel type and excluding temporary traffic, as mentioned above, are presented in Figure 18.3 and Figure 18.4.

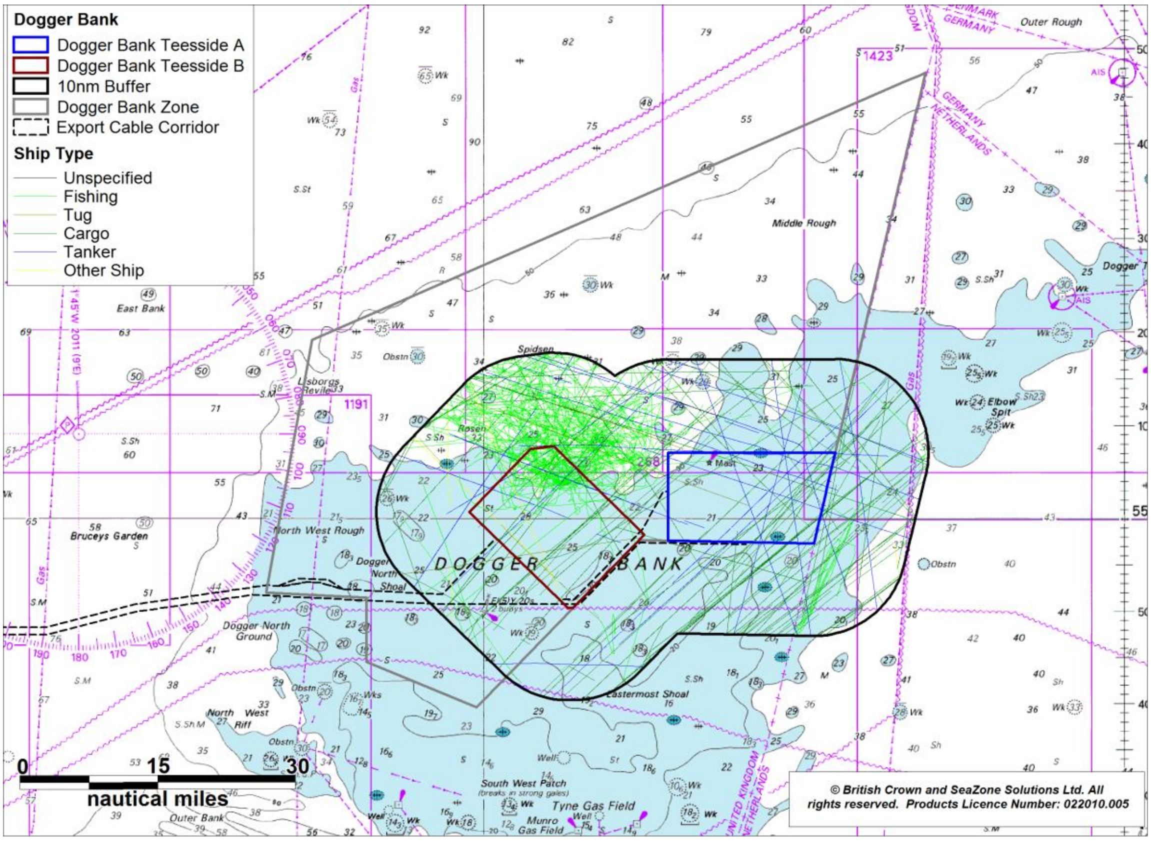

Figure 18.3 AIS and Radar Data Excluding Temporary Traffic (28 Days Winter 2011 / 2012)

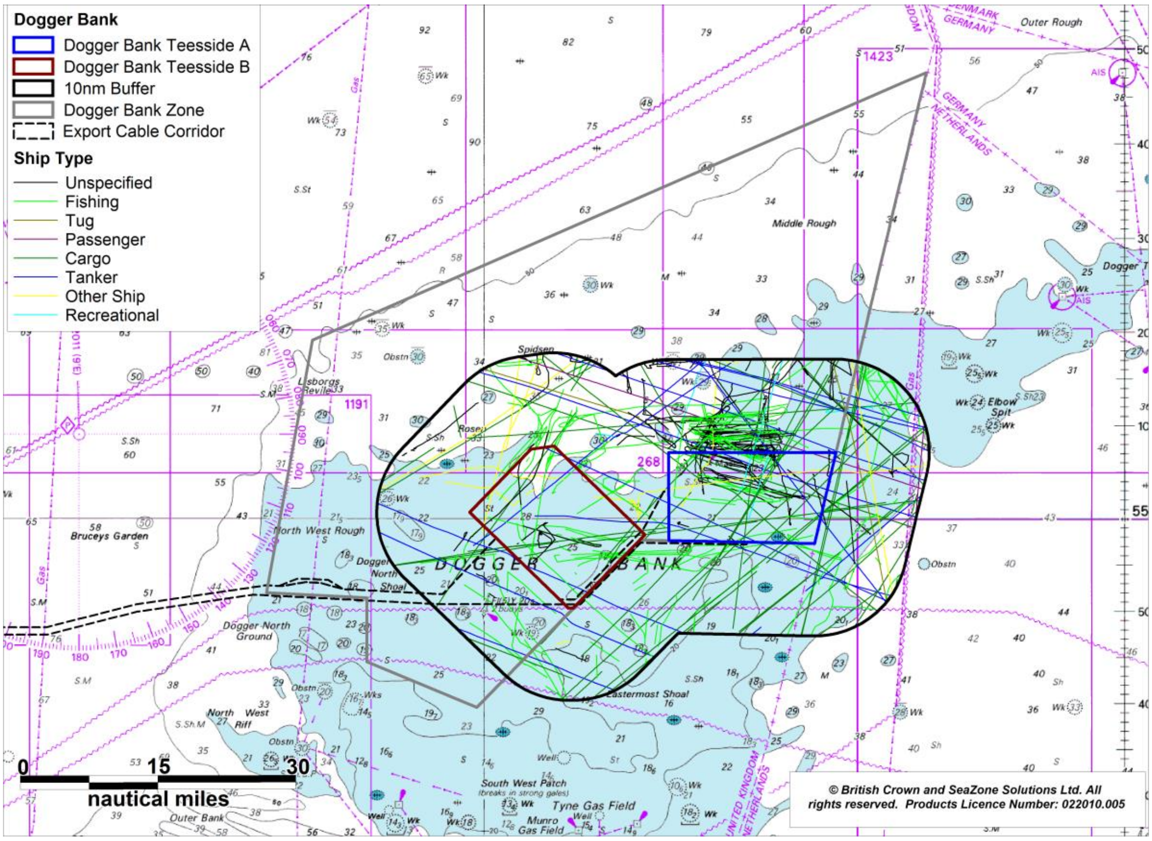

Figure 18.4 AIS and Radar Data Excluding Temporary Traffic (14 Days Spring / Summer 2012)

The average number of unique vessels recorded on AIS and Radar per day passing within 10nm of Dogger Bank Teesside A & B was 7 vessels during the winter 2011 / 2012 survey period and 10 vessels during the spring / summer 2012 survey period. In terms of vessels actually intersecting Dogger Bank Teesside A, there were approximately 1 to 2 unique vessels per day during winter 2011 / 2012 and approximately 3 during spring / summer 2012. The average number of unique vessels recorded on AIS and Radar intersecting Dogger Bank Teesside B was 2 to 3 vessels per day during both winter 2011 / 2012 and spring / summer 2012.

Figure 18.5 and Figure 18.6 show the daily number of unique vessels passing through the 10nm buffer and intersecting Dogger Bank Teesside A & B during the survey periods.

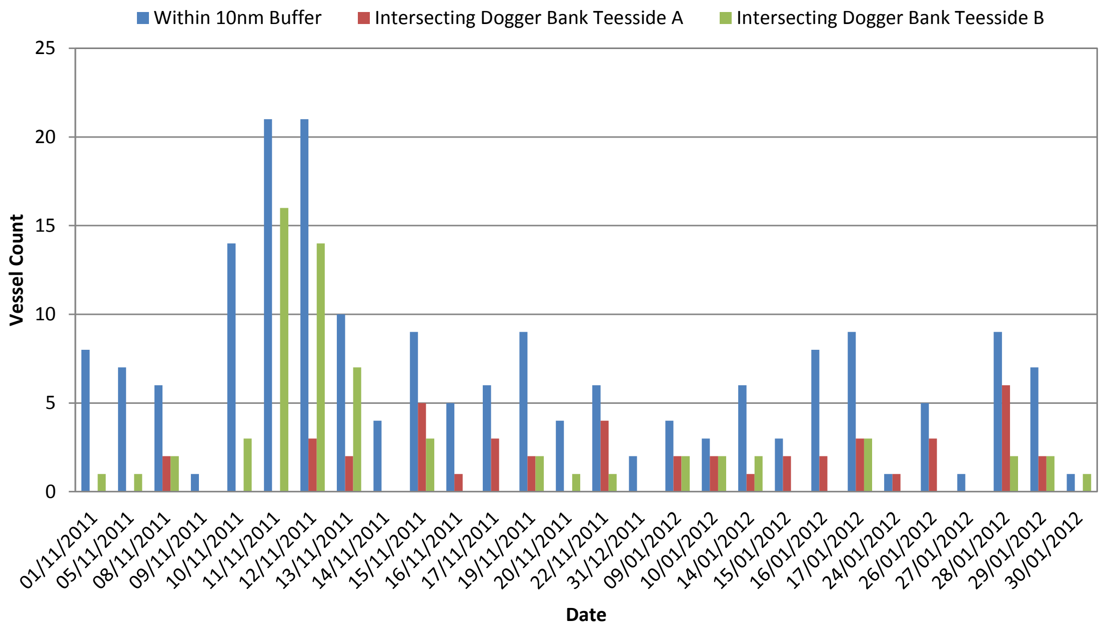

Figure 18.5 Number of Unique Vessels Per Day (28 Days Winter 2011 / 2012)

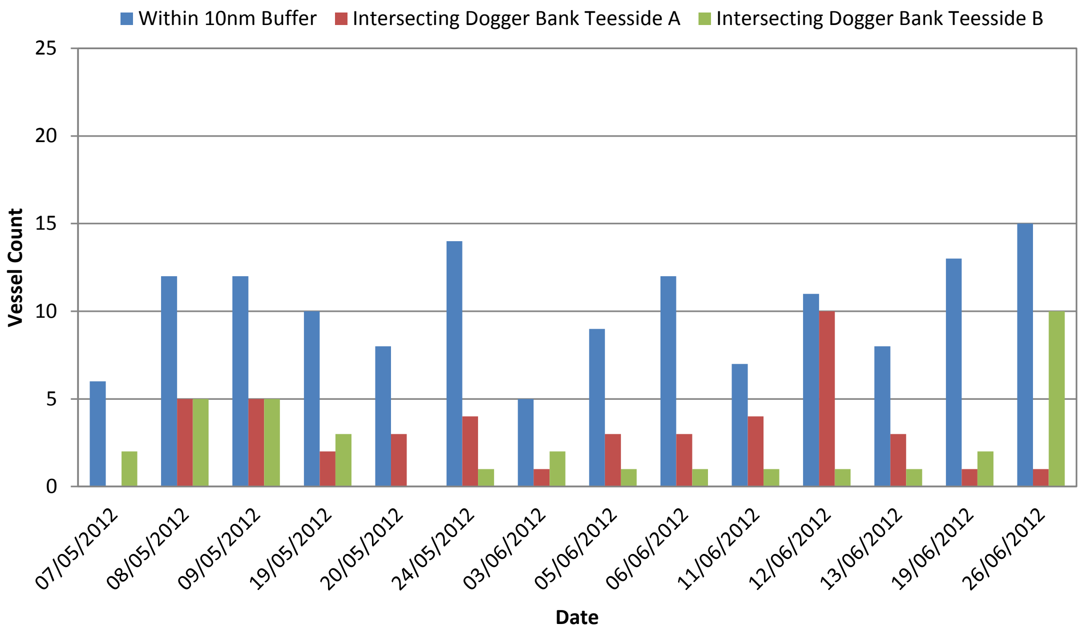

Figure 18.6 Number of Unique Vessels Per Day (14 Days Spring / Summer 2012)

The busiest days during the 28 day winter 2011 / 2012 survey were 11th and 12th November 2011 when 21 unique vessels were recorded within 10nm of Dogger Bank Teesside A & B. The busiest day during the 14 day spring / summer 2012 survey period was 26th June 2012 when 15 unique vessels were recorded. Vessel tracks recorded on the busiest days are presented in Figure 18.7 and Figure 18.8.

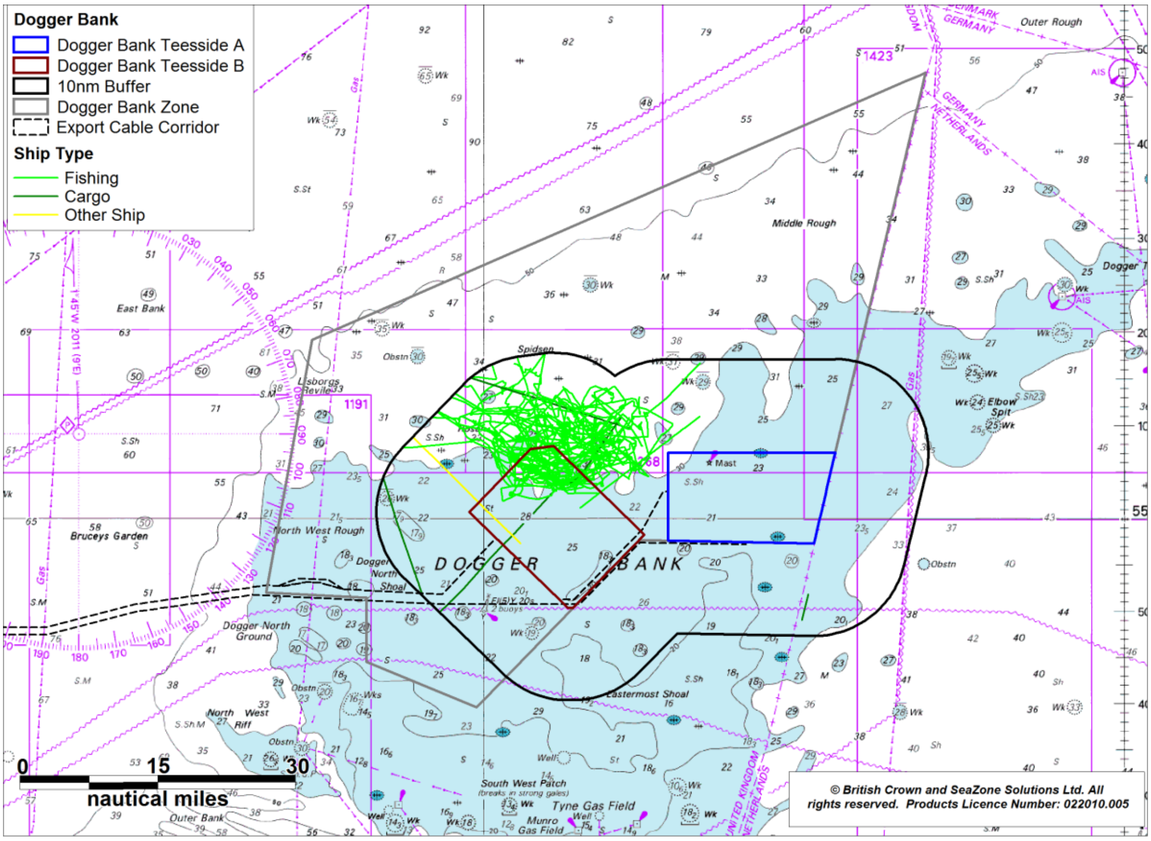

Figure 18.7 Busiest Day Winter 2011 – 11th November 2011

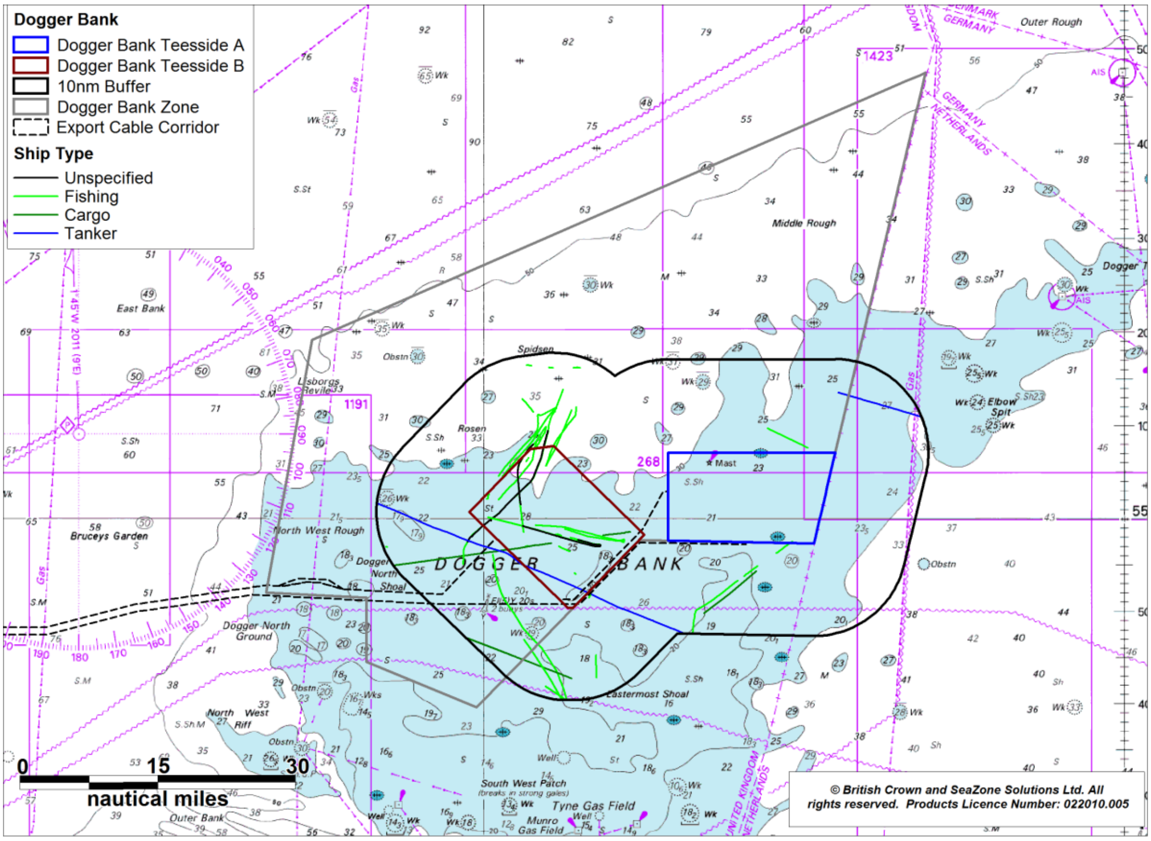

Figure 18.8 Busiest Day Summer 2012 – 06th June 2012

The daily count of unique fishing vessels are presented in Figure 18.9 and Figure 18.10.

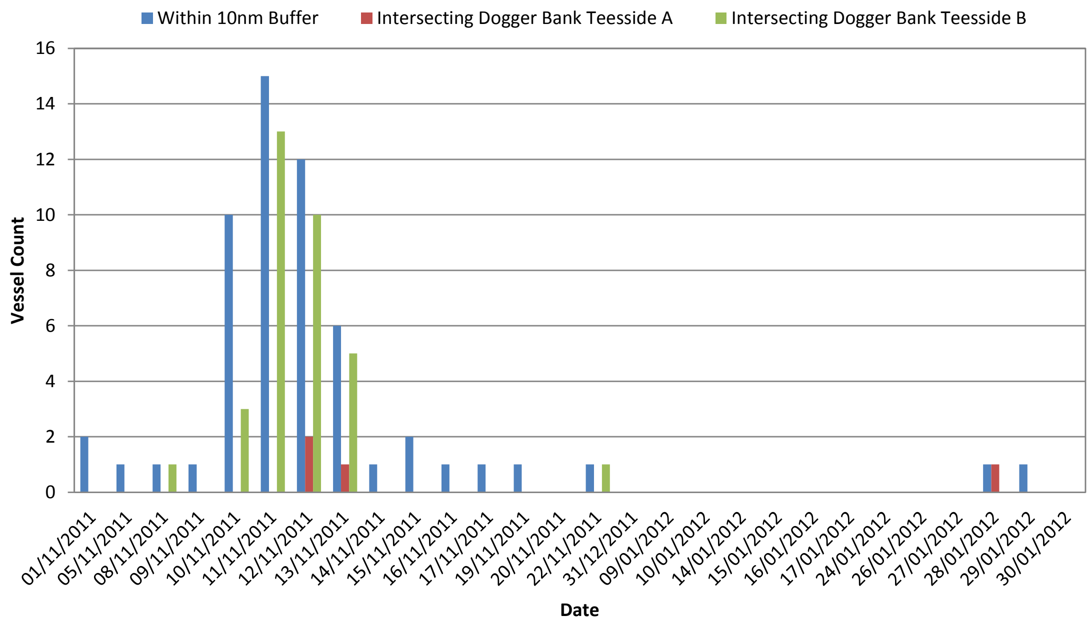

Figure 18.9 Unique Fishing Vessels per Day (28 Days Winter 2011 / 2012)

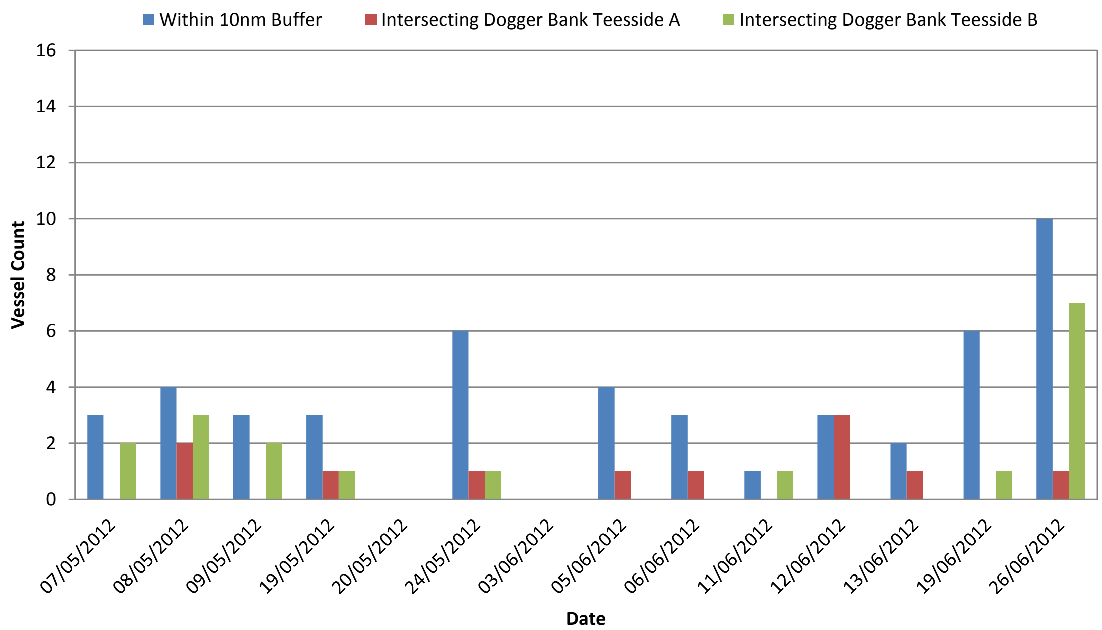

Figure 18.10 Unique Fishing Vessels per Day (14 Days Spring / Summer 2012)

It can be seen that the busiest day in terms of fishing vessel activity was 11th November 2011 when 15 unique vessels were recorded within the 10nm buffer around Dogger Bank Teesside A & B. Fishing vessel tracks recorded on this day are presented in Figure 18.11.

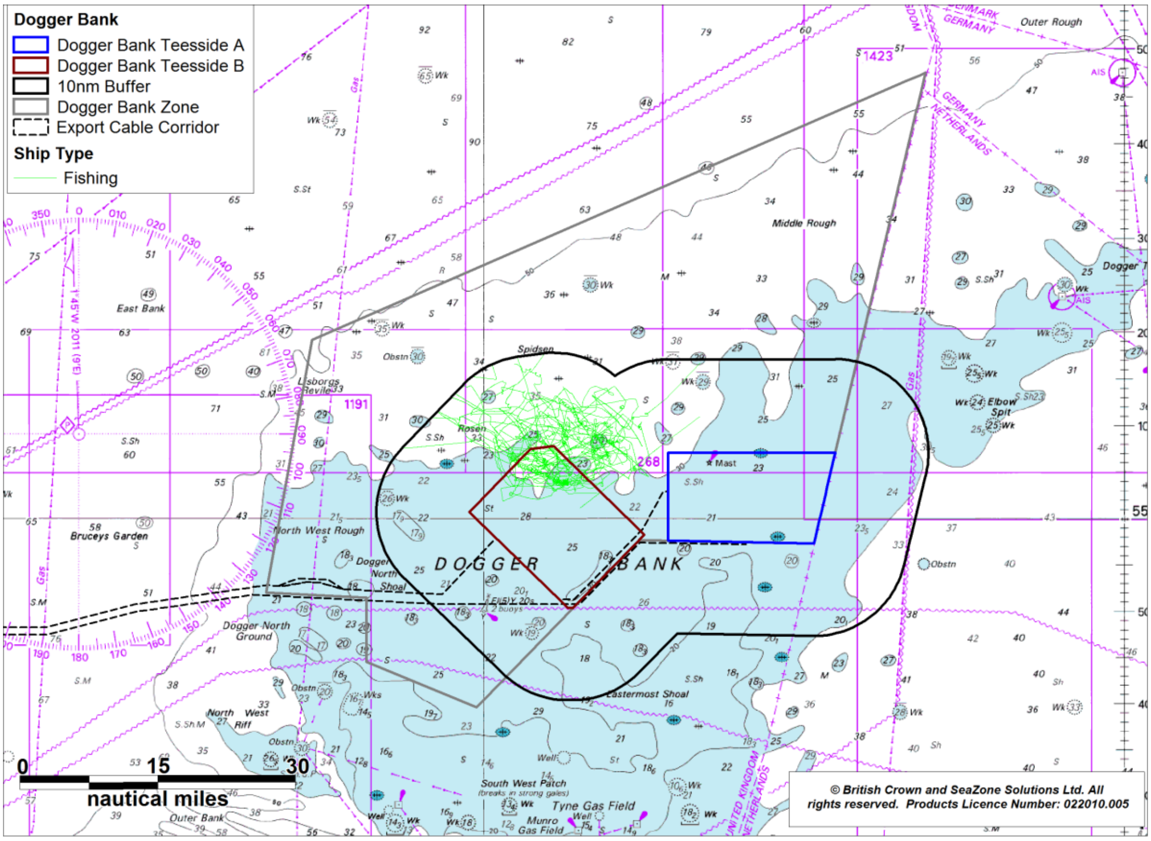

Figure 18.11 Fishing Vessels Busiest Day – 11th November 2011

Analyses of the vessel types recorded within the 10nm buffer around Dogger Bank Teesside A & B during the two survey periods are presented in Figure 18.12 and Figure 18.13. This excludes types which were unspecified. In winter 2011 / 2012, 2% of vessels were unspecified, with 12% in spring / summer 2012.

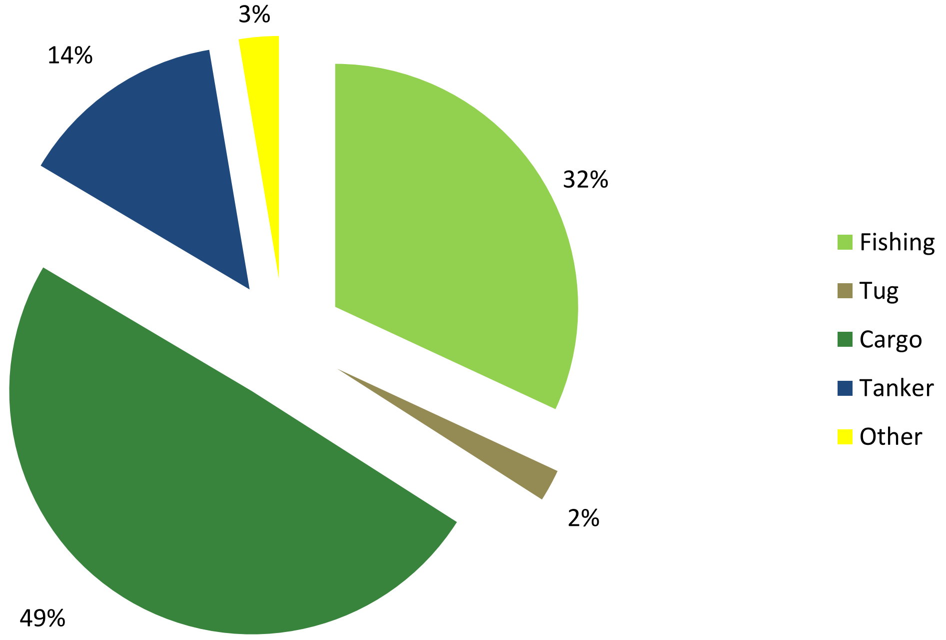

Figure 18.12 Vessel Types Within 10nm Buffer (28 Days Winter 2011 / 2012)

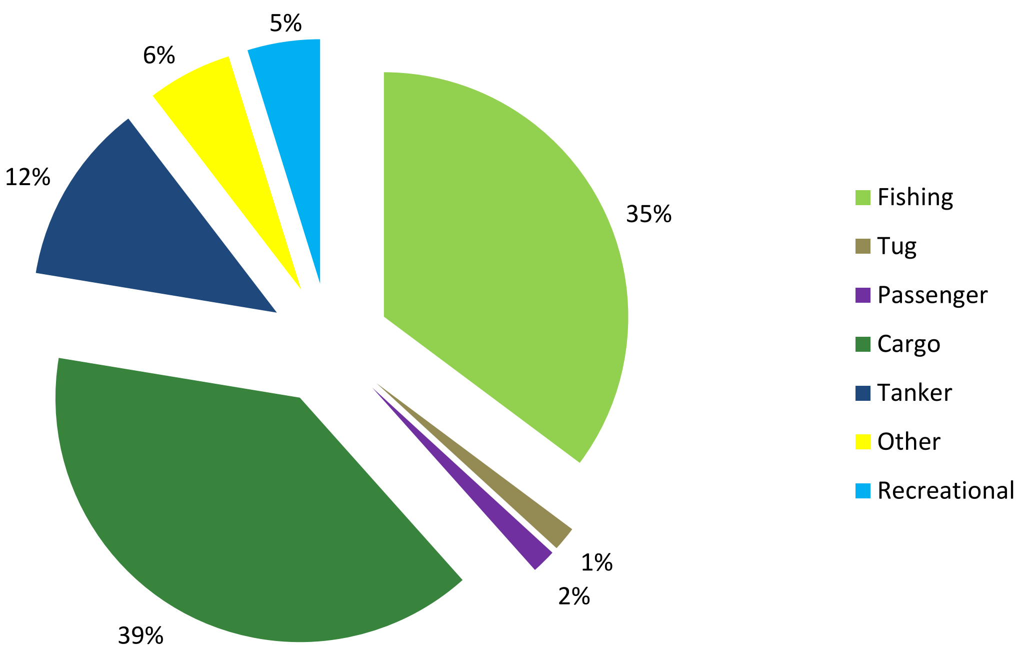

Figure 18.13 Vessel Types Within 10nm Buffer (14 Days Spring / Summer 2012)

In winter 2011 / 2012, 49% of the vessels recorded were cargo vessels, 32% were fishing vessels and 14% were tankers. In summer 2012, cargo vessels accounted for 39% of the vessels recorded, with fishing vessels comprising 35% of traffic and tankers 12%. Figure 18.14 to Figure 18.19 present plots of cargo vessel, fishing vessel and tanker tracks for the two survey periods.

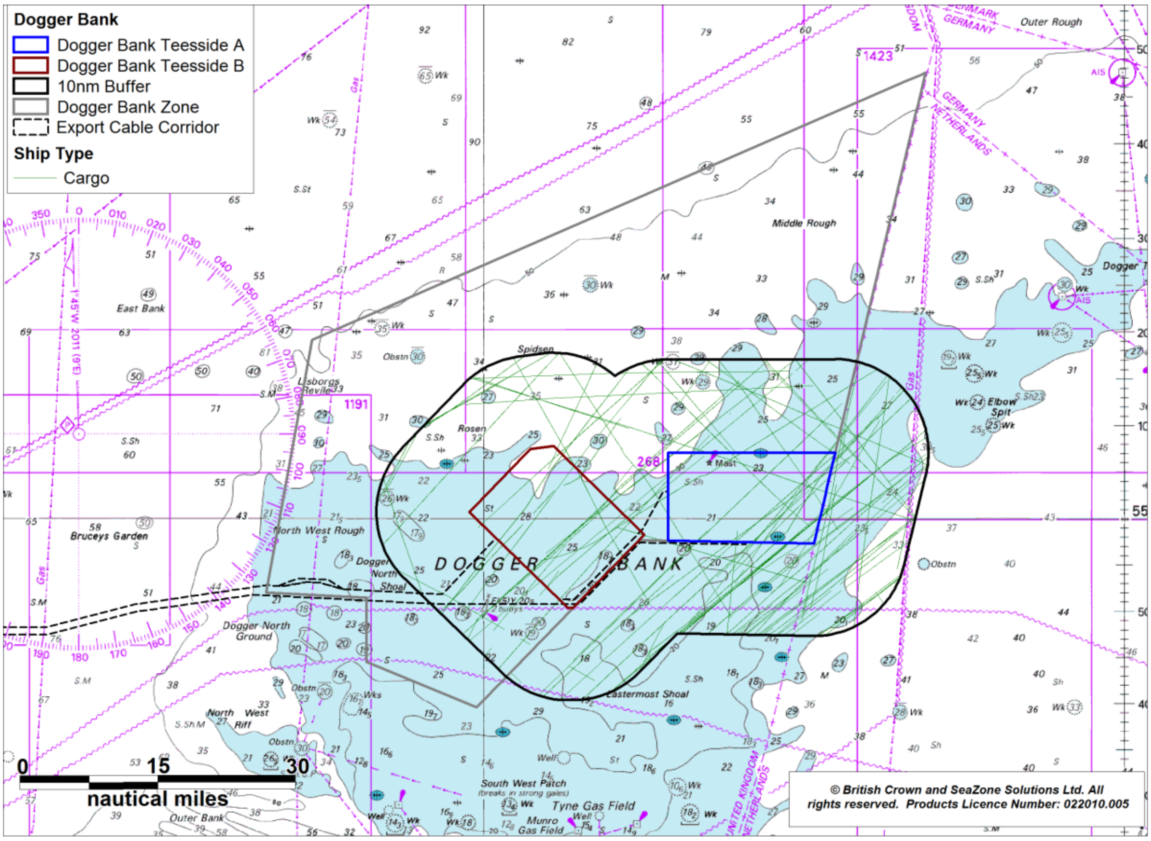

Figure 18.14 Cargo Vessels (28 Days Winter 2011 / 2012)

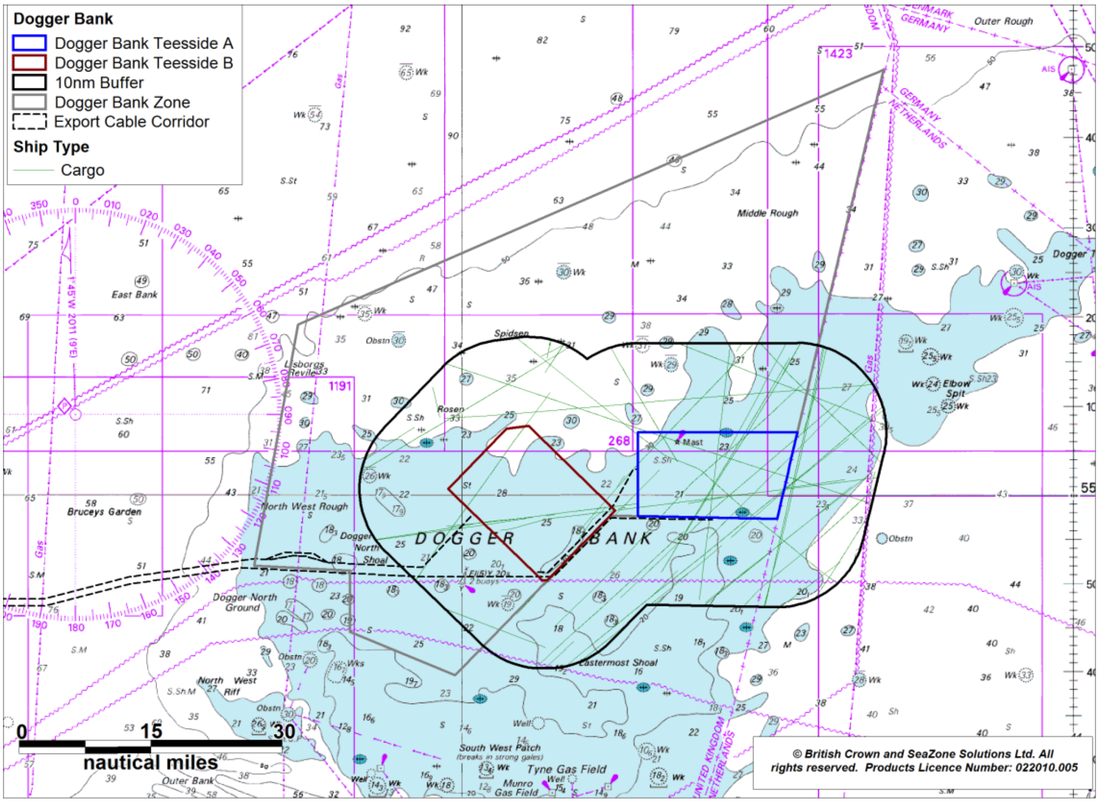

Figure 18.15 Cargo Vessels (14 Days Spring / Summer 2012)

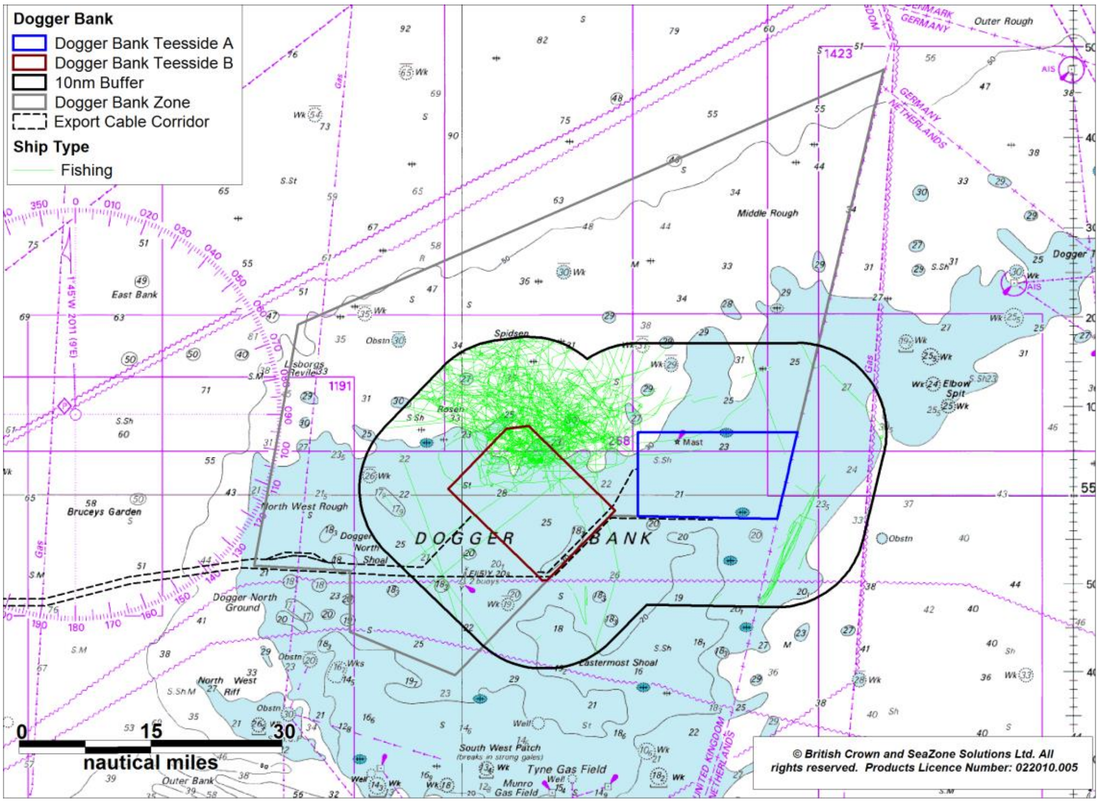

Figure 18.16 Fishing Vessels (28 Days Winter 2011 / 2012)

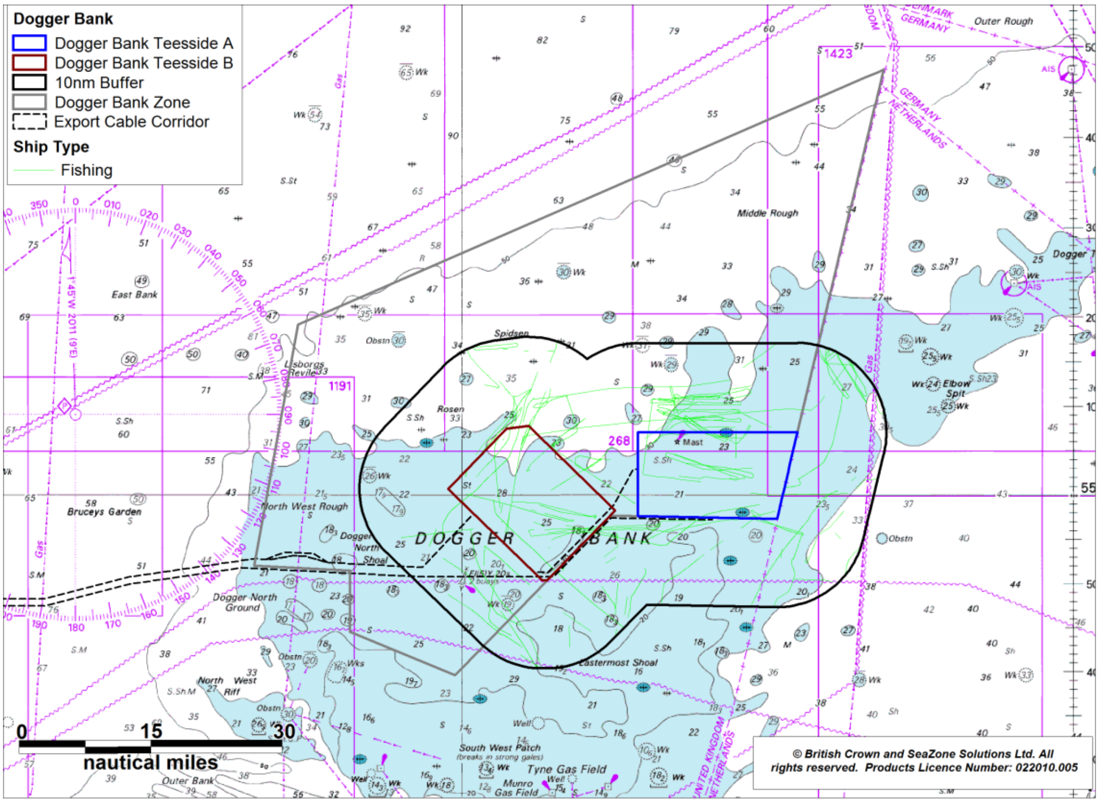

Figure 18.17 Fishing Vessels (14 Days Spring / Summer 2012)

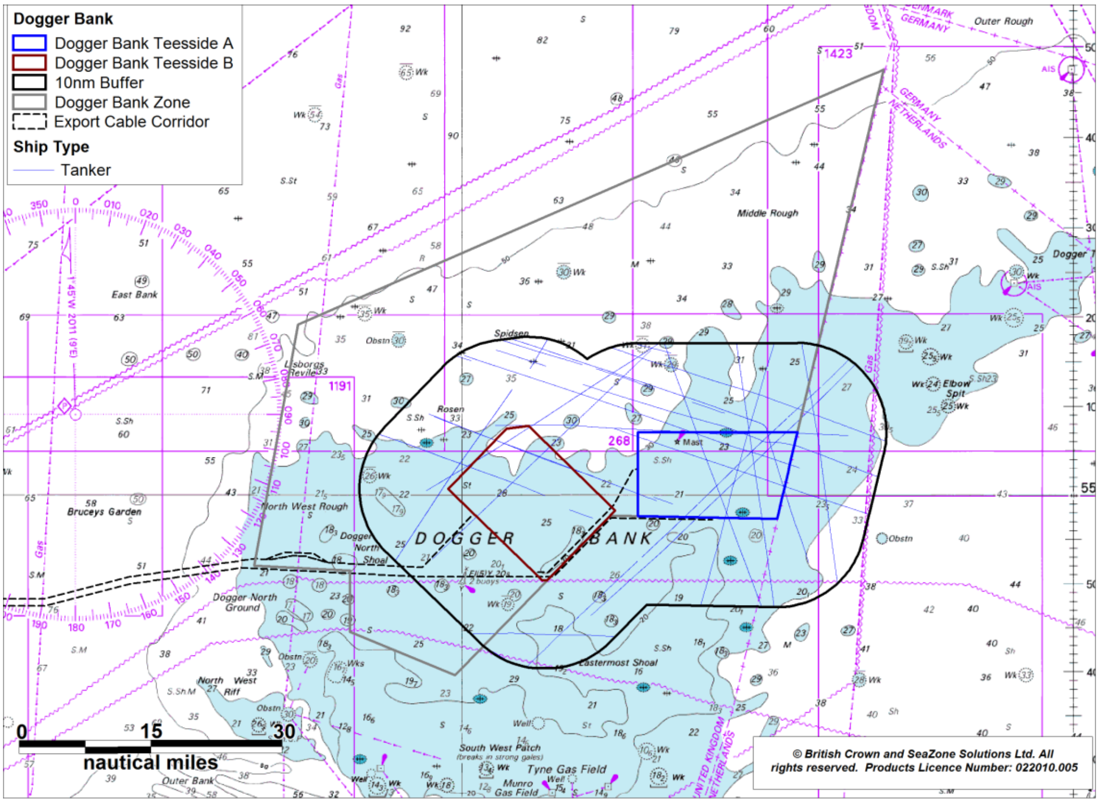

Figure 18.18 Tankers (28 Days Winter 2011 / 2012)

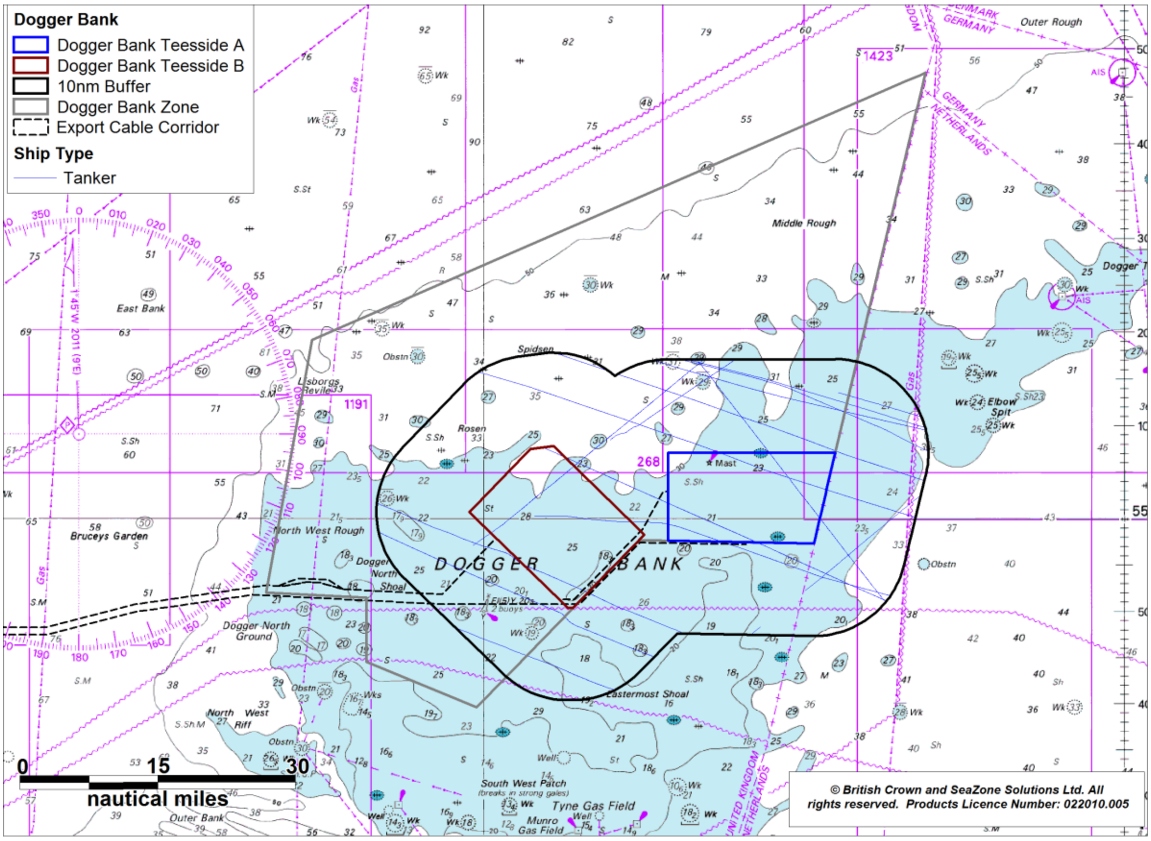

Figure 18.19 Tankers (14 Days Spring / Summer 2012)

18.3 *Spring 2013 Survey Analysis*

This section presents marine traffic survey data within 10nm of Dogger Bank Teesside A & B recorded by AIS and Radar (14 days in spring 2013). The survey vessels operating throughout the spring period were the 72 m-long *Vigilant* and 21m-long *Jubilee Spirit*. The *Jubilee Spirit* remained within the survey area for the whole 14 day survey period whereas the *Vigilant* was on site for only four days.

Plots of AIS and Radar vessel tracks recorded during the 14 day survey period, thematically mapped by vessel type, are presented in Figure 18.20. Following this a more detailed plot of vessel tracks recorded throughout the survey period is presented in Figure 18.21.

It should be noted that these figures include tracks of the survey vessels *Vigilant* and *Jubilee Spirit*.

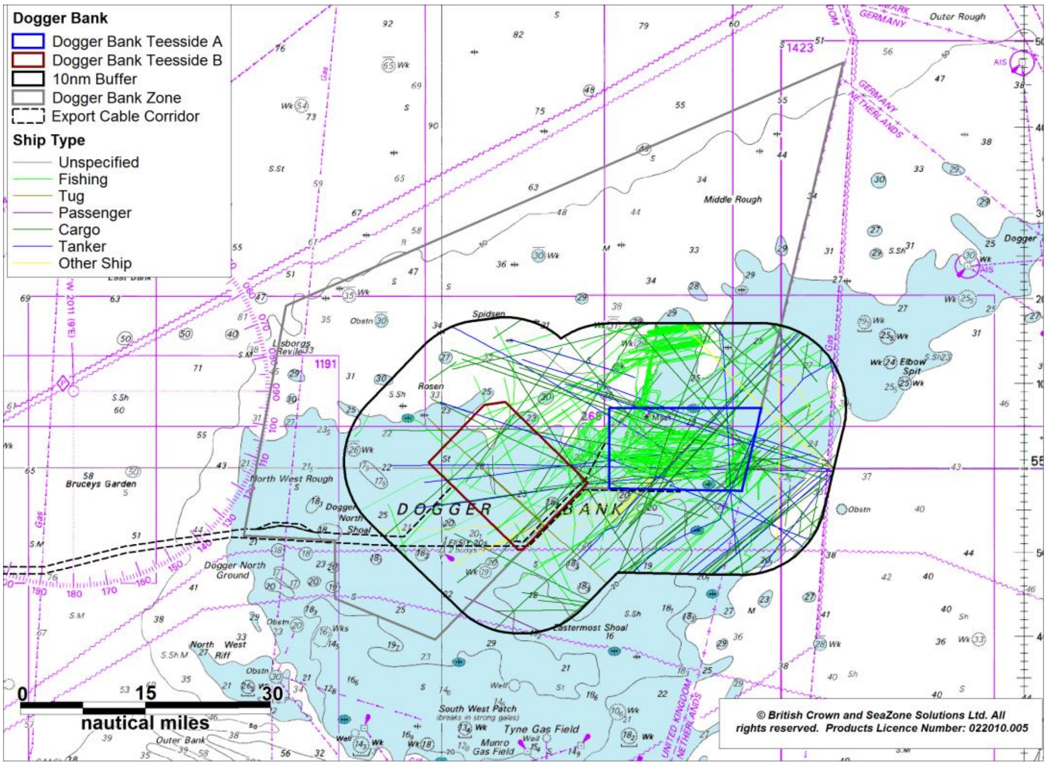

Figure 18.20 AIS and Radar Data of All Tracks (14 Days Spring 2013)

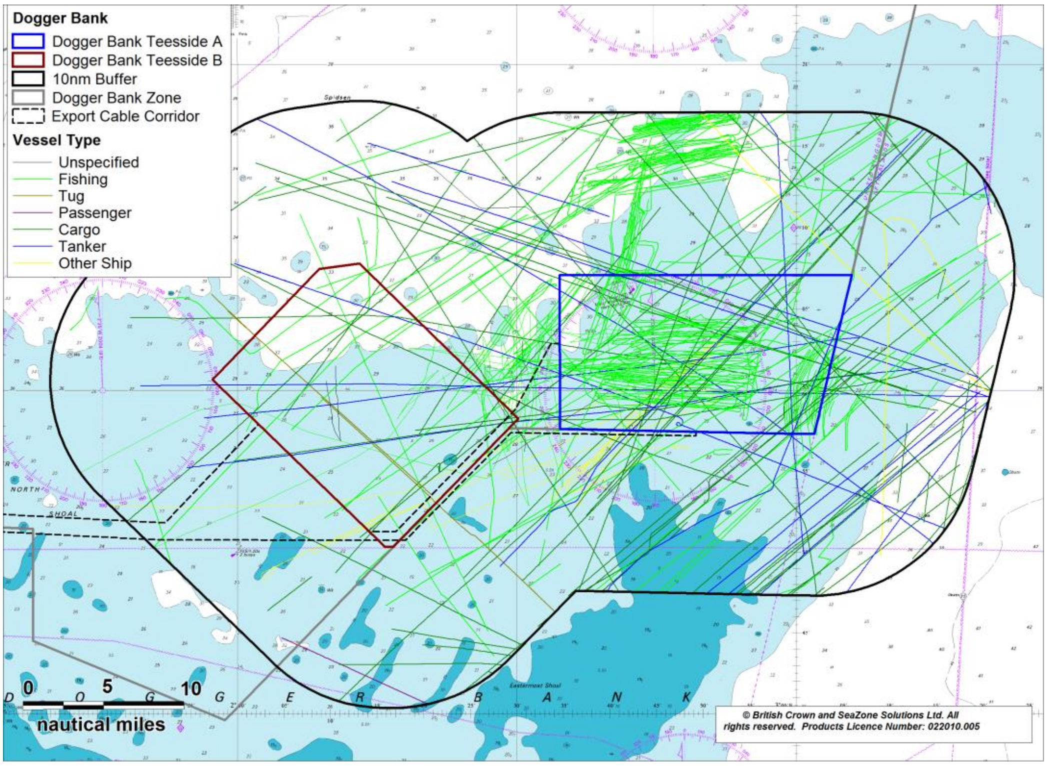

Figure 18.21 Detailed overview of AIS and Radar Data of All Tracks (14 Days Spring 2013)

A number of tracks recorded during the survey periods were classified as temporary (non-routine) traffic, such as the tracks of the survey vessels. These tracks have therefore been excluded from further analysis. Oil and Gas vessels supporting permanent installations were retained in the analysis.

A plot of AIS and radar vessel tracks recorded during the survey period, thematically mapped by vessel type and excluding temporary traffic, as mentioned above, is presented in Figure 18.22. Following this, a more detailed plot of vessel tracks, excluding temporary traffic is presented in Figure 18.23.

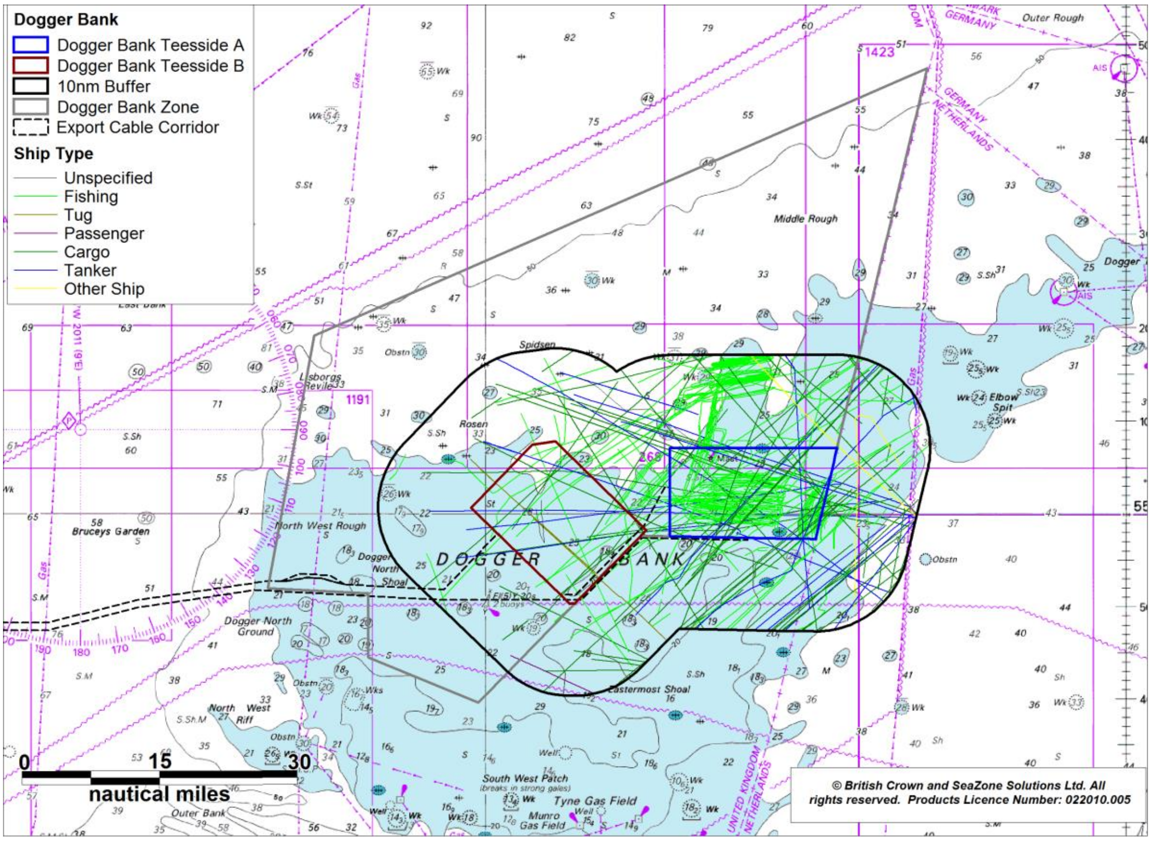

Figure 18.22 AIS and Radar Data Excluding Temporary Traffic (14 Days Spring 2013)

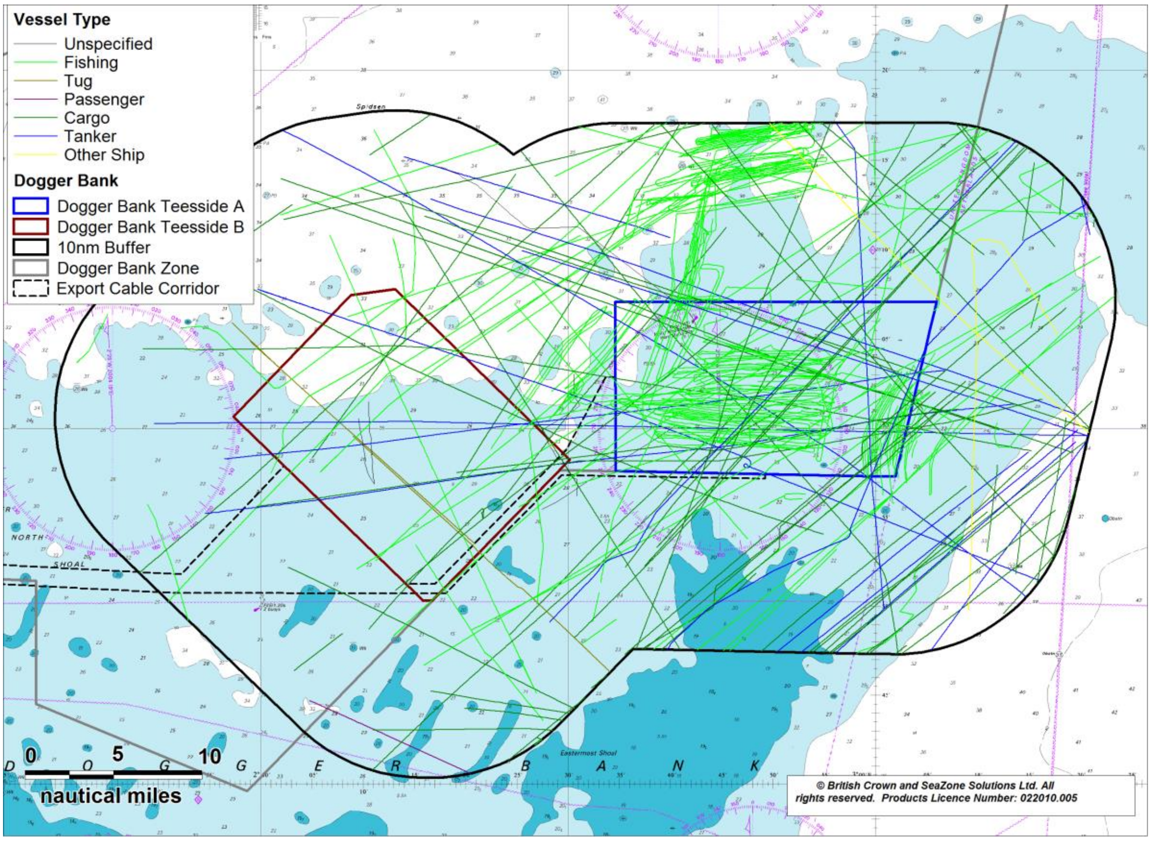

Figure 18.23 Detailed overview of AIS and Radar Data Excluding Temporary Traffic (14 Days Spring 2013)

Figure 18.24 illustrates the daily number of unique vessels passing through the 10nm buffer and intersecting Dogger Bank Teesside A & B during the survey periods.

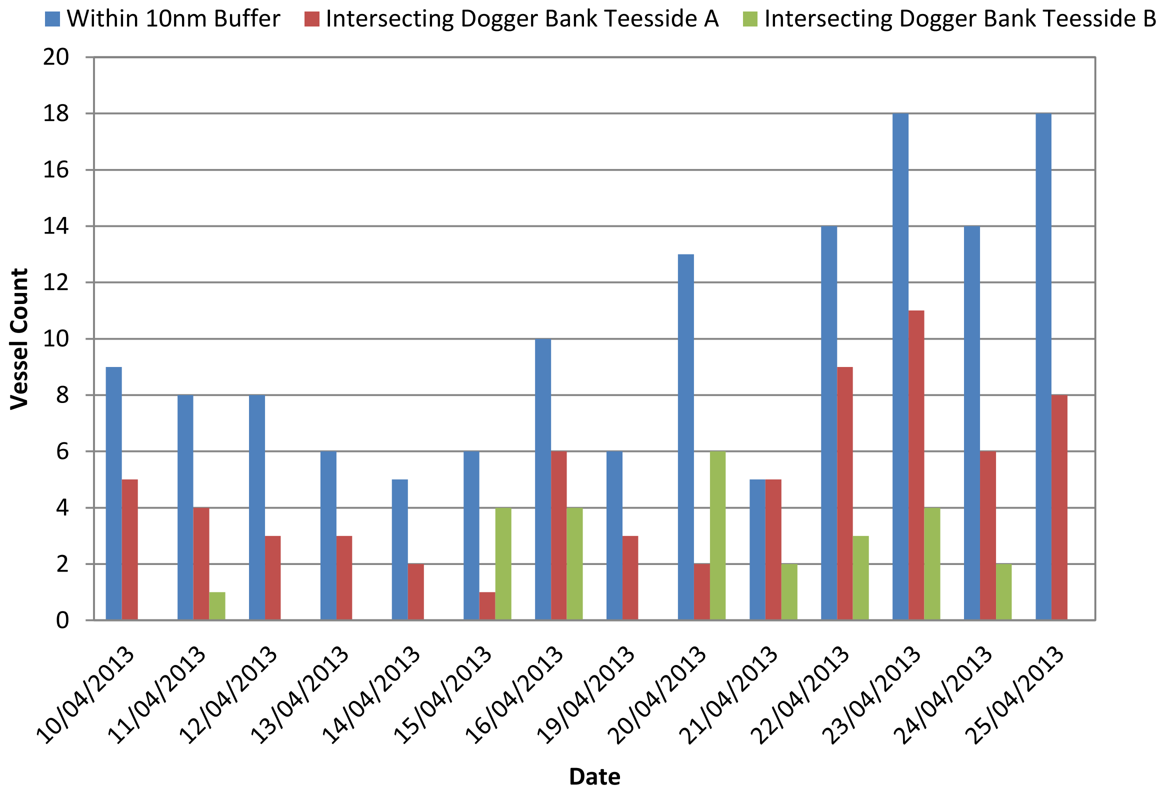

Figure 18.24 Number of Unique Vessels per Day (14 Days Spring 2013)

The average number of unique vessels (excluding temporary traffic) recorded on AIS and Radar per day passing within 10nm of Dogger Bank Teesside A & B was 10 vessels throughout the survey period. The busiest days recorded during the survey period were the 23rd and 25th April 2013, when 18 unique vessels were recorded. The quietest full days were the 14th and 21st April 2013, when 5 unique vessels were recorded.

In terms of vessels actually intersecting Dogger Bank Teesside A, there were approximately 5 unique vessels per day. The busiest day was also the 23rd April 2013, when 11 unique vessels were recorded intersecting the site boundary. The quietest full day was the 15th April 2013, when no vessels were recorded.

The average number of unique vessels recorded on AIS and Radar intersecting Dogger Bank Teesside B was 2 to 3 vessels per day. The busiest day was the 25th April 2013, when 7 unique vessels were recorded. The quietest full days were the 10th, 12th, 13th, 14th and 19th April 2013, when no vessels were recorded.

Throughout the survey period Dogger Bank Teesside B is approximately half as busy as Dogger Bank Teesside A, with 51% fewer unique vessels recorded over the total duration of the survey period.

A plot of vessel tracks recorded within 10nm of Dogger Bank Teesside A & B on one of the joint busiest days of the survey (23rd April 2013) is presented in Figure 18.25.

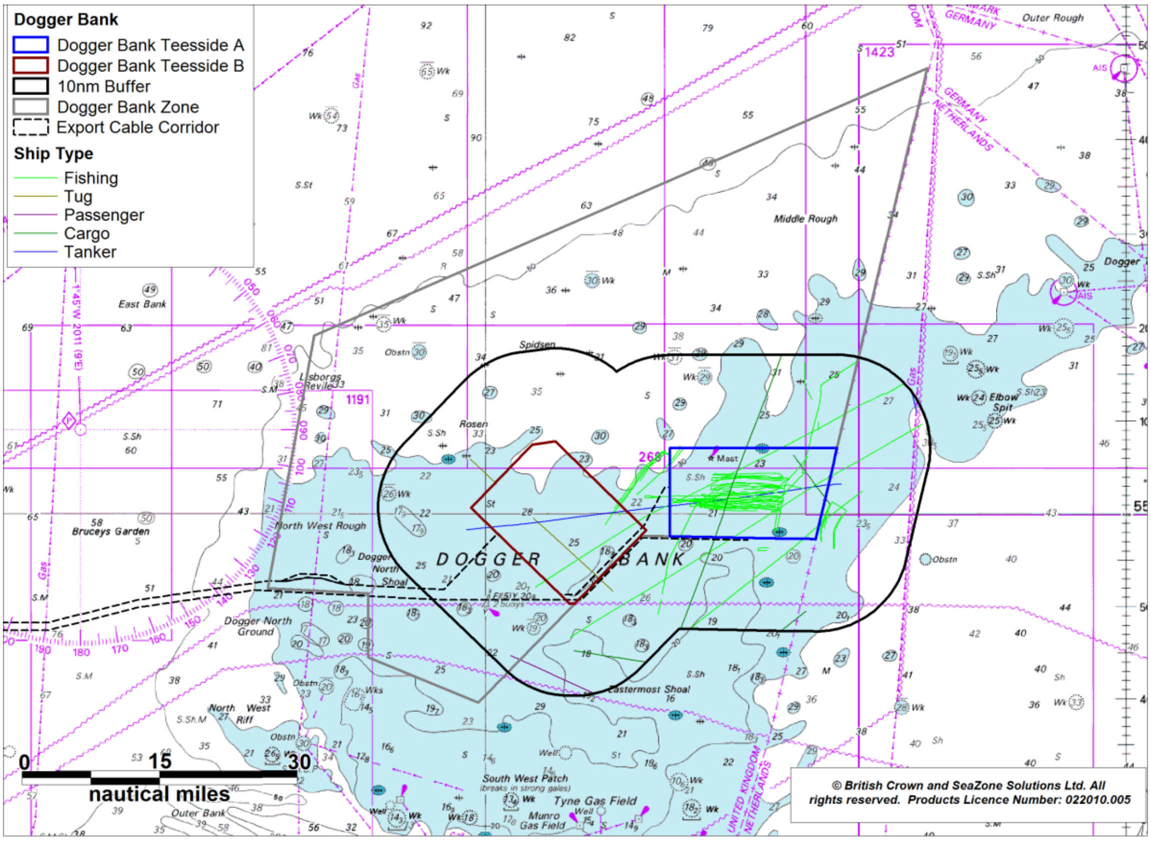

Figure 18.25 Joint Busiest Day Spring 2013 – 23rd April 2013

The daily count of unique fishing vessels are presented in Figure 18.26.

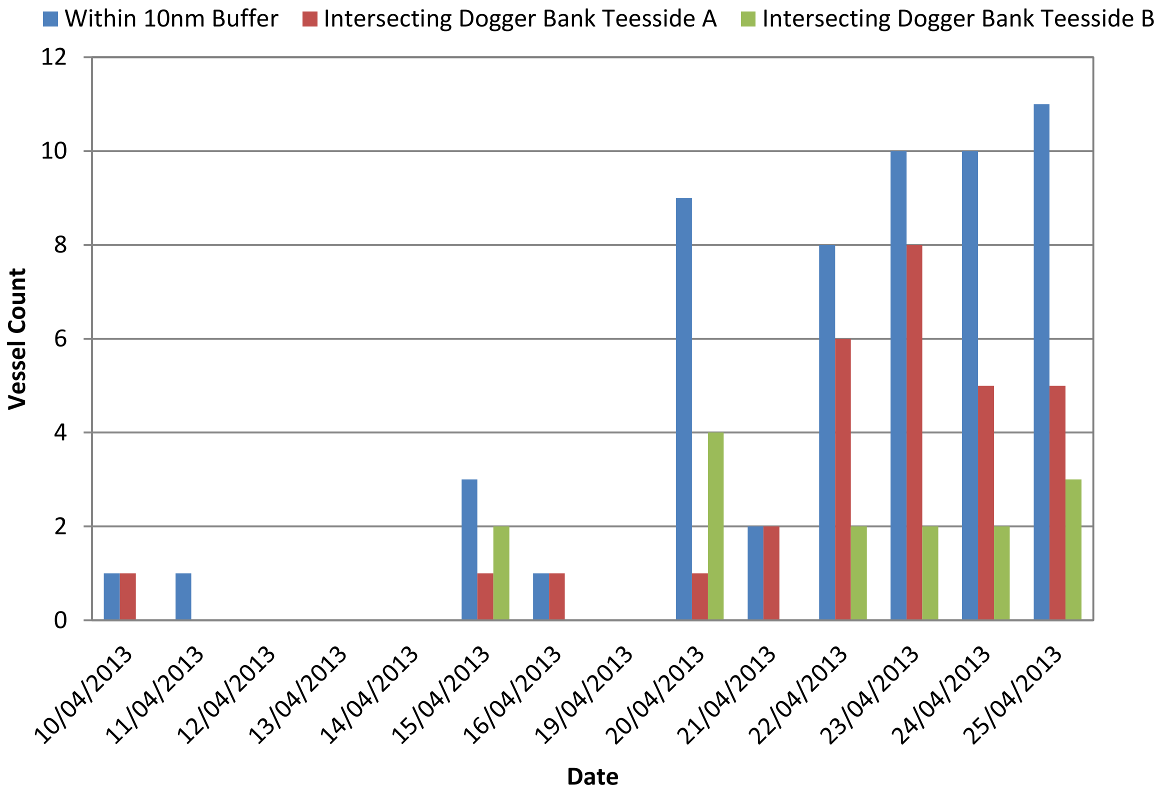

Figure 18.26 Unique Fishing Vessels per Day (14 Days Spring 2013)

It can be seen that the level of fishing activity was greatest throughout the final 4 days of the survey. The busiest day, in terms of fishing vessel activity was 23rd April 2013 when 11 unique fishing vessels were recorded within the 10nm buffer around Dogger Bank Teesside A & B. Fishing vessel tracks recorded on this day are presented in Figure 18.27.

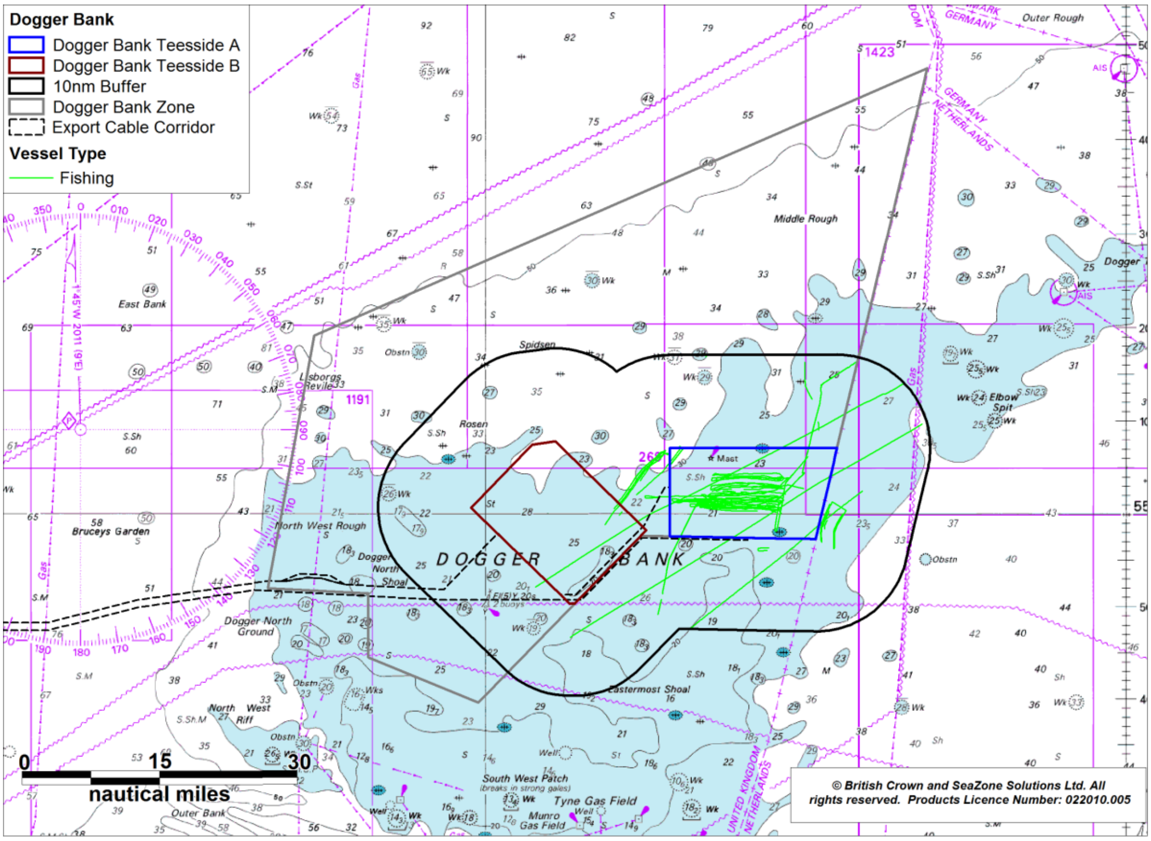

Figure 18.27 Fishing Vessels Busiest Day – 23rd April 2013

Analyses of the vessel types recorded within the 10nm buffer around Dogger Bank Teesside A & B during the survey period is presented in Figure 18.28.

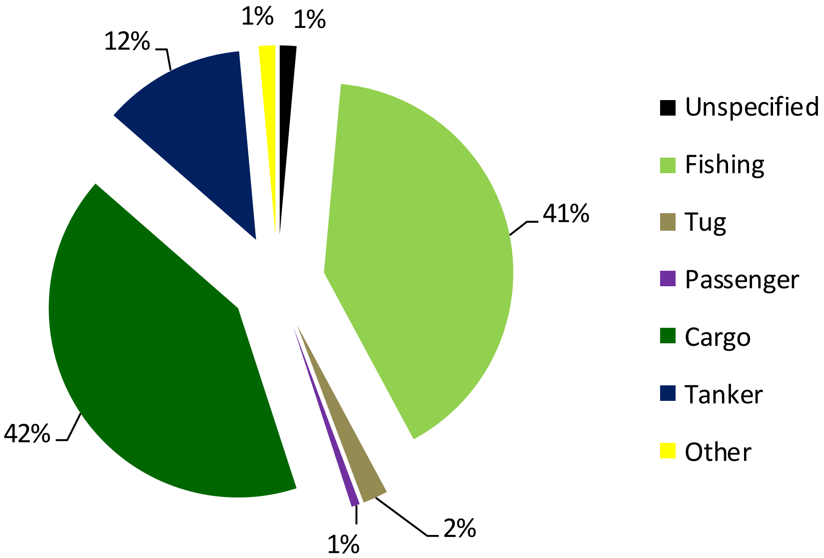

Figure 18.28 Vessel Types Within 10nm Buffer (14 Days Spring 2013)

Throughout the survey period, 41% of the vessels recorded were fishing vessels, 42% were cargo vessels and 12% were tankers. Figure 18.29 to Figure 18.31 present plots of fishing vessel, cargo vessel and tanker tracks recorded throughout the survey period.

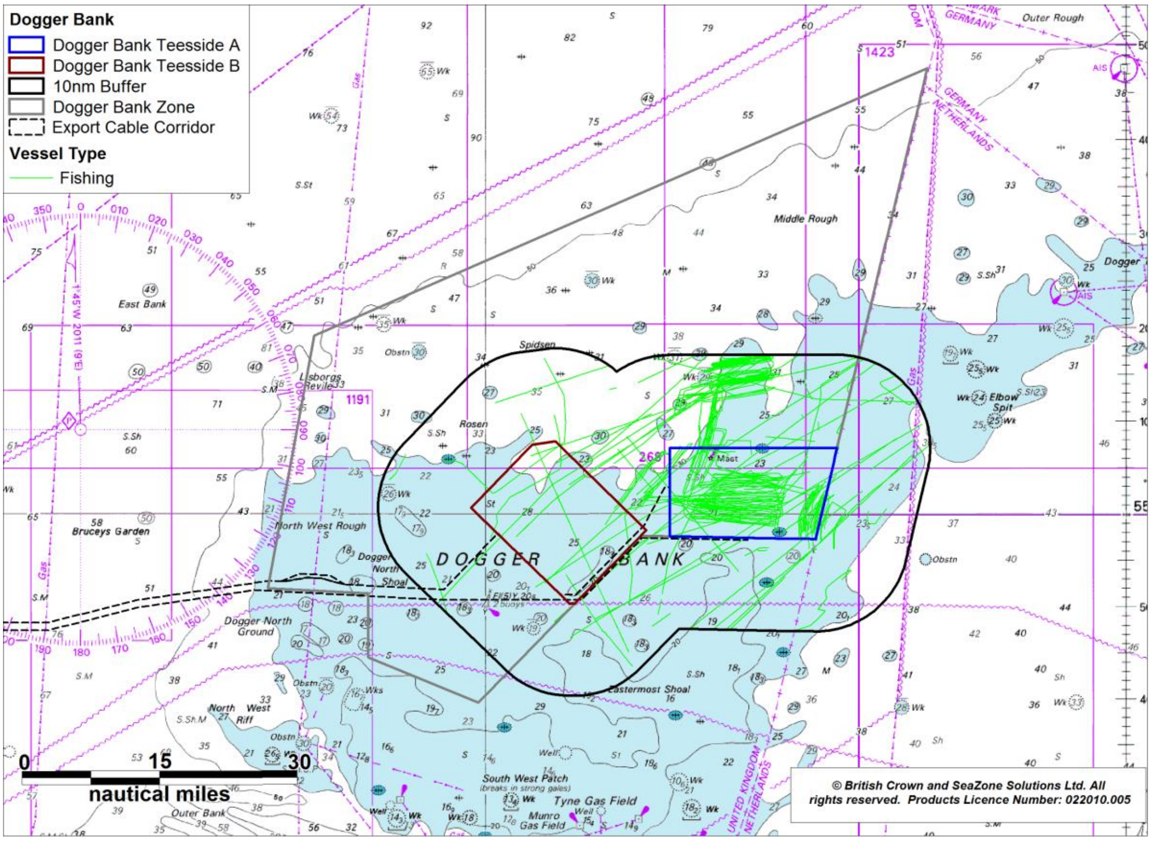

Figure 18.29 Fishing Vessels (14 Days Spring 2013)

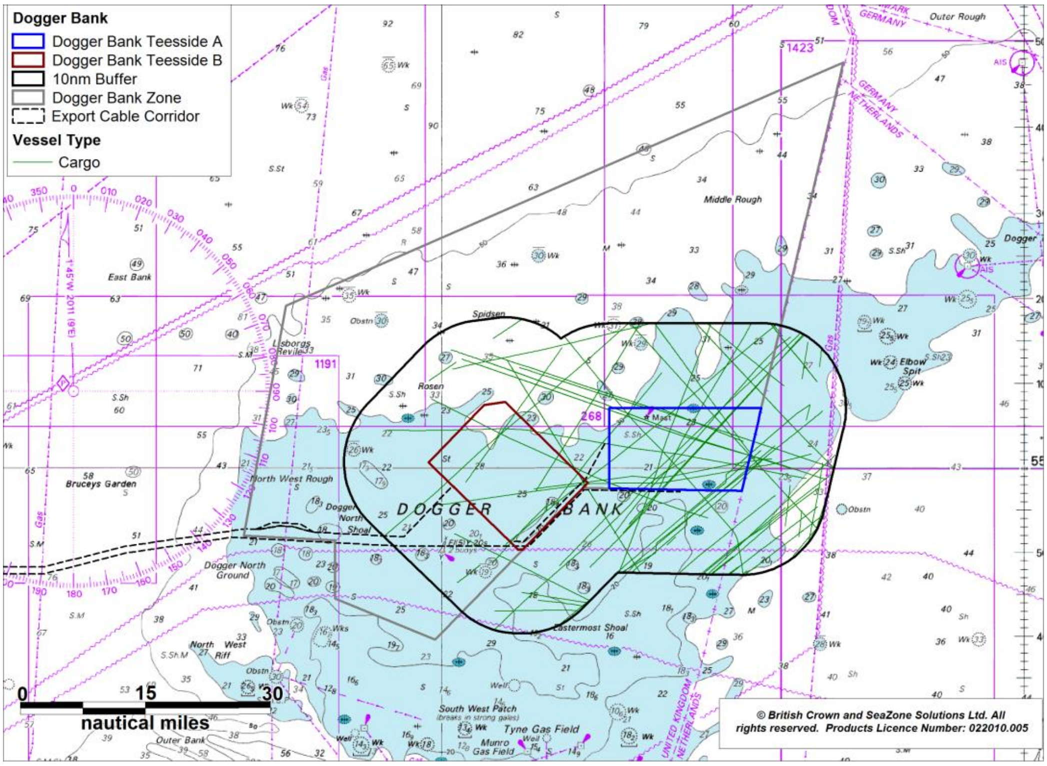

Figure 18.30 Cargo Vessels (14 Days Spring 2013)

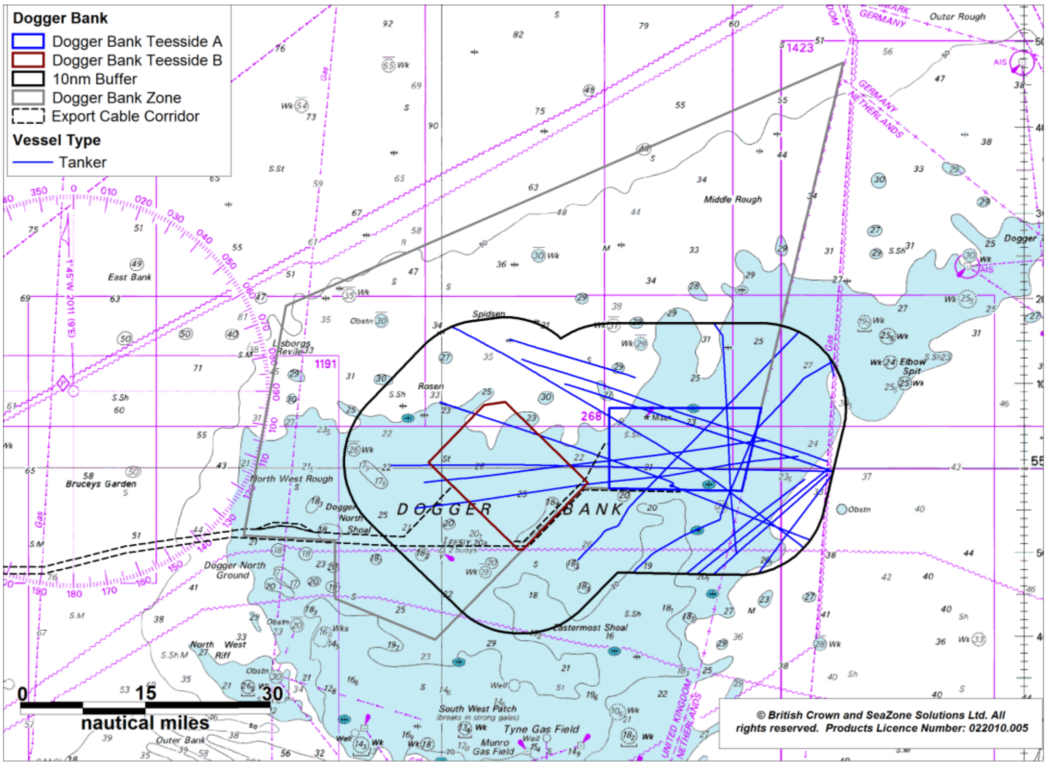

Figure 18.31 Tankers (14 Days Spring 2013)

18.4 *Anchored Vessels*

No anchored vessels were observed within 10nm of Dogger Bank Teesside A & B during the survey periods.

18.5 *Definition of a Route*

Main routes have been identified by principles set out in MCA guidance MGN 371 (MCA 2008a). AIS data are assessed and vessels transiting at similar headings and locations are identified as a route. To help clarify routes, AIS data can also be interrogated to show vessels (by name and/or operator) that frequently transit those routes identifying 'regular runner/operator' routes. The shipping route width is then calculated using the 90th percentile rule from the median line of the potential shipping route as shown in Figure 18.32.

AIS and Radar data will be continually collected and processed throughout the Zone Characterisation to continue to inform and update information on shipping activities across the Zone.

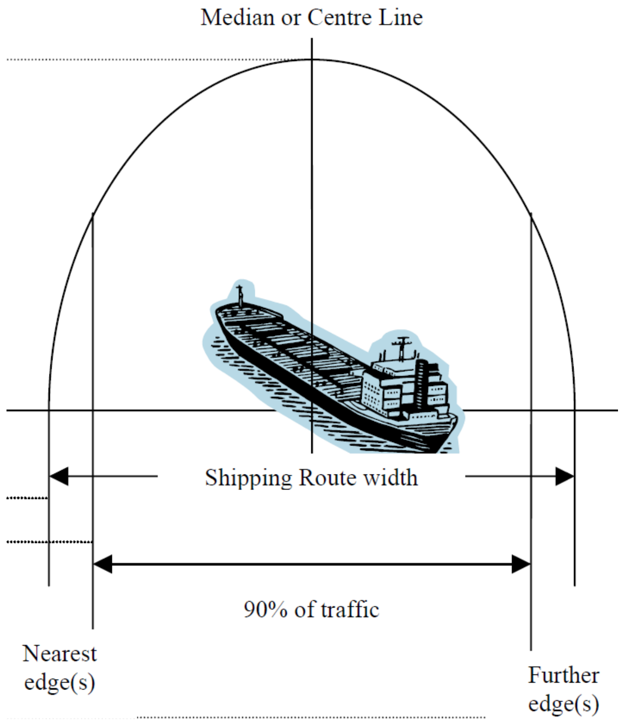

Figure 18.32 Illustration of Route Calculation

18.6 *Zone – Commercial traffic*

This NRA is for the development of Dogger Bank Teesside A & B. However, to allow consideration for cumulative effects, the following section also gives an overview of main routes and 90th percentiles for the entire Dogger Bank Zone. Main route identification was undertaken on a Zonal level, 10 routes were identified.

Figure 18.33 show the main routes and 90th percentiles around the Dogger Bank Zone.

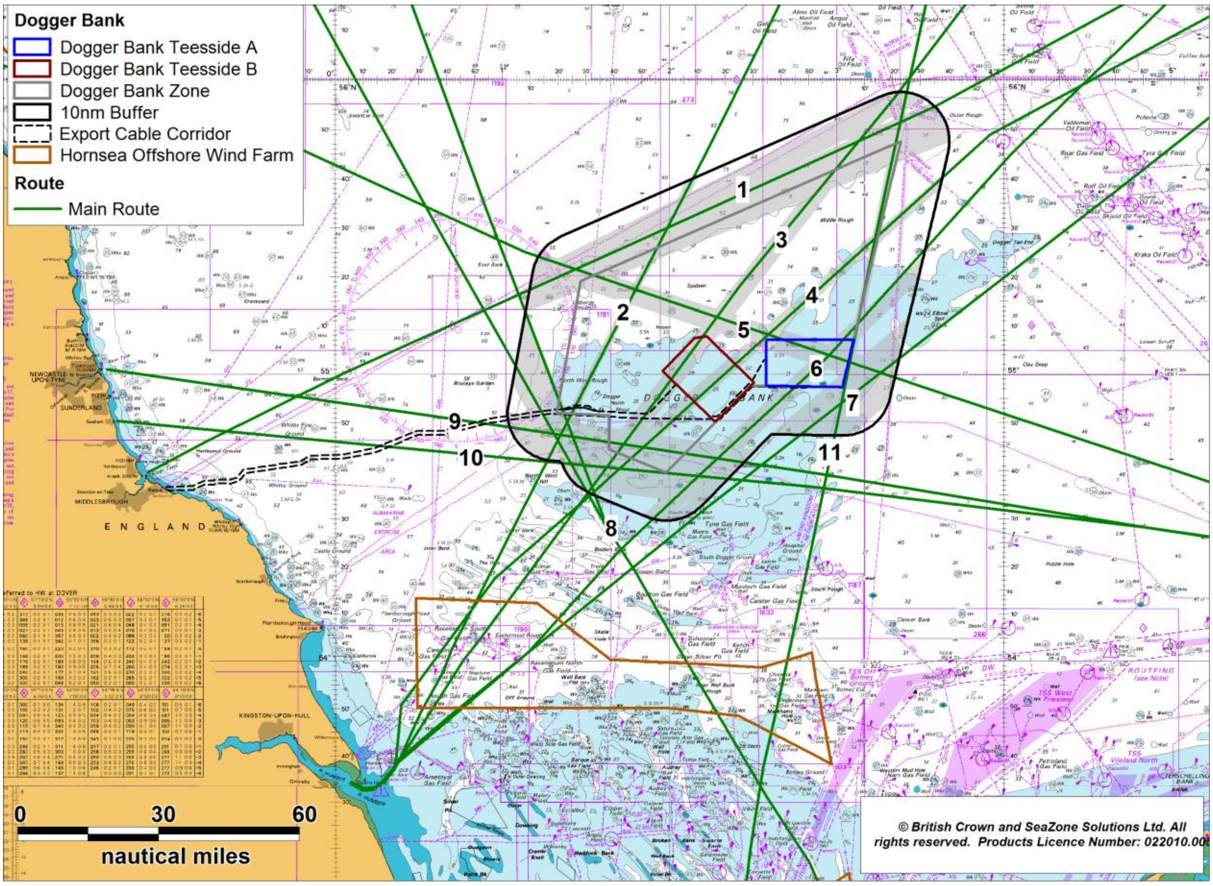

Figure 18.33 Main Routes and 90th Percentile Lanes in Proximity to Dogger Bank Zone

18.7 *Base Case Main Routes*

Eleven main commercial vessel routes have been identified as transiting within 10nm of the Dogger Bank Zone, seven of which intersect the buffer around Dogger Bank Teesside A & B. Plots of the main routes and 90th percentiles are presented in Figure 18.34 and Figure 18.35.

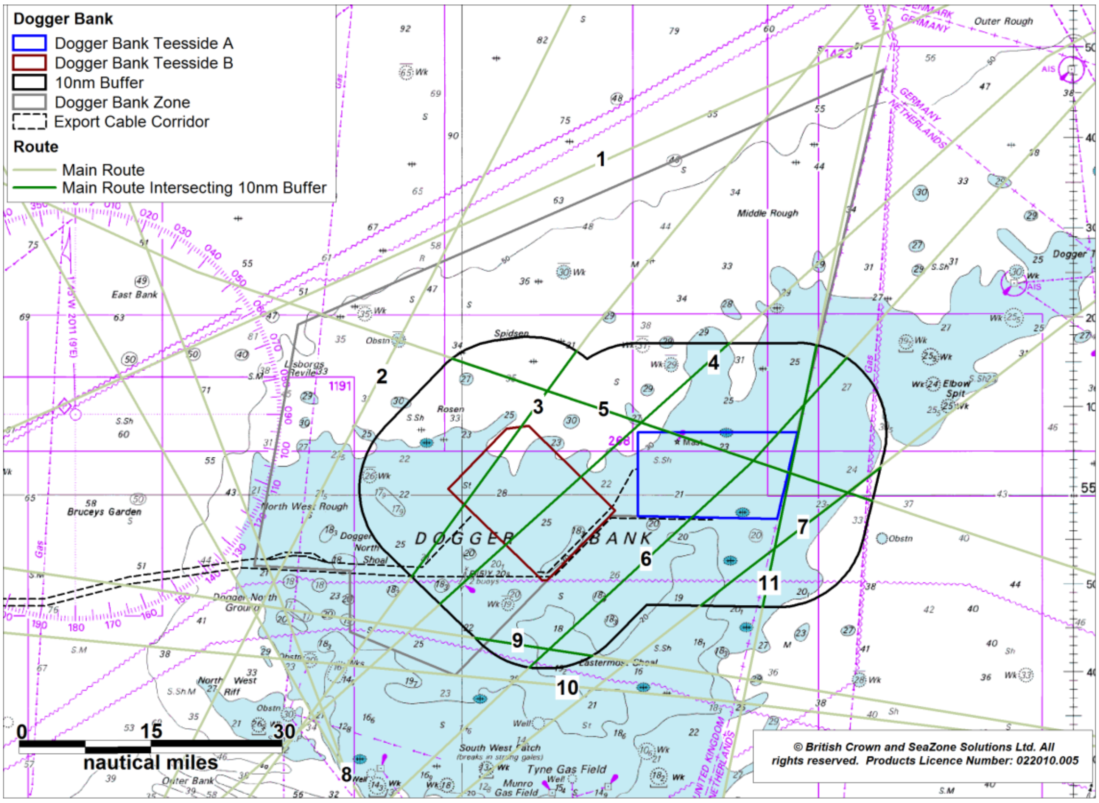

Figure 18.34 Main Routes

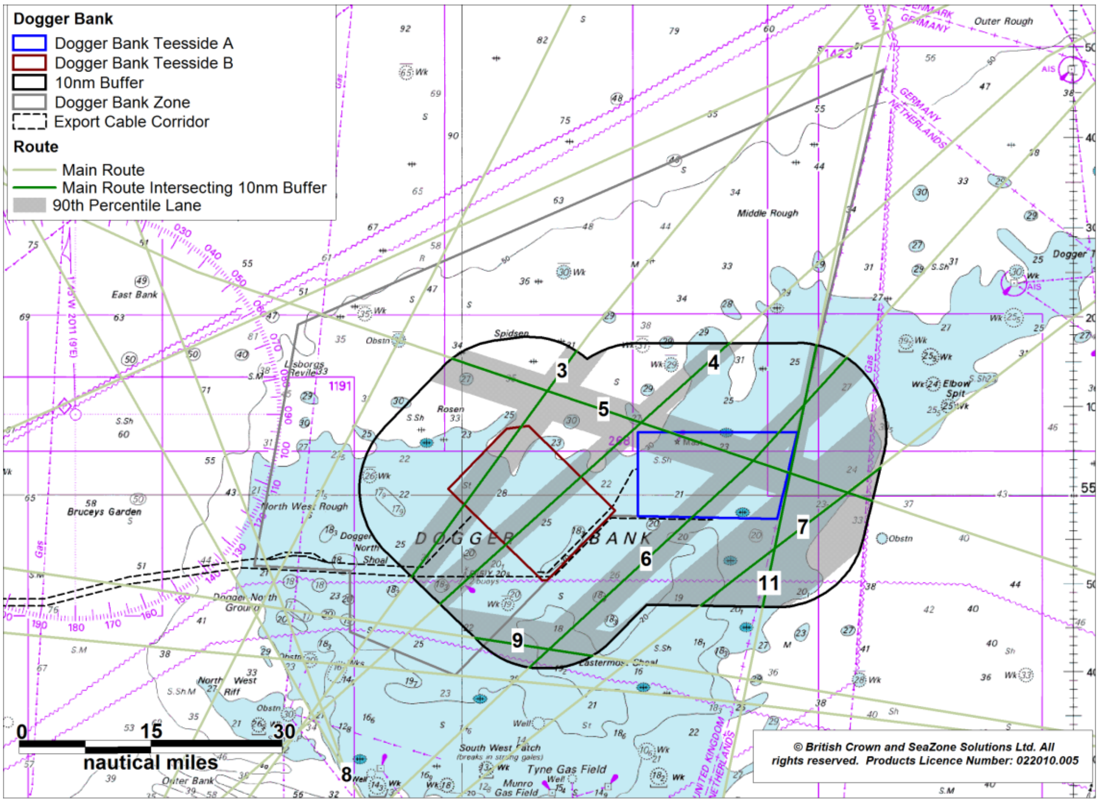

Figure 18.35 90th Percentile Lanes

A brief description of the traffic on each of the main routes is presented in Table 18.1.

Table 18.1 Description of Main Routes

Route Number	Route Description	Vessels Numbers	Vessel Types
3	Humber, UK and Egersund, Norway	1 vessel every 11 days	Cargo, Tanker
4	Humber, UK and Helsinki, Finland	1 vessel every 6 days	Cargo
5	Forth, UK and Germany	1 vessel every 6 days	Cargo, Tanker
6	Humber, UK and Scandinavia (South)	1 vessel every 3 days	Cargo, Tanker
7	Humber, UK and Baltic	1 vessel every day	Cargo, Tanker
9	Newcastle, UK and Hamburg, Germany	1 vessel every 13 days	Cargo, Tanker
11	Thames, UK and Norway	1 vessel every 9 days	Cargo

18.8 *Main Route Validation*

18.8.1 Introduction

Throughout the zone appraisal of the Dogger Bank Zone, 527 days of AIS survey data were collected between 15th April 2010 and 29th June 2012. The data was collected by the vessels *Vigilant*, *L'Espoir* and *Tridens 1* during geophysical survey work within the zone.

Figure 18.36 presents 16 weeks (112 days) of AIS data from November 2011 to June 2012 thematically mapped by vessel type within 10nm of the Dogger Bank zone. It should be noted that only 16 weeks of the complete data set has been presented in order to ease interpretation and increase clarity of the figure.

Following this, the complete 527 days AIS data set collected throughout the zone appraisal phase has been converted to a 1km x 1km vessel density grid to assist in identifying hot spots of vessel activity. The resultant density grid is presented in Figure 18.37.

The complete 527 days of AIS data collected throughout the zone appraisal process has been used to identify the main commercial vessel routes in proximity to the Dogger Bank zone. Figure 18.38 illustrates the main routes identified, along with the 90th percentiles and 16 weeks AIS data.

AIS tracks are identified by a vessels Maritime Mobile Service Identity (MMSI) number, which is unique to every vessel in the world. This allows us to accurately track vessels movements and where tracks are broken, due to coverage or atmospheric issues we can identify where a vessel is transiting to/from. This allows us to correctly identify main routes for use in navigational assessments. However, it should be noted that in figures we do not extrapolate AIS tracks to complete broken tracks but instead reflect an accurate picture of what data has been collected.

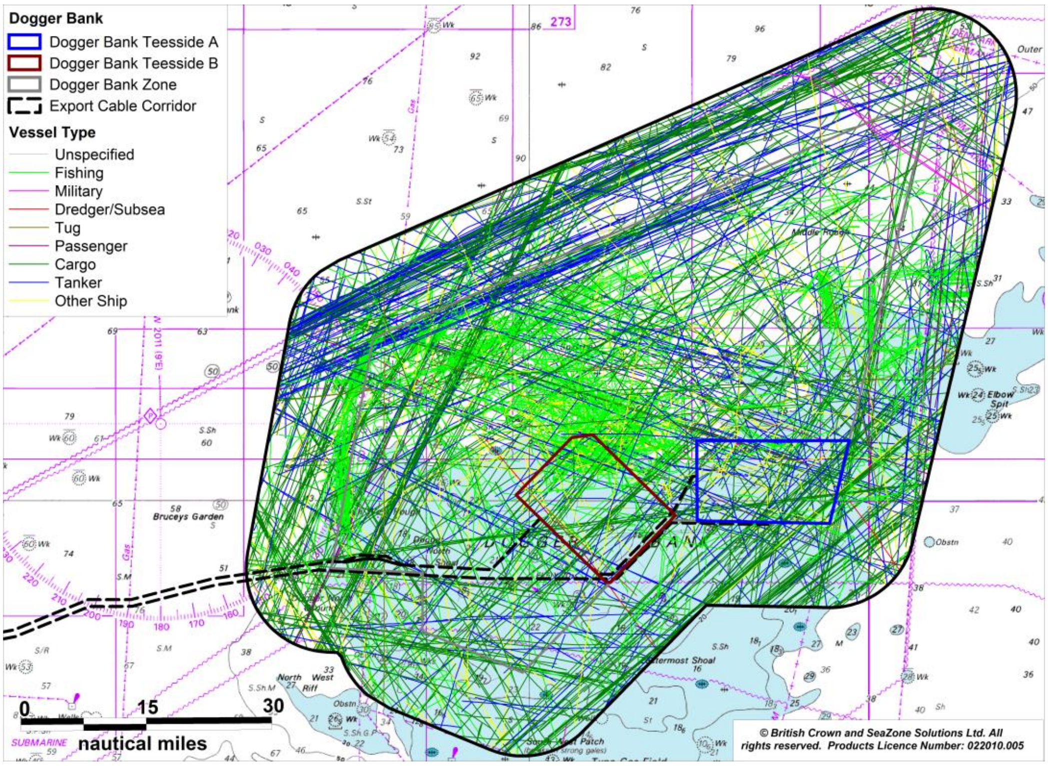

Figure 18.36 16 Weeks (November 2011 – June 2012) AIS Data thematically mapped by Vessel Type.

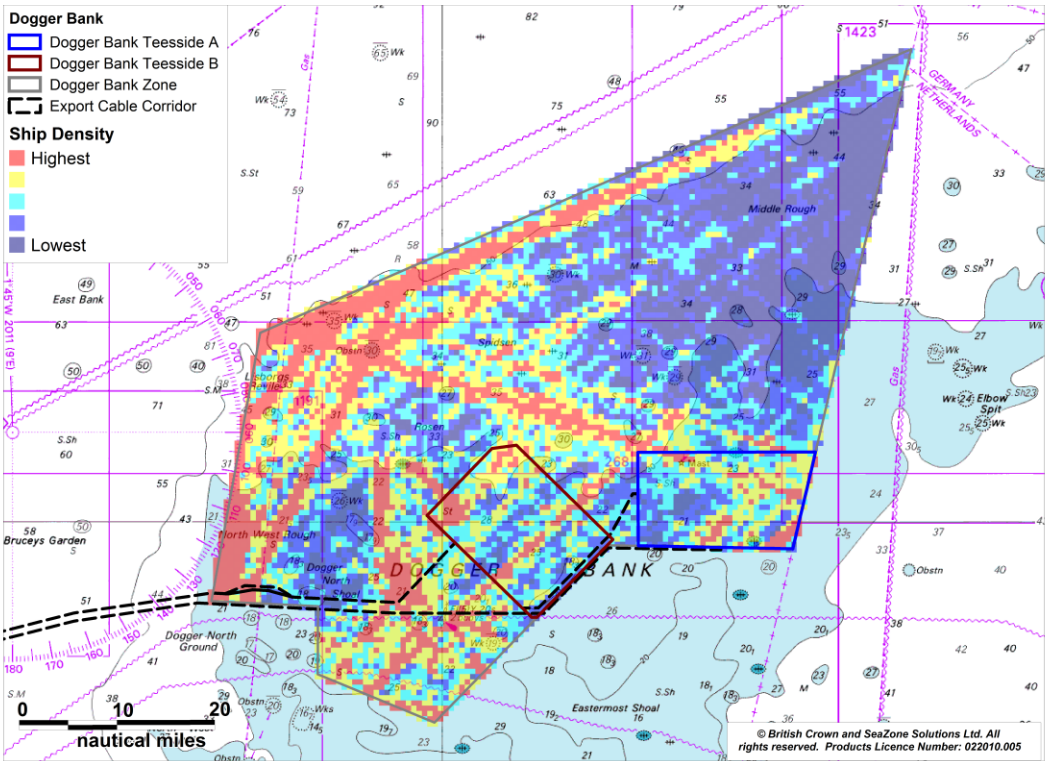

Figure 18.37 Dogger Bank Zone Vessel Density Grid

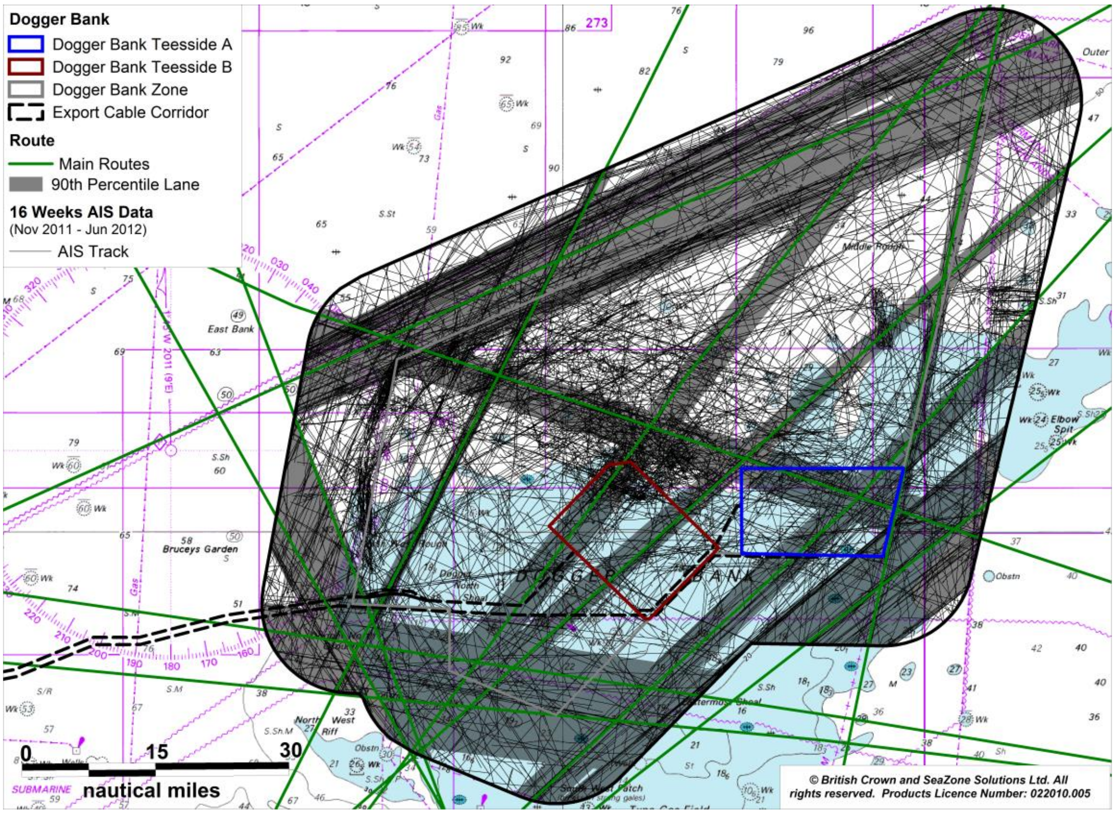

Figure 18.38 Dogger Bank Zone Main Commercial Vessel Routes

18.8.2 Adverse Weather

Adverse weather routes are considered to be significant course adjustments to mitigate vessel movement in adverse conditions. Additionally, in such conditions, vessels may opt to increase their closest point of approach (CPA) to navigational hazards such as shallow waters.

Due to the location and open sea area around Dogger Bank Teesside A & B including areas of water, such as *South West Patch* that can prove too difficult to navigate in particular tidal and weather conditions. The development of the wind farms however is not expected to have any adverse impacts on current vessel adverse weather routeing due to the areas of open water available for navigation around the proposed sites. It noted that adverse weather routeing in an area like Dogger Bank Teesside A & B is different to other near shore areas where vessels are more restricted as to course due to navigable areas and obstructions.

Implementation of the layout rules will allow vessels (likely to be wind farm support craft and commercial fishing vessels) to navigate safely in the event of adverse weather. Commercial vessels, as shown in consultation responses, are expected to avoid navigation between structures and wind farms as early course alterations will enable them to easily, and without commercial implications, route around the wind farms.

There are therefore not expected to be any increased impacts and effects associated with the development of Dogger Bank Teesside A & B.

18.9 *Recreational vessel activity*

This section reviews recreational vessel activity in the assessment area based on information published by the RYA, in addition to AIS and Radar tracking of recreational vessels during the maritime traffic surveys.

18.9.1 Survey Data

Six recreational vessels were recorded on AIS and Radar during the survey. These vessels were all recorded during the summer period, with none being tracked during the winter survey. All of the recreational vessels tracked were yachts. Four of these yachts intersected the boundary of Dogger Bank Teesside A, with none recorded within the boundary of Dogger Bank Teesside B. Tracks of the recreational vessels recorded within 10nm of Dogger Bank Teesside A & B are presented in Figure 18.39.

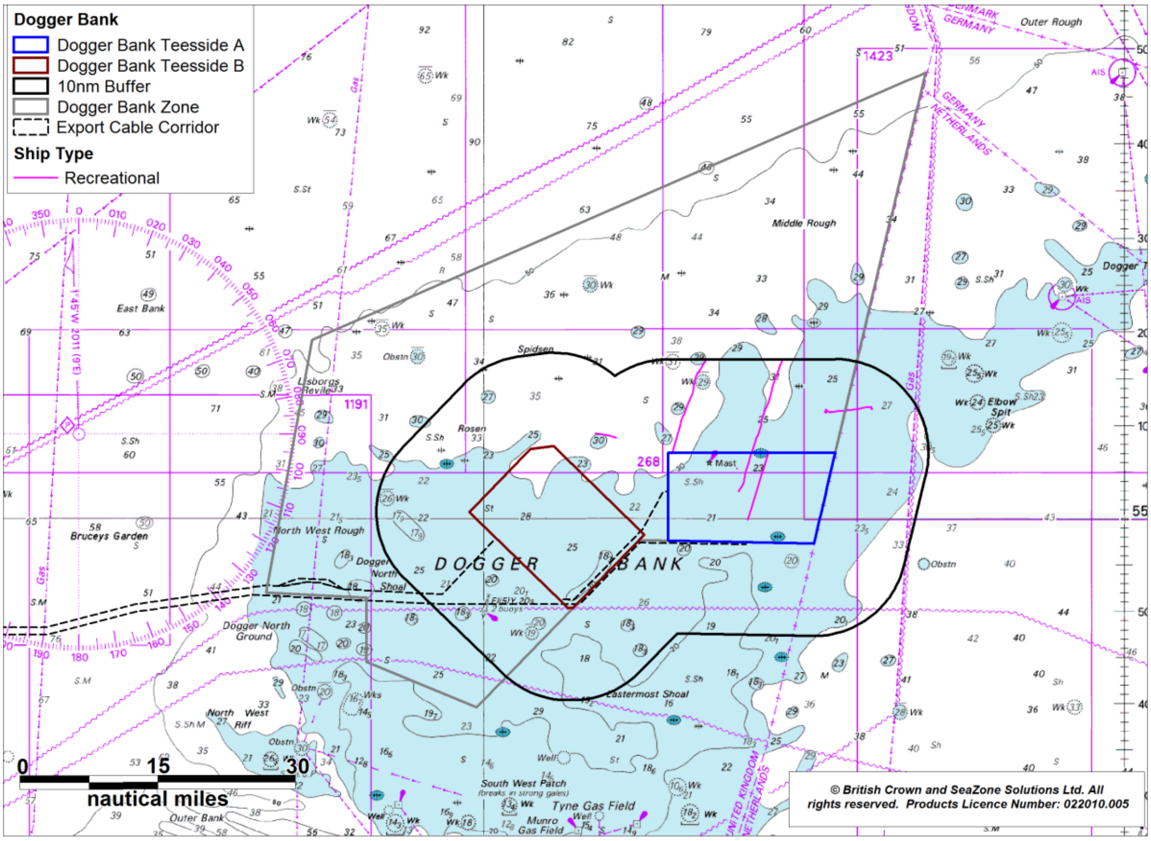

Figure 18.39 Recreational Vessels (14 Days Spring / Summer 2012)

18.9.2 Recreational Cruising Routes

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 CA, started to identify recreational cruising routes, general sailing and racing areas (RYA, 2011). This work was based on extensive consultation and qualitative data collection from RYA and CA 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.

The results of this work were published in Sharing the Wind (RYA, 2004) and updated GIS layers published in the Coastal Atlas (RYA, 2010).

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 will 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 will 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.

These routes were defined by a study undertaken by the RYA and CA. They are not designated courses but are general indications of known recreational routes between specific destinations popular with recreational craft.

18.9.3 Recreational Data

A plot of the recreational activity based on the latest RYA Cruising Routes (2009) is presented in Figure 18.40. There are two medium use cruising routes crossing the Dogger Bank Zone, one of which intersects the southern corner of Dogger Bank Teesside B.

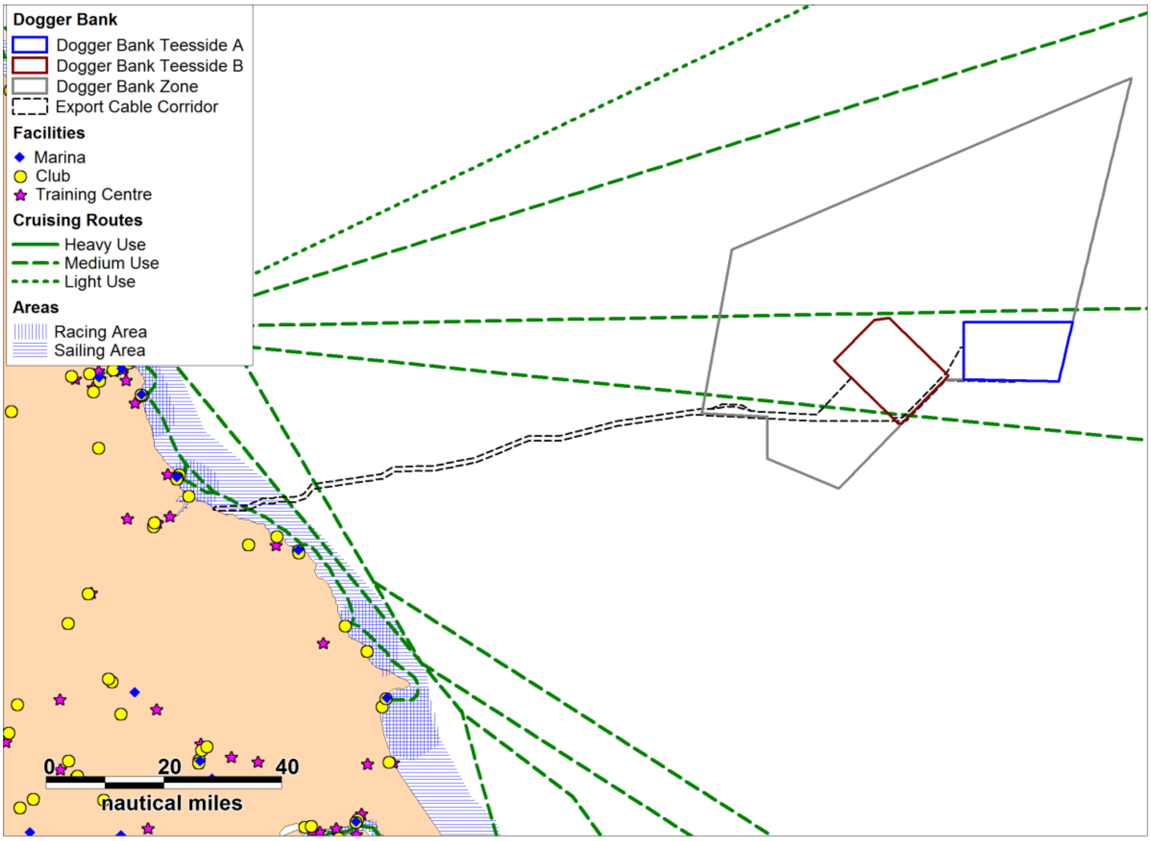

Figure 18.40 RYA Cruising Routes and Facilities

The biennial North Sea Triangle Challenge takes place during June of every odd year. Recreational vessels race between Den Helder in The Netherlands, either Kirkwall in Orkney or Lerwick in Shetland, and Farsund in Norway, with the race then finishing back in Den

Helder. The likely route of the race between these locations is presented in Figure 18.41. It can be seen that there is the potential for recreational vessels to pass through the Dogger Bank Zone but this depends largely on weather and tidal conditions.

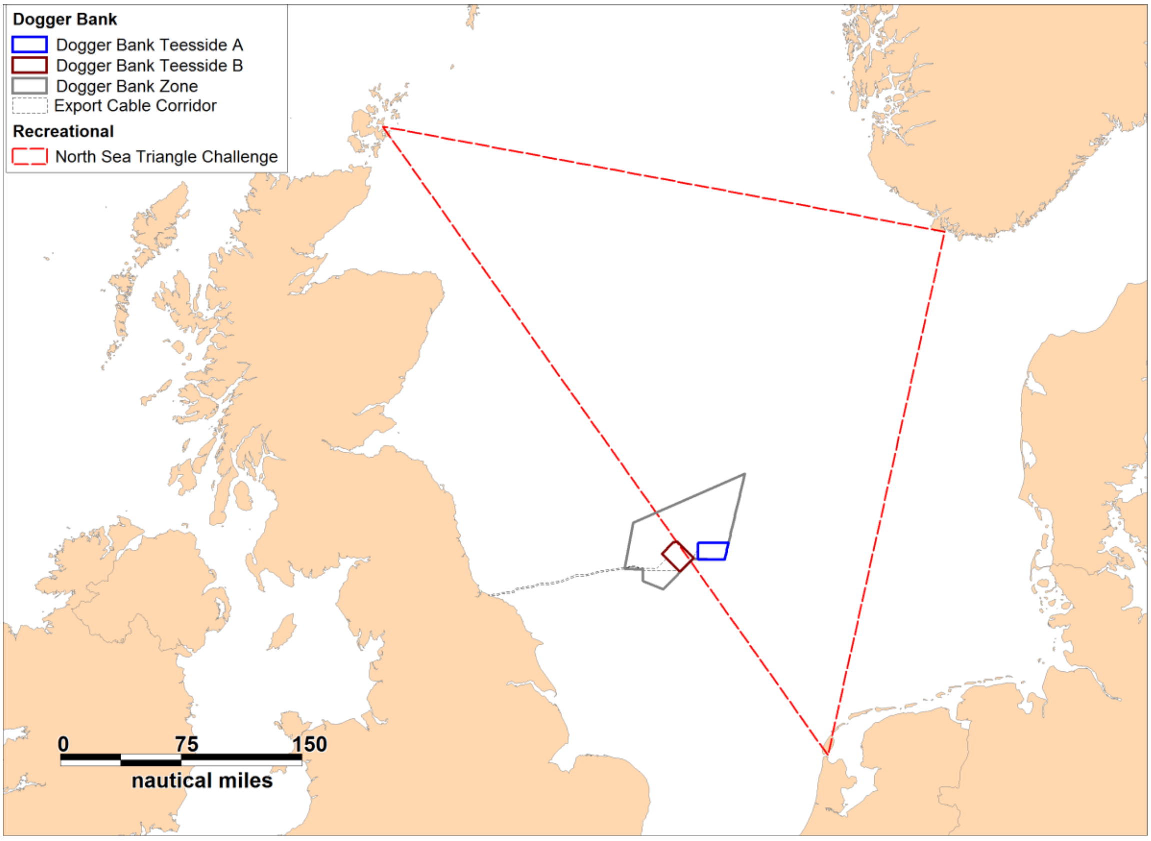

Figure 18.41 Route for North Sea Triangle Challenge

Figure 18.42 Recreational Vessels taking part in North Sea Triangle Challenge

18.9.4 Impacts of Structures on Wind Masking/Turbulence or Shear

Offshore turbines have the potential to affect vessels under sail when passing through the site from effects such as wind shear, masking and turbulence. From previous studies of offshore wind farms it was concluded that turbines do reduce wind velocity by the order of 10% downwind of a turbine (RYA, 2011). The temporary effect is not considered to have a large impact and is similar to that experienced passing a large ship 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.

18.10 *Fishing Vessel Activity*

This section reviews the fishing vessel activity in the assessment area based on the maritime traffic survey and Chapter 15 Commercial Fisheries study.

18.10.1 Survey Tracks

Fishing vessel activity was recorded during the AIS and Radar surveys, as presented in Figure 18.43. Activity has been recorded throughout the 10nm buffer and within both Dogger Bank Teesside A & B. It is likely that fishing vessel activity is underrepresented due to the likelihood that a number of vessels tracked as 'unspecified' were fishing vessels.

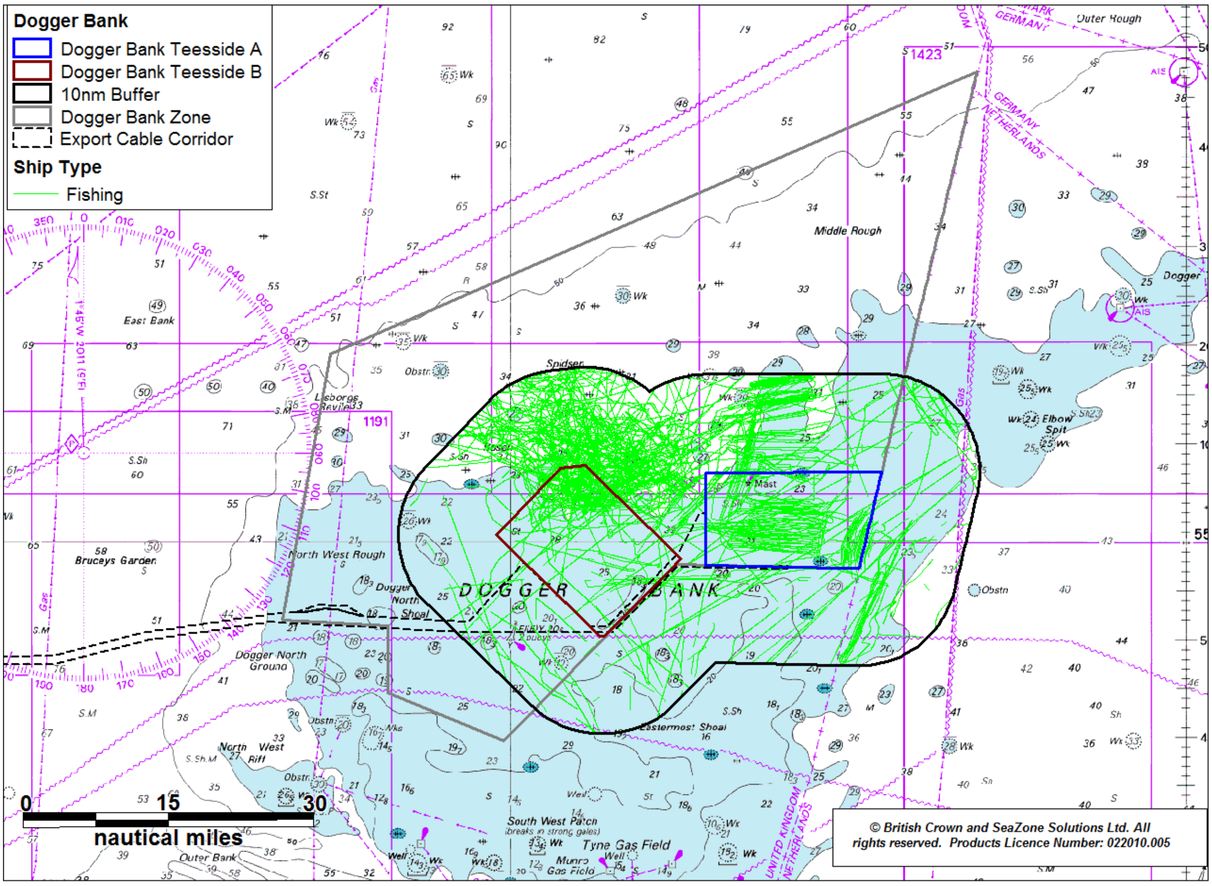

Figure 18.43 Fishing Vessels (56 Days)

It can be seen that the vast majority of fishing vessel activity occurs to the north of Dogger Bank Teesside B.

High levels of sand eel fishing activity occur within certain areas of Dogger Bank, with one of the areas of most concentrated activity being to the northwest of Dogger Bank Teesside B. Analysis of data for the area has shown that up to 11 unique vessels can be in the areas within one day (excluding those vessels which disable their AIS whilst fishing). Figure 18.44 presents AIS data of fishing vessels within a 10nm buffer around the Zone from 21 days in April 2011 (during the sand eel fishing season) to highlight the area where sand eel fishing is extensively carried out relative to Dogger Bank Teesside A & B.

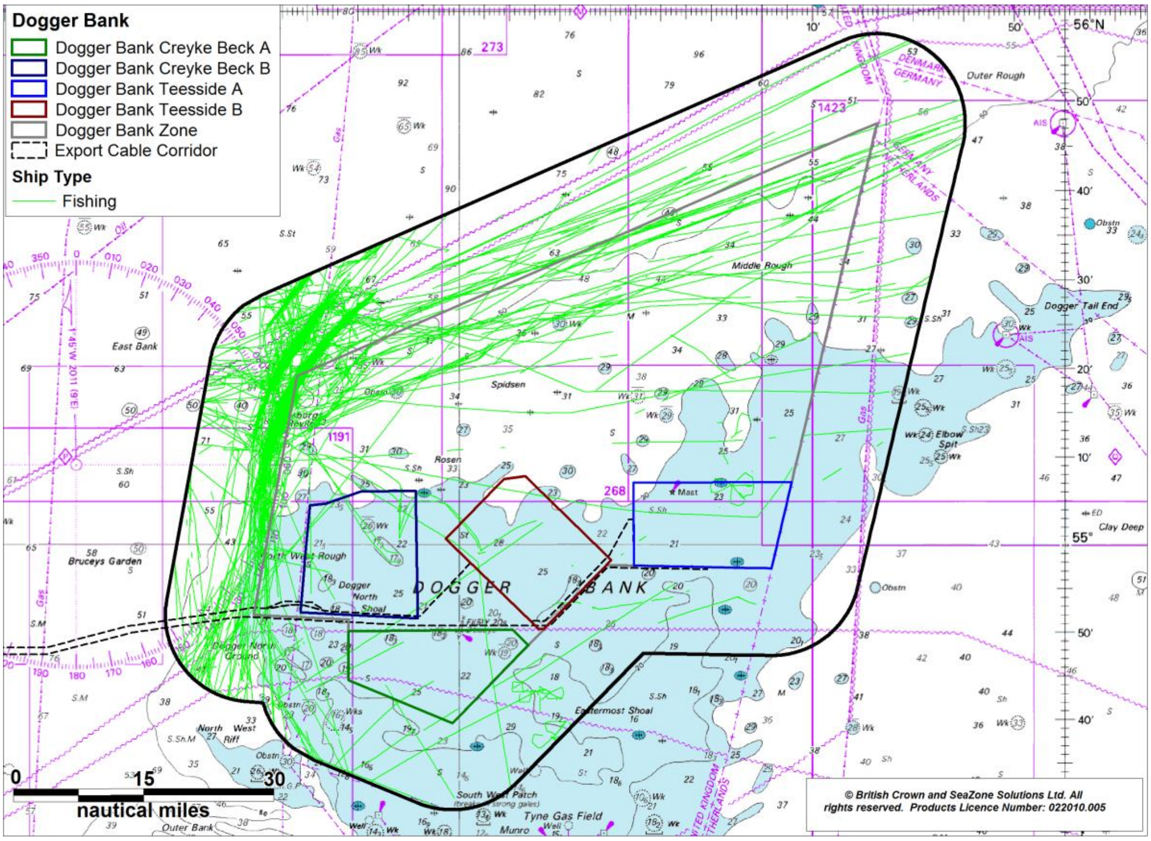

Figure 18.44 Fishing Vessels During Sand Eel Fishing Season

18.10.2 Satellite Data

Satellite data cover fishing vessels of 15m length and over. The latest satellite data set analysed is from 2009 and the data include both UK and foreign vessels of 15m length and over. Plots of vessel positions (received every 2 hours) have been converted to a 0.5 x 0.5nm density grid and are presented in Figure 18.45.

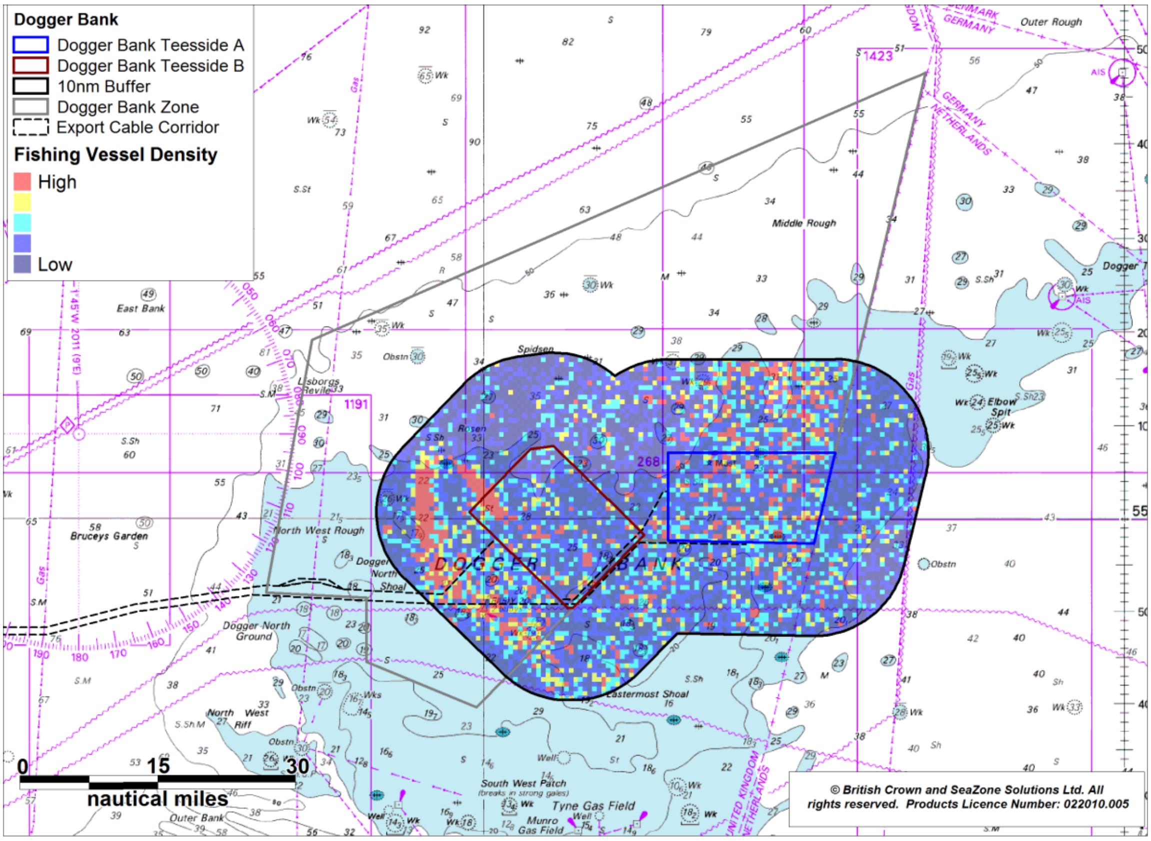

Figure 18.45 Fishing Vessel Density (from Satellite Data 2009)

The overall distribution of vessel nationality, based on the satellite data, is summarised in Figure 18.46. The majority of fishing vessels were registered in Denmark, accounting for 61% of the overall total. UK registered fishing vessels were the next most commonly sighted (25%), followed by Dutch (5%), Norwegian (3%) and German (2%).

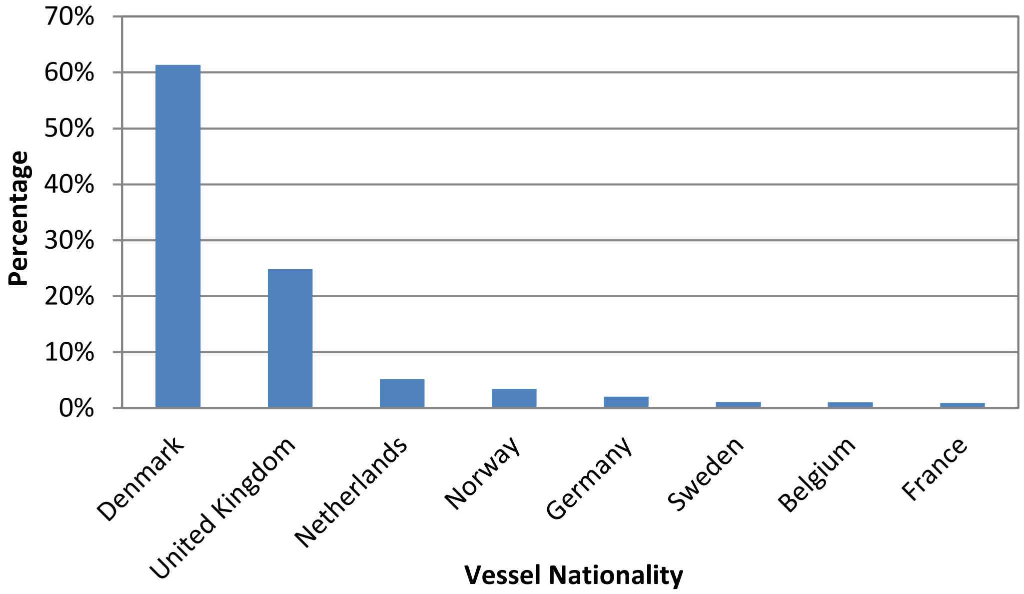

Figure 18.46 Nationality Distribution (from Satellite Data 2009)

Gear type information was available for approximately 21% of satellite fishing vessel positions within 10nm of Dogger Bank Teesside A & B. The most common fishing methods identified were beam trawling, accounting for 12% of the overall total and bottom seining (5%).

Based on analysis of the speed of fishing vessels recorded by the satellite data, it has been identified that approximately 67% of vessels within the 10nm buffer were engaged in fishing (any vessel travelling at a speed of 5 knots or less is assumed to be fishing).

19. Maritime Traffic Survey – Export Cable Route

19.1 *Introduction*

This section presents shipping data for the Dogger Bank Teesside A & B export cable corridor recorded on AIS during surveys in June 2011 (7 days) and June 2012 (7 days). The AIS surveys were carried out by the vessels *L'Espoir* and *Vigilant* (June 2011) and *Tridens-1* and *Vigilant* (June 2012) during geophysical survey work in the area. The data collected from these vessels were supplemented by other AIS data available from coastal and offshore stations. It should be noted that the 2012 dataset has been cropped to the westernmost boundary of Dogger Bank Teesside B. Dedicated vessel surveys carried out within the project area (see section 18) provide optimal coverage for the section of cable route out with this buffer.

19.2 *Survey Analysis*

A plot of all vessel tracks recorded during a 7 day survey period in June 2011, thematically mapped by vessel type, is presented in Figure 19.1, with a plot of all vessel tracks recorded during a 7 day survey period in June 2012, thematically mapped by vessel type presented in Figure 19.2. It should be noted that data from June 2012 has been cropped to the westernmost extent of Dogger Bank Teesside B as vessel routeing within the Dogger Bank Zone has been assessed separately within Section 18: Maritime Traffic Survey Dogger Bank Teesside A & B.

These figures include tracks for the survey vessels *L'Espoir*, *Tridens-1* and *Vigilant*, in addition to other research vessels and temporary traffic operating in the area.

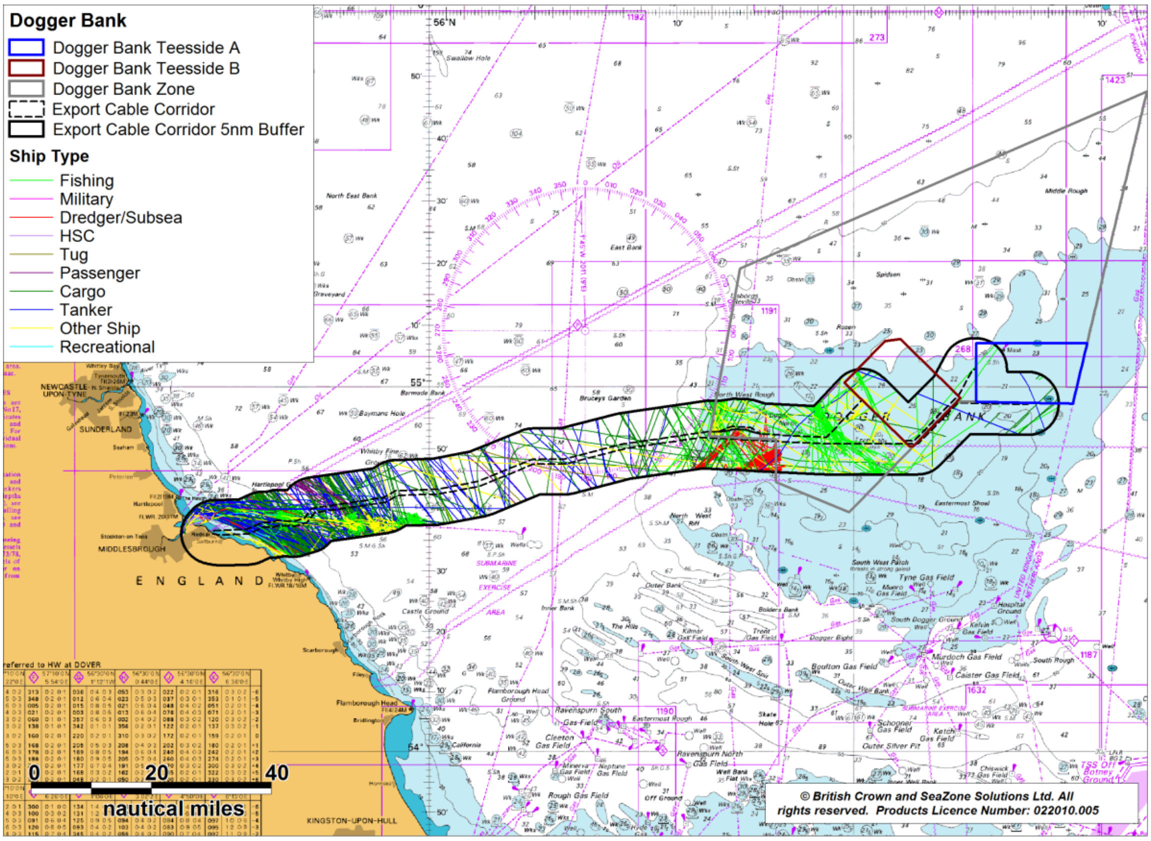

Figure 19.1 All Vessels within 5nm of Export Cable Corridor (7 Days June 2011)

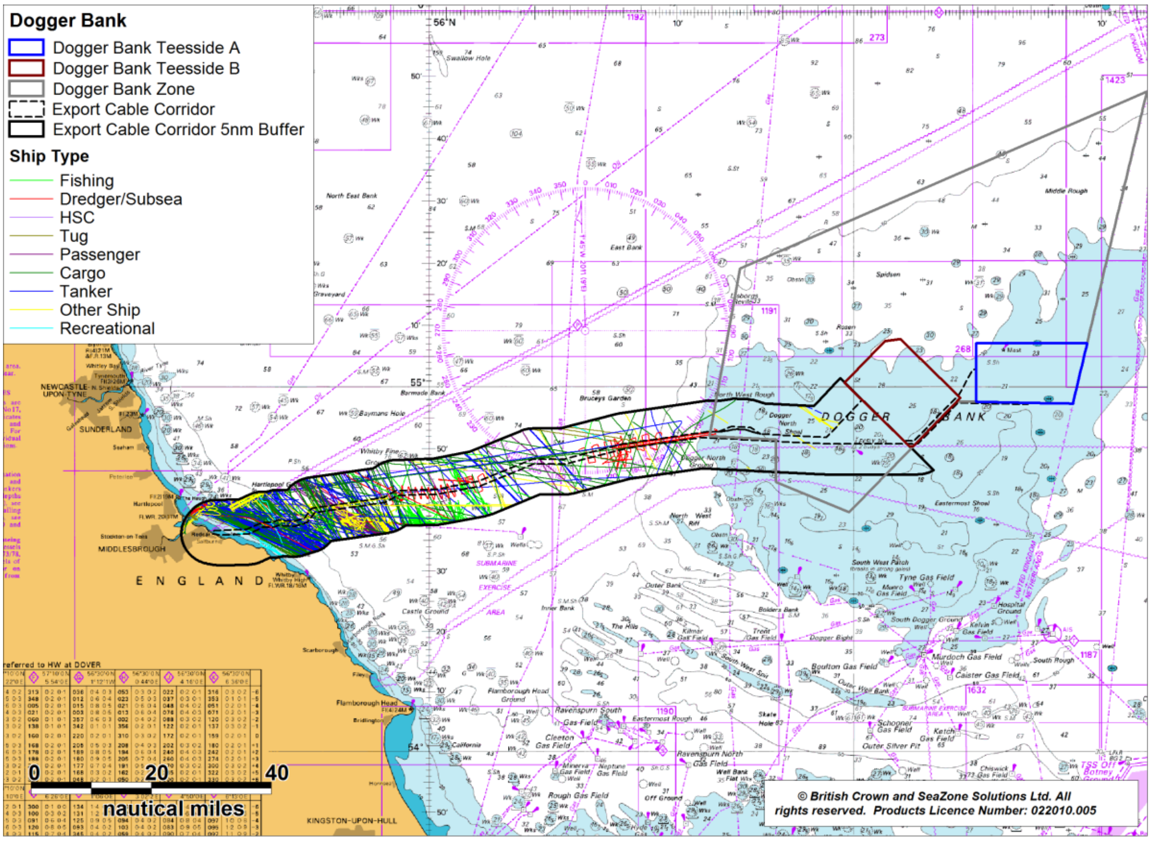

Figure 19.2 All Vessels within 5nm of Export Cable Corridor (7 Days June 2012)

Numerous tracks recorded during the survey were classified as temporary (non-routine), such as the tracks of the survey vessels and research vessels operating in the area. A number of vessels were associated with the Breagh pipeline (which spans from Coatham Sands to Breagh Alpha platform and intersects the cable corridor approximately 14nm from shore), including several fishing vessels which were acting as guard vessels, which have also been classified as temporary traffic. These tracks have been excluded from further analysis.

Plots of the vessel tracks recorded during the survey periods, thematically mapped by vessel type and excluding temporary traffic are presented in Figure 19.3 and Figure 19.4.

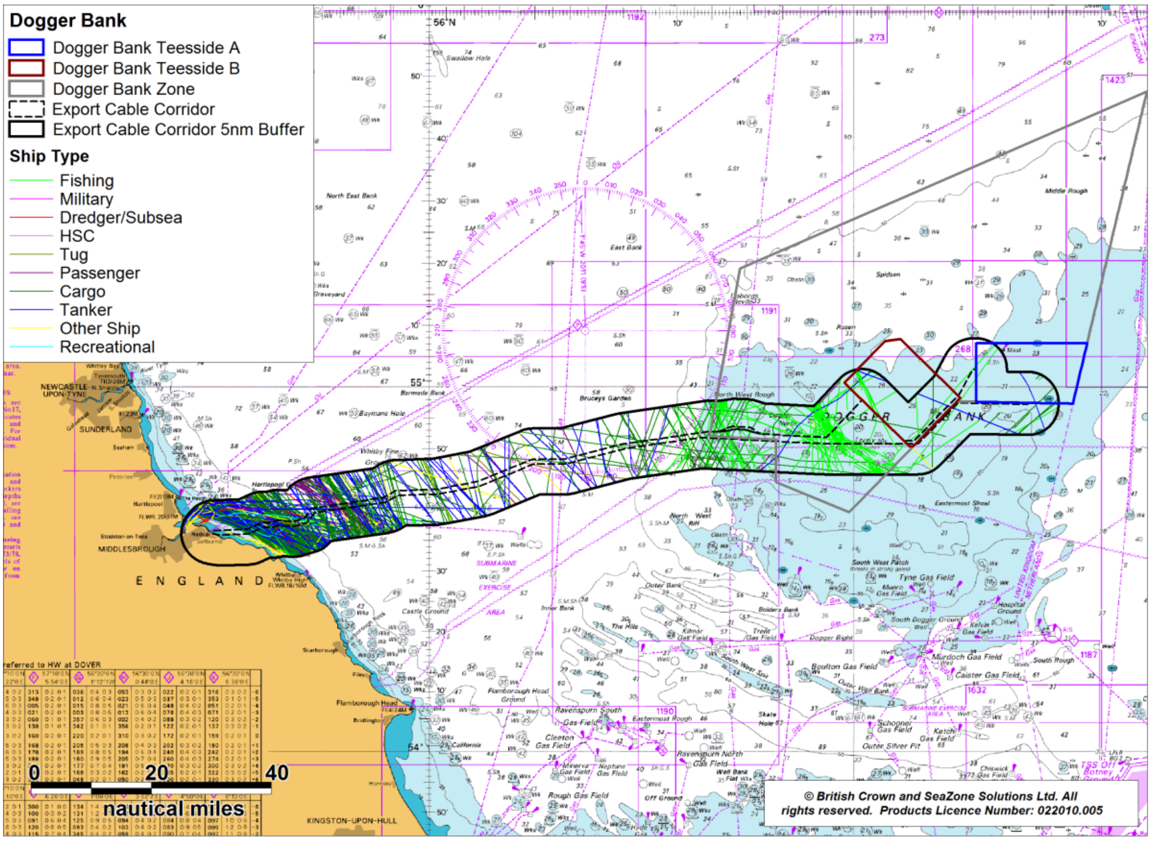

Figure 19.3 All Vessels within 5nm of Export Cable Corridor excluding Temporary Traffic (7 Days June 2011)

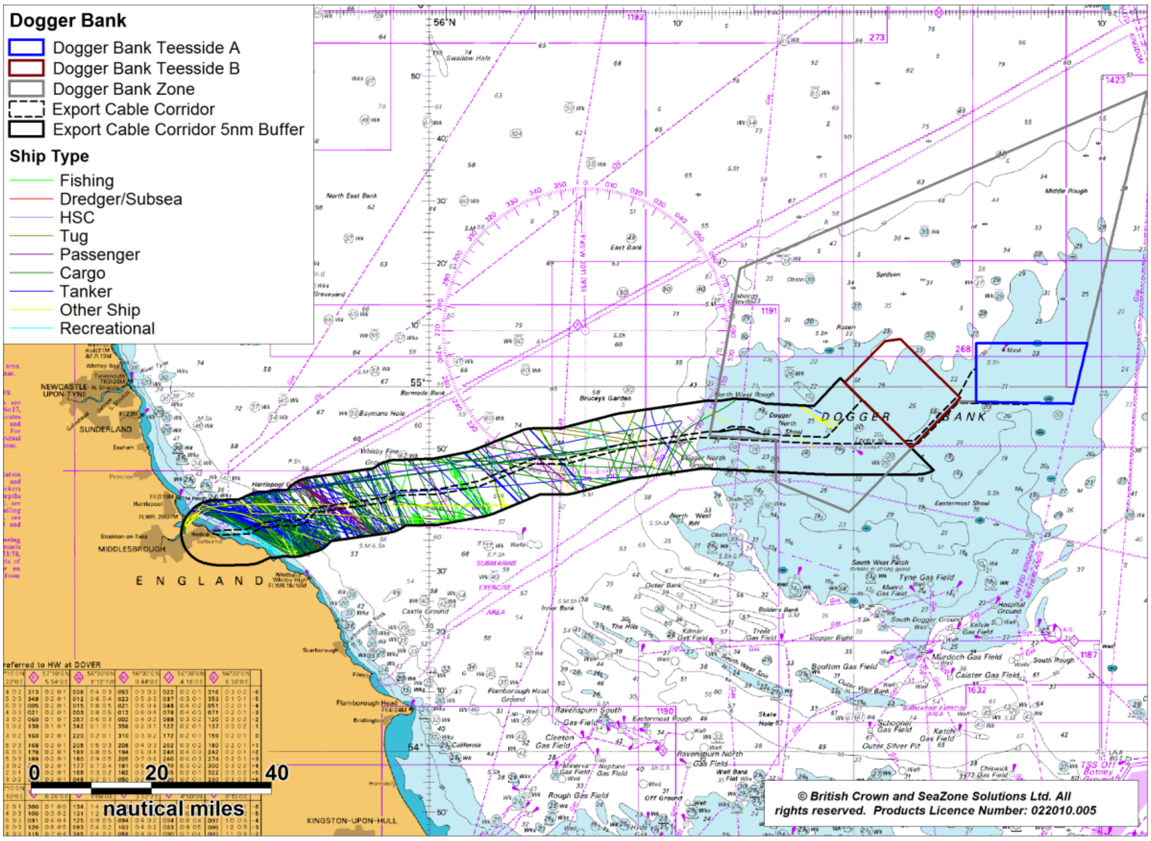

Figure 19.4 All Vessels within 5nm of Export Cable Corridor excluding Temporary Traffic (7 Days in June 2012)

In total there was an average of 78 unique vessels per day recorded on AIS passing within 5nm of the export cable corridor during the combined 14 day survey period.

Figure 19.5 shows the daily number of vessels passing within 5nm of the export cable corridor during the survey.

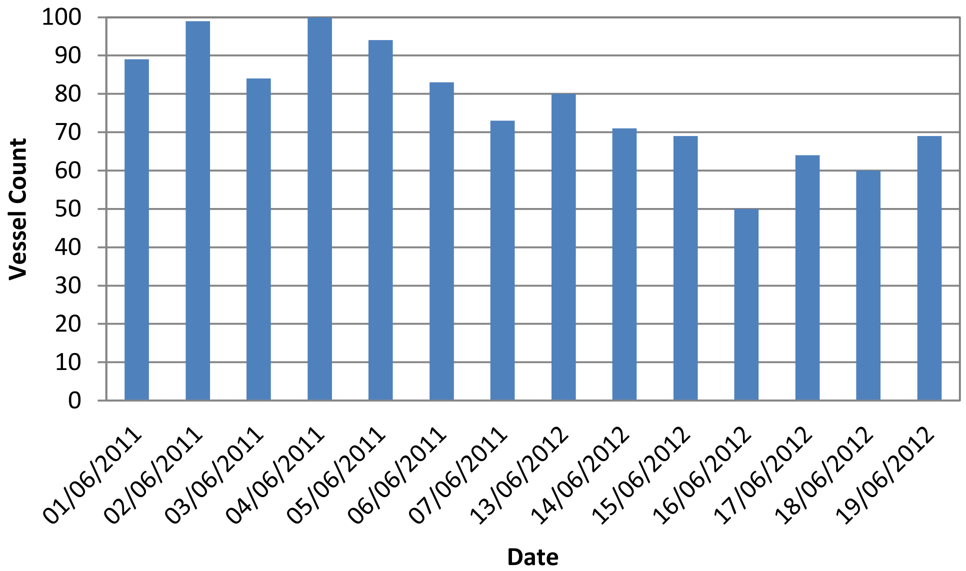

Figure 19.5 Unique Vessels per Day (14 Days Summer 2011 and Summer 2012)

An analysis of the unique vessel types recorded passing within 5nm of the export cable corridor during the 14 day survey period is presented in Figure 19.6. Vessels which were broadcasting their type as 'unspecified' were further researched and assigned an appropriate type.

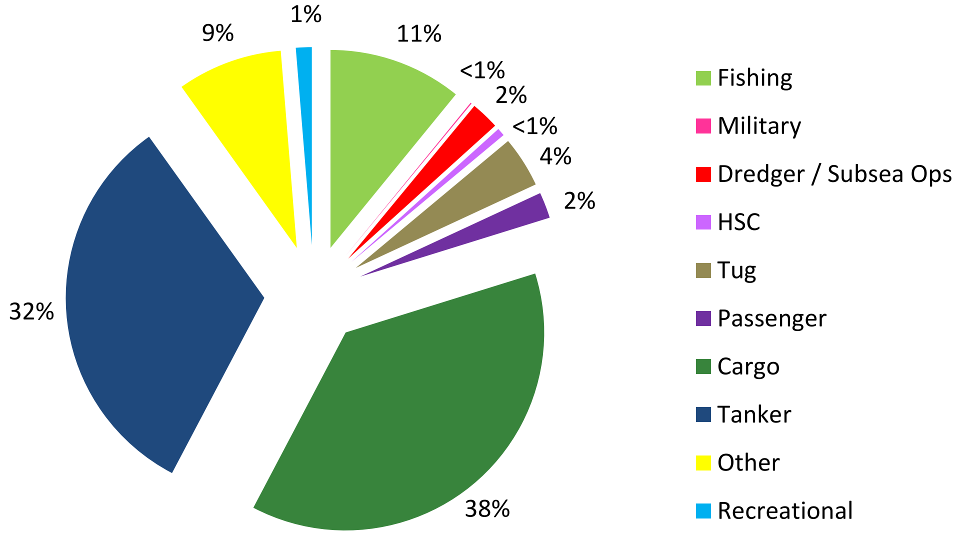

Figure 19.6 Vessel Types Within 5nm of Export Cable Corridor (14 Days Summer 2011 and Summer 2012)

Cargo vessels represented 38% of the total number of vessels tracked, with tankers representing 32% of vessels.

Plots of cargo vessels and tankers are presented in Figure 19.7 and Figure 19.8.

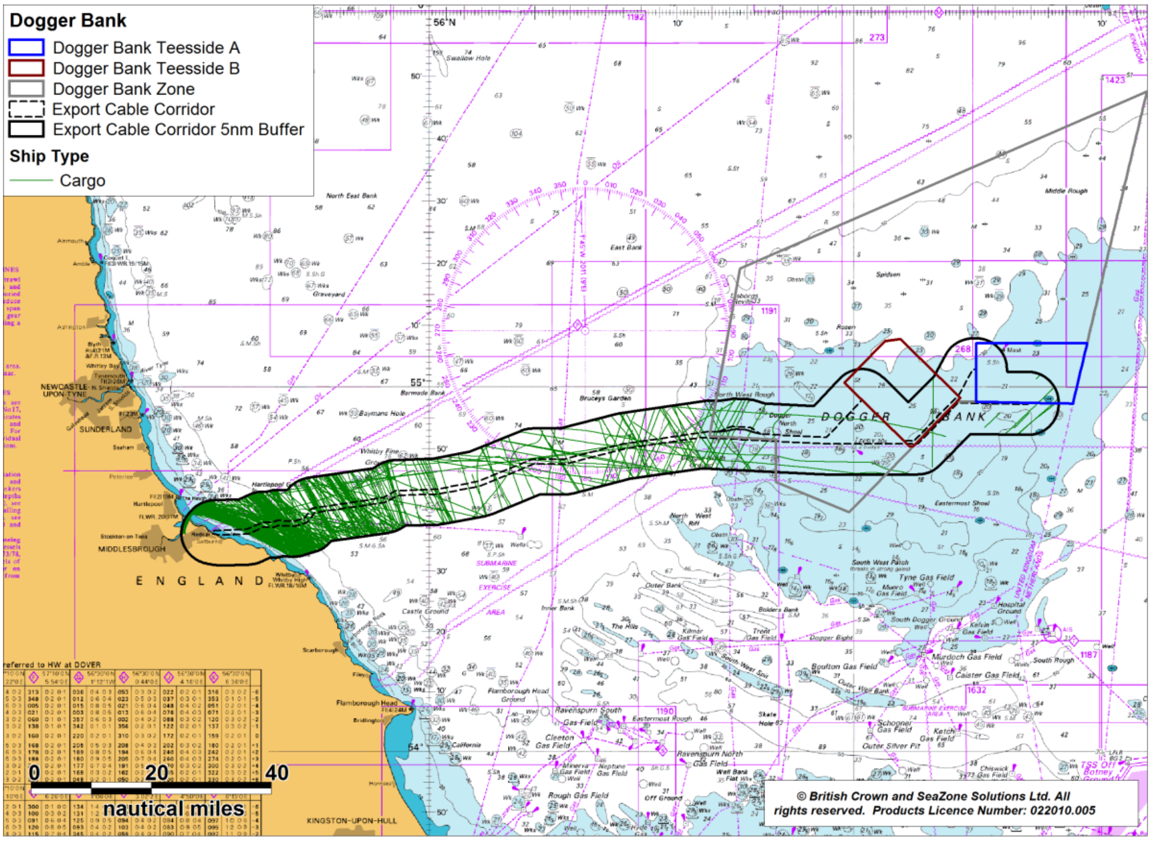

Figure 19.7 Cargo Vessels (14 Days Summer 2011 and Summer 2012)

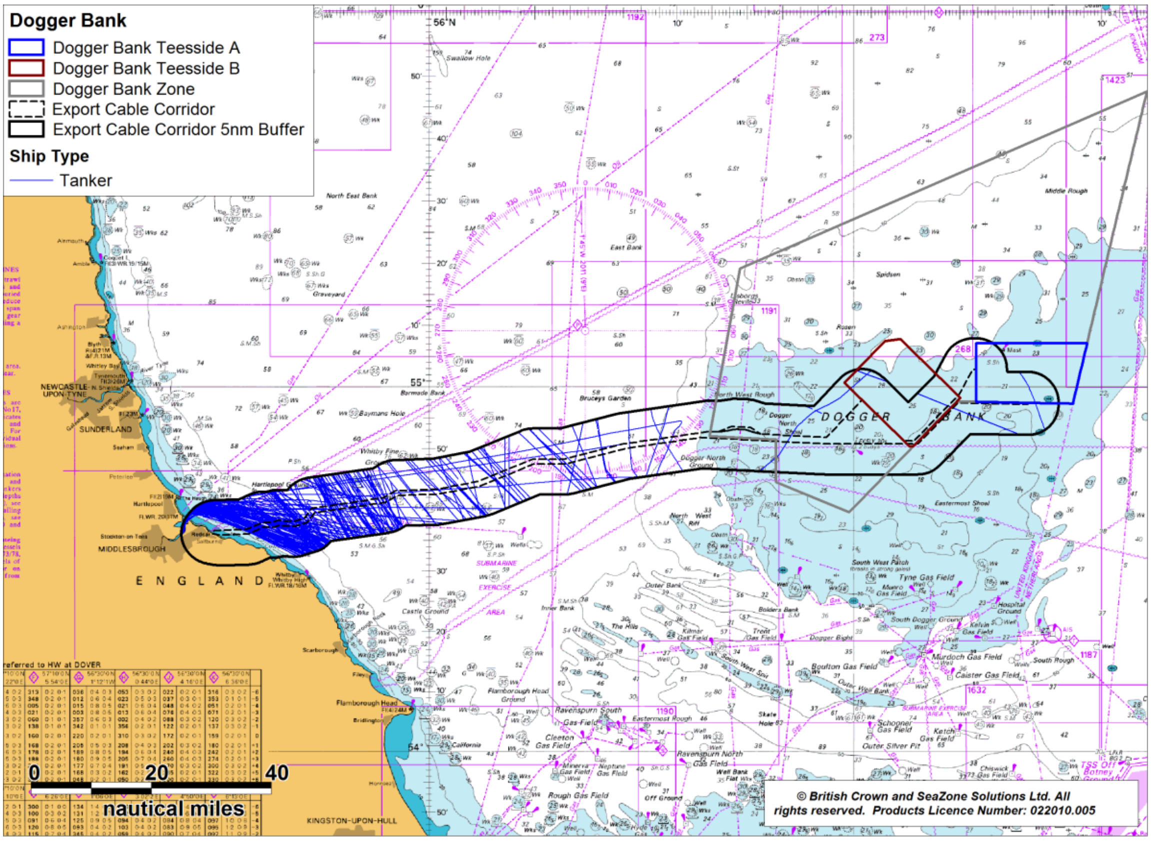

Figure 19.8 Tankers (14 Days Summer 2011 and Summer 2012)

19.3 *Vessel Draught*

Figure 19.9 presents the 14 days of vessel tracks from the combined survey period, thematically mapped by operating draught. The average draught (excluding unspecified draughts) of vessels passing within 5nm of the export cable corridor was 5.7m.

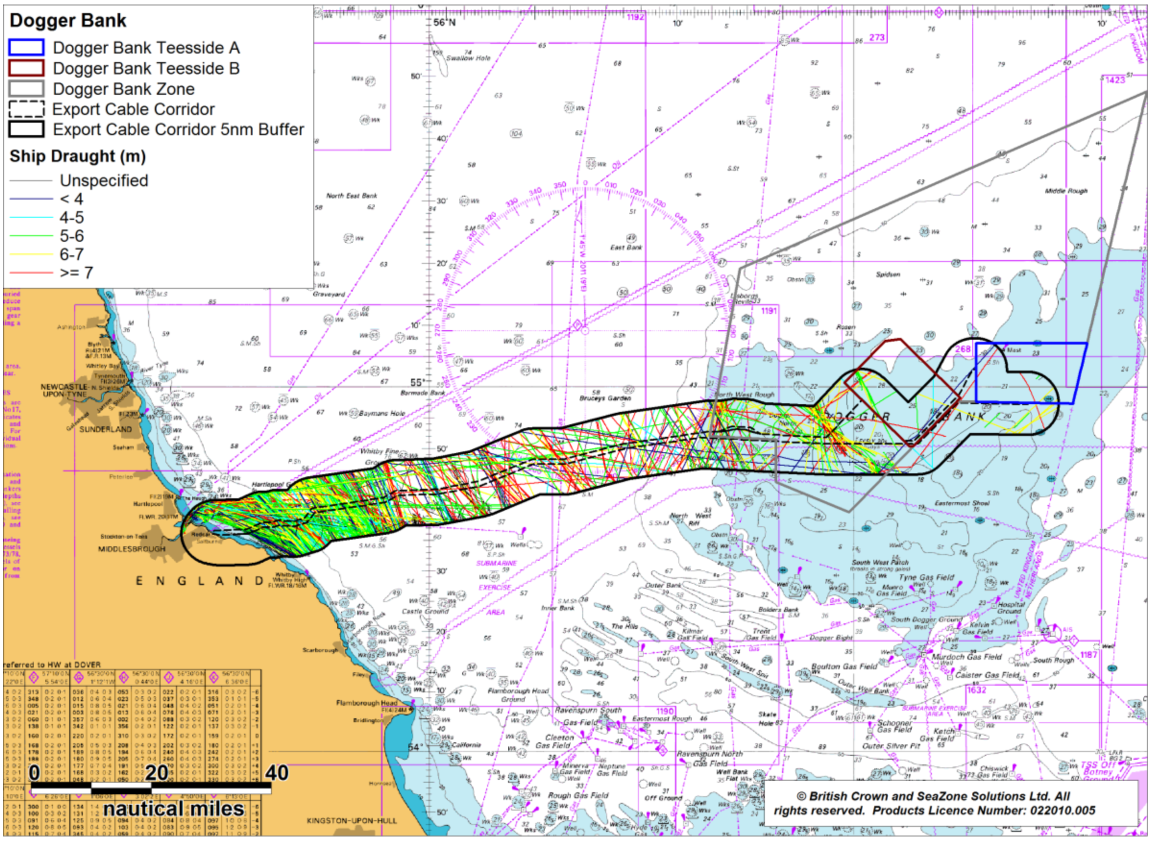

Figure 19.9 Vessel Draught (14 Days Summer 2011 and Summer 2012)

The water depth decreases close to the shore where the cable makes landfall. The entrance to Teesport is encompassed by the export cable corridor 5nm buffer, meaning that a number of vessels tracked within the study area are entering or exiting Teesport. As a result of this, the average draught of vessels does not significantly change closer to the shore.

A larger scale plot of vessels in these areas, thematically mapped by draught, is presented in Figure 19.10.

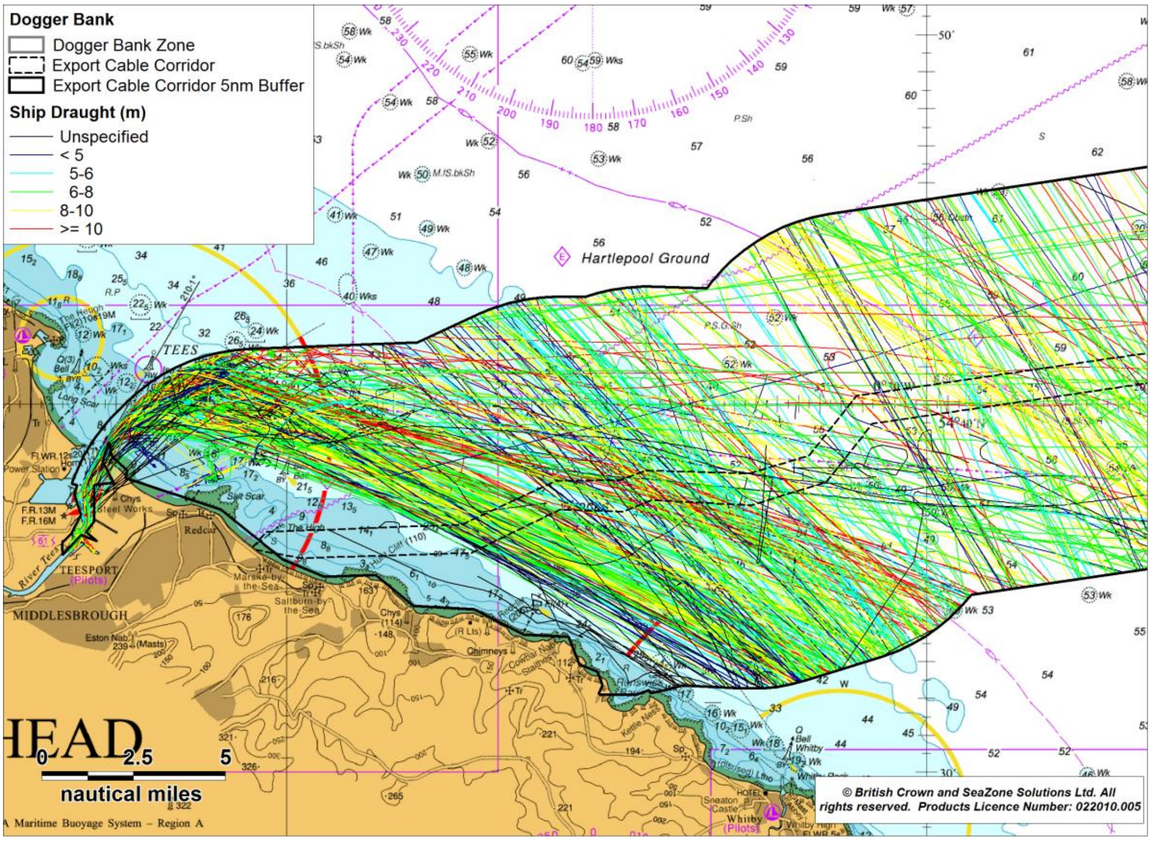

Figure 19.10 Large Scale plot of Vessel Draught (14 Days Summer 2011 and Summer 2012)

19.4 *Anchored Vessels*

Anchored vessels can be identified based on the AIS navigational status which is set on the AIS transmitter on board a vessel. Information is manually entered into the AIS; therefore it is common for vessels not to update the navigational status if they are anchored for only a short period of time. For this reason, those vessels which travelled at a speed of less than 1 knot for more than 30 minutes were assumed to also be at anchor and were included in this report.

AIS data were used to analyse the vessels at anchor in the vicinity of the Dogger Bank Teesside A & B cable route landing point from 1st to the 7th April 2013. Figure 19.11 presents the anchor activities in the area during this period. No other anchored vessels were found outside of this area; however they are not prohibited from anchoring within other areas of the cable corridor unless specifically noted on an admiralty chart.

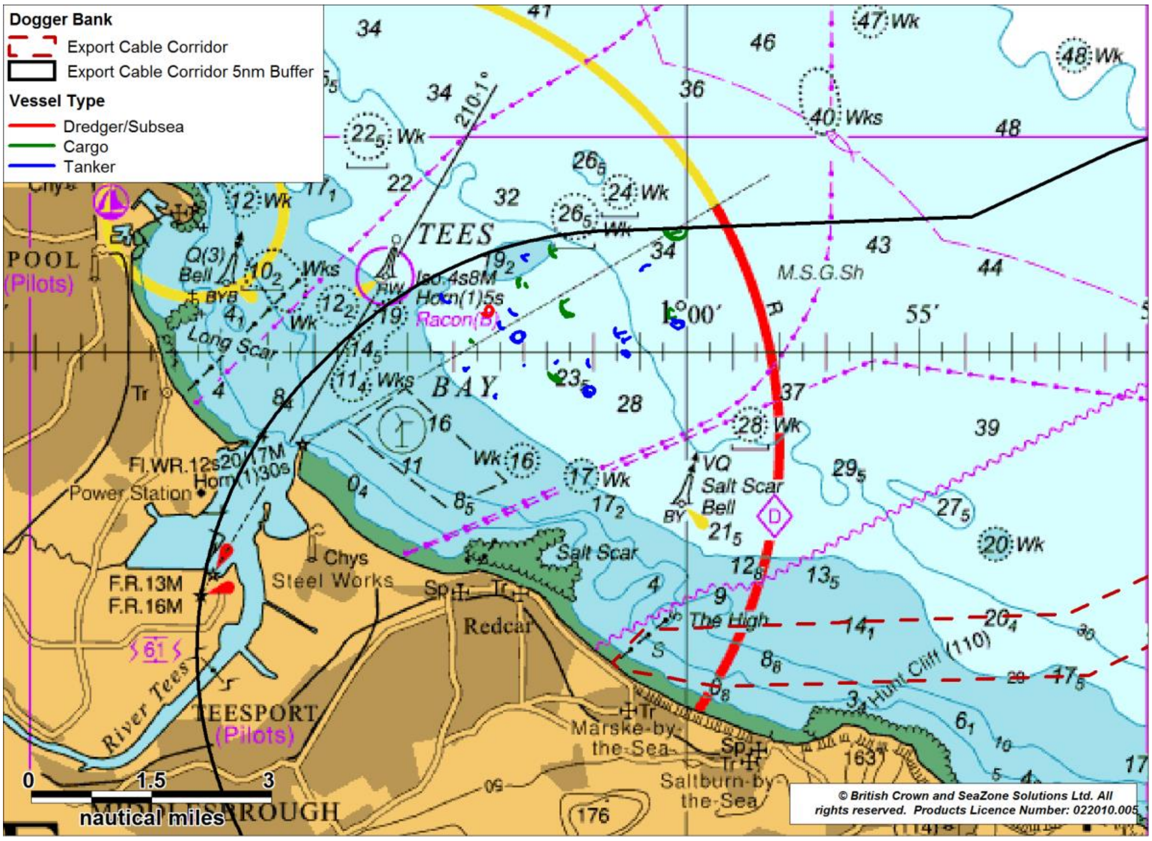

Figure 19.11 Anchored Vessels within 5nm of Export Cable Corridor (7 Days Spring 2013)

It should be noted that vessels which were moored within the harbour of Teesport throughout the study period have been excluded from Figure 19.11.

Figure 19.12 presents a detailed plot of anchored vessels in the vicinity of the Dogger Bank Teesside A & B cable route landing point. Details for each of the vessels can be found in Table 19.1.

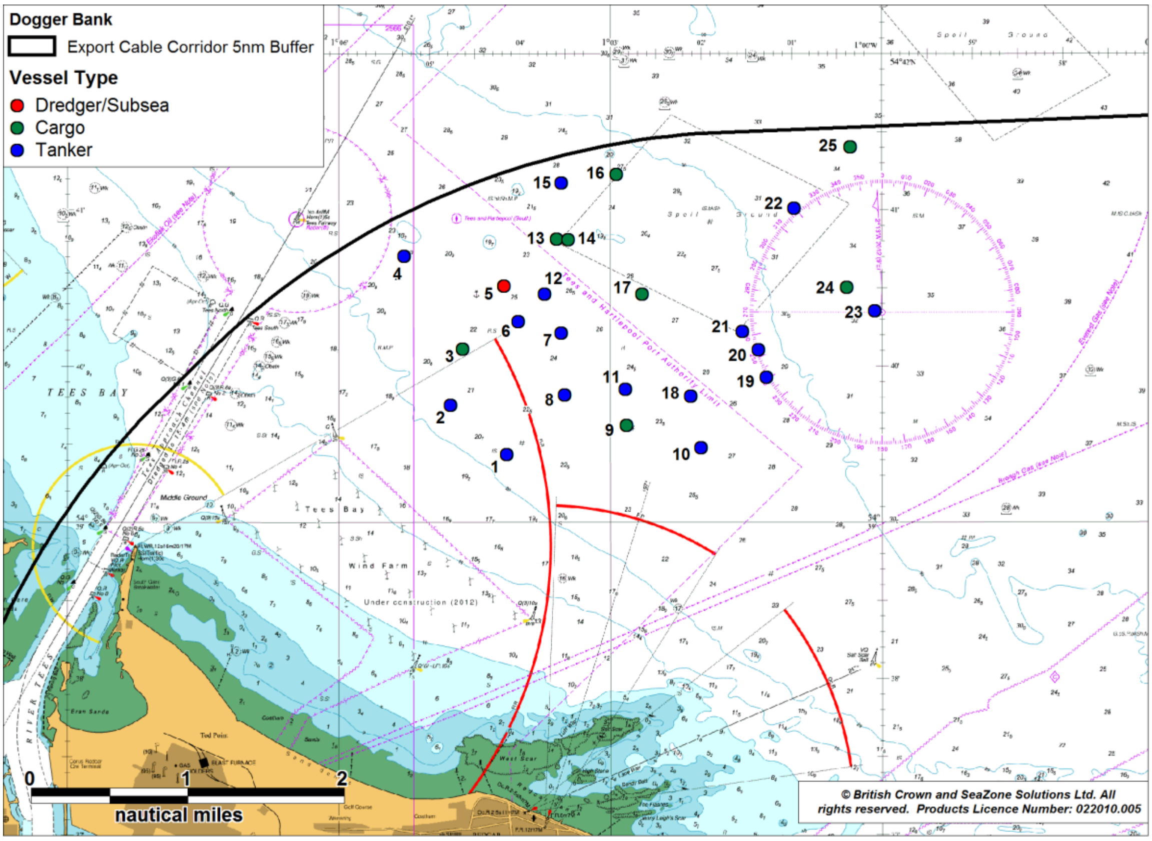

Figure 19.12 Detailed Plot of Anchored Vessels (7 Day Spring 2013)

Table 19.1 Anchored Vessel Details (7 Days Spring 2013)

ID	Vessel Name	Type	Vessel Length (m)	Vessel Draught (m)	Vessel DWT (Tons)	Anchor Duration (hours / minutes)
1	*Prins Johan Willem*	Tanker	97	5	4,905	3 hrs 49 mins
2	*Gas Ice*	Tanker		5	3,590	15 hrs 13 mins
3	*Smaragd*	Cargo	90	3	3,155	11 hrs 10 mins
4	*Fure Sun*	Tanker	145	8	15,015	9 hrs 27 mins
5	*Arco Humber*	Dredger	107	5	8.962	12 hrs 17 mins
6 & 20	*B Gas Lotta*	Tanker	73	5	2,003	60 hrs 30 mins
7	*Castello Di Gradara*	Tanker	9	6	4,115	65 hrs 24 mins
8	*B Gas Ettrick*	Tanker	88	0	3,620	0 hrs 35 mins
9	*Triton Seahawk*	Cargo	183	8	40,439	69 hrs 35 mins
10	*Elisabeth*	Tanker	97	5	3,990	69 hrs 8 mins
11	*Coastal Water*	Tanker	91	5	3,500	1 hrs 12 mins
12	*Twaite*	Tanker	105	3	1,520	1 hrs 17 mins
13	*Elbdeich*	Cargo	127	7	8,724	9 hrs 55 mins

14	*Cecilia*	Cargo	116	6	7,400	3 hrs 15 mins
15	*Dutch Spirit*	Tanker	100	5	4,441	11 hrs 54 mins
16	*ContainerShips 6*	Cargo	155	7	13,645	23 hrs 29 mins
17	*UBC Sacramento*	Cargo	171	9	31,773	114 hrs, 20 mins
18	*Umar 1*	Tanker	100	6	4,755	0 hrs 33 mins
19	*Avalon*	Tanker	168	9	24,035	25 hrs 38 mins
21	*Forbin*	Tanker	100	6	5,072	24 hrs 41 mins
22	*Coral Lophelia*	Tanker	108	5	6,175	2 hrs 20 mins
23	*Stolt Sandpiper*	Tanker	91	5	4,449	3 hrs 15 mins
24	*Alida*	Cargo	134	9	11,416	3 hrs 9 mins
25	*Orient Champion*	Cargo	255	13	115,000	80 hrs 30 mins

The total duration of vessels at anchor have been converted to a 0.5 x 0.5nm density grid and are presented in Figure 19.13.

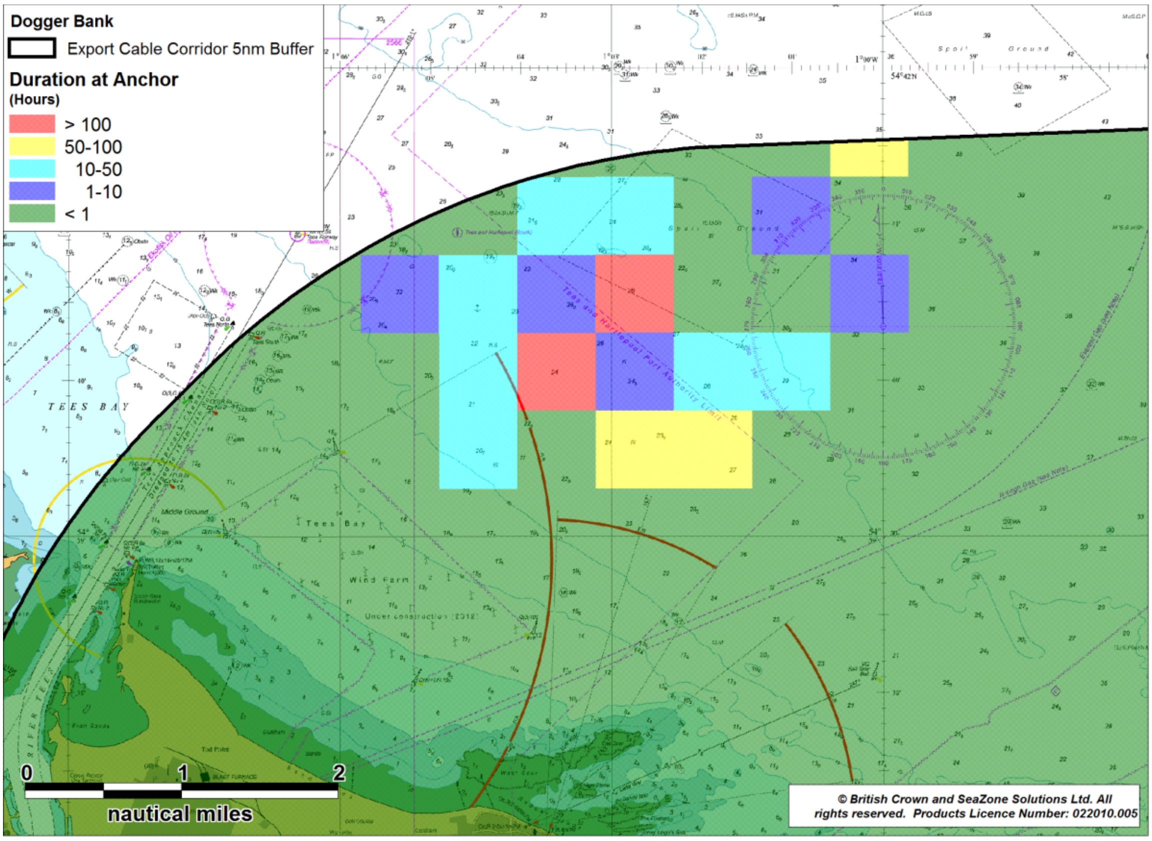

Figure 19.13 Duration at Anchor (hours)

The highest anchored vessel durations were recorded in the recommended anchorage area within Tees Bay.

An analysis of the anchored vessel types recorded within 5nm of the export cable corridor during the 7 day survey period is presented in Figure 19.14.

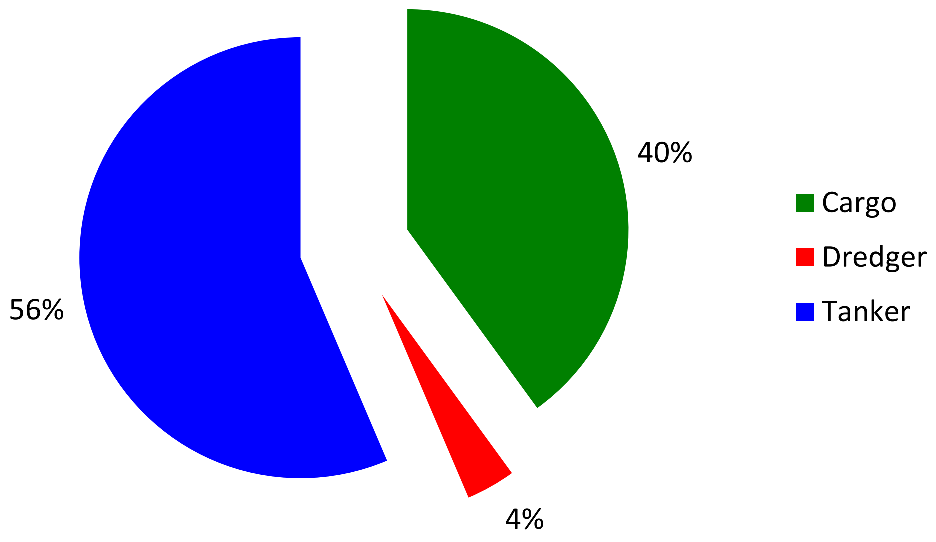

Figure 19.14 Anchored Vessel Types Within 5nm of Export Cable Corridor (7 days Spring 2013)

Tankers represented 56% of the total number of anchored vessels, with cargo vessels representing 40% of vessels.

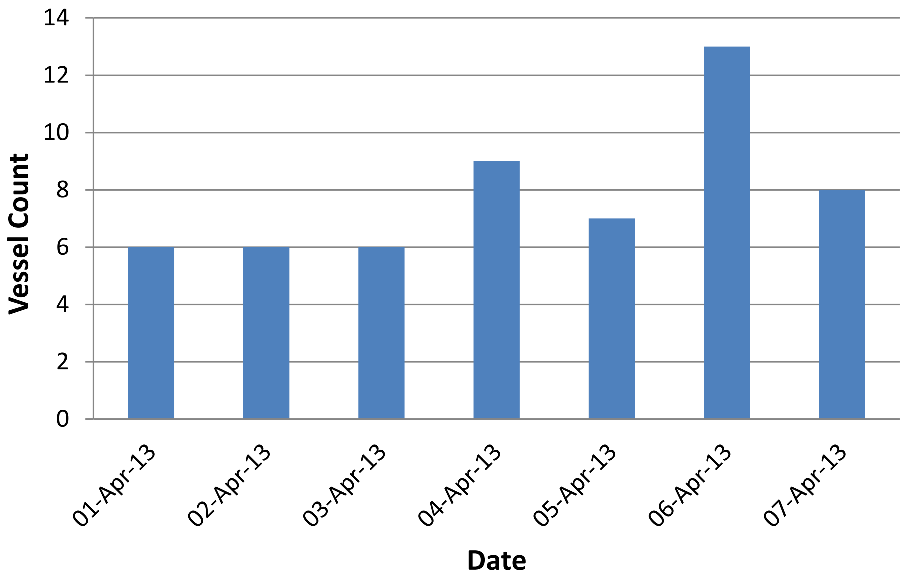

Figure 19.15 Daily Count of Anchored Vessels

The busiest day was the 6th April 2013, when 13 unique vessels were recorded at anchor within 5nm of the export cable corridor.

Figure 19.16 presents closest point of approach of vessels anchored within 5nm of the export cable corridor.

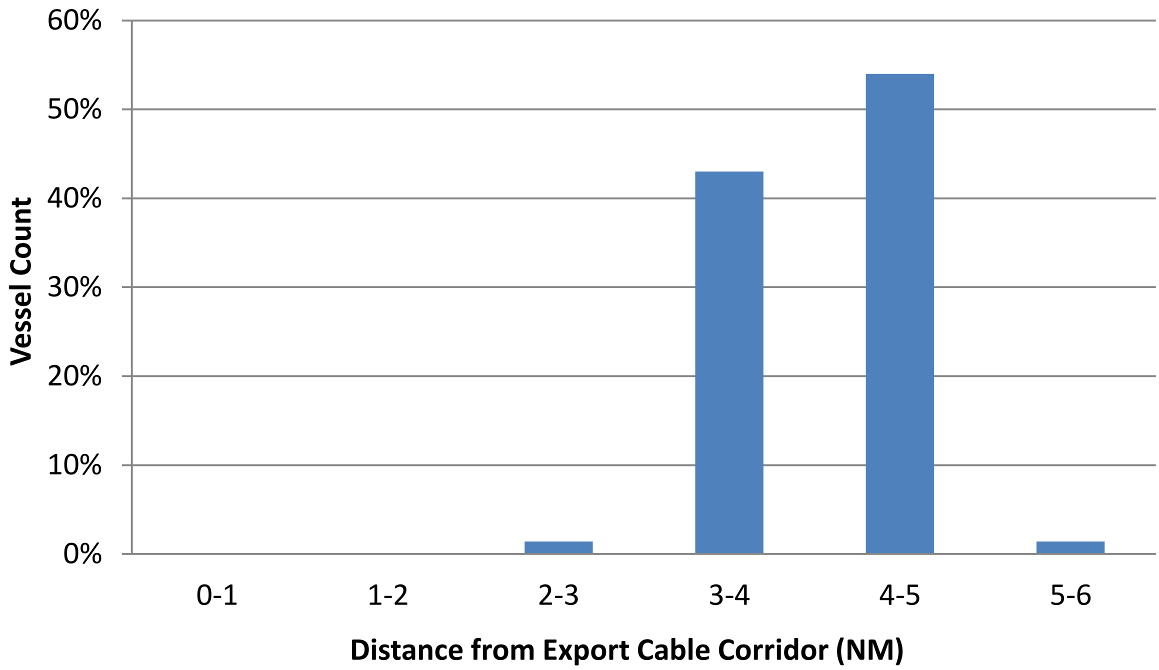

Figure 19.16 Closest Point of Approach Analysis

The majority of vessels (54%) which anchored within the export cable corridor buffer were located 4 to 5nm away from the export cable. 43% of vessels were recorded anchoring 3 to 4nm from the export cable and no vessels were recorded anchoring closer than 2-3nm away.

19.4.1 Size Distribution

In order to examine the size distribution of anchoring vessels, four size classes were applied which are defined by Deadweight Tonnage (DWT). These classes are presented in Table 19.2.

Table 19.2 Size Classes and DWT

Size class	DWT
1	< 5000
2	5000 – 15,000
3	15,000 – 40,000
4	> 40,000

The distribution of anchored vessels recorded in each size class throughout the survey period is presented in Figure 19.17.

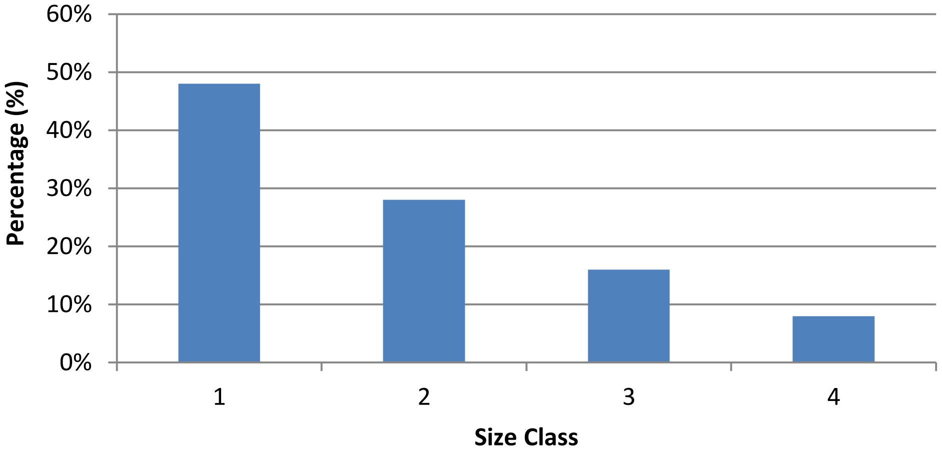

Figure 19.17 Size Distribution of Anchoring Vessels

The majority (48%) of vessels recorded at anchor within 5nm of the export cable corridor were in size class 1 (DWT <5000).

19.5 *Recreational Vessel Activity*

This section reviews recreational vessel activity in the vicinity of the export cable route based on information published by the RYA.

A plot of the recreational activity based on the latest RYA Cruising Routes (2010) is presented in Figure 19.18. The export cable corridor is intersected by three medium use cruising routes. There is a general sailing area extending approximately 14nm from the coast into the export cable route. A general racing area is located, at its closest point, approximately 0.3nm northwest of the export cable corridor, in the vicinity of the landfall point. South Gare Marine Club is located within 5nm of the export cable corridor.

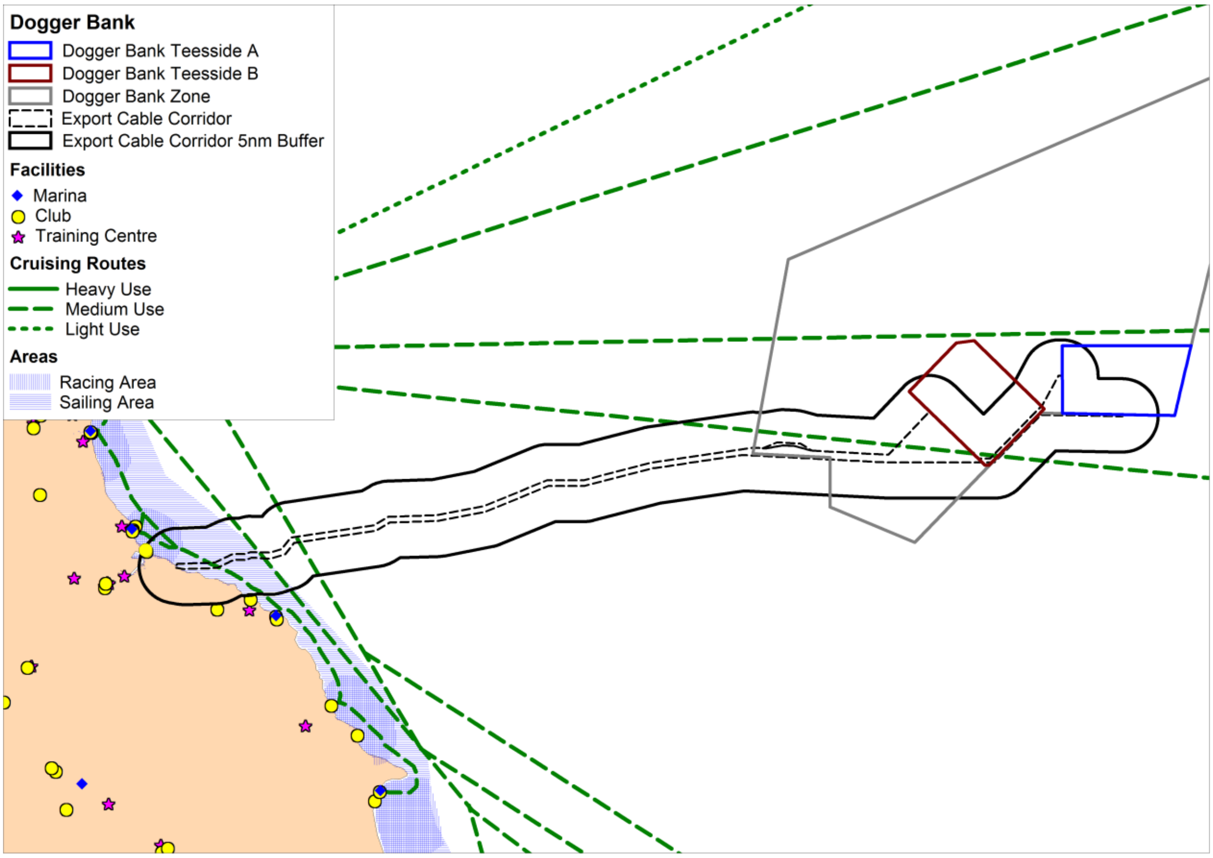

Figure 19.18 RYA Cruising Routes and Facilities in proximity to Export Cable Corridor

19.6 *Fishing Vessel Activity*

This section reviews the fishing vessel activity within 5nm of the export cable corridor based on the maritime traffic survey, satellite data and Chapter 15 Commercial Fisheries study.

19.6.1 Survey Tracks

Fishing vessel activity was recorded during the previously mentioned AIS and Radar surveys. Figure 19.19 presents fishing vessels tracked on AIS and Radar during the combined 14 day survey period.

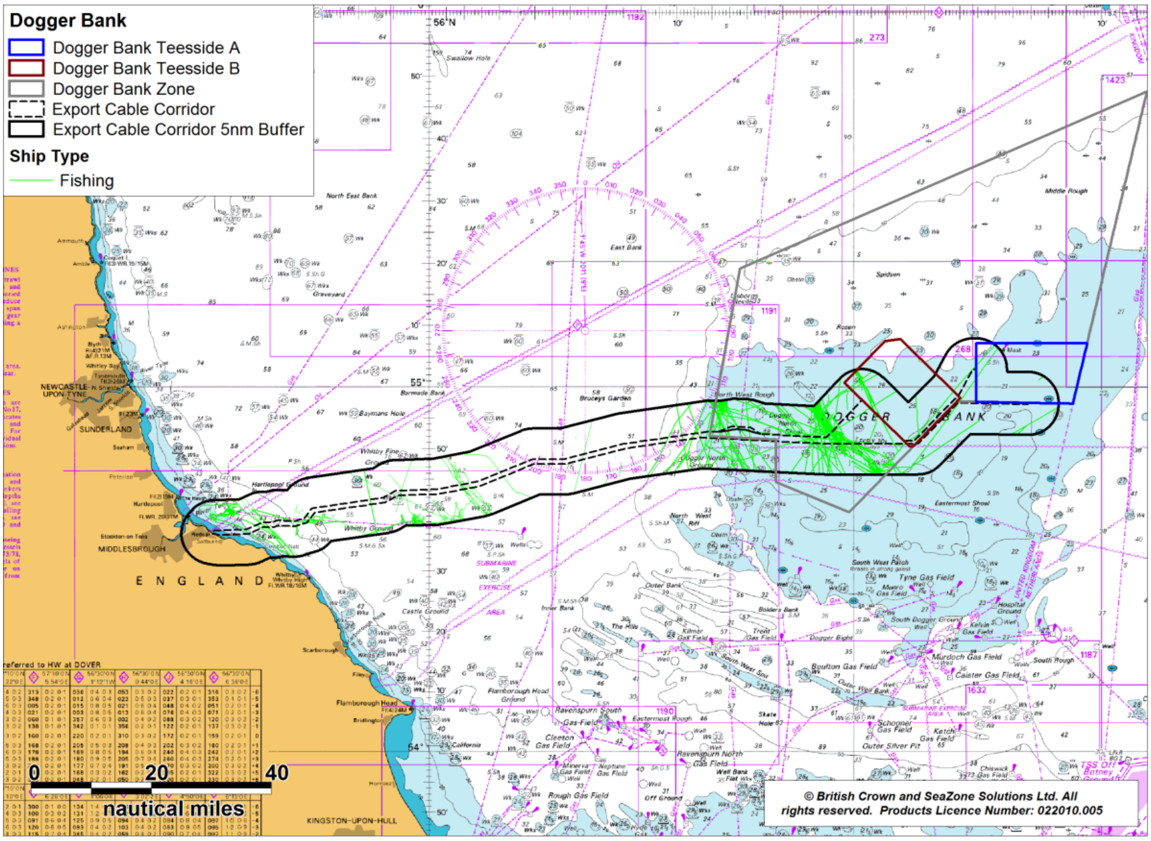

Figure 19.19 Fishing Vessels (14 Days Summer 2011 and 2012) AIS & Radar Data

Satellite data covers fishing vessels of 15m in length and over. The latest satellite dataset analysed is from 2009 (2009 is the latest publically available data set) and the data include both UK and foreign vessels of 15 m length and over. Vessel positions (received approximately every 2 hours) have been converted to a 0.5nm x 0.5nm density grid to highlight the hot spots of fishing vessel activity, as presented in Figure 19.20.

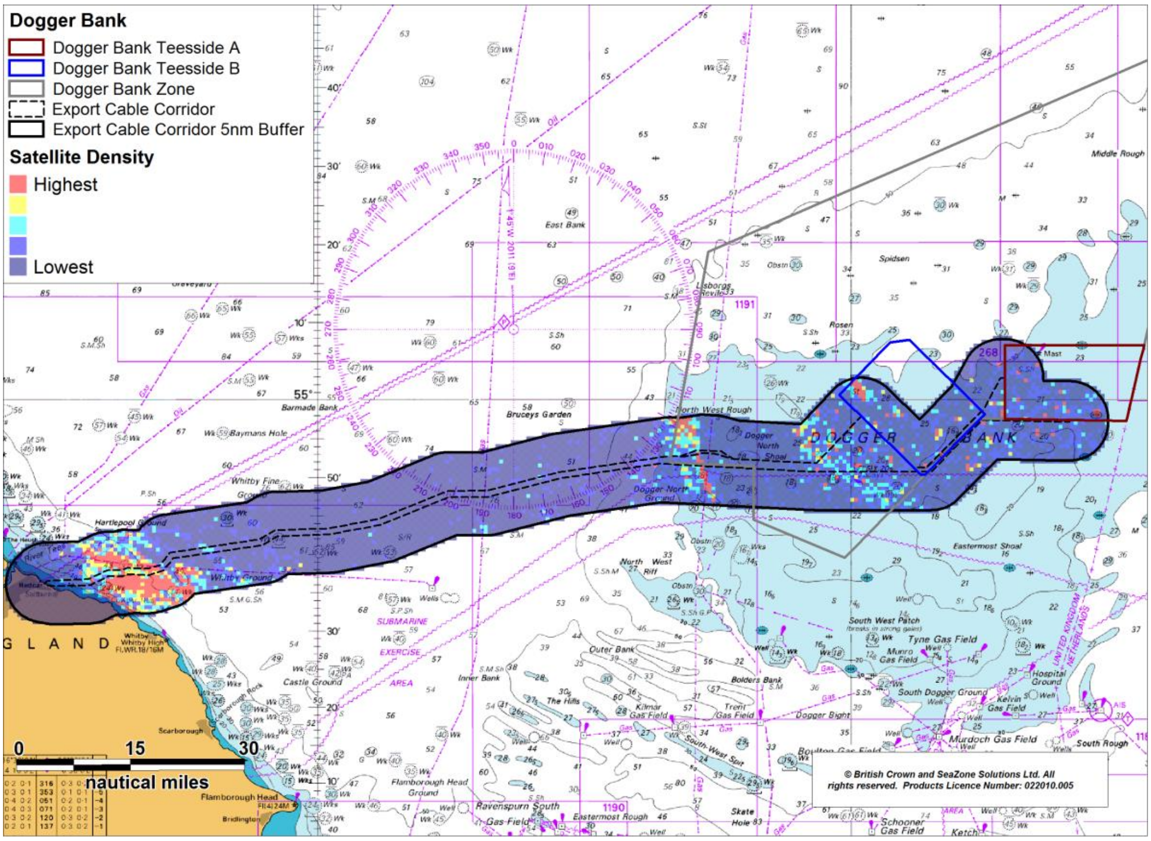

Figure 19.20 Fishing Vessel Density (from Satellite Data 2009)

It can be seen that the highest fishing vessel densities are located in proximity to the western boundary of the Dogger Bank Zone, to the west of Dogger Bank Teesside B and to the west of the cable route corridor in proximity to the coastline.

The overall distribution of vessel nationality, based on the 2009 satellite data within 5nm of the export cable corridor is summarised in Figure 19.21. In order to ease comparison, nationalities which contributed less than 1% of the overall total have not been illustrated. Vessels which had unspecified nationalities have also been excluded.

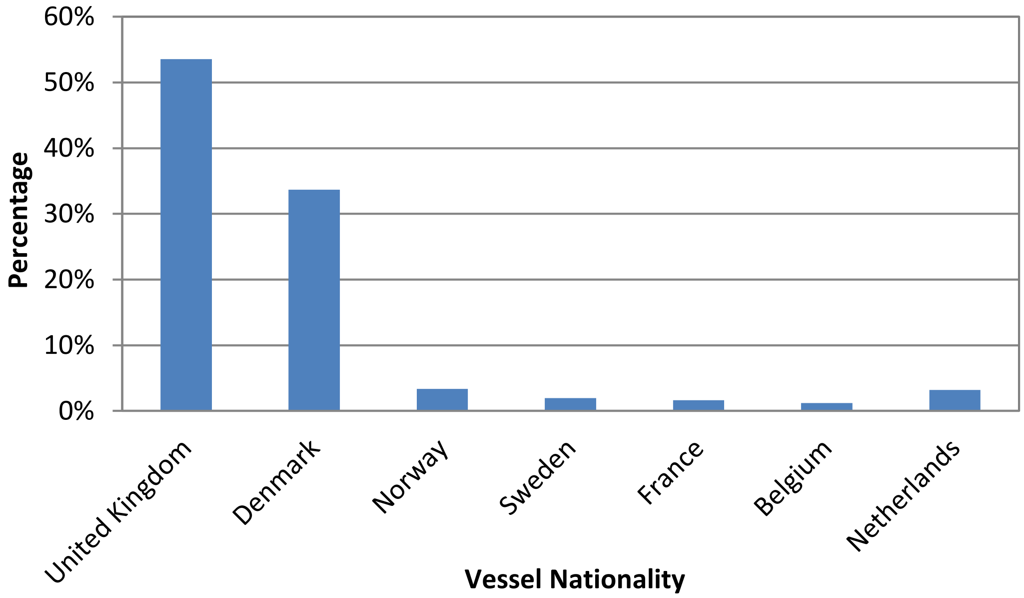

Figure 19.21 Nationality Distribution (from Satellite Data 2009)

The majority of fishing vessels were registered in the United Kingdom, accounting for 54% of the overall total. Danish vessels were the next most common recorded, accounting for 34% of the total.

The overall distribution of vessel gear type, based on the 2009 satellite data within 5nm of the export cable corridor is presented in Figure 19.22.

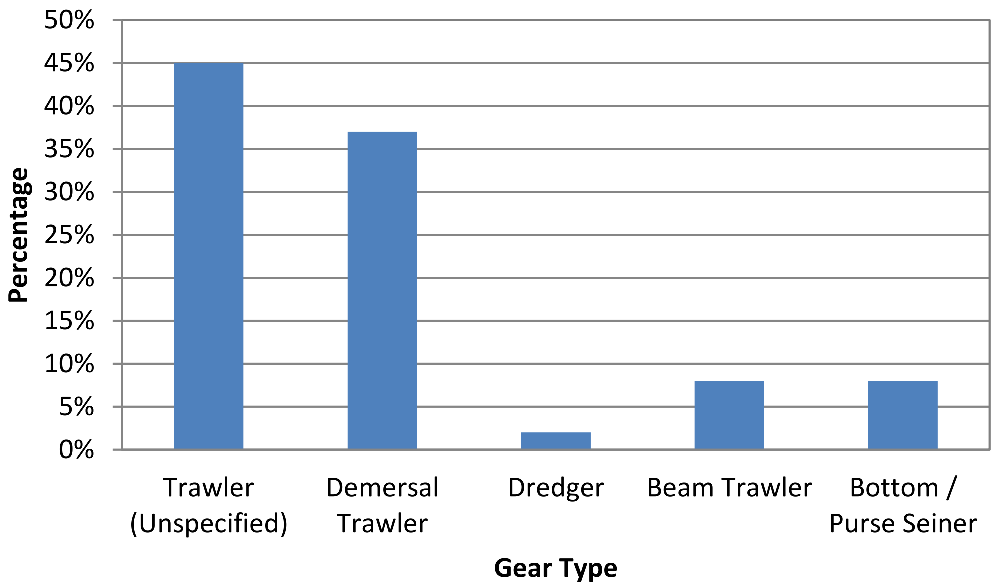

Figure 19.22 Gear Type Distribution (from Satellite Data 2009)

Gear type information was available for approximately 49% of fishing vessel positions within 5nm of the export cable corridor. Of these vessels with identified gear types, the most common fishing methods identified were unspecified trawling (45%) and demersal trawling (37%).

Based on analysis of the speed of fishing vessels recorded in the satellite data, it was identified that 73% of vessels within 5nm of the export cable corridor were engaged in fishing (any vessel at a speed of 5 knots or less is assumed to be fishing).

20. Construction, Significant Maintenance and Decommissioning Vessels

This study has primarily focused on the operational and maintenance phase of the proposed Dogger Bank Teesside A & B, however, it is recognised that there will be additional potential impacts during the construction and decommissioning phases of the project.

In general, whilst the same hazards apply as during operation and maintenance, there are additional hazards which are distinctly associated with these phases of the project and require different risk control measures.

The following figures show example construction, crew transfer and maintenance vessels.

Figure 20.1 Sample Jack Up Barge

Figure 20.2 Sample Crew Transfer/ Maintenance Wind Cat

20.1 *Hazards during Construction / Decommissioning*

The maximum construction period will be 6 years. During this phase and the decommissioning phase there will be an increased level of vessel activity within the Dogger Bank Teesside A & B development areas and along the cable corridor.

The presence of construction vessels within the area is likely to pose an additional navigational risk, although such vessels can also provide on-site response and mitigation.

It is noted that, to a large extent, the hazards will depend on the vessels and procedures which are to be used for these operations; these procedures could include consideration for UXO hazards particularly in relation to Jack Ups. This will not be known in detail until the structures, construction methods and vessels/contractors have been selected. It is therefore planned that hazard/risk assessments be carried out as part of the project-planning process.

An example measure might be that, wherever possible, construction vessels would follow prescribed transit corridors. These corridors would be defined in consultation with local maritime stakeholders.

This process will build mutual understanding of the activities and operating constraints of the different parties involved and allow effective procedures to be developed. Separate workshops should be held for each phase of the project as well as for distinct activities.

It is noted that the construction company appointed will have their own internal health and safety procedures that they will adhere to during the work, providing additional security. Experience and lessons learned from the construction of other offshore projects will also be considered prior to the Dogger Bank Teesside A & B offshore wind farms being constructed. The same process will apply during the decommissioning phase of the project.

All vessels used in the process of constructing, operating and decommissioning the project will adhere to the appropriate International, Port and Flag state Regulations.

21. Future Case Marine Traffic

This section presents the future case level of activity in the vicinity of Dogger Bank Teesside A & B, which has been input into the collision risk modelling.

21.1 *Increases in Traffic Associated with Ports*

Due to the distance offshore of Dogger Bank Teesside A & B, it was not considered likely that any increase in port traffic would impact on the general traffic levels around the developments. Therefore, within the collision risk modelling scenarios, a general increase of 10% was used to show an example future case scenario in traffic.

21.2 *Increases in Fishing Vessel Activity*

For commercial fishing vessel transits a 10% increase was used to demonstrate potential impacts. Changes in fishing activities have been covered in Chapter 15 Commercial Fisheries.

21.3 *Increases in Recreational Vessel Activity*

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

21.4 *Increase in Traffic Associated with Dogger Bank Teesside A & B*

There will be a maximum of 66 vessels on site at any one time during the construction phase of each wind farm. During the operational phase of each wind farm (based on the worst case 6MW option) there are estimated to be three large and 11 small O&M vessels visiting each turbine per year. Although not considered in the collision risk modelling as routes will not be defined, these vessels have been considered in the hazard log.

21.5 *Collision Probabilities*

The potential increase in vessel activity levels would increase the probability of vessel-to-structure allisions (both powered and drifting). Whilst in reality the risk would vary by vessel type, size and route, it is estimated this would lead to a linear 10% increase on the base case with wind farm collision risk.

The increased activity would also increase the probability of vessel-to-vessel encounters and hence collisions. Whilst this is not a direct result of Dogger Bank Teesside A & B, the increased congestion caused by the site and potential displacement of traffic in the area may have an influence. Again, a 10% overall increase was assumed on base case with wind farm risk.

21.6 *Commercial traffic routeing*

21.6.1 Deviations per Route

The following section analyses the potential alternative routeing options for routes where displacement may occur. It is not possible to consider all options and the shortest and therefore most likely alternatives have been considered. Assumptions for re-routes include:

- All alternative routes maintain a minimum of 1nm from offshore installations and potential turbine boundaries in line with the MCA shipping template;
- Time increases are calculated using the average speed for vessels on each individual route; and
- All mean routes take into account areas of shallow water and known routeing preferences.

It should be noted that alternatives do not consider adverse weather routeing. Due to the open sea room and navigable water depths in the vicinity of Dogger Bank Teesside A & B, however, it is likely that vessels will be able to alter their headings to reduce the impacts of adverse weather.

Illustrations of the anticipated shift in main route positions following the development of Dogger Bank Teesside A in isolation, Dogger Bank Teesside B in isolation and Dogger Bank Teesside A & B together are presented in Figure 21.1 to Figure 21.3. Information on the route deviations and associated time increases is presented in Table 22.1 to Table 22.3. Time increases have been calculated using the average speed for vessels on each route.

21.6.1.1 Dogger Bank Teesside A

With Dogger Bank Teesside A built in isolation, deviations would be required for routes 4, 5, 6 and 11.

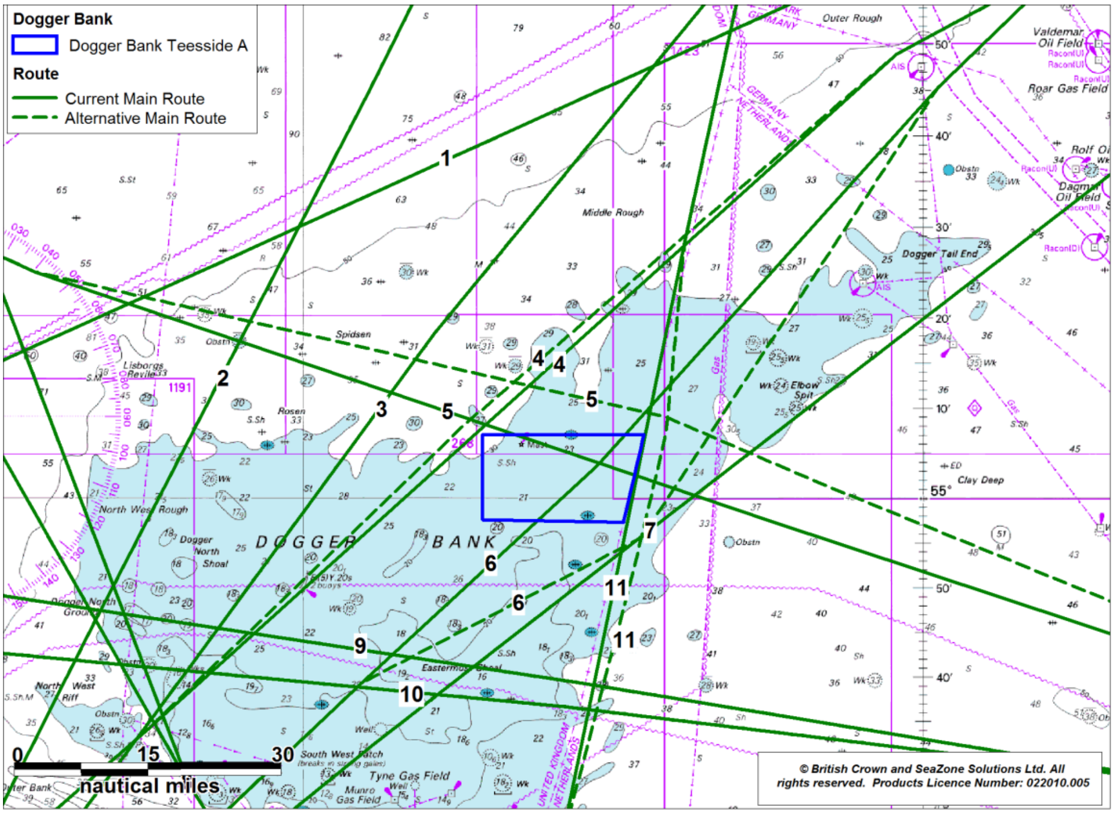

Figure 21.1 Alternative Routes for Dogger Bank Teesside A

Table 21.1 Route Deviations Dogger Bank Teesside A

Route	Increase in Distance (nm)	% Difference	Change in Time for Average Speed Vessel (mins)
Route 4	No increase	--	--
Route 5	0.3	0.07%	1.5
Route 6	2.9	0.75%	14.5
Route 11	0.2	0.03%	1

21.6.1.2 Dogger Bank Teesside B

With Dogger Bank Teesside B built in isolation, deviations would be required for routes 3, and 4.

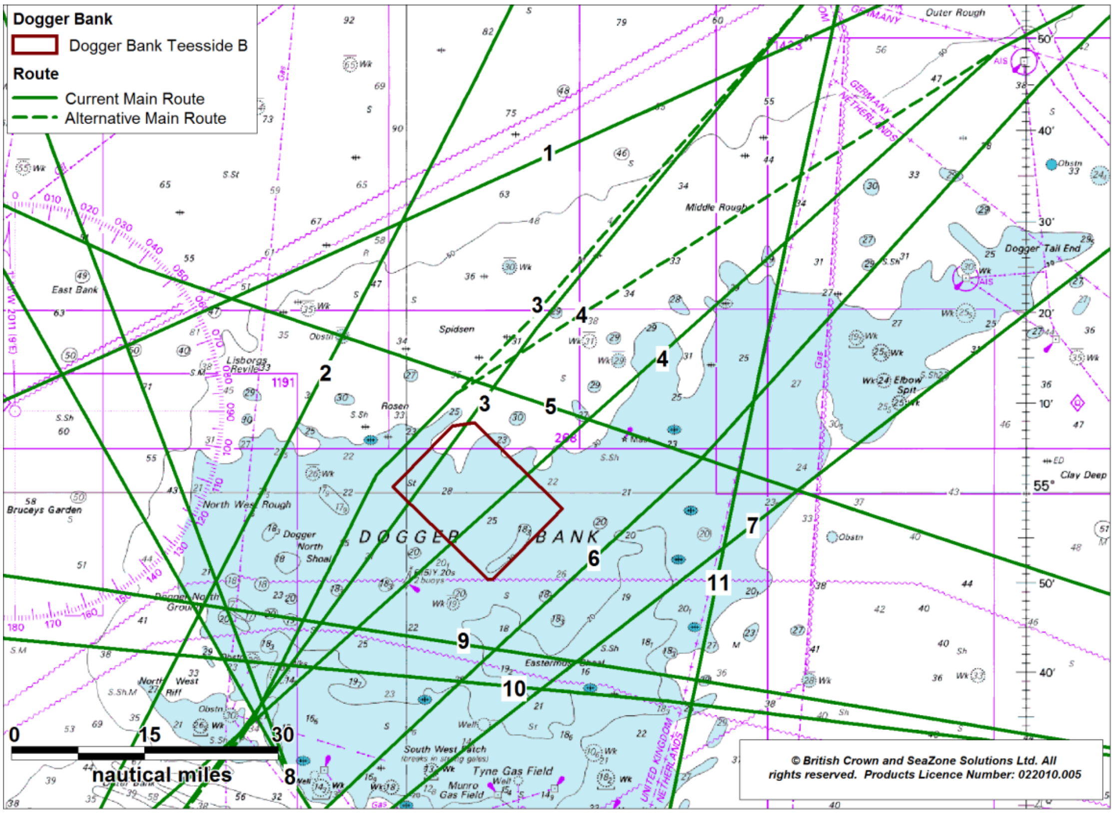

Figure 21.2 Alternative Routes for Dogger Bank Teesside B

Table 21.2 Route Deviations Dogger Bank Teesside B

Route	Increase in Distance (nm)	% Difference	Change in Time for Average Speed Vessel (mins)
Route 3	0.7	0.20%	3.5
Route 4	2.9	0.52%	14.5

21.6.1.3 Dogger Bank Teesside A & B

With Dogger Bank Teesside A & B built together, deviations would be required for routes 3, 4, 5, 6 and 11.

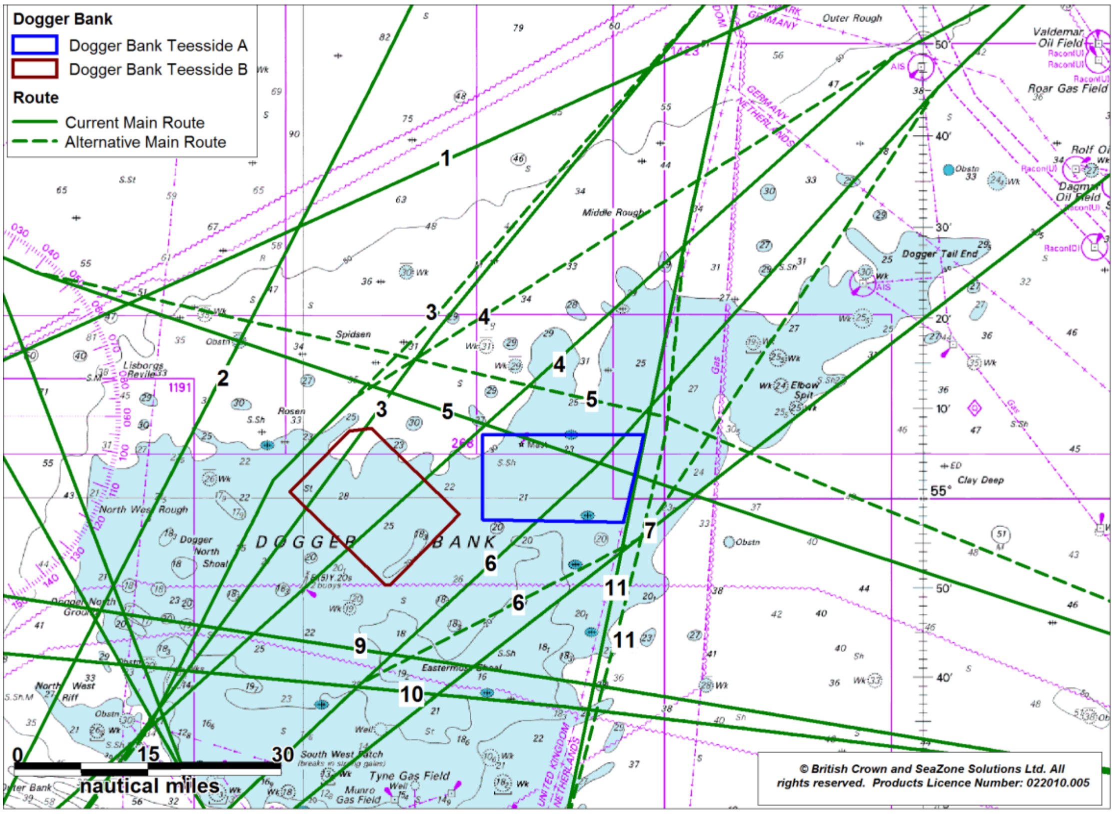

Figure 21.3 Alternative Routes for Dogger Bank Teesside A & B

Table 21.3 Route Deviations Dogger Bank Teesside A & B

Route	Increase in Distance (nm)	% Difference	Change in Time for Average Speed Vessel (mins)
Route 3	0.7	0.20%	3.5
Route 4	2.9	0.52%	14.5
Route 5	0.3	0.07%	1.5
Route 6	2.9	0.75%	14.5
Route 11	0.2	0.03%	1

22. Collision Risk Modelling and Assessment

This section assesses the major hazards associated with the development of Dogger Bank Teesside A & B in isolation and with both developments being built. This is divided into a base case and a future case assessment with and without the developments 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.

The base case assessment used the present day vessel activity level identified from the marine traffic surveys, consultation and other data sources. The future case assessment made conservative assumptions on shipping traffic growth over the life of Dogger Bank Teesside A & B.

The modelling was undertaken for the three scenarios using the worst case assessment of four collector stations, one converter station, two accommodation platforms and five met masts per wind farm. Additional information regarding the structures within the wind farm can be found in Section 10.

The three scenarios modelled are as follows:

- Dogger Bank Teesside A
- Dogger Bank Teesside B
- Dogger Bank Teesside A & B

22.1 *Base Case without Wind Farm Developments*

22.1.1 Base Case Vessel to Vessel Encounters

An assessment of current vessel to vessel encounters was carried out by replaying at high-speed 56 days of AIS data from the survey vessels over the combined survey periods.

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 a wind farms, could potentially increase congestion and therefore also increase the risk of encounters/collisions.

22.1.1.1 Dogger Bank Teesside A

The tracks of encountering vessels recorded during the 56 days within 10nm of Dogger Bank Teesside A are presented in Figure 22.1.

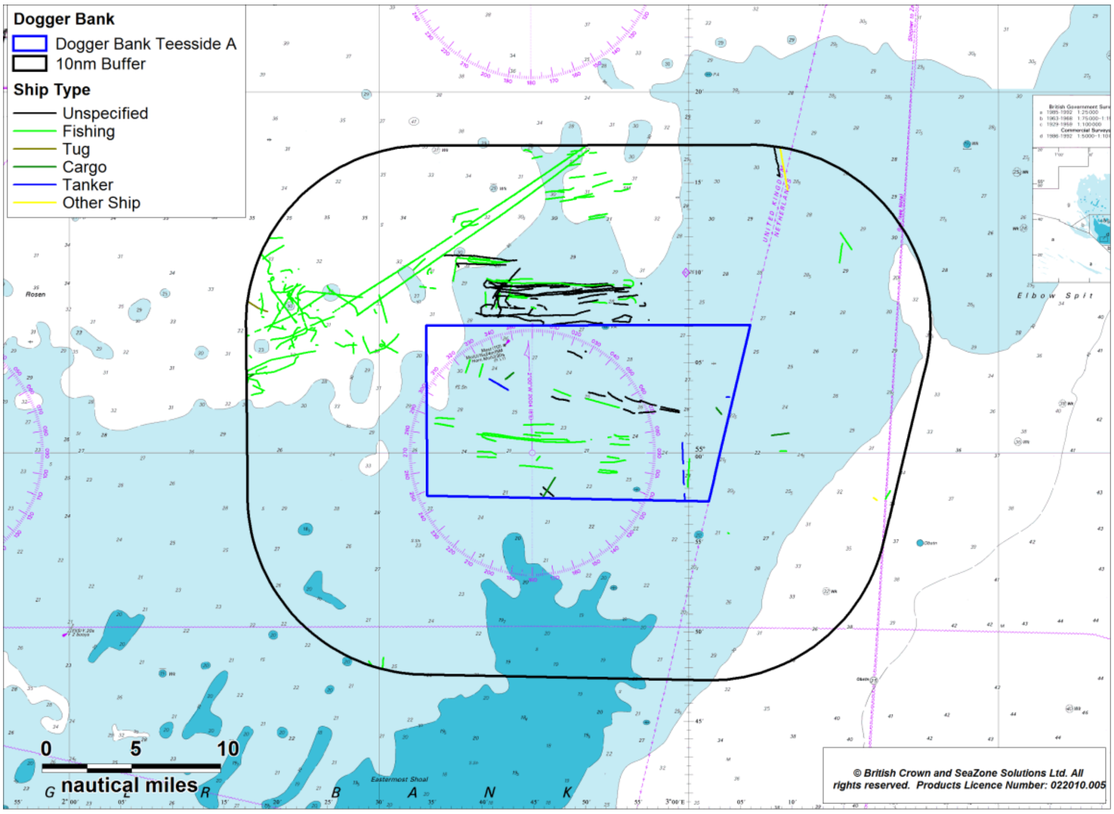

Figure 22.1 Vessel encounters within 10nm of Dogger Bank Teesside A

Figure 22.2 presents the number of encounters per day within 10nm of Dogger Bank Teesside A.

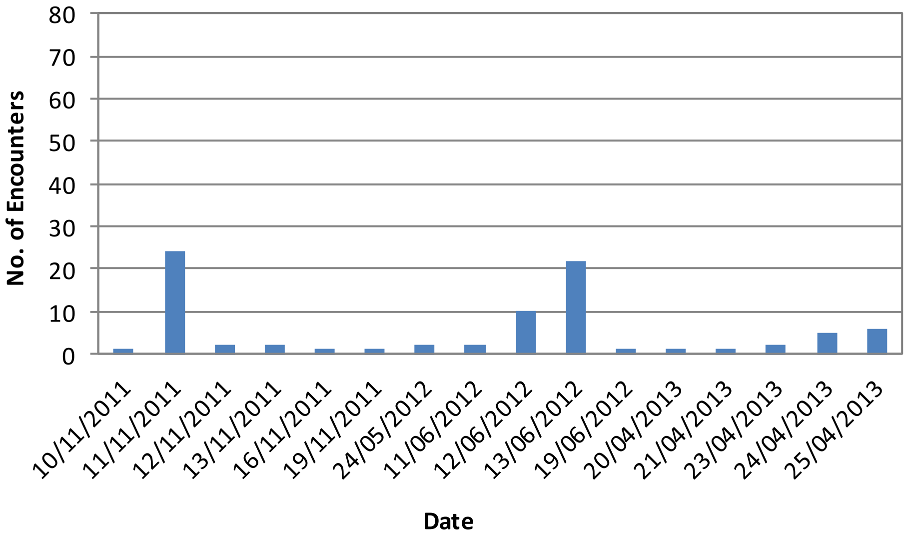

Figure 22.2 Number of Encounters per Day within 10nm of Dogger Bank Teesside A

There were 83 encounters during the 56 day period within 10nm of Dogger Bank Teesside A. There was an average of 3 encounters every 2 days, with the highest number of encounters (24 encounters) observed on 11th November 2011 .

Figure 22.3 presents the vessel types involved in encounters within 10nm of Dogger Bank Teesside A.

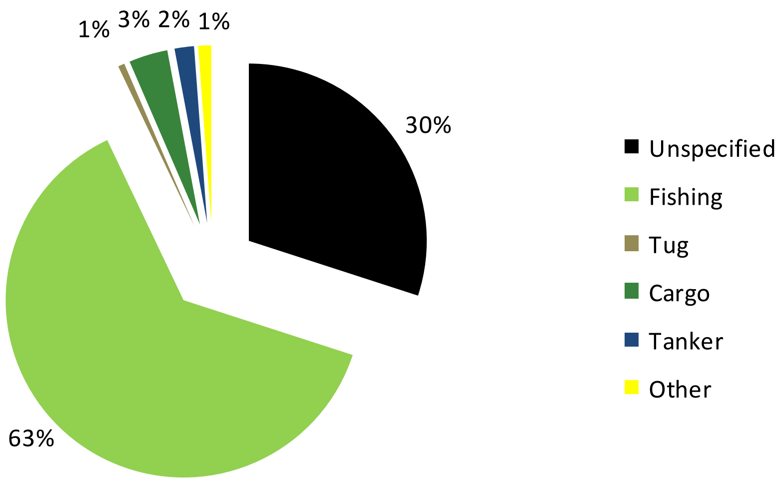

Figure 22.3 Vessel Types involved in Encounters within 10nm of Dogger Bank Teesside A

63% of vessels involved were fishing vessels. 30% of vessels were unspecified, which are likely to be fishing vessels. The remaining 7% were cargo vessels, tankers, 'other' vessels and a tug.

22.1.1.2 Dogger Bank Teesside B

The tracks of encountering vessels recorded during the 56 days within 10nm of Dogger Bank Teesside B are presented in Table 22.4.

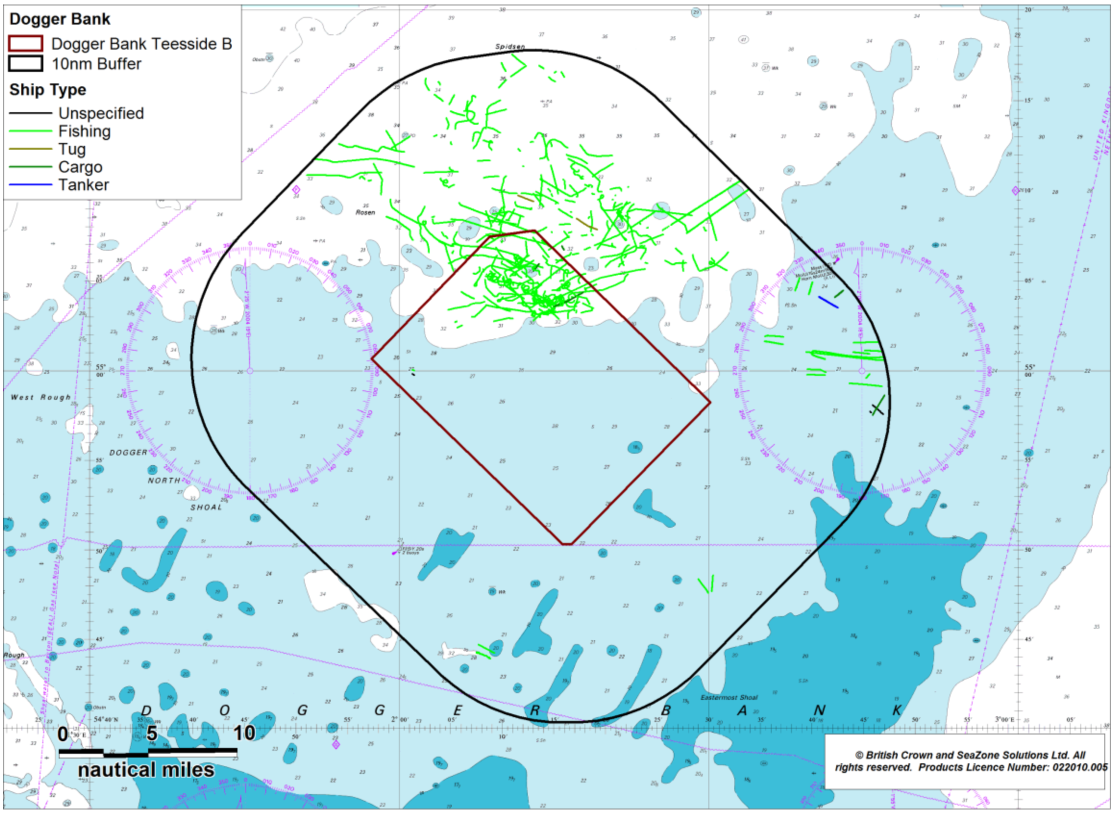

Figure 22.4 Vessel encounters within 10nm of Dogger Bank Teesside B

Figure 22.5 presents the number of encounters per day within 10nm of Dogger Bank Teesside B.

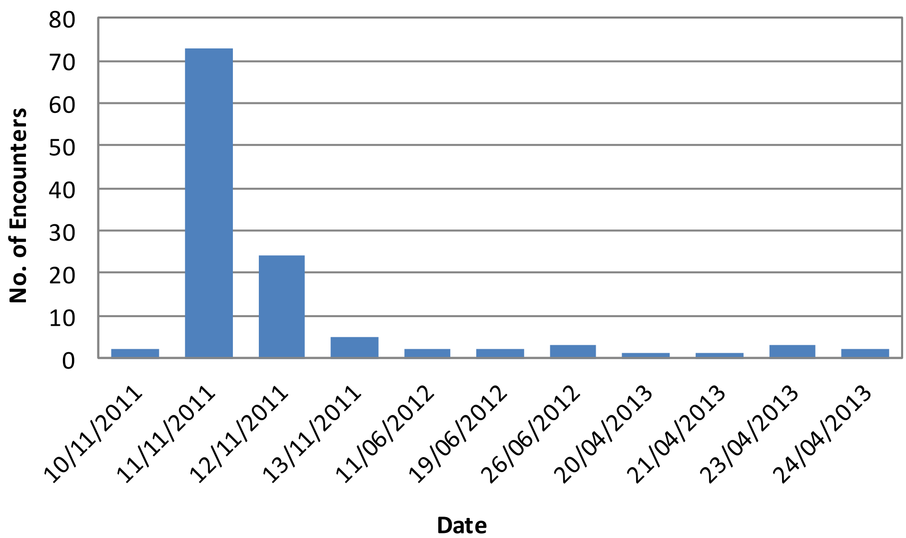

Figure 22.5 Number of Encounters per Day within 10nm of Dogger Bank Teesside B

There were 118 encounters during the 56 day period within 10nm of Dogger Bank Teesside B. There was an average of two encounters per day, with the highest number of encounters (73 encounters) observed on 11th November 2011. This was a unique peak of results due to a busy period of fishing activity on that day.

Figure 22.6 presents the vessel types involved in encounters within 10nm of Dogger Bank Teesside B.

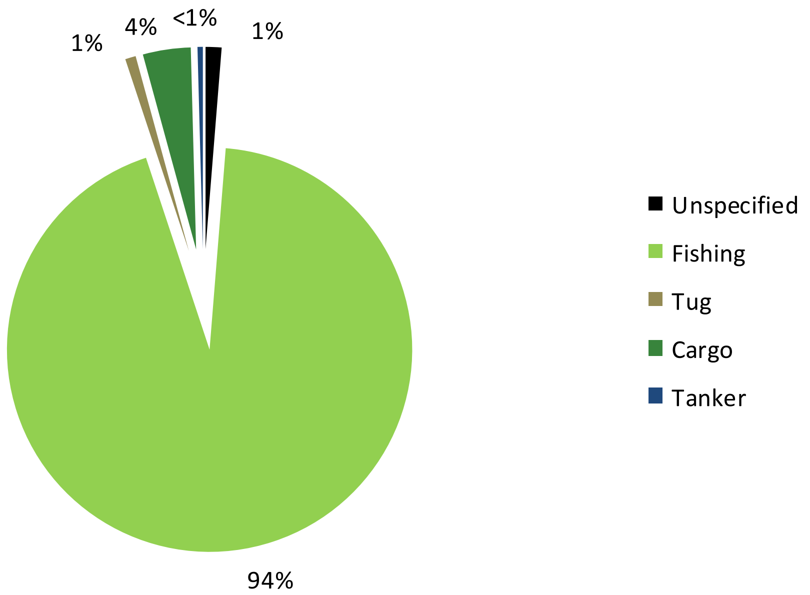

Figure 22.6 Vessel Types involved in Encounters within 10nm of Dogger Bank Teesside B

94% of vessels involved were fishing vessels with the remaining 6% being comprised of unspecified vessels, tugs, cargo vessels and a tanker.

22.1.1.3 Dogger Bank Teesside A & B

The tracks of encountering vessels recorded during the 56 days within 10nm of Dogger Bank Teesside A & B are presented in Table 22.7

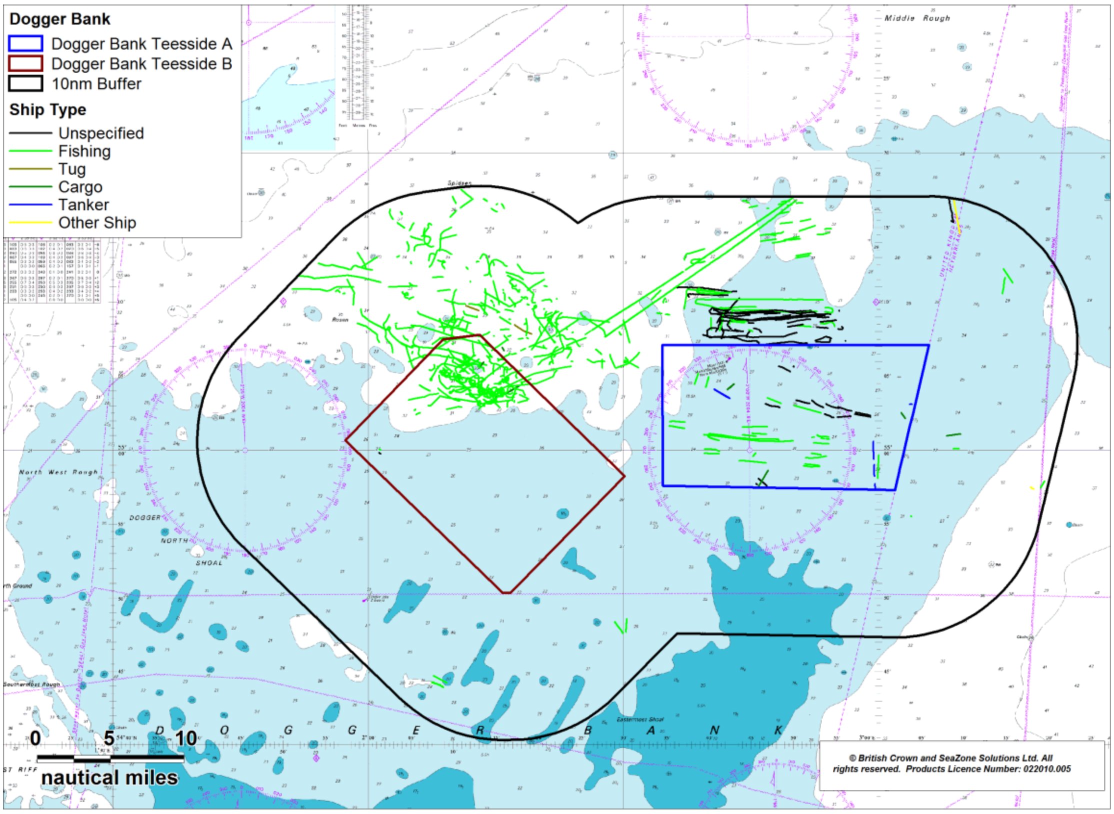

Figure 22.7 Vessel encounters within 10nm of Dogger Bank Teesside A & B

Figure 22.8 presents the number of encounters per day within 10nm of Dogger Bank Teesside B.

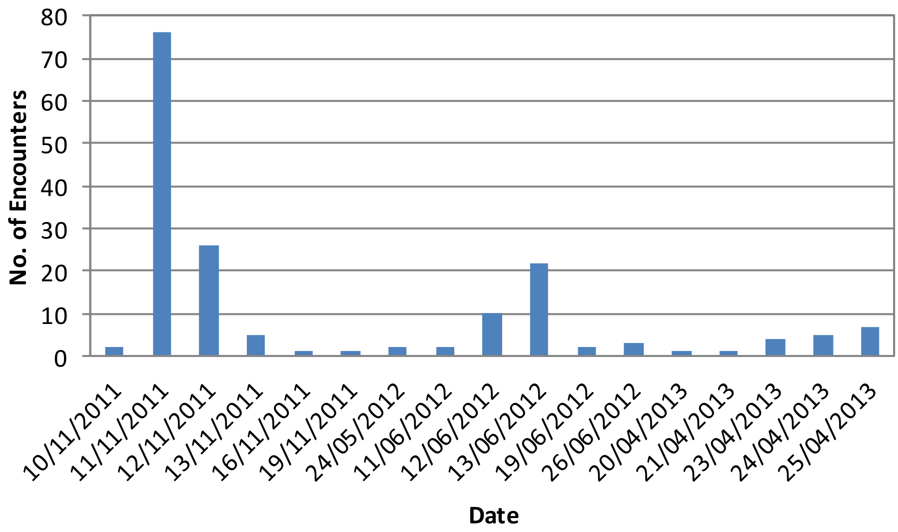

Figure 22.8 Number of Encounters per Day within 10nm of Dogger Bank Teesside B

There were 170 encounters during the 56 day period within 10nm of Dogger Bank Teesside B. There was an average of three encounters per day, with the highest number of encounters (76 encounters) observed on 11th November 2011.

Figure 22.9 presents the vessel types involved in encounters within 10nm of Dogger Bank Teesside A & B.

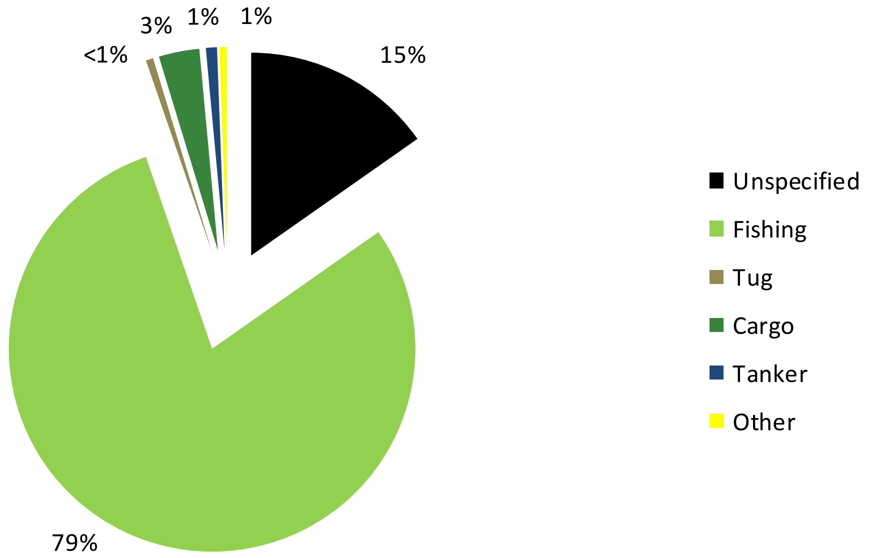

Figure 22.9 Vessel Types involved in Encounters within 10nm of Dogger Bank Teesside B

79% of vessels involved were fishing vessels with 15% unspecified. The remaining 6% was comprised of cargo vessels, tugs, tankers and "other" vessels.

22.1.2 Vessel-to-Vessel Collisions

Based on the existing routeing and encounter levels in the area, Anatec's COLLRISK model has been run to estimate the existing vessel-to-vessel collision risks in the local area around Dogger Bank Teesside A & B. The route positions and widths are based on the survey analysis with the annual densities based on port logs and Anatec's ShipRoutes database, which take annual seasonal variations into consideration.

The baseline vessel-to-vessel collision risk levels pre-wind farm development are presented in Table 22.1.

Table 22.1 Vessel-to-Vessel Collisions – Without Wind Farm Developments (Base Case)

Scenario	Collision Frequency
Dogger Bank Teesside A	1 major collision in 569 years
Dogger Bank Teesside B	1 major collision in 1112 years
Dogger Bank Teesside A & B	1 major collision in 312 years

It is emphasised 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 14.

22.2 *Base Case with Wind Farm Developments*

22.2.1 Potential for increased vessel to vessel collisions

The revised routeing pattern following construction has been estimated for Dogger Bank Teesside A in isolation, Dogger Bank Teesside B in isolation and Dogger Bank Teesside A & B together, based on the review of impact on navigation (see Section 21.6.1).

Based on vessel-to-vessel collision risk modelling of the revised traffic pattern for each of the three scenarios, the changes in collision frequency due to the development(s) are presented in Table 22.2. The model is calibrated based on major incidents at sea which allows for bench marking but does not cover all incidents, such as minor impacts.

Table 22.2 Vessel-to-Vessel Collisions - With Wind Farm Developments (Base Case)

Scenario	Collision Frequency	Increase in Collision Risk
Dogger Bank Teesside A	1 major collision in 461 years	23.41%
Dogger Bank Teesside B	1 major collision in 624 years	78.31%
Dogger Bank Teesside A & B	1 major collision in 242 years	29.07%

The following potential effects have not been quantified but may indirectly influence the vessel-to-vessel collision risk and have been discussed in section 28.6.

- Interference with navigational equipment; and
- Visual impacts associated with a structure obstructing vessels.

22.2.2 Potential for additional vessel to structure allision risk

The two main scenarios for passing vessels alliding with a structure in the wind farm (such as wind turbine, met mast, collector/converter station, accommodation platform) are:

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

22.2.2.1 Powered Vessel Allision

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.

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

Based on modelling of the revised routeing, the proposed layouts and local metocean data, the frequency of a passing powered vessel allision was estimated and the results are presented in Table 22.3.

Table 22.3 Powered Vessel-to-Structure Allisions - With Wind Farm Developments (Base Case)

Scenario	Annual Allision Frequency	Allision Return Period
Dogger Bank Teesside A	1.45E-03	1 every 692 years
Dogger Bank Teesside B	3.67E-04	1 every 2728 years
Dogger Bank Teesside A & B	1.57E-03	1 every 636 years

These allision frequencies can be compared to the historical average of 5.3×10^{-4} per installation-year for offshore installations on the UKCS (1 in 1,900 years). The risk to Dogger Bank Teesside B is estimated to be lower than the historical average when built in isolation. The risks to Dogger Bank Teesside A in isolation, and Dogger Bank Teesside A and Dogger Bank Teesside B when built together, are estimated to be approximately 3 times higher than the historical average.

Plots showing the passing powered allision frequency for each structure in each of the scenarios modelled are presented in the following figures.

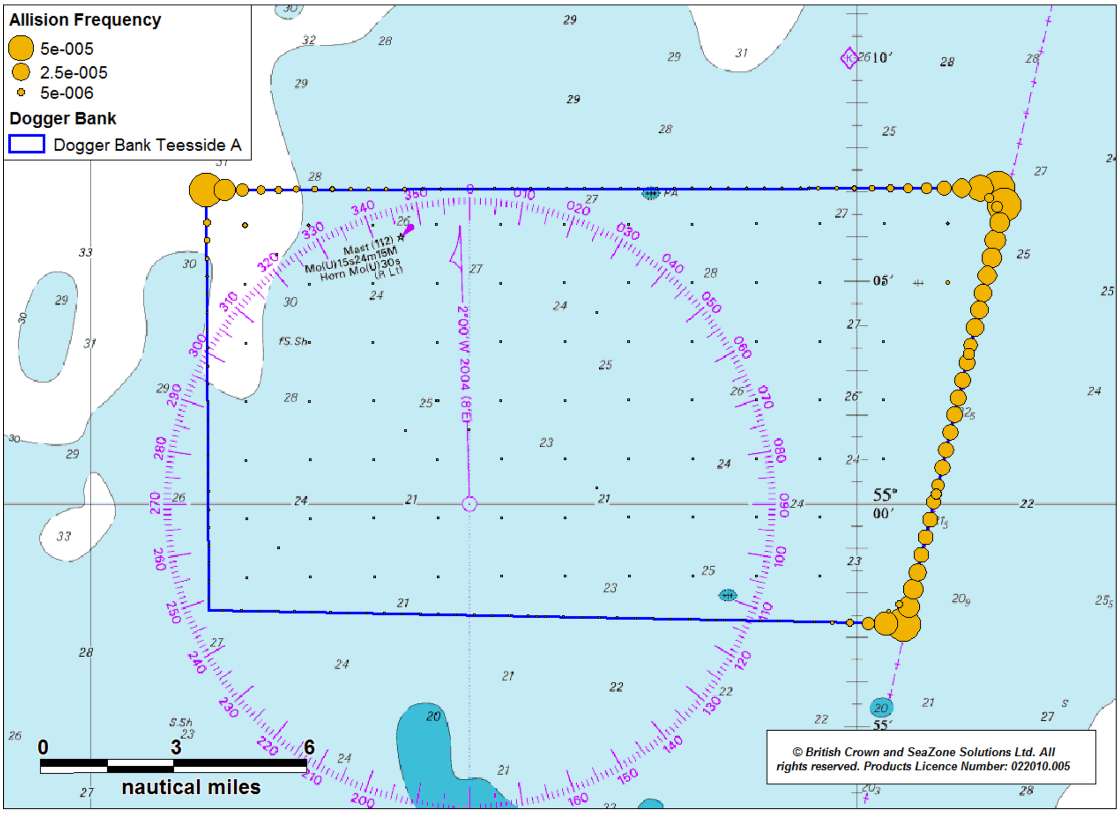

Figure 22.10 Annual Passing Powered Allision Frequency for Dogger Bank Teesside A

For Dogger Bank Teesside A in isolation, the individual turbine allision frequencies ranged from 2.13 x 10^{-4} for a structure at the south of the eastern boundary to negligible for structures within the centre of the wind farm.

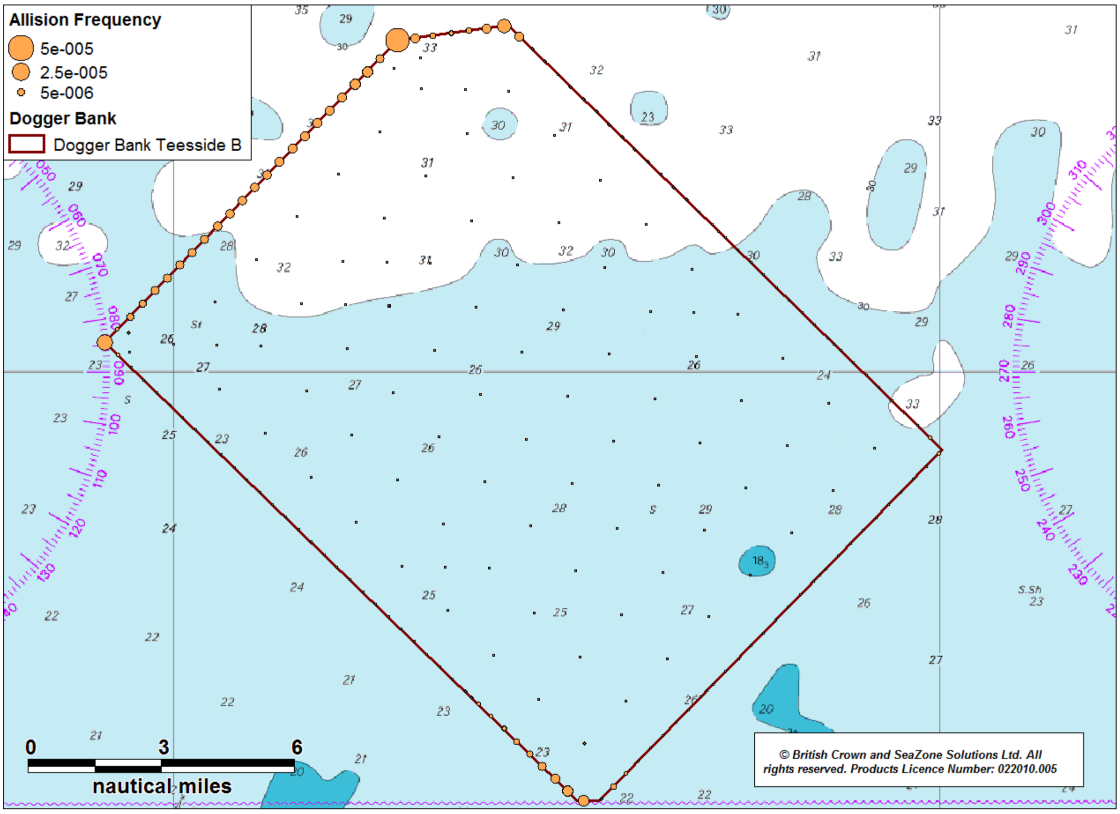

Figure 22.11 Annual Passing Powered Allision Frequency for Dogger Bank Teesside B

For Dogger Bank Teesside B in isolation, the individual turbine allision frequencies ranged from 4.22 x 10^{-5} for a structure in the northwest corner to negligible for structures within the centre of the wind farm.

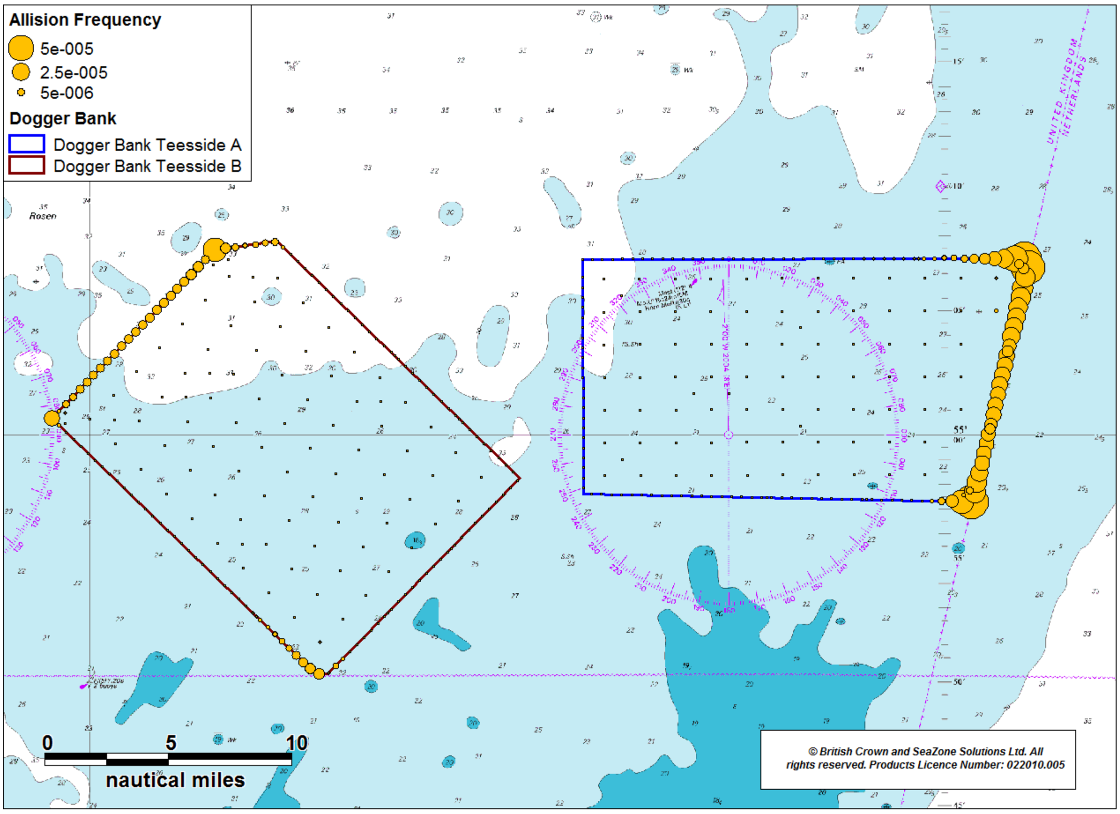

Figure 22.12 Annual Passing Powered Allision Frequency for Dogger Bank Teesside A & B

For Dogger Bank Teesside A & B together, the individual turbine allision frequencies ranged from 2.13 x 10^{-4} for a structure at the south of the eastern boundary of Dogger Bank Teesside A to negligible for structures in the centre of Dogger Bank Teesside A and Dogger Bank Teesside B.

22.2.2.2 NUC Vessel Allision

The risk of a vessel losing power and drifting into a wind farm structure was assessed using Anatec's COLLRISK model. This model is based on the premise that propulsion on a vessel must fail before a vessel will drift. The model takes account of the type and size of the vessel, number of engines and average time to repair in different conditions but it does not consider human error.

The exposure times for an NUC scenario are based on the ship-hours spent in proximity to the development(s) (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.

Using this information, the overall rate of mechanical failure within the area surrounding the development(s) 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.

The following drift scenarios were modelled:

- Wind;
- Peak Spring Flood Tide; and
- Peak Spring Ebb Tide.

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

After modelling the three scenarios it was established that wind-dominated drift produced the worst case results in each scenario. The annual allision frequencies have been estimated and are presented in Table 22.4.

Table 22.4 NUC Vessel-to-Structure Allisions - With Wind Farm Developments (Base Case)

Scenario	Annual Allision Frequency	Allision Return Period
Dogger Bank Teesside A	7.45E-05	1 every 13420 years
Dogger Bank Teesside B	5.18E-05	1 every 19292 years
Dogger Bank Teesside A & B	1.11E-04	1 every 8934 years

NUC allisions are assessed to be less frequent than powered allisions, which reflects historical data. There have been no reported ‘passing’ NUC ship allisions with offshore installations on the UKCS in over 6,000 operational-years. Whilst a large number of NUC 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’.

The majority of the NUC vessel collision frequency is associated with structures on the periphery of the wind farms, particularly the south east boundary of Dogger Bank Teesside A and the north west corner of Dogger Bank Teesside B.

22.2.3 Fishing Vessel Allision

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 HSE).

The two main inputs to the model are the fishing vessel density for the area and the structure details. The fishing vessel density in the area of Dogger Bank Teesside A & B was based on fishing vessel satellite data (2009).

Using the above site-specific data as input to the model, the annual fishing vessel allision frequency with wind farm structures was estimated for each of the three scenarios.

Table 22.5 Fishing Vessel Allisions - With Wind Farm Developments (Base Case)

Scenario	Annual Allision Frequency	Allision Return Period
Dogger Bank Teesside A	0.08	12 years
Dogger Bank Teesside B	0.08	12 years
Dogger Bank Teesside A & B	0.17	6 years

The estimated collision frequencies are high and reflect the maximum target area assumed for all the structures based on multipole foundations. It also assumes the fishing vessel density following development will remain the same as current levels.

22.2.4 Recreational Vessel Collision

There are two main collision/allision hazards from recreational vessels interacting with wind farms:

- Turbine Rotor Blade to Yacht Mast Collision; and
- Vessel Allision with Main Structures.

22.2.4.1 Blade and Mast Collision

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

In order to mitigate this risk, the development of Dogger Bank Teesside A & B will adhere to guidance on the construction of wind farms including ensuring that the minimum rotor blade clearance for the wind turbines is at least 22m above MHWS, however it is noted that the MCA would still recommend developers achieve at least 22m above HAT.

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 22.13 based on a fleet size of over 2,500 vessels. IRC is a rating (or 'handicapping' system) 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.

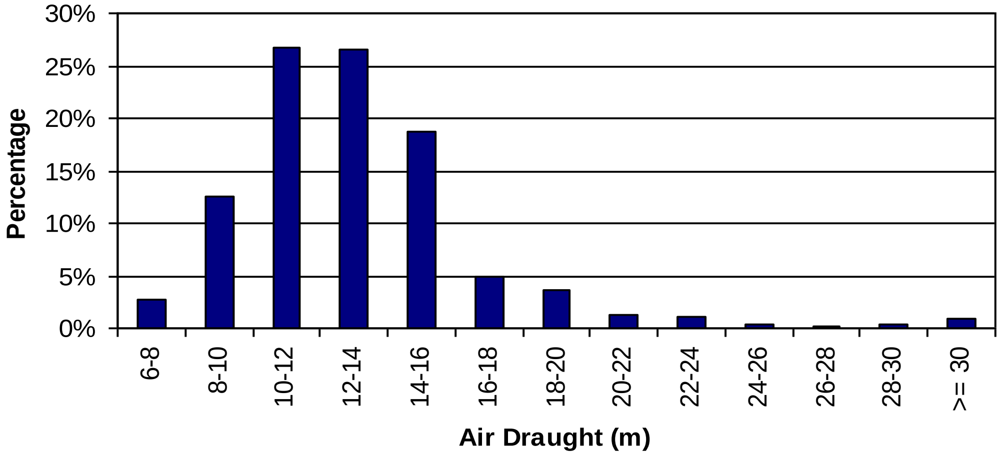

Figure 22.13 Air draught data – IRC fleet (data collected from 2009-2011) (RYA, 2012)

From these 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.

The Operator will also ensure promulgation of information to the recreational craft community is widespread and effective throughout all phases.

These measures mean that whilst the collision risk cannot be completely eliminated, it will be reduced to a level as low as reasonably practicable. In terms of consequences, most collisions with the turbines should be relatively low speed and hence low energy. If the seaworthiness of the recreational craft was threatened by the impact, the turbines will 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.

22.3 *Cable Interaction – Anchoring and Trawling*

All the subsea cables will be buried and/or trenched where seabed conditions allow maintaining current water depths and provide protection from all forms of hostile seabed interaction, such as fishing activity, dragging of anchors and dropped objects. There will be periodic inspections and surveys to ensure they do not become exposed. They will 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.

The proposed export cable route to shore runs from Dogger Bank Teesside A & B to land at Marske-by-the-Sea. The route is crossed by a number of shipping lanes and coastal routes.

There was no anchoring activity recorded within 10nm of Dogger Bank Teesside A & B during the surveys. The proposed export cable route does not pass over any designated anchorages. From analysis of AIS data, a low level of anchoring was observed within 5nm of the export cable corridor, with anchored vessels only being recorded in proximity to the coast.

The level of fishing vessel activity along the export cable corridor is generally higher towards the zone, with a number of fishing vessels also being recorded toward the coast.

It is therefore assumed the cable will be suitably protected for the seabed conditions (assessed separately) and principally the fishing activity in the area through burial and trenching, information promulgation and periodic inspection.

22.4 *Risk Results Summary*

The base case and future case (based on the assumptions detailed in Section 21) annual levels of risk for each of the three scenarios are summarised below. The change in risk is also shown, i.e. the estimated collision risk with the wind farm(s) minus the baseline collision risk without the wind farm(s) (which is zero except for vessel-to-vessel collisions).

Table 22.6 Summary of Results: Annual Risk - Dogger Bank Teesside A

Collision Scenario	Base Case			Future Case		
	Without	With	Change	Without	With	Change
Passing Powered	--	1.45E-03	1.45E-03	--	1.59E-03	1.59E-03
Passing Drifting	--	7.45E-05	7.45E-05	--	8.20E-05	8.20E-05
Vessel-to-Vessel	1.76E-03	2.17E-03	4.11E-04	1.93E-03	2.38E-03	4.52E-04
Fishing	--	8.22E-02	8.22E-02	--	9.04E-02	9.04E-02
Total	1.76E-03	8.58E-02	8.41E-02	1.93E-03	9.44E-02	9.25E-02

Table 22.7 Summary of Results: Annual Risk - Dogger Bank Teesside B

Collision Scenario	Base Case			Future Case		
	Without	With	Change	Without	With	Change
Passing Powered	--	3.67E-04	3.67E-04	--	4.03E-04	4.03E-04

Passing Drifting	--	5.18E-05	5.18E-05	--	5.70E-05	5.70E-05
Vessel-to-Vessel	8.99E-04	1.60E-03	7.04E-04	9.89E-04	1.76E-03	7.74E-04
Fishing	--	8.61E-02	8.61E-02	--	9.47E-02	9.47E-02
Total	8.99E-04	8.81E-02	8.72E-02	9.89E-04	9.69E-02	9.59E-02

Table 22.8 Summary of Results: Annual Risk - Dogger Bank Teesside A & B

Collision Scenario	Base Case			Future Case		
	Without	**With**	**Change**	**Without**	**With**	**Change**
Passing Powered	--	1.57E-03	1.57E-03	--	1.73E-03	1.73E-03
Passing Drifting	--	1.12E-04	1.12E-04	--	1.23E-04	1.23E-04
Vessel-to-Vessel	3.20E-03	4.13E-03	9.31E-04	3.52E-03	4.55E-03	1.02E-03
Fishing	--	1.68E0-1	1.68E0-1	--	1.85E-01	1.85E-01
Total	3.20E-03	1.74E-01	1.71E-01	3.52E-03	1.91E-01	1.88E-01

22.5 *Consequences*

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.

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 wind farm 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).

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.

A quantitative assessment of the potential consequences of collision/allision for each of the scenarios is presented in Appendix B. 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 22.9 and Table 22.10.

Table 22.9 Annual predicted change in Potential Loss of life (PLL) due to Dogger Bank Teesside A & B

	Dogger Bank Teesside A	Dogger Bank Teesside B	Dogger Bank Teesside A & B
Base Case PLL (fatalities per year)	2.86E-03	3.00E-03	5.86E-03
Future Case PLL (fatalities per year)	3.15E-03	3.30E-03	6.44E-03

Table 22.10 Annual predicted oil spilled due to Dogger Bank Teesside A & B

	Dogger Bank Teesside A	Dogger Bank Teesside B	Dogger Bank Teesside A & B
Base Case (tonnes of oil per year)	0.33	0.26	0.56
Future Case (tonnes of oil per year)	0.36	0.29	0.62

The overall increase in PLL estimated due to the development is as follows:

- Dogger Bank Teesside A: 2.86 x 10^{-3} fatalities per year (base case), which equates to one additional fatality in 350 years.
- Dogger Bank Teesside B: 3.00 x 10^{-3} fatalities per year (base case), which equates to one additional fatality in 333 years.
- Dogger Bank Teesside A & B: 5.86 x 10^{-3} fatalities per year (base case), which equates to one additional fatality in 171 years.

These are small changes compared to the MAIB statistics which indicate an average of 29 fatalities per year in UK territorial waters.

In terms of individual risk to people, the incremental increase for commercial ships (in the region of 10^{-9} for all three scenarios) is very low compared to the background risk level for the UK sea transport industry of 2.9 x 10^{-4} per year.

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^{-5} for all three scenarios), it is low compared to the background risk level for the UK sea fishing industry of 1.2 x 10^{-3} per year.

Therefore, the incremental increase in risk to both people and the environment caused by Dogger Bank Teesside A, Dogger Bank Teesside B and Dogger Bank Teesside A & B was estimated to be low.

23. Export Cable Risk Assessment

This section describes the main hazards which could pose a risk to the export cable. The following hazards are described in detail:

- Fishing Gear Interaction
- Vessel Foundering
- Anchoring

23.1 *Fishing Gear Interaction*

The fishing types considered to pose the most risk to a subsea cable are bottom trawling and scallop dredging, both of which are carried out in the vicinity of the export cable. These fishing methods differ from mid water trawling (pelagic) where the net is towed higher in the water column and poses minimal risk of interaction with a subsea cable. A description of bottom trawling methods (otter trawling and beam trawling) and scallop dredging are provided in Sections 23.1.1 to 23.1.3.

23.1.1 Otter Trawl

This is the most commonly used towed gear in UK fisheries. Both finfish and shellfish found on or near the bottom are taken by this method. The gear consists of a cone shaped net attached to the vessel by wire ropes or 'warps'. The length of the warp is normally about three and a half to four times the depth of the water and can be used in depths of 100-450m from the stern of the vessel. As the net is towed over the sea floor the mouth is kept open by large rectangular otter boards composed of timber or steel. The tail end of the net where the fish are trapped is the 'cod end'. The otter boards scrape the seabed as they are towed behind the vessel, thus creating a cloud of seabed material and creating the potential for interactions with subsea cables and pipelines. The main components of an otter trawl that have the potential to hook a subsea cable are the trawl doors and the clump weight. Figure 23.1 presents a schematic of a typical bottom otter trawler.

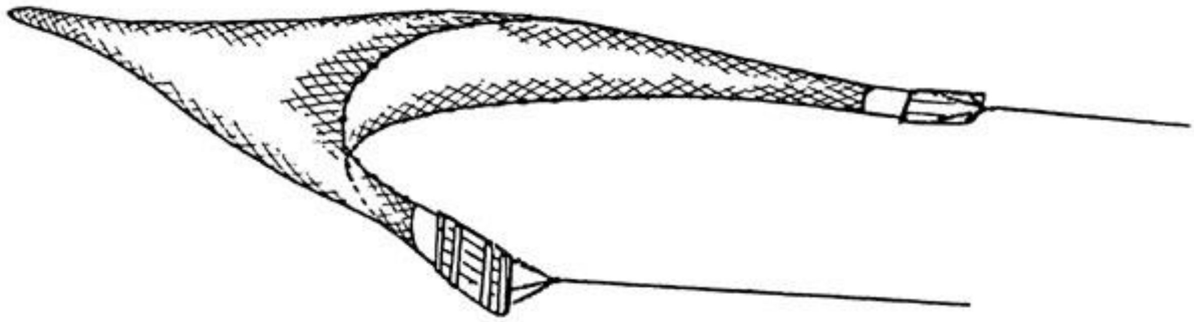

Figure 23.1 Example of Bottom (Otter) Trawl Gear (FAO, 2012)

23.1.2 Beam Trawl

The beam trawl is a bottom fishing trawl net, used mainly by small vessels for catching demersal flatfish relatively close to the shore. In beam trawling, the net is held open by a rigid beam which is attached to the netting. The net is heavily weighted with a chain on the underside and has tickler chains running in front. As was described with otter trawling, the seabed is disturbed by this fishing activity which creates the potential for cable and pipeline interactions. The main components of a beam trawl that have the potential to hook a pipeline are the beam and runners/shoes. A schematic of a typical beam trawler is presented in Figure 23.2 below.

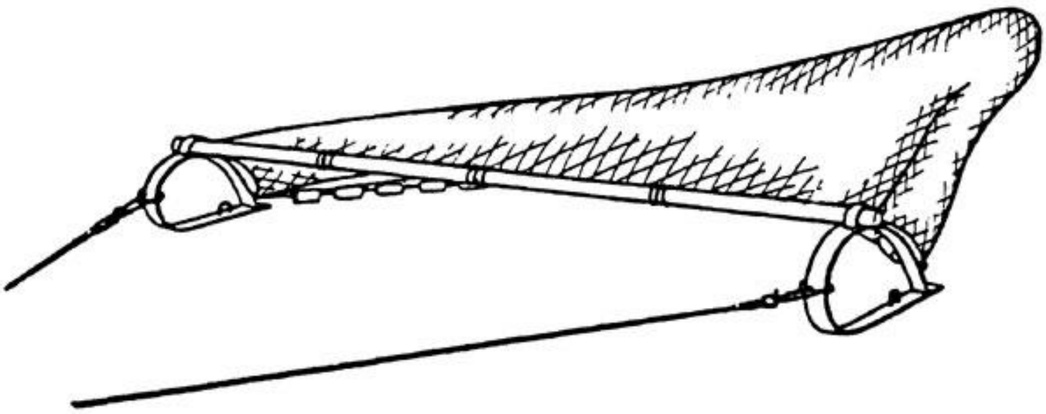

Figure 23.2 Beam Trawl Gear (FAO, 2012)

23.1.3 Gear Interaction with Cables

When trawl gear is towed over or along a cable, the interaction can be considered in three phases as described below.

- Impact:
  - The initial phase when the trawl board, beam shoe or clump weight hits the cable. This impact occurs over a short time frame and mainly results in localised damage to the shell and protective coating of the cable. This stage has the potential to damage the cables but rarely damages the trawl gear and there is negligible risk to the fishermen on board the vessel.

- Pull over:
  - This occurs when a trawl board, beam trawl or clump weight is pulled over the cable. The duration of this phase is longer than that of the initial impact and forces can be notably greater. Again the risks to fishermen during this phase of the interaction are limited.

- Hooking:
  - Hooking occurs when the trawl equipment becomes "stuck" under the cable. This tends to be a low probability event but it represents the greatest risk to fishermen as it can result in the vessel capsizing.

23.2 *Vessel Foundering*

A foundering is considered to be when a vessel suffers structural failure and sinks. This type of incident has the potential to damage a subsea cable if the vessel sinks over the cable. It is noted that this type of incident is considered to have a very low frequency based on historical incident data for the UK (from 1994-2008 approximately 4% of all MAIB incident types were listed as flooding/foundering).

23.3 *Anchoring*

Anchoring has the potential to damage a subsea cable if a vessel drops anchor on the cable or drags anchor over the cable. The damage caused depends on the penetration depth of the anchor (which depends on vessel size and type of anchor), the type of seabed and the cable burial depth. It is considered that anchor interaction with a subsea cable will be similar to that of fishing gear interaction, based on impact, pull over and potential snagging phases.

Anchoring can take place for a number of reasons. The following scenarios could lead to a vessel anchoring:

- Adverse weather anchoring (e.g. seeking refuge in a safe haven);
- Machinery failure (e.g. to slow drift speed/stop and/or to carry out repairs);
- Waiting on orders (e.g. commercial vessels and/or drilling rigs);
- Waiting on approach to a port (e.g. port berth or pilotage); and
- Subsea operations/survey vessel and semi-submersible drilling rig anchoring.

It is noted that when the cable is installed and charted, the probability of planned anchoring in close proximity to the cable route is reduced.

23.4 *Export Cable Route Risk Assessment*

A 1nm x 1nm grid consisting of 1,881 cells was created for the area 5nm around the export cable corridor.

Sections 23.4.1 to 23.4.3 present the methodology for ranking the abovementioned identified hazards (fishing gear interaction, vessel foundering and anchoring) with a value between zero and five for each of the grid cells. The values for each of the three hazards were summed (maximum 15) and distributed into five sensitivity ranges. An overview chart showing the grid 5nm around the export cable corridor, colour-coded by risk ranking, is presented in Figure 23.3.

23.4.1 Risk Ranking for Fishing Gear Interaction

Fishing vessel density per grid cell in the area 5nm around the export cable corridor was categorised based on the satellite data (see Section 18.10.2) which provided more comprehensive coverage of fishing vessel activity in the vicinity of the export cable corridor compared to the sightings data and the survey data collected. It covers larger fishing vessels (15m+) which have the most potential to interact with subsea equipment.

Satellite tracking positions with speeds equal to or less than 5 knots were selected (it is assumed a vessel travelling over 5 knots will not be fishing) and grid cells were ranked from zero (no activity) to five (highest activity).

23.4.2 Risk Ranking for Vessel Foundering

AIS data from the *Vigilant* and *L'Espoir* survey (7 days in June 2011) and the *Vigilant* and *Tridens-1* survey (7 days in June 2012) (both supplemented by other AIS data available from coastal and offshore stations) were used to identify cells with a higher density of shipping (which would therefore have a higher risk of foundering). Any cells where the number of vessel intersects was greater than or equal to 1 vessel per day were given a ranking of 1.

In addition to this, ten years of RNLI (2001-2010) and MAIB (2002-2011) incident data were analysed to extract incidents where a vessel foundered or was lost. For the areas where one of these incidents was recorded, a 500m radius was created around each incident (to take into account vessel break-up or drifting once submerged). Cells that were intersected by a foundering incident area were given the highest risk ranking (5).

23.4.3 Risk Ranking for Anchoring

Vessel anchoring was identified from the anchoring study (7 days in spring 2013). Cells intersected by one anchored vessel were given a rank of 3 and cells intersected by two or more vessels and/or multiple days of anchoring were given a rank of 5.

Vessels that were involved in machinery or mechanical failure incidents can drop anchor to arrest or slow down their drift (when they are not under command). For this reason, incidents which recorded a machinery or mechanical failure were extracted from the RNLI and MAIB incident databases and the cells were given a ranking of 5.

Figure 23.3 below presents an overview of the cable risk ranking for 5nm around the Export Cable Corridor, based on the three rankings described above.

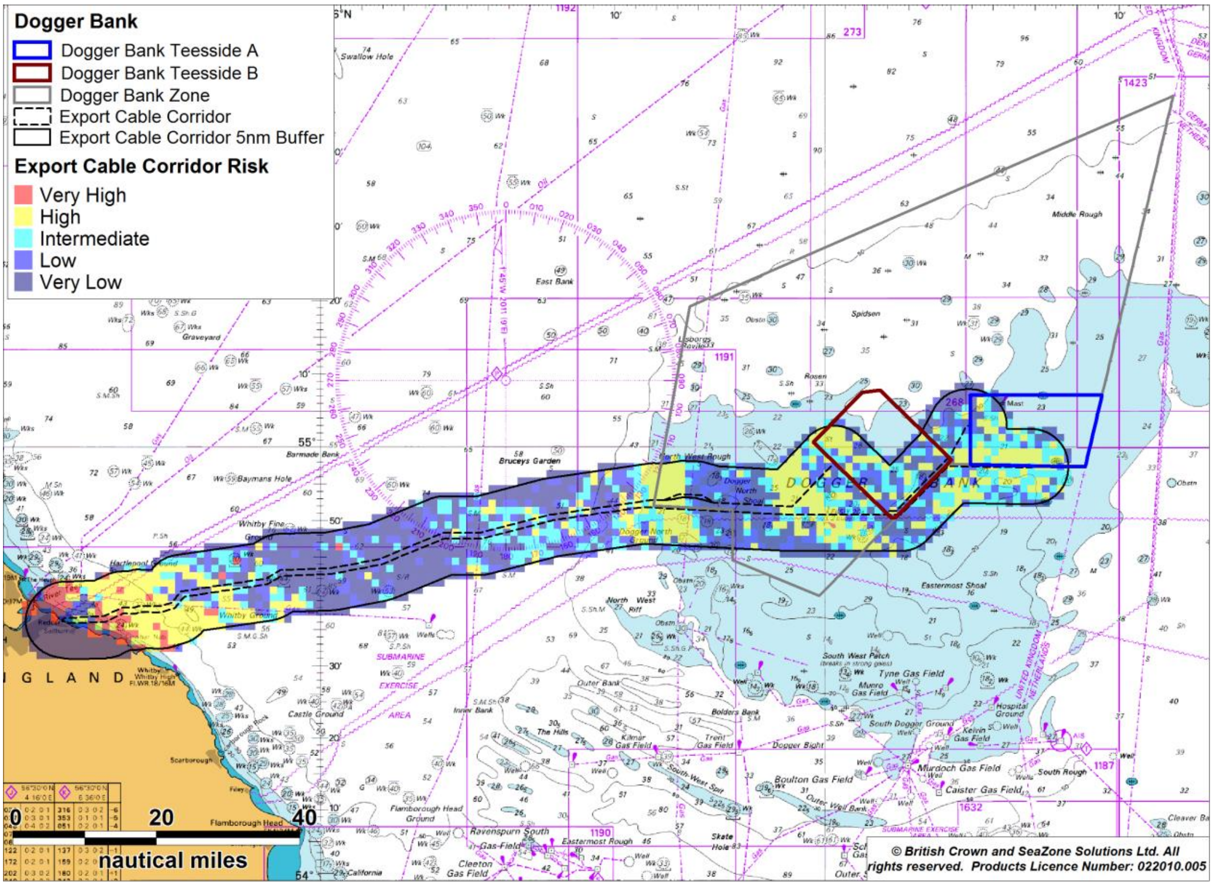

Figure 23.3 Overview of Cable Risk Ranking for 5nm around Export Cable Corridor

24. Hazard Workshop

In order to provide expert opinion and local knowledge, a hazard workshop was undertaken to create a hazard log that was wind farm and site specific. The hazard log identifies hazards caused or changed by the introduction of structures in Dogger Bank Teesside A & B and the export cable. 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 wind farms are Broadly Acceptable or Tolerable on the basis of As Low As Reasonably Practicable (ALARP) declarations.

24.1 *Hazard Workshop*

The Dogger Bank Teesside A & B workshop was held in April 2012 to identify the navigational hazards associated with the development. This workshop was attended by maritime stakeholders, as outlined in Table 24.1. Stakeholders who were invited to the workshop but did not attend are also listed in Table 24.1.

Table 24.1 Hazard Workshop Invitees

Invitee	Company/Organisation	Attendance
Julie Drew	Forewind	Yes
Martin Goff	Forewind	Yes
Nachaat Tahmaz	Forewind	Yes
Sam Westwood	Anatec Ltd.	Yes
Judith Murray	Anatec Ltd.	Yes
Courtney French	Brown and May Marine	Yes
Richard Nevinson	Chamber of Shipping (CoS)	Yes
Henrik Lund	Danish Fishermen's Association	Yes
Andries de Boer	Dutch Fishermen / NFFO	Yes
Anna Farley	GDF Suez	Yes
Andrew Souter	Marine Management Organisation (MMO)	Yes

Invitee	Company/Organisation	Attendance
Roly McKie	Maritime and Coastguard Agency (MCA)	Yes
Stuart Carruthers	Royal Yachting Association (RYA)	Yes
Alana Murphy	RYA	Yes
Rachael O'Sullivan	RWE	Yes
Ian Rowe	NFFO	Did not attend
Sandy Bennett	EMEA	Did not attend
Sandy Smith	Shell UK	Did not attend
Annemette Jepsen	Unifeeder	Declined
Morton Glamso	Danish Ship-owners Association	Declined
Nick Garside	NFFO	Declined
Joseph Holcroft	Cemex	Declined
Graeme Proctor	MCA	Declined
Roger Barker	THLS	Declined
Roy Kersey	DFDS	No Response
Richard Smith	Finnlines	No Response
Peter Prins	Royal Association of Netherlands Ship-owners	No Response
Nigel Proctor	Precision Marine Survey Ltd	No Response
Jerry Drewitt	PD Ports	No Response
Ted Osbourn	Cruising Association	No Response
Des Egan	MOD	No Response
David Shepard	RNLI	No Response
Mike Bill	MRCC Humber	No Response
Roy Cahill	DfT	No Response
Andrew Sanders	Perenco	No Response
Nina Krogh Nielsen	Conoco Phillips	No Response
Stephen Dawe	Cable and Wireless	No Response
Glen Lipsham	BT Subsea	No Response
Caren Van Den Brekel	Wintershall	No Response

24.2 *Hazard Workshop Process*

As part of the workshop, key maritime hazards associated with structures in Dogger Bank Teesside A & B and the export cable were identified and discussed. Where appropriate, vessel types were considered separately to ensure the risk levels were assessed for each and the control options could be identified on a type-specific basis, e.g., risk control measures for fishing vessels differ to those for commercial ships. Other general hazards associated with the construction, decommissioning and operations phases, such as dropped objects, man overboard, pollution incidents and search and rescue operations, were also discussed.

After the workshop, the most likely and worst case consequences of the hazards were noted. The risks associated with the hazards were ranked based on the discussions held during the workshop and risk reduction measures were identified.

24.3 *Hazard Log*

The Hazard Log can be found in Appendix C.

24.4 *Tolerability of Risks Identified at the Hazard Workshop*

Figure 24.1 presents a summary of the overall breakdown by tolerability region for the identified hazards.

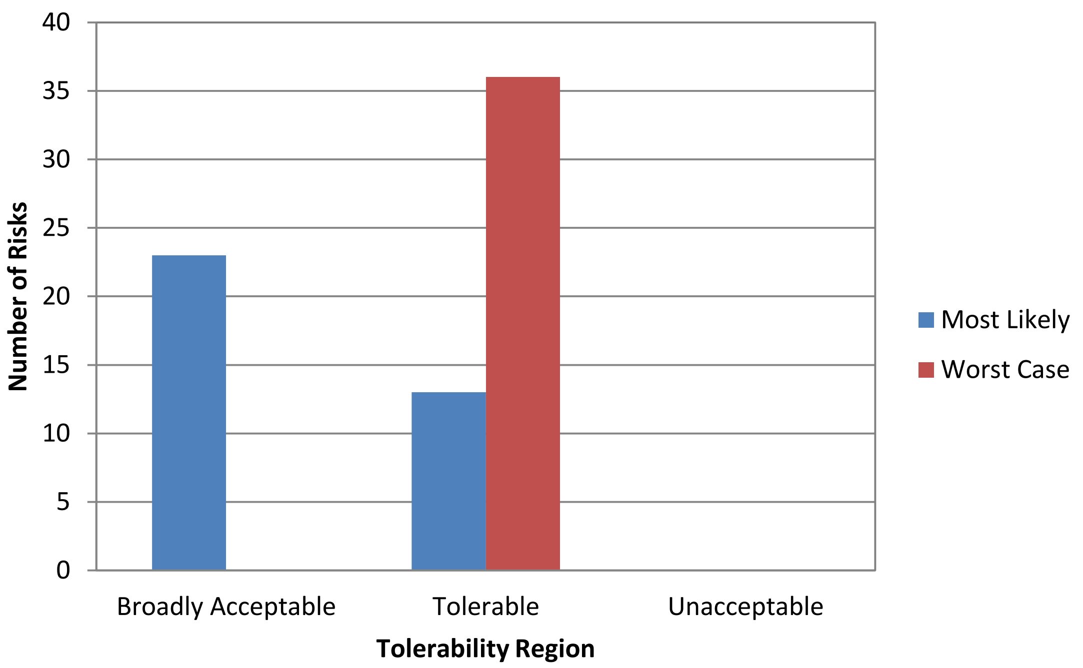

Figure 24.1 Risk Ranking Results

For the most likely outcome, 23 of the risks were broadly acceptable, 13 were in the tolerable region and none were ranked as unacceptable. When worst case consequences were assessed, there were no risks which were ranked as broadly acceptable. All risks were ranked in the tolerable region.

25. Embedded Mitigation Measures

Mitigation and safety measures will be applied to the development appropriate to the level and type of risk determined during the EIA. The specific measures to be employed will be selected in consultation with the MCA Navigation Safety Branch and other relevant statutory stakeholders where required.

Table 25.1 Industry Standard Mitigations

Industry Standard Mitigation Measures	**Description**
Application and Use of Safety Zones of up to 500 metres during Construction and Decommissioning	• Application for and use of safety zones to protect the development site. Section 95 of the Energy Act 2004 states that where there is a proposal to construct or operate a renewable energy installation such as wind turbines and associated infrastructure, a notice may be issued declaring specific areas around the installation to be safety zones in order to secure the safety of the turbine, converter station, collector station, accommodation platform and reactive station. Schedule 16 of the Energy Act 2004 and The Electricity (Offshore Generating Stations) (Safety Zones) (Application Procedures and Control of Access) Regulations 2007 provide details of the application process. • 500 m 'rolling' safety zone around each wind turbine during construction and decommissioning. This will be evidenced by the presence of a jack-up rig or other large construction/installation vessel. Safety Zones for the construction, major maintenance and eventual decommissioning phases of a turbine, converter station, collector station, accommodation platform and reactive station's life will be established on a 'rolling' basis,

Industry Standard Mitigation Measures	Description
	covering only those areas of the total site in which such activities are actually taking place at a given time in order to reduce the amount of time that mariners and other users of the sea will be required to deviate around the safety zones. • 500 m 'rolling' safety zone around each wind turbine during construction and decommissioning. Safety Zones for the construction, major maintenance and eventual decommissioning phases of a turbine, converter station, collector station, accommodation platform and reactive station's life will be established on a 'rolling' basis, covering only those areas of the total site in which such activities are actually taking place at a given time in order to minimise disruption to mariners and other users of the sea. Once the activity has been completed in that specific location, the safety zone will then 'roll on' to cover the next specific location within the site in which activity is taking place. • Additionally up to 50 metres around wind turbines where construction has finished but other work is on-going (pre commissioning) may also be applied for. • It is noted that these safety zone applications will include a safety case. • At this stage of the consent process operational safety zones are not being considered.
Blade Clearance	Turbines will be constructed to ensure that the minimum rotor blade clearance is at least 22m above MHWS.
Cable Burial and/ or Protection	Cables will be trenched and buried where seabed conditions allow or protected with suitable methods to ensure the risk of snagging or anchor interaction is mitigated. This will include consideration for under keel clearance and protection methods used will be assessed to ensure they do not create a risk to transiting vessels. Following guidance issued by the MCA in 2013 Dogger Bank Teesside will also consider under keel water clearance when identifying cable burial and / or protection methods. Forewind have already committed to over trawlability of protection methods used but will also ensure that Chart Datum water depths are not reduced by more than 5% with flexibility

Industry Standard Mitigation Measures	Description
	dependent on transiting traffic types and surrounding water depths in consultation with the MCA and THLS. Due to the different seabed conditions across the Dogger Bank Teesside A & B export cable corridor, it is expected that certain sections will not be feasible to bury, and as such would require surface laying and appropriate cable protection, for example rock placement, concrete matressing etc. (as detailed in Chapter 5 – Project Description). The impact of these protection methods on navigation and the requirement for appropriate risk mitigation measures will be assessed by Forewind as part of the ongoing cable works programme, with the intention to minimise risks to navigation where possible. Micro siting will be undertaken as part of the cable burial assessment to ensure that obstacles such as wrecks are avoided. The subsea cables will be subject to periodic inspection to ensure they remain buried and do not become a hazard to marine navigation. This will include ad hoc inspections after potential anchor interactions.
Compliance with International Maritime Organisation Conventions including COLREGs and SOLAS.	Compliance to ensure that standard levels of navigation and vessel safety continue to be adhered to by all receptors during all phases.
Emergency Response and Cooperation Plan	This will be developed and implemented for the construction, operation/maintenance and decommissioning phases of a renewable energy development. ERCoPs are initially discussed with the MCA Search and Rescue and Navigational Safety Branches and then completed in consultation with the relevant MRCC for the area. As an example, the ERCoP for the construction phase should include company details and contact details (for routine and emergency situations), cooperation and consultation on an ERCoP, applicable to all phases and include arrangements between company and MRCC, details on how information

Industry Standard Mitigation Measures	Description
	will be passed on during emergency situations, shut down and turbine control requirements, details of what is to be built, information about vessels and activities on site (updated regularly), contact details for the MRCC, information about nearby SAR facilities including surface craft rescue resources and airborne rescue resources and planned response to pollution events. The ERCoP should link directly to the Forewind Safety Management System to ensure that the information is part of a documented review process and updated as required.,
Export Cable - Charting	Cables will be marked on nautical charts in line with the UK Hydrographic Office (UKHO) standards. Note: depending on scale, inter array cabling may not be shown and it may only be the export cable that is visible on some charts.
IALA Guidance and Aids to Navigation	Structures within the Wind Farm will 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 sound aids to navigation. Further information is provided in section 25.1.
Marine Aggregate Dredging Buffers	Following consultation with Marine Aggregate Dredging Companies it was noted that due to tidal direction, buffers would be installed 0.5NM (approx. 926 metres) structures and 0.25 NM (approx. 500m) from cables, although it is noted that the distance is greater than this.. These buffers are currently being consulted on as part of the Forewind process.
Marine Pollution Contingency Planning	Creation of an Emergency Response Cooperation Plan in line with guidance from the relevant Maritime Rescue Coordination Centre from the construction phase onwards is proposed. This should include cooperation with UK National Contingency Plan.
MGN 371	Wind turbines will be designed in accordance with Marine Guidance Note (MGN) 371 (MCA, 2008a) and procedures put in place for generator shut down and other operational requirements in emergency situations. See section 25.2 for further detail. Any amendments to MGN 371 that are made post consent may be considered retrospectively.
Monitoring by AIS	The project will continue to have either shore based or

Industry Standard Mitigation Measures	Description
	structure based AIS monitoring that can be reviewed when required by regulators.
Personal Protective Equipment	All personnel will be conversant with Safety Management Systems (SMS) and emergency response procedures and will wear the correct Personal Protective Equipment (PPE) at all times, as defined by the relevant QHSE documentation. This will include consideration for the use of Personnel Locator Beacons.
QHSE Documentation	Standard marine quality, health, safety and environment (QHSE) documentation to ensure safe operation on a daily basis, including work vessel operations will be included within the SMS.
Scour Protection	There are a number of different scour protection materials that may be used, such as: • loose rock / rough gravel; • concrete mattresses, made of concrete blocks that are woven together and placed • around the foundation to prevent scour; and • fronded mats. Scour and scour protection are not expected to have any impacts on surface navigation, but could present a snagging risk. The method of protection therefore selected, especially in shallow water depths should give full consideration to the potential hazards posed to vessels anchoring, include hose that are required to anchor in an emergency.
Wind Farm - Charting	The Wind Farm will be marked on relevant United Kingdom Hydrographic Office (UKHO) admiralty charts. These areas have generally been marked as ‘submarine power cable area’ as well as will the wind farm symbol to advise mariners of the issues when passage planning. Forewind are currently consulting with navigational stakeholders to assess the impacts on

25.1 *Marine Aids to Navigation (AtoN)*

Throughout the construction, operation and maintenance of the proposed Dogger Bank Teesside A & B, AtoN will be provided in accordance with THLS requirements, with consideration being given to IALA standard O-139 on the Marking of Offshore Wind Farms (IALA, 2008) and the DECC Standard Marking Schedule for Offshore Installations (2011).

25.1.1 Construction and Decommissioning Markings

During the construction/decommissioning of the wind farm, working areas will be established and marked, where required, in accordance with THLS requirements based on the IALA Maritime Buoyage System. In addition to this, where advised by THLS, additional temporary marking may also be applied.

Notices to Mariners (including local), Radio Navigational Warnings, NAVTEX and/or broadcast warnings as well as Notices to Airmen will be promulgated in advance of any proposed works, where required.

25.1.2 IALA Guidance of the Marking of Groups of Structures (Wind Farms)

Following a meeting with THLS in March 2013 it was agreed that a sample lighting scheme could be developed for use as part of the night time visual assessment but that specific lighting requirements could not be agreed until the final layout has been submitted for regulatory approval post consent but pre construction. It is noted that that the IALA 0-139 guidance does not have to be followed and the THLS may request additional or alternative mitigations.

Table 25.2 and Figure 25.1 show both the outline navigational requirements and a sample layout.

Table 25.2 Navigational Lighting Requirements for Structures

Guidance	THLS Requirement
• A Significant Peripheral Structure (SPS) is the 'corner' or other significant point on the periphery of the wind farm. • Flashing yellow as per IALA special mark characteristics (any rhythm other than those described in cardinal, isolated danger and safety water marks). • All navigational lights will be synchronised. • Range no less than 5NM • Lights visible from all directions in the horizontal plane. • SPSs placed so as to not exceed 3NM and at corner structures. Omnidirectional fog signals as appropriate/where prescribed by THLS.	Significant Periphery Structures (SPS) to be placed at each of the periphery corners of the wind farm. The Dogger Bank Teesside A & B Met Masts will also have SPS marking when no longer an isolated structure. Fog signals are likely to be located on the corners of the wind farm.
• Flashing yellow with a flash character distinctly different from those displayed on the SPS's (and any rhythm other than those described in cardinal, isolated danger and safety water marks).	Intermediate Structures likely to be used on the periphery north west edge. Other structures may be identified as IPS on the

• All navigational lights will be synchronised. • Range no less than 2NM • Lights visible from all directions in the horizontal plane. The lateral distance between such lit structures or the nearest SPS should not exceed 2NM.	periphery following final site design.
• No additional navigational aids will be required unless the structures are placed on the periphery of the site. • The lights shall be placed not less than 6m and not more than 30m above Mean High Water Springs (MHWS) with a minimum effective intensity of 1400 candelas. • The lights shall be operated in unison with a flashing character according to Morse letter 'U' with a maximum period of 15 seconds. • The vertical distribution of the projected beam shall be such that the light will be visible from the immediate vicinity of the structure to the maximum luminous range of the light. • Each structure shall, where practicable, display identification panels with black letters or numbers 1 m high on a yellow background visible in all directions. These panels shall be easily visible in daylight as well as at night, either by the use of illumination or retro reflecting material. • The sound signals should be placed not less than 6m and not more than 30m above MHWS with a range of at least 2 nautical miles. The character shall be rhythmic blasts corresponding to Morse letter 'U' every 30 seconds. • The minimum duration of the short blast shall be 0.75 seconds. The sound signals shall be operated when the meteorological visibility is two nautical miles or less.	Offshore Substation Platforms will not have navigational lighting if within turbine alignment. All structures will be marked at night by one or more low intensity white lights, fixed as to ensure that at least one light is visible upon approaching the structure from any direction. If any structure is not aligned within a final site design it may require additional marking.

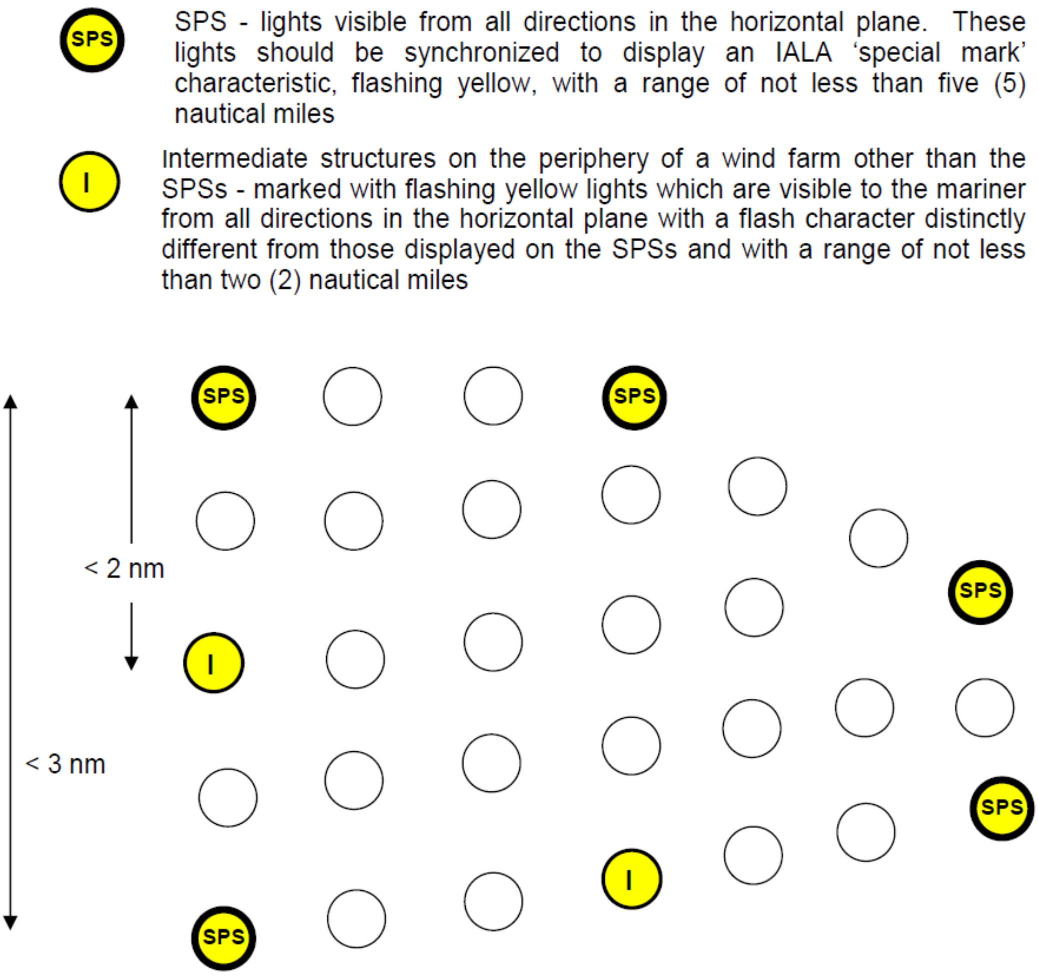

Figure 25.1 Sample Marking of a Wind Farm

At final site design stage marking of peripheral turbines will be discussed in detail with THLS to aid mitigation for allision risk from passing powered vessels, information contained within Figure 25.1 Sample Marking of a Wind Farm

and Table 25.2 is indicative only at this stage.

25.1.3 **Other Aid to Navigation Consideration**

The following section identifies additional measures that are requirements or are currently being considered by Forewind in conjunction with Trinity House Lighthouse Services.

Low Level Lighting on Ladders/Platforms

- Use of low level lighting and retro reflective (BS873) areas on signage, access platforms and ladders on all structures will be installed to access to aid navigation through the wind farm.

Day Marks

- The tower of every wind generator should be painted yellow all-round from the level of Highest Astronomical Tide (HAT) to 15 metres or the height of the Aid to Navigation, if fitted, whichever is greater. Alternative marking may include horizontal yellow bands of not less than 2 metres in height and separation.

Location of Lights

- The Aids to Navigation on the structure of a wind generator should be mounted below the lowest point of the arc of the rotor blades. They should be exhibited at a height of at least 6 metres above the level of the HAT.

Use of Virtual Buoys, Racons or Radar Reflectors

- The use of virtual buoys (dependant on technological advances) Racons, Radar reflectors/target enhancers or AIS (as AtoN) may also be considered as an option by THLS. These will be placed on the periphery of the site to assist safe navigation particularly in reduced visibility.

Sound Signals

- Provision of sound signals where appropriate, taking into account the prevailing visibility, topography and vessel traffic conditions. The typical range of such a sound signal should not be less than two (2) nautical miles. Sample locations are shown in 25.1 however final locations will be defined by THLS.

Spurious White Lights

- Additional white lights should be kept to a minimum and Forewind should ensure that regular checks are undertaken to identify any lights which should not be visible are extinguished after use.

Aviation Lighting

- Aviation lighting will be as per Civil Aviation Authority Requirements, however will likely to be synchronised to Morse 'W' at the request of THLS.

Remote Monitoring and Sensors

- Remote monitoring and sensors should be included as part of the lighting and marking scope to ensure high level availability for all aids to navigation.

Numbering of Structures

- It is recommended that, where possible, individual OREI markings 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 and potential future expansion of each OREI development. The MCA will advise during the consent process on the specific requirements for the proposed Dogger Bank Teesside A & B.

25.2 *OREI Design specifications Noted as per MGN 371*

The wind farm has been designed to satisfy the following design requirements for emergency response in the event of a search and rescue (SAR), counter pollution or salvage operation in or around a wind farm (as per MGN 371 guidance - MCA, 2008a);

Table 25.3 OREI Design Specifications (from MGN 371)

Wind turbine specification to assist with emergency response including SAR.	Marked with clearly visible unique identification characters.
	The identification characters will be illuminated by a low-intensity light visible from a vessel thus enabling the structure to be detected at a suitable distance to avoid a collision with it.
	The size of identification characters in combination with lighting should be such that under normal visibility conditions and known tidal conditions they are clearly readable by an observer stationed at 3m above sea level and at a distance of at least 150 m from the turbine.
	All lighting should be hooded or baffled so as to avoid unnecessary light pollution or confusion with navigation marks.
Aviation specification to assist with emergency response including SAR.	OREI structures should be marked with hazard warning lighting in accordance with Civil Aviation Authority (CAA) guidance and also with unique identification numbers (with illumination controlled from the site control centre and activated 'as required') on the upper works of the OREI structure so that aircraft can identify each installation from a height of 500 feet (150 m) above the highest part of the OREI structure.
	Wind Turbine Generators shall have high contrast markings (dots or stripes) placed at 10 m intervals on both sides of the blades to provide SAR helicopter pilots with a hover-reference point.
	Wind turbine control mechanisms should be able to fix and maintain the position of the wind turbine blades as determined by the emergency responders.
	Throughout the design process for an OREI, appropriate assessments and methods for safe shutdown should be established and agreed, through consultation with MCA's Navigation Safety Branch, Search and Rescue Branch and other emergency support services.
	OREI generators and transmission systems should be equipped with control mechanisms that can be operated from the OREI Central Control Room or through a single contact point
	Access ladders, although designed for entry by trained personnel using specialised equipment can conceivably be used, in an emergency situation, to provide refuge on the turbine structure for distressed mariners. This scenario will be considered when identifying the optimum position of such

	ladders and take into account the prevailing wind, wave and tidal conditions.
Control Room requirements to assist with emergency response including SAR.	Central Control Room, or mutually agreed single contact point, should be manned 24 hours a day.
	Central Control Room operator, or mutually agreed single contact point, should have a chart indicating the GPS position and unique identification numbers of each of the wind turbines in the wind farm or individual devices in other types of OREI.
	Emergency Responders shall be advised of the contact telephone number of the Central Control Room, or single contact point (and vice versa).
	Emergency Responders will have a chart indicating the GPS position and unique identification number of each of the wind turbines in all wind farms or all devices in other types of OREI.
	All search and rescue helicopter bases will be supplied with an accurate chart of all the OREI and their GPS positions.
Operational Procedures in the event of an emergency incident including SAR.	Upon receiving a distress call or other emergency alert from a vessel which is concerned about a possible collision with a wind turbines or is already close to or within a wind farm, or when the Coastguard receives a report that persons are in actual or possible danger in or near to a wind farm and search and rescue aircraft and/or rescue boats or craft are required to operate over or within the wind farm, the Coastguard will establish the position of the vessel and the identification numbers of any wind turbines which are visible to the vessel. This information will be passed immediately to the Central Control Room, or single contact point, by the MRCC. A similar procedure will be followed when vessels are close to or within other types of OREI site.
	The control room operator, or single contact point, should immediately initiate the shut-down procedure for those wind turbines as requested by the Coastguard or emergency responder, and maintain the wind turbines in the appropriate shut-down position, as requested by the Coastguard or emergency responder, or as agreed with MCA Navigation Safety Branch or SAR Branch for that particular installation, until receiving notification from the responders that it is safe to restart the wind turbine.
	Communication procedures should be tested satisfactorily at least twice a year. Shutdown and other procedures should be tested as and when mutually agreed the MCA.
SAR Helicopter Procedures	Emergency evacuation of persons directly from a wind

and Guidance - Helicopter Search and Rescue units have specific requirements to allow them to operate safely within wind farms and close to, or over, wind turbine generators.	turbine nacelle by SAR helicopter is a last resort. It will normally be considered where risk to life is such that the speed of reaction and transfer of survivors to a place of safety or of injured persons directly to shore medical facilities can most effectively be achieved by SAR helicopter.
	If winching is to take place from/to a wind turbine, the wind turbine blades will have to be feathered and the rotor brakes applied (where feasible blades should be pinned - perhaps before major works commence). The nacelle should be rotated so that the blades are at 90 degrees off the wind with the wind blowing on to the left side of the nacelle e.g., if wind is blowing from 270 degrees, the nacelle will need to be rotated to right so that the hub is facing 360 degrees.
	If winching is to take place to/from a nacelle, wherever possible wind farm personnel should be in the nacelle to assist the winch man.
	In poor visibility or at night, any lighting on wind turbines may be required to be switched on or off - at the discretion of the helicopter pilot.
	For SAR helicopter operations, Radar is a prime flight safety tool - especially at night, in bad weather and poor visibility. It is therefore fundamental to the safe operation of SAR helicopters within and around wind farms that the wind turbines are detectable to airborne Radars (at a safe range) and that the aircraft crew, using Radar, can discriminate between individual turbines.

26. Additional Mitigation Measures

The following section identifies mitigation measures that have been identified as part of the baseline assessment as a method of reducing risk for shipping and navigation receptors shown within the ES chapter.

Table 26.1 Additional Mitigation Measures

Additional Mitigation Measure	Description
Advanced ERCoP	The current MCA ERCoP template was developed for smaller round one and two wind parks, recent consultation has noted that developers now need to move beyond this requirement and develop an ERCoP that is enhanced to cover the principles of self-help and relative to the size, location and nature of the development. This ERCoP will be part of Forewind Safety Management System.
Advanced Promulgation of Information	Although a standard level of information promulgation will occur this mitigation details Forewind requirement to go above industry level and directly target receptors with information. Promulgation of information and warnings through VHF warnings, notices to mariners and other appropriate media such as direct promulgation of information to local clubs and marinas for recreational users. This will enable vessels to plan their passage accordingly and therefore effectively and safely navigate around Dogger Bank Teesside A & B. At this level, information should be targeted to specific receptors that may be affected by particular parts of the construction, operation or decommissioning activities. This may include on site marking and notices to warn fishing vessels of potential hazards.
Cable Burial and Protection	Offshore cables will be buried or appropriately protected along their length. The most suitable burial depth and level of protection specific to each area will be assessed during a detailed cable burial and protection risk assessment. This will also include consideration of operating characteristics, sediment type, and risk of damage to the cable from mobile sediments or external activities such as fishing or vessels anchoring.
Consultation on Aids to	The site will be designed to ensure that the overall design or

Navigation during Operation	peripheral turbines do not increase risk by creating high risk areas. This may include the use of markers to aid traffic flow around the wind farms. These requirements will be discussed in consultation with MCA and THLS on marking and lighting of the wind farms final layouts pre construction.
Emergency Response Study	A study has been undertaken as part of the on-going Zonal works for the Dogger Bank Zone which has identified current levels of resources, undertaken a gap analysis and then identified an initial base level of self-help capability and emergency response requirements that will be consulted on. Forewind are committed to developing an adequate level of self-help across all sites within the Dogger Bank Wind Farm Zone.
Future Monitoring	Unmanned AIS monitoring from an offsite location will be undertaken to allow continual assessment of traffic movements around the site. The site shall also be monitored to assess the activities of other receptors which may need further mitigation that cannot be identified or assessed at this stage.
H&S Vessel Requirements	As industry standard mitigation, Forewind will ensure that all vessels meet both IMO conventions for safe operation as well as HSE requirements where applicable. However the following details general good practice that wind park associated vessels will comply with International Maritime Regulations as well as: • All vessels, regardless of size, will be required to carry Automatic Identification System (AIS) Equipment on board. • All vessels engaged in activities will comply with relevant regulations for their size and class of operation and assessed on their 'fit for purpose' for any activities that they are required to carry out. • All marine operations will be governed by operational limits, tidal conditions, weather conditions and vessel traffic information. Marine operations will be carried out in daylight as far as is practicable. Final decisions will be taken by the Master of any vessel. • Coastguard and local rescue and emergency services will be informed in advance as per ERCoP and additional notification will be publicised via maritime safety information including notification of any hazardous occurrences. • The Coastguard should be notified as per ERCoP each

	time a vessel departs for operations within the wind park area. The report will include person on board, activities being carried out, and turbine number (if appropriate) and estimated times of arrival/departure. All vessels used should be subject to a risk assessment as part of works vessel planning to assess any impacts associated within the location or type of activity present in the area.
Implementation of Layout Rules	Layout rules will ensure that the layout pattern does not cause any unacceptable impacts upon navigation safety for commercial vessels, recreational craft and fishing vessels including them manoeuvring between turbines.
Inter Array Cable Information Promulgated	Inter-array cable layout will be available so vessels can easily identify the location of cables if required (this may be through use of charts or cables information sheets).
Inspection and maintenance regime	Implement an inspection and maintenance regime to ensure that cables do not become exposed and present a hazard to navigation.
Mitigating EMF	With the possible exception of a small number of specific locations (such as the vicinity of the cable landfall) impacts associated with compass deviation will be minimal. However where an issue is identified during the detailed design phase some localised areas may be subject to a specific navigational risk assessment and further mitigation if appropriate.
Operational Safety Zones	Operational safety zones cannot be applied for pre-construction. Following recent MCA and NOREL minuted correspondence, 50m fixed safety zones may be applied for, post consent, in line with DECC legislation should a navigation safety case be presented. However it is noted at this stage, and in conjunction with the MCA, that 50m safety zones are not considered a required mitigation and have therefore not been considered during the impact assessment.
Safety Management System	The SMS should include processes in places to ensure that the mitigations identified as reducing risks are maintained and monitored effectively. This is likely to be done through the marine coordination centre.
Safety Zones Around Partially developed Structures	Establishing 500 metres working safety zones around partially developed structures that pose a threat to navigation safety.
Temporary Aids to	Use of temporary aids to navigation (including buoyage and

Navigation during Construction, Decommissioning and Significant Maintenance	lighting) to mark hazards during the construction and decommissioning phases of the project and significant periods of maintenance. These aids to navigation would guide vessels around temporary navigational hazards such as turbines which are partially constructed and not yet adequately lit. It is noted that the development will occur in phases and therefore Forewind will be required to consult with THLS on the temporary marking of those phases when they have been defined.
Use of Guard Vessels during Construction and Decommissioning	The use of guard vessels will be used during construction, decommissioning and significant maintenance to both protect the installations and workers on the 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. An assessment of the level of risk of the current activity will be assessed by Forewind pre works commencement. It is noted that during the construction and decommissioning phases.
Use of vessels own fenders as mitigation for low energy impacts	During consultation with recreational stakeholders, it was noted that a vessel could use its own fendering system to mitigate the impact of low energy impacts. This could include work vessels associated with the development where fenders could be placed in vulnerable positions.
Works Vessel Coordination	Establish a works vessels coordination centre to monitor and control movement within, to and from the park to both the construction and operation base/s. The works vessels coordination centre would also be responsible for the cooperation with emergency response coordinators. This could include the use of entry/exit point or construction traffic corridors. This will include the control of responses during events such as vessels not under command in proximity to the site.

27. Emergency Response Study

Existing emergency response has limited benefits for Dogger Bank zone developments due to the distance offshore and the limited number of vessels/aircraft that have the capability to reach the site.

The shortest time for a helicopter to reach the middle of the farthest site (Dogger Bank Teesside A) is likely to be 50 minutes plus readiness time, which is considered to be too long to provide emergency medical care in the event of a serious accident.

It is noted that IMO requirements, such as SOLAS, provide a good level of cover for emergency response including search and rescue, medical facilities and firefighting capability for onsite marine vessels however this ability has limited use for assisting with other installation incidents.

Additional requirements for emergency response at Dogger Bank Teesside A & B are therefore required to provide a safe level operation, however for initial development it is likely that this can be managed through adoptions to onsite vessels and facilities on board accommodation platforms/vessels.

Additional resources for consideration at this stage could include;

- Call off contracts for SAR helicopters and medical assistance including medivacs;
- Additional towage requirements fitted to some on site vessels and a call off contract for large salvage and/or pollution incidents.
- Pollution response and clean up equipment stored offshore to deal with Tier one incidents, which further capability on call off contract.
- MOB capabilities on all offshore vessels
- Additional medical training for designated people working offshore including a dedicated emergency medical team located on accommodation platform.
- Specialist training in near-drowning and secondary drowning, electrocution and fall from height.

As the development grows it is likely that the number of incidents also may increase, leading to additional emergency response requirements. Although each offshore wind farm development will have individual operators it is essential that emergency response facilities are considered as a joint service.

Recommended next steps include consulting with the Maritime and Coastguard Navigation Safety branch, HM Coastguard Representatives and potential SAR providers.

It would also be beneficial to liaise with other groups such as BP Jigsaw for feedback and guidance as well as other offshore developers in proximity to the Dogger Bank zone.

28. Communication and On Board Navigation

28.1 *Communications and Position Fixing*

The following summarises the potential impacts of the different communications and position fixing devices used in and around offshore wind farms. The basis for the assessment is the trials carried out by the MCA, British Wind Energy Association (BWEA now operating as Renewables UK) and QinetiQ which included analysis impacts on marine navigation and communication systems for personnel / vessels operating in and around other offshore wind farm sites.

28.1.1 Very High Frequency (VHF) Communications (including Digital Selective Calling)

As part of the 2004 trails 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 wind farm structures.

The wind farm structures had no noticeable effect on voice communications within the wind farm 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.

During this trial a number of mobile telephone calls were made from ashore, within the wind farm, and on its seaward side. No effects were recorded using any system provider (MCA and QinetiQ, 2004).

Following assessment of these independent reports no significant impact is anticipated at the proposed Dogger Bank Teesside A & B.

28.1.2 VHF Direction Finding

During the same trails 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 50m). This is deemed to be a relatively small scale impact due to the limited use of VHF direction finding equipment and will not impact operational or SAR activities, especially as the effect is now recognised by the MCA (MCA and QinetiQ, 2004).

28.1.3 Automatic Identification System (AIS)

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 Offshore Wind Farm site and no significant impact is anticipated for AIS signals being transmitted and received at the proposed Dogger Bank Teesside A & B (MCA and QinetiQ, 2004).

28.1.4 Navtex Systems

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.

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.

The 490 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.

Although no specific trials have been undertaken no significant effect has been noted at operational sites and therefore no effects are expected at the Dogger Bank Teesside A & B.

28.1.5 Global Positioning System (GPS)

Global Positioning System (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’.

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).

Therefore there are not expected to be any significant impacts associated with the use of GPS systems within or in proximity to the wind farm.

28.1.6 Electromagnetic Interference on Navigation Equipment

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 can be used to calculate heading, used with a sextant to calculate latitude, and with a marine chronometer to calculate longitude.

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.

No impacts 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).

An additional navigational impact was identified based on electromagnetic interference on small vessels' (mainly recreational craft and small fishing boats) magnetic compasses.

The offshore export cable is proposed to be Direct Current (DC) which will then be converted to Alternating Current (AC) onshore. Direct current export cables have the potential to cause localised compass deviations when vessels are in close proximity to them due to the electromagnetic fields generated by the cable. The amount by which the compass is offset depends on the angle the cable makes with the magnetic meridian and the water depth.

Compass deviations are greatest in water depths less than 10 metres and where the cable is not buried or bundled. For the landfall option at Teesport, the water depth does not fall below 10 metres until about one nautical mile

Given the lower numbers of vessel movements in the area that are likely to be operating solely on a magnetic compass and the small area of the offshore export cable route where the water depth is below 10 m the effect is considered to be minor. Cables will be buried or otherwise protected thus decreasing the deviations further with the possible exception of a small number of specific locations. Therefore where an issue is identified during the detailed design phase some localised areas may be subject to a specific navigational risk assessment and further mitigation if appropriate.

This should be monitored throughout the design/cable selection stage of the project and the potential for compass deviations taken into account at all stages.

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.

It is noted that Forewind are committed to reducing this impact to as low as reasonably practicable in line with FSA requirements.

28.2 *Impact on Marine Radar systems*

In 2004, the MCA conducted trials at the North Hoyle offshore wind farm off North Wales to determine any effect of wind turbines on marine communications and navigation systems (DfT, 2004).

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

This trial identified areas of concern with regard to the potential impact on ship 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 (PLA) around the Kentish Flats offshore wind farm in the Thames Estuary. Based on the results of the North Hoyle trial, the MCA produced a wind farm/shipping route template to give guidance on the distances which should be established between shipping routes and offshore wind farms.

A second trial was conducted at Kentish Flats between 30 April 2006 and 27 June 2006 on behalf of British Wind Energy Association (BWEA, 2007). The project steering group had members from Department for Business Enterprise & Regulatory Reform (BERR), the MCA and the PLA. This trial was conducted in Pilotage waters and in an area covered by the PLA VTS. 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.

The trial concluded that:

- The phenomena referred to above detected on marine Radar displays in the vicinity of wind farms can be produced by other strong echoes close to the observing ship although not necessarily to the same extent;
- Reflections and distortions by ships structures and fittings created many of the effects and that the effects vary from ship to ship and Radar to Radar;
- VTS scanners static Radars can 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 in or near the wind farm were detectable by Radar on ships operating near the array but were less detectable when the ship was operating within the array.

The potential Radar interference is mainly a problem during periods of bad visibility when mariners may not be able to visually confirm the presence of other vessels in the vicinity (i.e. those without AIS installed which are usually fishing and recreational craft).

Based on the trials carried out to date, the onset range from the wind turbines of false returns is approximately 1.5NM, with progressive deterioration in the Radar display as the range closes. If interfering echoes develop, the requirements of the COLREGS Rule 6 Safe speed are particularly applicable and must be observed with due regard to the prevailing circumstances. In restricted visibility, Rule 19 Conduct of vessels in restricted visibility applies and compliance with Rule 6 becomes especially relevant. In such conditions mariners are required, under Rule 5 Lookout to take into account information from other sources which may include sound signals and VHF information, for example from a VTS, or AIS (MCA, 2008b).

Figure 28.1 and Figure 28.2 present the deviated routes for the proposed Dogger Bank Teesside A and Dogger Bank Teesside B, respectively. 500 m, 1.5NM and 2NM buffers have been applied around each wind turbine location to illustrate current passing distances.

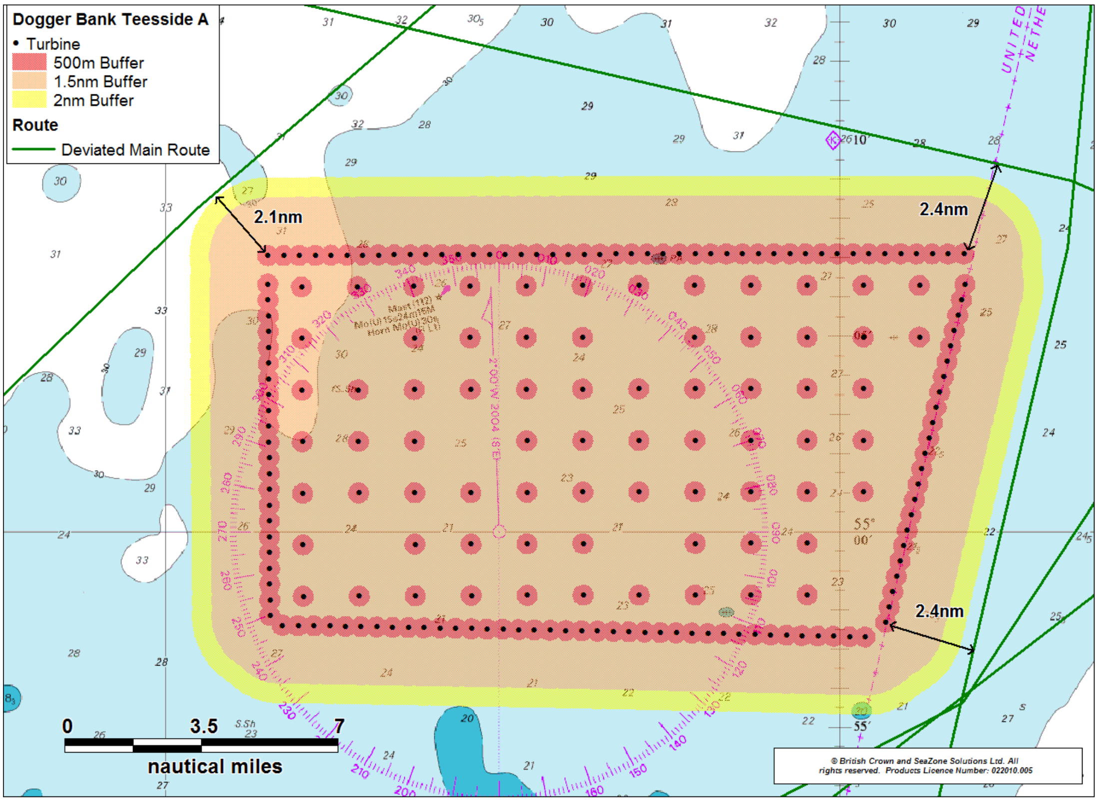

Figure 28.1 Dogger Bank Teesside A Deviated Main Routes and Passing Distances

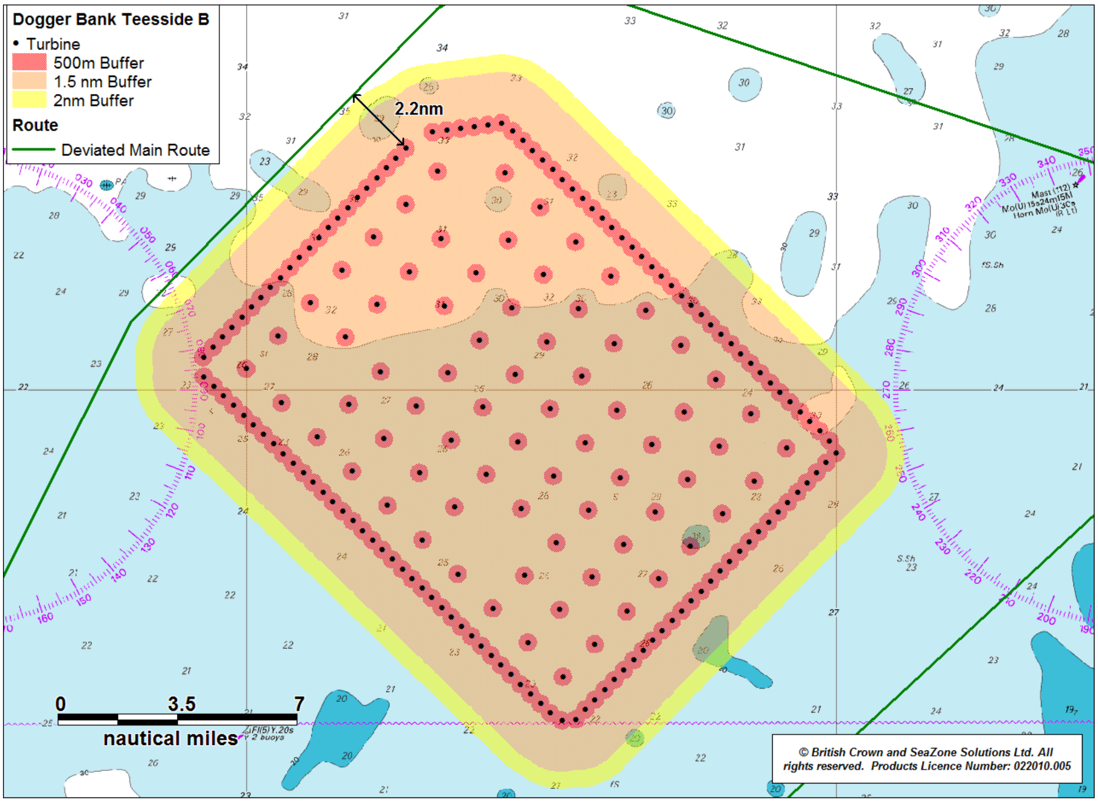

Figure 28.2 Dogger Bank Teesside B Deviated Main Routes and Passing Distances

It is noted that upon development of the proposed Dogger Bank Teesside A and Dogger Bank Teesside B, commercial vessels are likely to pass 1 to 1.5NM from the site, thereby subject to a small level of Radar interference. There is sufficient sea room around the proposed wind farm for vessels to increase their clearance further if they consider it necessary.

Experienced mariners should be able to suppress the observed problems to an extent and for short periods (a few sweeps) by careful adjustment of the receiver amplification (gain), sea clutter and range settings of the Radar. However, there is a consequential risk of losing targets with a small Radar cross section, which may include buoys or small craft, particularly yachts or Glass Reinforced Plastic (GRP) constructed craft, therefore due care is needed in making such adjustments. The Kentish Flats study observed that the use of an easily identifiable reference target (a small buoy) can help the operator select the optimum Radar settings.

The performance of a vessel's automatic Radar plotting aid (ARPA) could also be affected when tracking targets in or near the proposed wind farm. However, although greater vigilance is required, it appears that during the Kentish Flats trials, false targets were quickly identified as such by the mariners and then the equipment itself.

The evidence from mariners operating in the vicinity of existing wind farms is that they quickly learn to work with and around the effects. The MCA has produced guidance to mariners operating in the vicinity of UK OREIs which highlights Radar issues amongst others to be taken into account when planning and undertaking voyages in the vicinity of OREIs off the UK coast (MCA, 2008b).

AIS information can also be used to verify the targets of larger vessels, generally ships above 300 tonnes, however small fishing and recreational craft are increasingly utilising the cheaper Class B AIS units.

28.3 *Structures and Generators affecting Sonar Systems in Area*

No evidence has been found to date with regard to existing wind farms 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 Dogger Bank Teesside A & B.

28.4 *Noise Impact*

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

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 ship (based on length).

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 Dogger Bank Teesside A & B. Foghorns will also be audible over the background noise of the wind farm.

Therefore, there is no indication that the sound level of Dogger Bank Teesside A & B will have any significant influence on marine safety.

28.4.1 Noise Impacting Sonar

Once in operation it is not believed that there will be any subsea acoustic noise generated by the proposed Dogger Bank Teesside A & B that will have any significant impact on sonar systems due to the fact that these systems are already designed to work in noisy environments.

28.5 *Human Element*

MGN 372 has been developed to provide guidance on planning and undertaking voyages in the vicinity of OREIs and states 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.

28.6 *Visual Navigation and Collision Avoidance*

The boundaries of Dogger Bank Teesside A & B are not expected to increase navigational risk for vessels transiting due to the areas of open sea that are available for vessels to increase their closest point of approach from the site as well as the low number of vessels that transit on each route daily (maximum number of vessels per day was 5). Routes generally run in a south west to north east direction either to the west or east of Dogger Bank A and B and therefore are not expected to increase encounter numbers or create areas of congestion or pinch points.

Commercial vessels are expected to avoid transiting through the site however commercial fishing vessels, wind farm operations and maintenance vessels and minimal recreational vessels may transit through. Marine vessels coordination and promulgation of information into current areas of activity will enable these vessels to avoid encounters or create areas of congestion.

28.6.1 Visual Impacts (vessel detection by Radar or sight)

The detection of vessels by Radar when within or in close proximity to wind farms may be impaired, therefore increasing the risk of vessel encounters. It is anticipated that a large number of fishing vessels and the wind farm associated vessels will continue to transit through the development. It is noted that wind farm associated traffic will be controlled through a marine traffic coordination centre.

Both the MCA and RenewablesUK (Previously known as the British Wind Energy Association, BWEA) commissioned and undertook reports in the effects of wind turbines on marine Radar systems. Investigations of Technical and Operational Effects on Marine Radar Close to Kentish Flats Offshore Wind (BWEA, 2007) investigated both the effects on small craft and commercial vessels and concluded that;

- The phenomena detected on marine radar displays in the vicinity of a wind farm can be produced by other strong echoes close to the observing ship, although not necessarily to the same extent. Trained mariners will recognise and understand the causes of these effects;
- Selected small craft operating in and near the wind farm were detectable by radar on ships operating near the array. The return signals appeared to be relatively unaffected by passing through the array although normal or automatic gain levels could eclipse very small targets;
- Echoes of small craft within the wind farm can merge with strong echoes generated by the turbines when the craft pass close to the towers making them invisible to radar observers or automatic plotting facilities. While navigating, this effect will only be temporary until the craft moves away from the turbine; and

- Small craft operating within the wind farm array were less detectable by type approved, or non-approved, radars on other vessels when the latter were operating within the array. This appeared to be due to enhanced effects from the close approach to the turbine towers and the reflective effects caused by them. Careful adjustment of Gain could improve detection but skill was required on the part of the operator.

Figure 28.3 shows the Radar display photographed during the Radar trials at Kentish Flats, the arrow shows a small craft being tracked through the site.

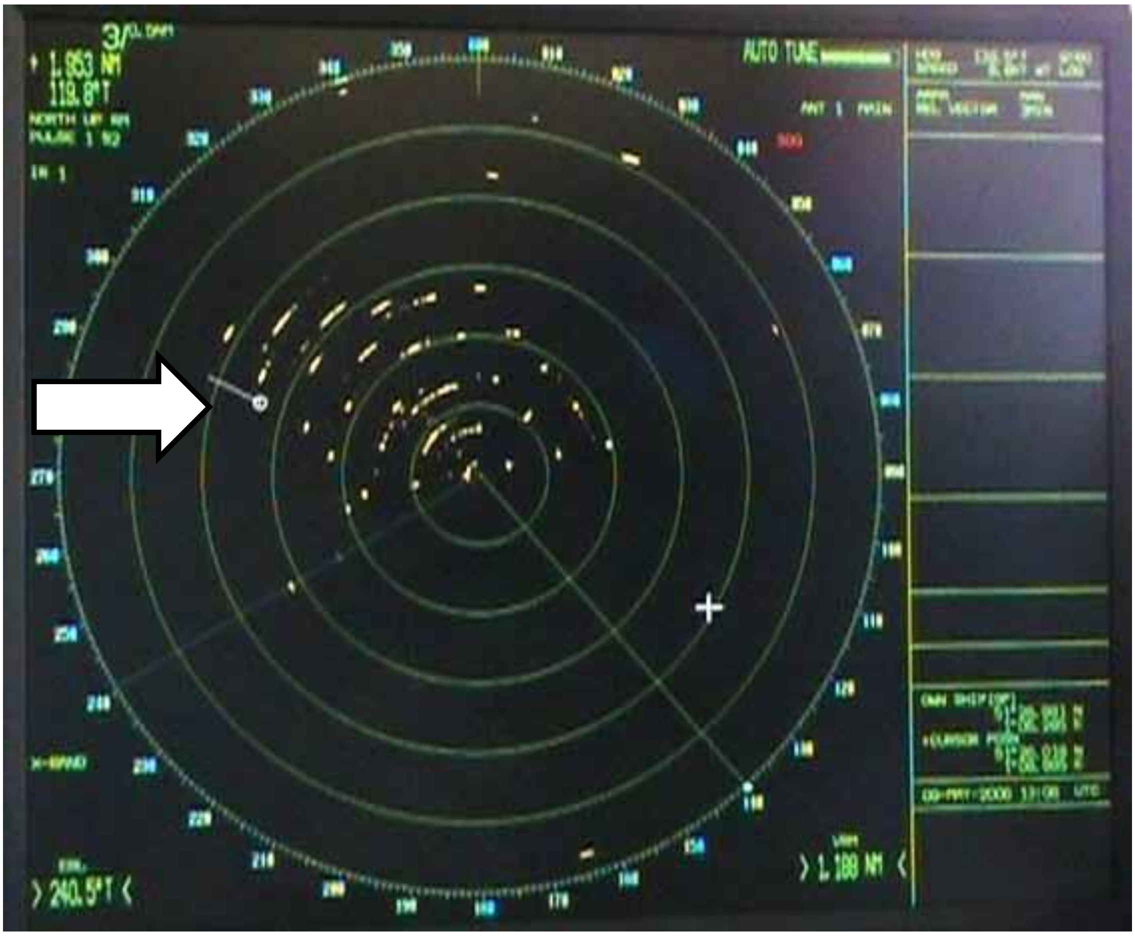

Figure 28.3 Radar Image Showing Small Craft Tracked Within Kentish Flats (BWEA, 2007)

Following assessment of studies undertaken and consultation with regulators they are not expected to be significant effects on with the use of Radars within the wind farm or monitoring vessels within the wind farm. Careful consideration for lighting and marking in conjunction with THLS will also enable a lighting scheme and sound signals to be developed that's does not hinder monitoring small craft movements within the wind farm in the hours of darkness or during reduced visibility.

28.6.2 Visual Impact (Navigational Aids and/or Landmarks)

Due to the distance offshore of Dogger Bank Teesside A & B there will be no impacts on existing AtoN and/or landmarks.

29. Cumulative Effects

Cumulative and in-combination effects have been considered for the Dogger Bank Teesside A & B, Creyke Beck A & B, Dogger Bank Teesside C & D, other proposed offshore wind developments and the impacts arising from other marine activities or uses of the sea.

Following assessment of the baseline it has been identified that the development of the Dogger Bank Teesside A & B have cumulative and/or in-combination effects with the navigational activity of other receptors. The following receptors have been identified which the potential to create an cumulative effect;

- Other Offshore Wind Farms;
- Recreational Craft (2.5 – 24 metres);
- Marine Aggregate Dredgers;
- Commercial Fishing;
- Port Operations; and
- MOD Defence – Practice and Exercise Areas.

Using the baseline information contained within this NRA, feedback from the hazard workshop, consultations and with consideration for The Crown Estates Report (2012), Strategic assessment of impacts on navigation of shipping and related effects on other marine activities arising from the development of Offshore Wind Farms in the UK REZ, the following cumulative or in-combination activities have been identified.

The following section analyses the marine traffic routeing when Dogger Bank Teesside and Creyke Beck are fully developed. The scenario of cumulative effects which has been considered is as follows:

- Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B; and
- Dogger Bank Teesside A & B, with Dogger Bank Creyke Beck A & B + Dogger Bank Teesside C & D.

29.1 *Other Offshore Wind Farms*

29.1.1 Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B

The following figures show the cumulative scenario being considered and the realistic worst case layouts that have been used within the collision and allision risk modelling. Dense boundaries have been selected due to the allision risk presented by the larger number of turbines exposed to passing traffic routes.

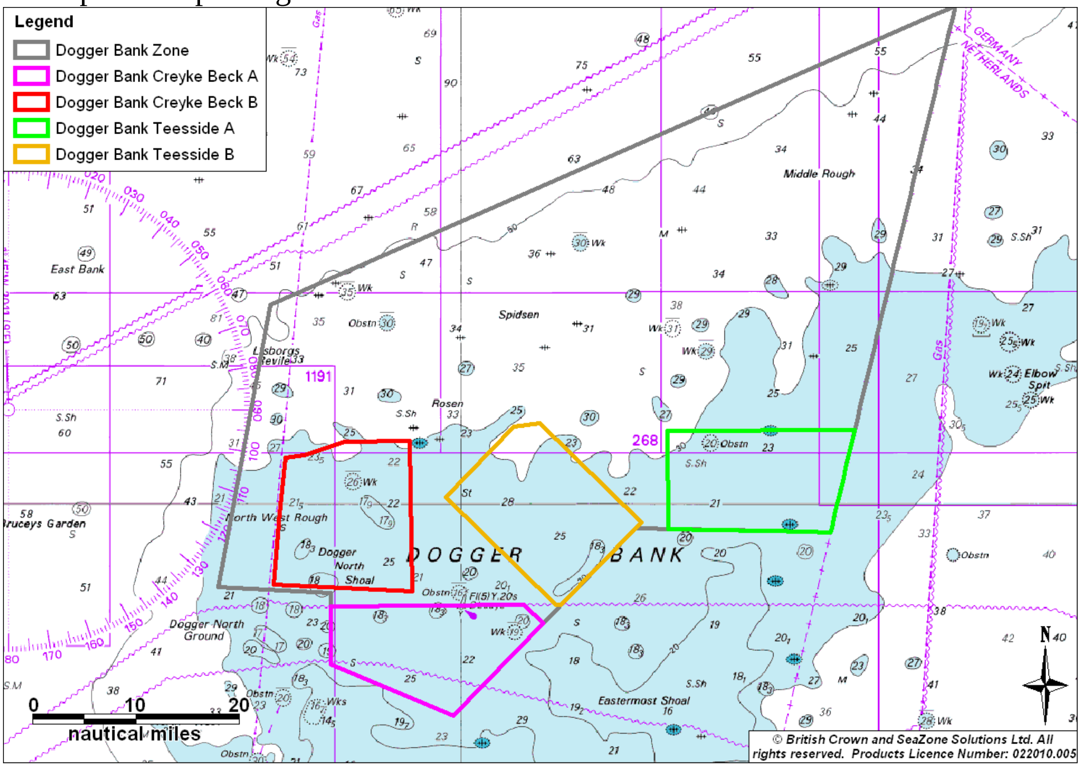

Figure 29.1 Cumulative Scenario – Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B

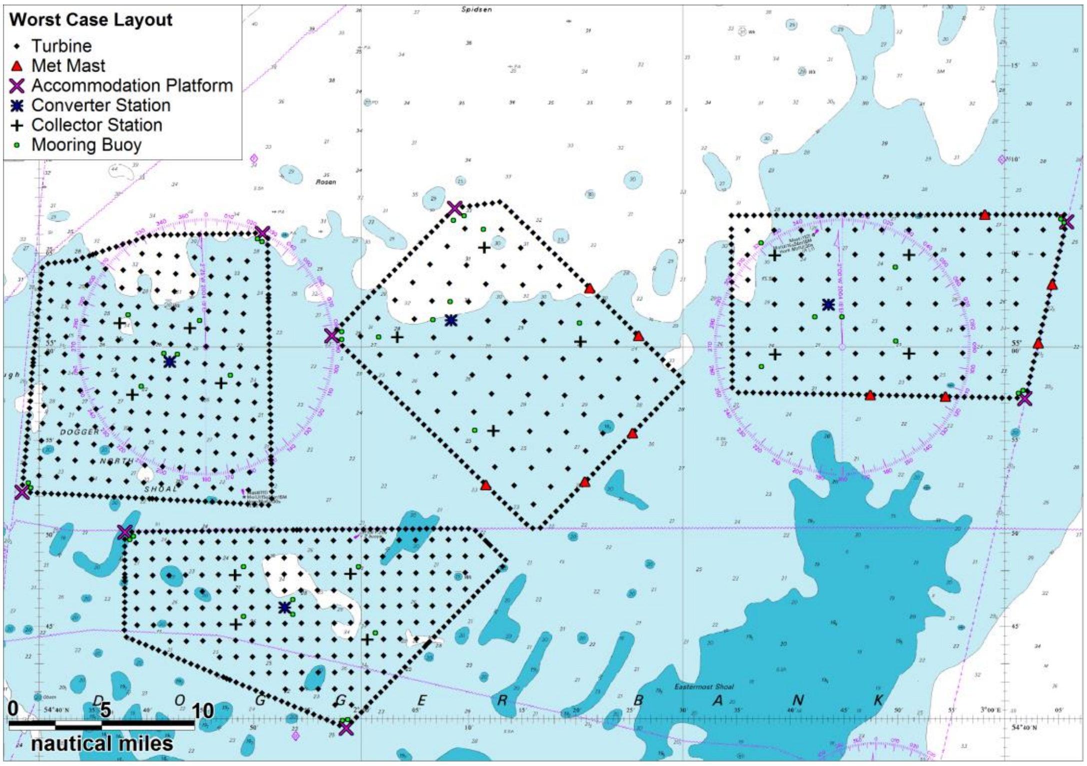

Figure 29.2 Cumulative Scenario – Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B Worst Case Layout.

29.1.2 Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B and Dogger Bank Teesside C & D.

The following figures show the cumulative scenario being considered and the layouts that have been used within the collision and allision risk modelling. Again as with the first scenario dense boundaries have been selected due to the allision risk presented by the larger number of turbines exposed to passing traffic routes.

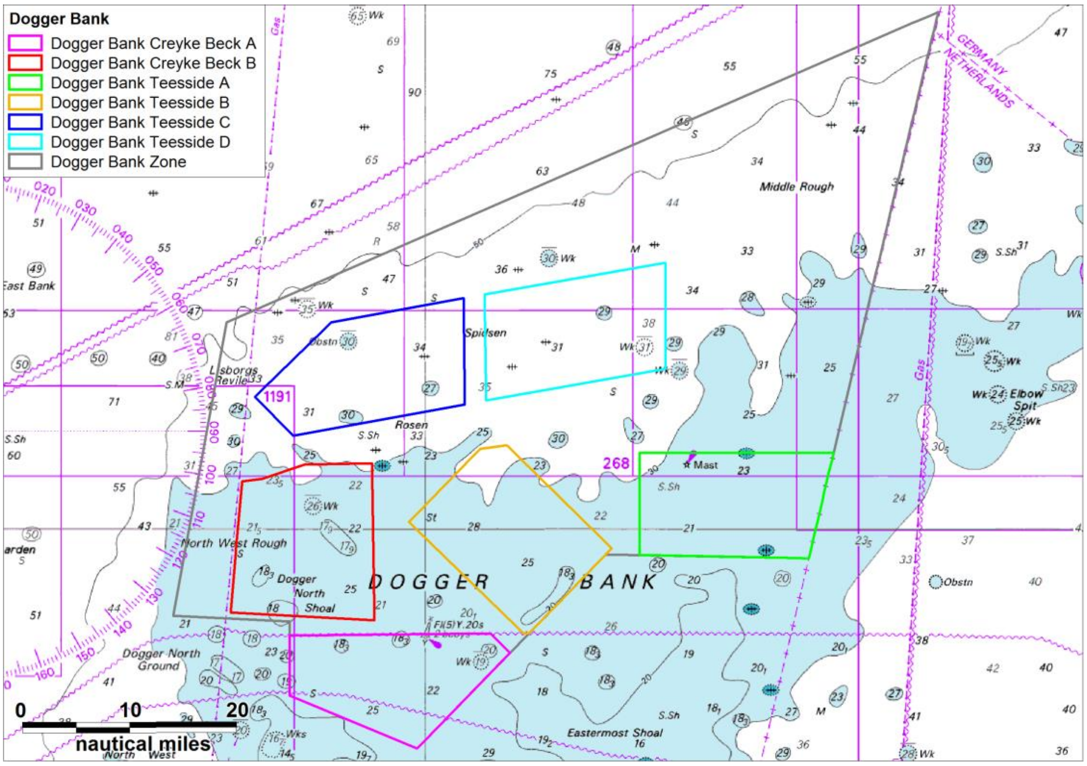

Figure 29.3 Cumulative Scenario – Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B and Dogger Bank Teesside C & D.

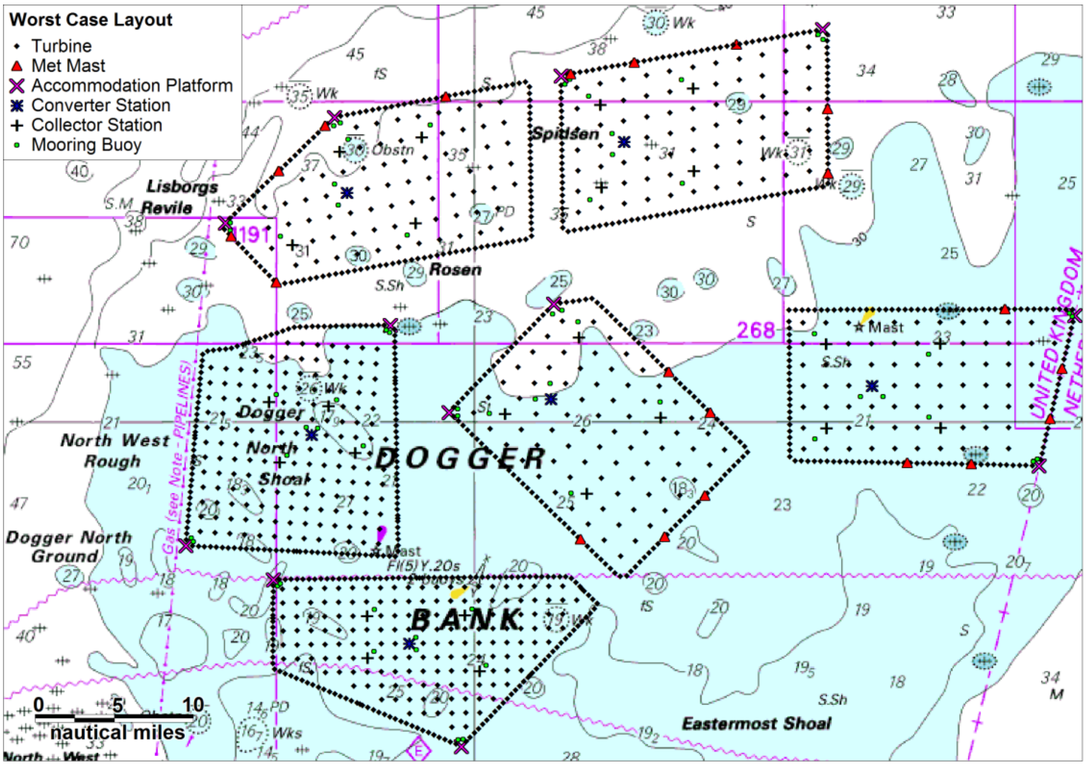

Figure 29.4 Cumulative Scenario – Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B and Dogger Bank Teesside C & D Worst Case Layout.

Following assessment of the cumulative baseline it has been identified that the development of Dogger Bank Creyke Beck A & B in combination with Dogger Bank Teesside A & B has the potential to;

- Displace and congest vessels from existing routes;
- Cause visual confusion due to alignment of structures;
- Create in-combination impacts with other offshore renewable developments;
- Impact adverse weather routes;
- Reduce access to existing infrastructure;
- Impair vessel detection – visual or Radar;
- Reduce the available sea room for defence activities; and
- Increase or diminish emergency response.

29.1.3 Displacement for vessels on existing routes

The following figure shows that although vessels will be further displaced by the development of Dogger Bank Creyke Beck A & B as well as Dogger Bank Teesside A & B, the actual increase in a total journey's lengths are minimal in particular when noted against the distance offshore the wind farms are located and therefore a vessels ability to make an early and minor course deviation.

The anticipated routes that vessels would be required to take in order to pass the wind farm structures at a safe distance have been identified. These routes are illustrated in Figure 29.5 and the associated increases in time and distance are presented in Table 29.1. The re-routes have been drawn in line with the factors identified in Section 18.5.

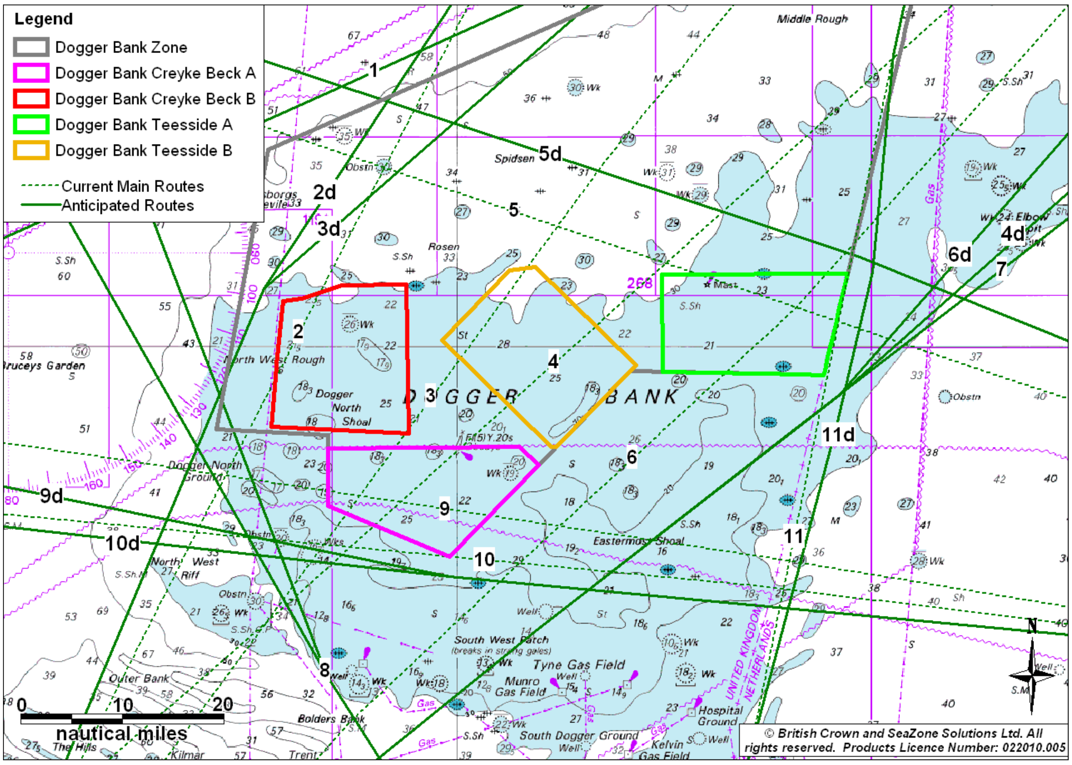

Figure 29.5 Alternative Routes for Cumulative Scenario – Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B

Table 29.1 shows a maximum increase of 22 minutes or 1.2% of the total journey distance for the average vessel on that route around Dogger Bank Creyke Beck A & Dogger Bank Creyke Beck B and Dogger Bank Teesside A & Dogger Bank Teesside B wind farms. This assumes that vessel make a late alteration to demonstrate a realistic worst case with regards to routeing.

Table 29.1 Increase in Route Distances for Cumulative Scenario

Route	Increase in Distance (nm)	% Difference	Change in Time for Average Speed Vessel (minutes)
Route 2	0.5	0.1%	2.5
Route 3	4.3	1.2%	22
Route 4	-4.9	-0.9%	-18

Route	Increase in Distance (nm)	% Difference	Change in Time for Average Speed Vessel (minutes)
Route 5	-0.5	-0.1%	-2
Route 6	1.1	0.3%	5.5
Route 9	0.8	0.2%	4
Route 10	0.1	0.0%	0.5
Route 11	0.2	0.03%	1

These values alongside the consultation received form regular operators in Section 16 indicate that impacts associated with displacement for Dogger Bank Creyke Beck & Dogger Bank Teesside A & B developments is expected to be minor with no further mitigation required.

29.1.4 Dogger Bank Teesside A & B, with Dogger Bank Creyke Beck A & B and Dogger Bank Teesside C & D

The following figure shows that although vessels will be displaced further by the development of Dogger Bank Creyke Beck A & B and Dogger Bank Teesside C & D, the actual increase in a total journey's lengths are negligible.

The anticipated routes that vessels would be required to take in order to pass the wind farm structures at a safe distance have been identified. These routes are illustrated in Figure 29.5 and the associated increases in time and distance are presented in Table 29.1. The re-routes have been drawn in line with the factors identified in Section 18.5.

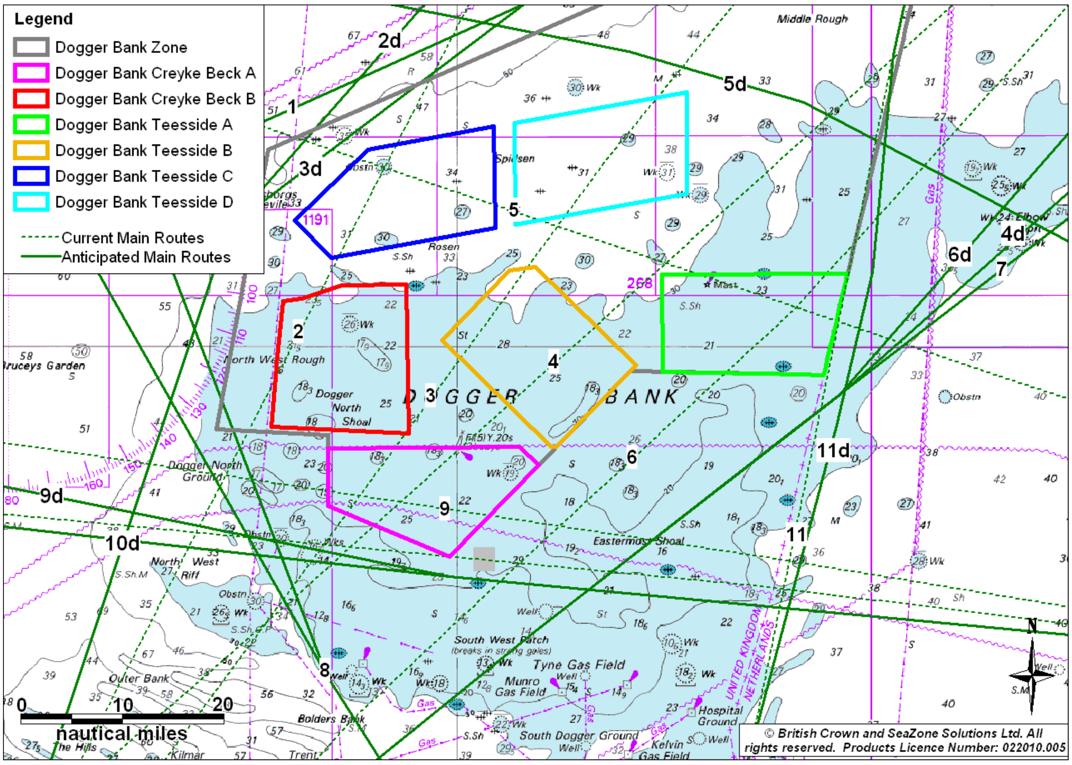

Figure 29.6 Alternative Routes for Cumulative Scenario – Dogger Bank Creyke Beck A & B and Dogger Bank Teesside A, B, C & D

Table 29.2 shows a maximum increase of 36.5 minutes or 2.0% of the total journey distance for the average vessel on that route around Dogger Bank Creyke Beck A, Dogger Bank Creyke Beck B and Dogger Bank Teesside A, Dogger Bank Teesside B, Dogger Bank Teesside C & Dogger Bank Teesside D Wind Farms. This assumes that vessel make a late alteration to demonstrate a realistic worst case with regards to routeing.

Table 29.2 Increase in Route Distances for Cumulative Scenario

Route	Increase in Distance (nm)	% Difference	Change in Time for Average Speed Vessel (minutes)
Route 2	1.8	0.5%	9
Route 3	7.1	2.0%	36.5
Route 4	-4.9	-0.9%	-18
Route 5	1	0.2%	4
Route 6	1.1	0.3%	5.5
Route 9	0.8	0.2%	4
Route 10	0.1	0.0%	0.5

Route	Increase in Distance (nm)	% Difference	Change in Time for Average Speed Vessel (minutes)
Route 11	0.2	0.03%	1

29.1.5 Change in Collision and Allision Risk

Cumulative development of Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B and Dogger Bank Teesside C & D will impact upon the vessel-to-vessel collision risk and the vessel to structure allision risk.

It should be noted that the cumulative modelling takes into account only commercial to commercial vessel collisions and does not factor in the likelihood of fishing vessel collisions. For comparison, Dogger Bank Teesside A & B vessel-to-vessel collision results without having factored in fishing vessel collisions are presented in Table 29.3.

Table 29.3 Vessel-to-Vessel Collisions (commercial vessels only) – Dogger Bank Teesside A & B

Scenario	Collision Frequency
Dogger Bank Teesside A	1 major collision in 2307 years
Dogger Bank Teesside B	1 major collision in 6861 years
Dogger Bank Teesside A & B	1 major collision in 1935 years

Table 29.4 presents the vessel-to-vessel collision risk and Table 29.5 presents the powered vessel-to-structure allision risk for the cumulative developments. Following this, Table 29.6 presents the worst case NUC drifting-to-structure allision risk for the worst case modelled scenario (weather dominated) for the cumulative developments.

Table 29.4 Vessel-to-Vessel Collisions - Cumulative

Scenario	Collision Frequency
Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B	1 major collision in 1117 years
Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B and Dogger Bank Teesside C & D	1 major collision in 656 years

Table 29.5 Powered Vessel-to-Structure Allisions - Cumulative

Scenario	Annual Allision Frequency	Allision Return Period

Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B	1.14E -03	1 every 879 years
Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B and Dogger Bank Teesside C & D	1.70E -03	1 every 590 years

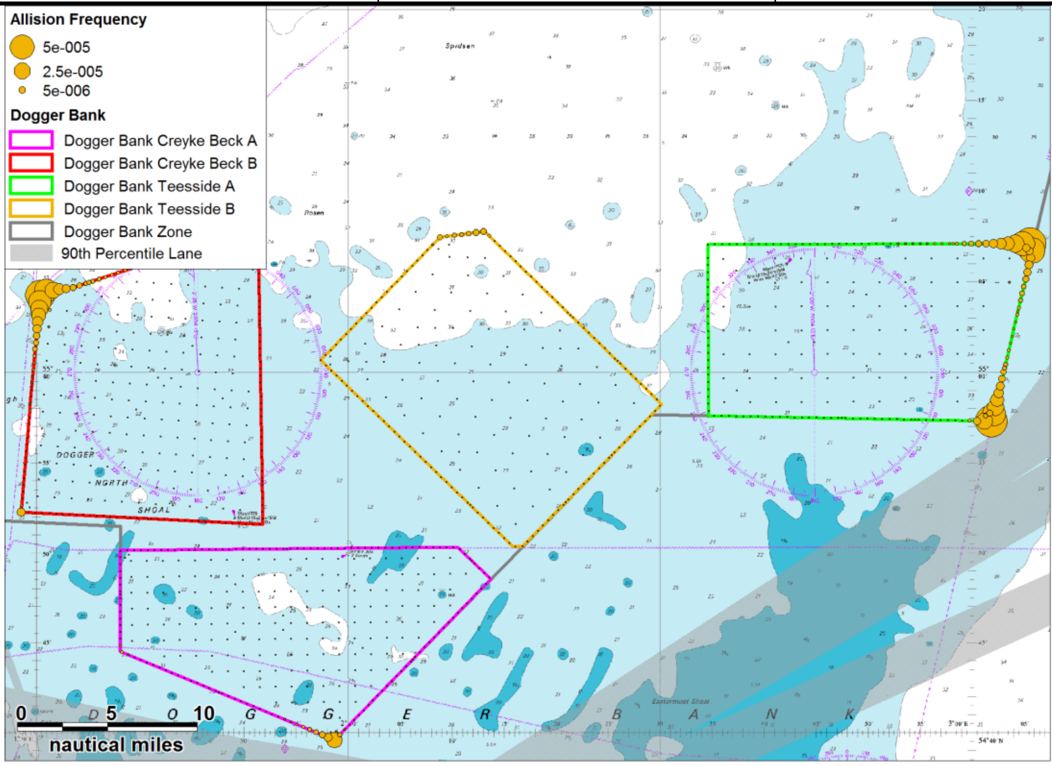

Figure 29.7 Annual Passing Powered Allision Frequency for Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B.

The majority of powered allision frequency is associated with structures on the periphery of the winds when development of Dogger Bank Teesside A & Dogger Bank Teesside B is considered with Dogger Bank Creyke Beck A & Dogger Bank Creyke Beck B, particularly the northwest corner of Dogger Bank Creyke Beck B and the eastern boundary of Dogger Bank Teesside A. It should be noted that the reduction in allision frequency when Dogger Bank Teesside A & Dogger Bank Teesside B and Dogger Bank Creyke Beck A & Dogger Bank Creyke Beck B (879 year return period) are considered against Dogger Bank Teesside A & Dogger Bank Teesside B in isolation (636 year return period) is due to changes in the routeing pattern of vessels in order to navigate around Dogger Bank Creyke Beck A and Dogger Bank Creyke Beck B. This greatly reduces the likelihood of an allision with structures on the western and southern boundaries of Dogger Bank Teesside B thus resulting in an overall lower allision frequency.

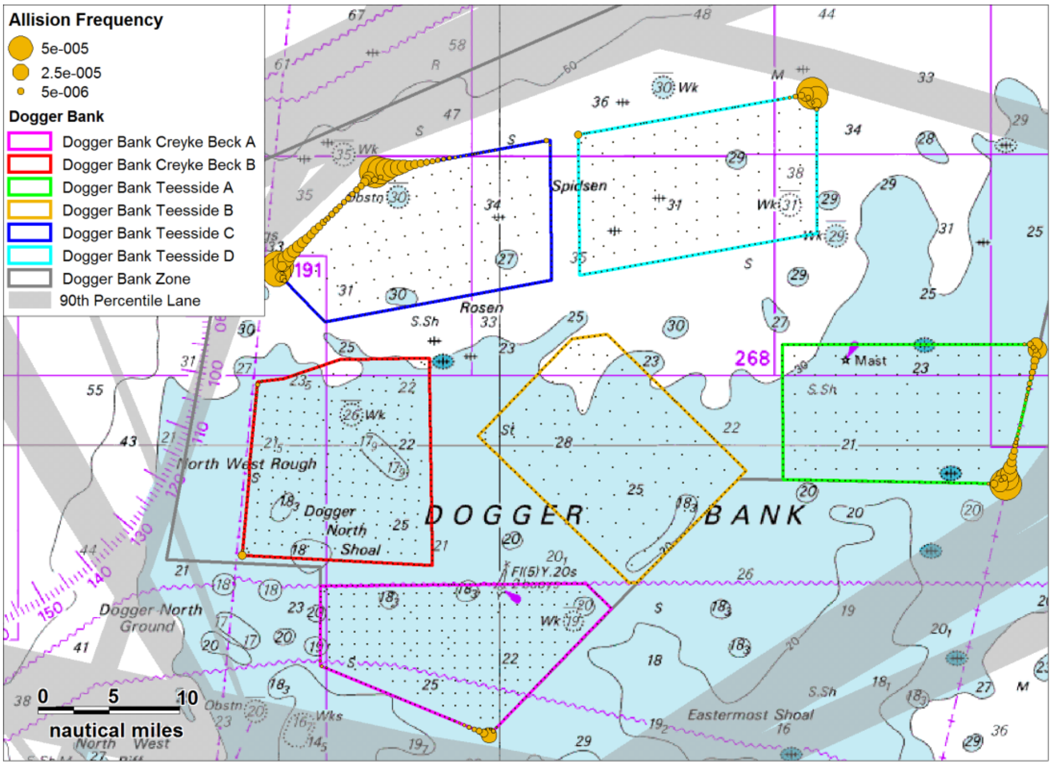

Figure 29.8 Annual Passing Powered Allision Frequency for Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B and Dogger Bank Teesside C & D.

When full development of the Dogger Bank Zone is considered, the majority of the passing powered allision frequency is associated with structures on the northwest boundary of Dogger Bank Teesside C, the northeast corner of Dogger Bank Teesside D and the eastern boundary of Dogger Bank Teesside A which are the closest sides in proximity to the main commercial vessel routes.

Table 29.6 NUC Vessel-to-Structure Allisions – Cumulative

Scenario	Annual Allision Frequency	Allision Return Period
Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B	1.12E -04	1 every 8954 years
Dogger Bank Teesside A & B with Dogger Bank Creyke Beck A & B and Dogger Bank Teesside C & D	2.08E -04	1 every 4809 years

NUC allisions are assessed to be less frequent than powered allision which reflects historical data. The majority of the NUC vessel collision frequency is associated with structures on the periphery of the wind farms when development of Dogger Bank Teesside A & Dogger Bank

Teesside B is considered with Dogger Bank Creyke Beck A & Dogger Bank Teesside B, particularly the northwest boundary of Dogger Bank Creyke Beck B and the eastern boundary of Dogger Bank Teesside A. The majority of NUC vessel collision frequency is associated with structures on the northwest boundary of Dogger Bank Teesside C and the southeast corner of corner of Dogger Bank Teesside A when full development of the Dogger Bank Zone is considered.

Once again the reduction in NUC allision frequency when Dogger Bank Teesside A & Dogger Bank Teesside B and Dogger Bank Creyke Beck A & Dogger Bank Creyke Beck B (8954 year return period) are considered against Dogger Bank Teesside A & Dogger Bank Teesside B in isolation (8934 year return period) is due to changes in the routeing pattern of vessels in order to navigate around Dogger Bank Creyke Beck. This greatly reduces the likelihood of an NUC allision with structures on the western and southern boundaries of Dogger Bank Teesside B thus resulting in an overall lower allision frequency.

29.1.6 Other Offshore Developments including Transboundary

There is the potential for cumulative impacts to arise from the proposed developments within other Round 3 zones in the southern North Sea (Hornsea Zone 4 and East Anglia Zone 5) as well as developments within Transboundary waters.

To address these issues the Southern North Sea Offshore Wind Forum (SNSOWF) was developed to extend the principles of zone appraisal beyond the boundaries of their respective zones in order to manage wider cumulative impact issues between developments. The assessments to date have included:

- Review of current marine traffic survey data collected to date for Dogger Bank, Hornsea and East Anglia Zones;
- Definition and characterisation of the 90th percentile routes across the three zones and within the immediate vicinity; and
- Estimation of potential deviations for 90th percentile routes through proposed routeing measures and/or project development areas.

The SNSOWF report was originally undertake in October 2011 updated in November 2013. The following sections summarise the main findings of the report. It is noted that since the original SNSOWF report was undertaken in 2011 a routeing measures in Dutch waters has changed. A new Traffic Separation Scheme (TSS) has been introduced and revisions made to the existing schemes that were already in place. These changes have also had effects on the SNSOWF routes changing their approach and departure headings from Ijmuiden. These changes were reflected in the 2013 report.

As part of the SNSOWF process the following projects were considered and screened in or out depending on a cumulative pathway being identified. Future developments within the round three zones have not been drawn unless they have already undertaken a scoping phase.

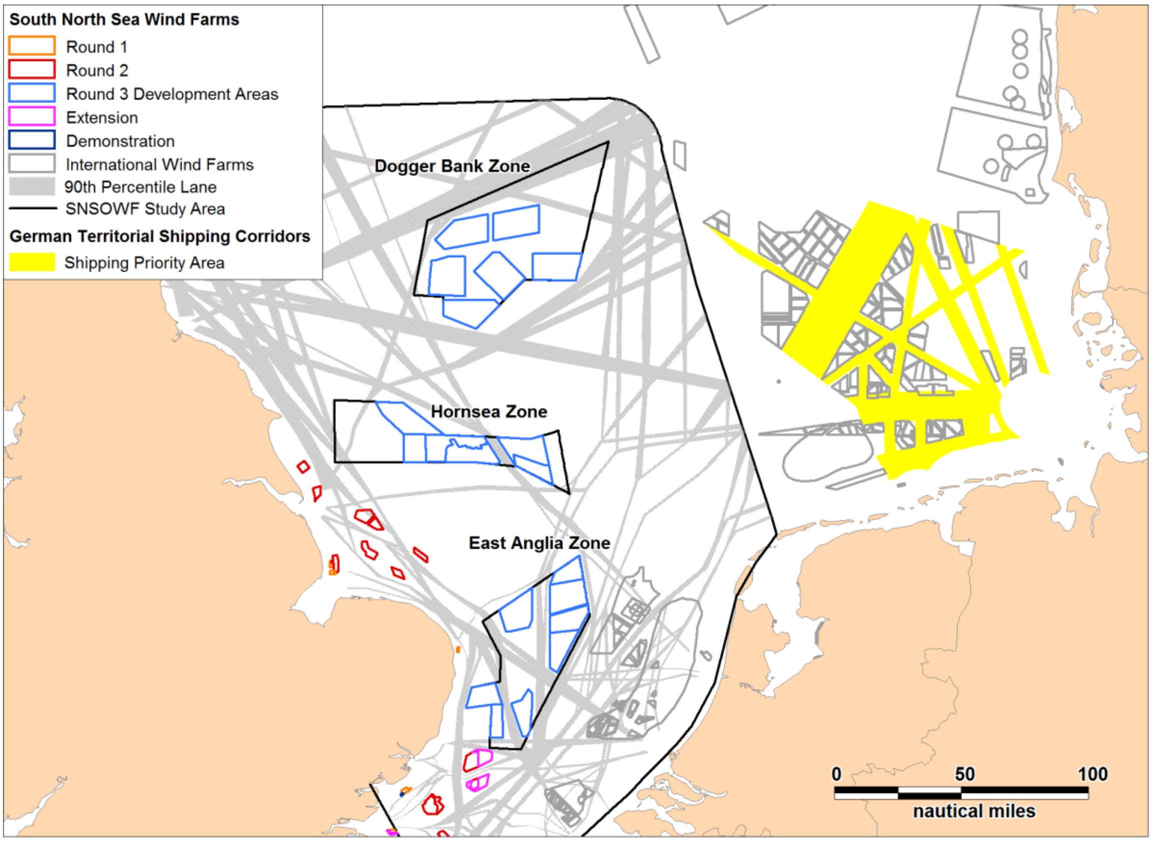

Figure 29.9 Overview of wind farm developments including Round 3 Zones and German Shipping Priority Lanes (Anatec, 2013)

It is considered that Round 1 and 2 wind farms along the east coast of the UK are of a scale and sufficient distance that that are not considered to be any significant cumulative impacts for developments within the Dogger Bank Zone. However they have been considered within the overall SNSOWF report (Anatec, 2013).

The following figure shows the development by phase. Only projects that are at one of the following phase have been screened into the SNSOWF analysis;

- Under Construction
- Partial Generation / Under Construction
- Fully Commissioned
- Consent Authorised; and
- Projects Identified (Scoped) within Round 3 Development Zones.

German Shipping Priority lanes, used by the German authorities to define areas for development within German territorial waters have also been shown and considered within the assessment.

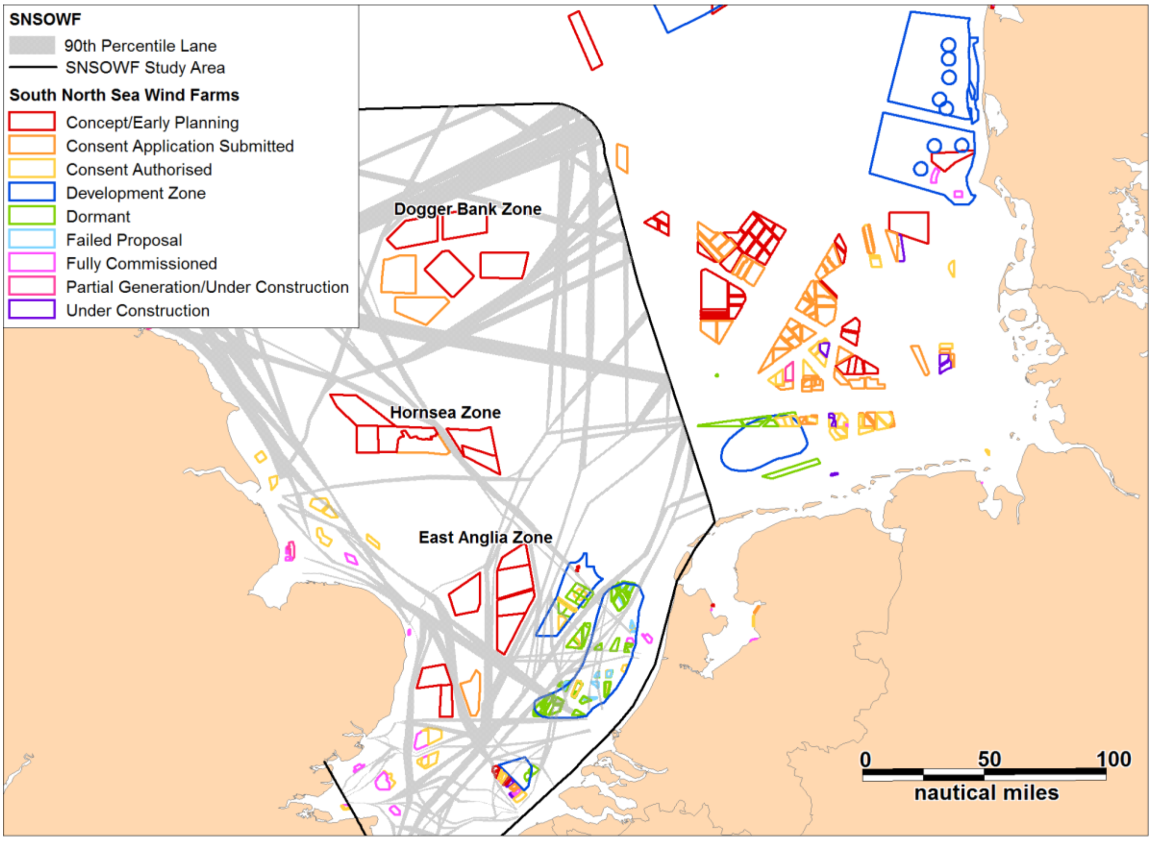

Figure 29.10 Overview of wind farm developments (including Round 3 Zones) colour-coded by development phase (Anatec, 2013)

Figure 29.12 and Figure 29.13 illustrate existing vessel routeing within the southern North Sea for the entire study area and in proximity to the Dogger Bank Zone respectively. Following this, Table 29.7 provides details on the existing vessel routes which pass in proximity to the Dogger Bank Zone. This routing has included consideration for:

- Marine aggregates dredging areas;
- British Marine Aggregates Producers Association (BMAPA) transit routes;
- Oil and gas pipelines;
- Oil and gas installations;
- Wells (all phases);
- Oil and Gas licence areas; and
- Fishing vessel transits.

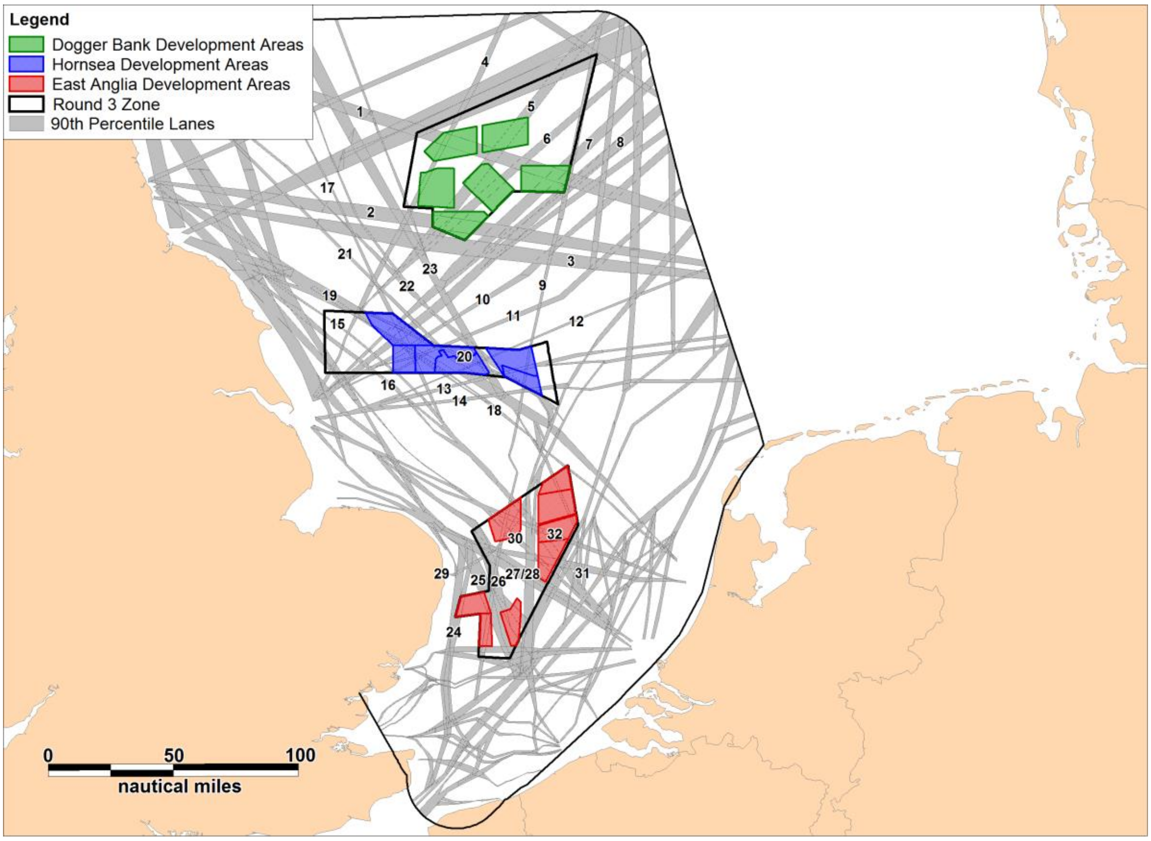

Figure 29.11 Existing Routeing within the Southern North Sea (Anatec, 2013)

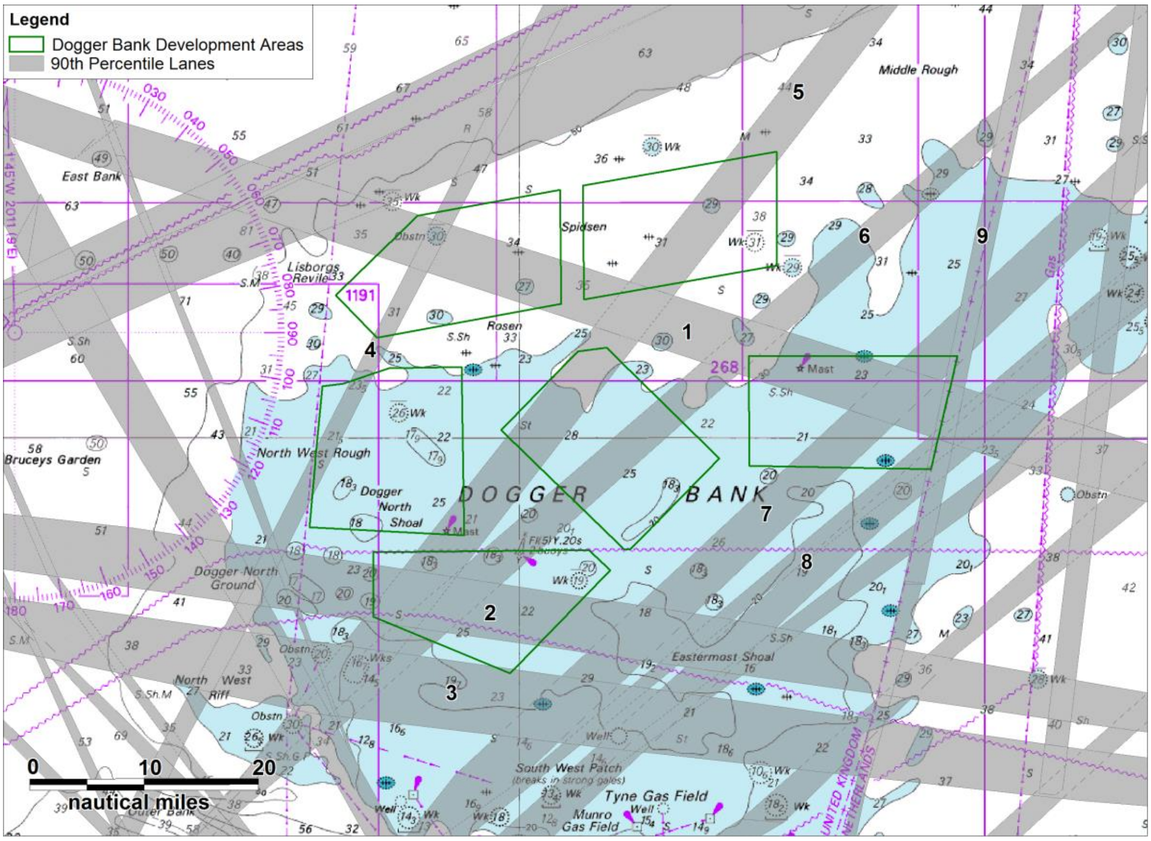

Figure 29.12 Existing Routeing within the Southern North Sea (Dogger Bank Zone Overview) (Anatec, 2013)

Table 29.7 Existing Vessel Routeing in proximity to Dogger Bank Zone.

Route	Destinations	Average Vessels Per Week	Traffic Characteristics
1	Forth Ports to Hamburg (Germany)	1	Cargo, Tanker
2	Tyne (UK) to Hamburg (Germany)	<1	Cargo, Tanker
3	NE UK to Germany / Kiel Canal	<1	Cargo
4	Immingham (UK) to Tananger (Norway)	2	Cargo
5	Humber (UK) to Egersund (Norway)	<1	Cargo, Tanker
6	Humber Ports (UK) and Helsinki (Finland)	1	Cargo

Route	Destinations	Average Vessels Per Week	Traffic Characteristics
7	Humber Ports (UK) to Scandinavia	2	Cargo, Tanker
8	Humber Ports (UK) to Baltic	7	Cargo, Tanker
9	Thames, UK and Norway	1	Cargo, Passenger

Figure 29.13 and Figure 29.14 show the reroutes that were undertaken as part of the SNSOWF project in 2013 and illustrate deviated 90th percentiles through all three projects for both the entire study area and in proximity to the Dogger Bank Zone.

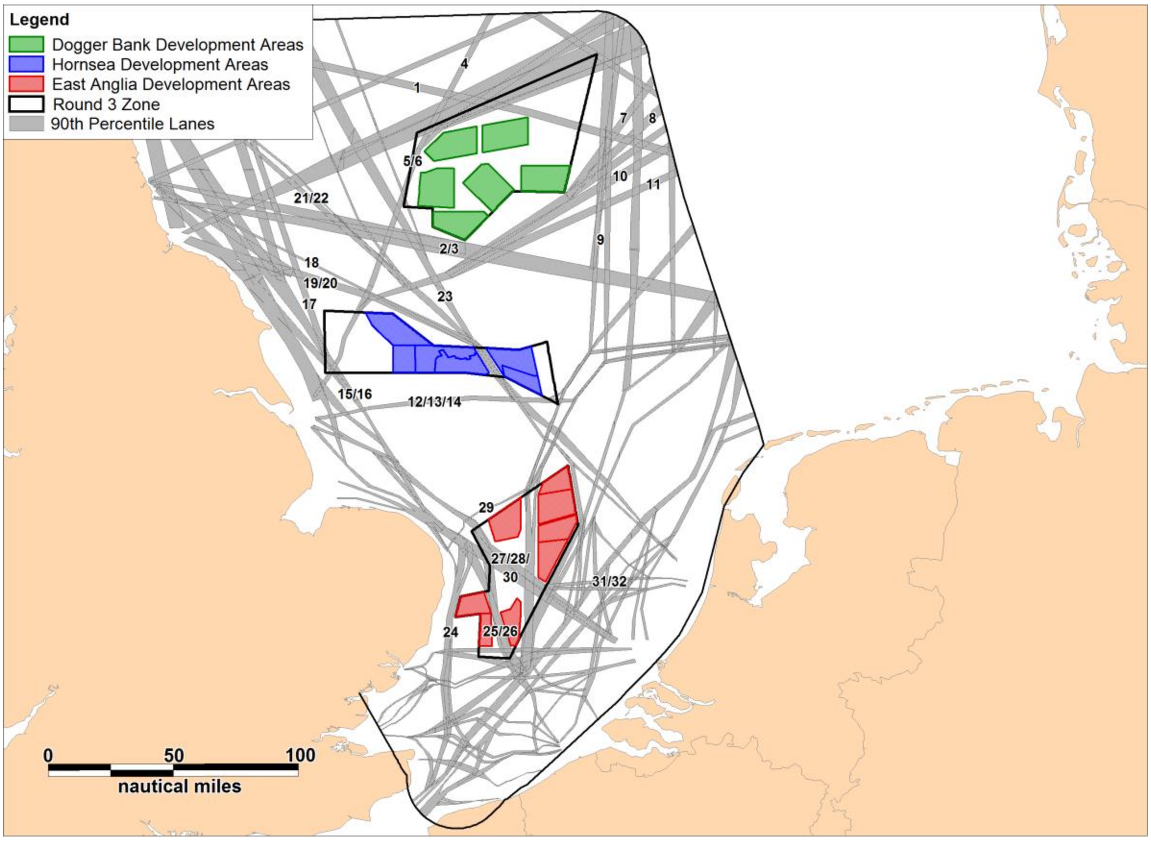

Figure 29.13 Deviated Routeing with Consideration for the SNSOWF Projects (Anatec, 2013)

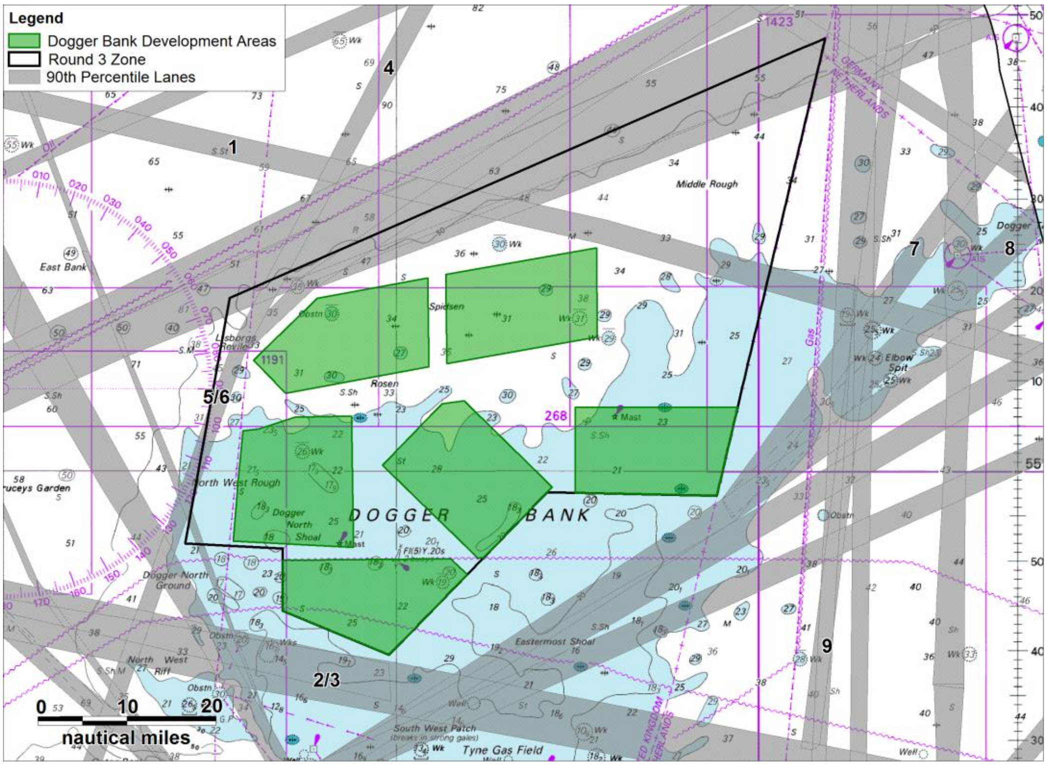

Figure 29.14 Deviated Routeing with Consideration for the SNSOWF Projects (Dogger Bank Zone Overview) (Anatec, 2013)

Cumulative impacts were also reviewed and analysed by The Crown Estate in 2012, and included a working group of key national and international stakeholders. The review indicates that as well as continuing to work with the SNSOWF members until a process is defined from the regulators, the developers should mitigate this impact through consultation with relevant organisations with the EU member states.

It is also noted that as each Round 3 zone is developed, and defined project information becomes available, cumulative impact assessments will be carried out for subsequent projects when these projects move forward and are subject to EIA. This approach complies with IPC requirements which recognise the need to account for the evolution of project plans.

In addition to wind farms in UK waters, there is also potential for cumulative issues related to international development plans for offshore renewables. It was identified that Transboundary issues could arise when developments impact on commercial shipping routes transiting to and from any non UK ports. This could also include impacts on international ports, shipping routes and/or routes being impacted by other international offshore renewable energy developments as well as non-align with mitigation measures put in place by other Transboundary nations such as routeing measures.

Both Transboundary recreational (limited activity) and fishing vessels currently use the proposed development area, and are likely to continue to use it during construction and operation.

29.1.7 SNSOWF and Other Offshore Activities

Figure 29.15 presents aggregate areas relative to the Dogger Bank Development Zone. The North West Rough application area, owned by CEMEX UK Marine Ltd, is located within the Dogger Bank Zone approximately 1.6nm to the north of Creyke Beck B. Dredger transit routes from BMAPA indicate that despite one application area being located within the Development Zone, the Dogger Bank Zone is the least frequently transited zone within the SNSOWF study area. Due to the location of the dredging site, dredger traffic is concentrated only in the south-western corner of the Development Area; however the transit routes frequently intersect the proposed cable corridors.

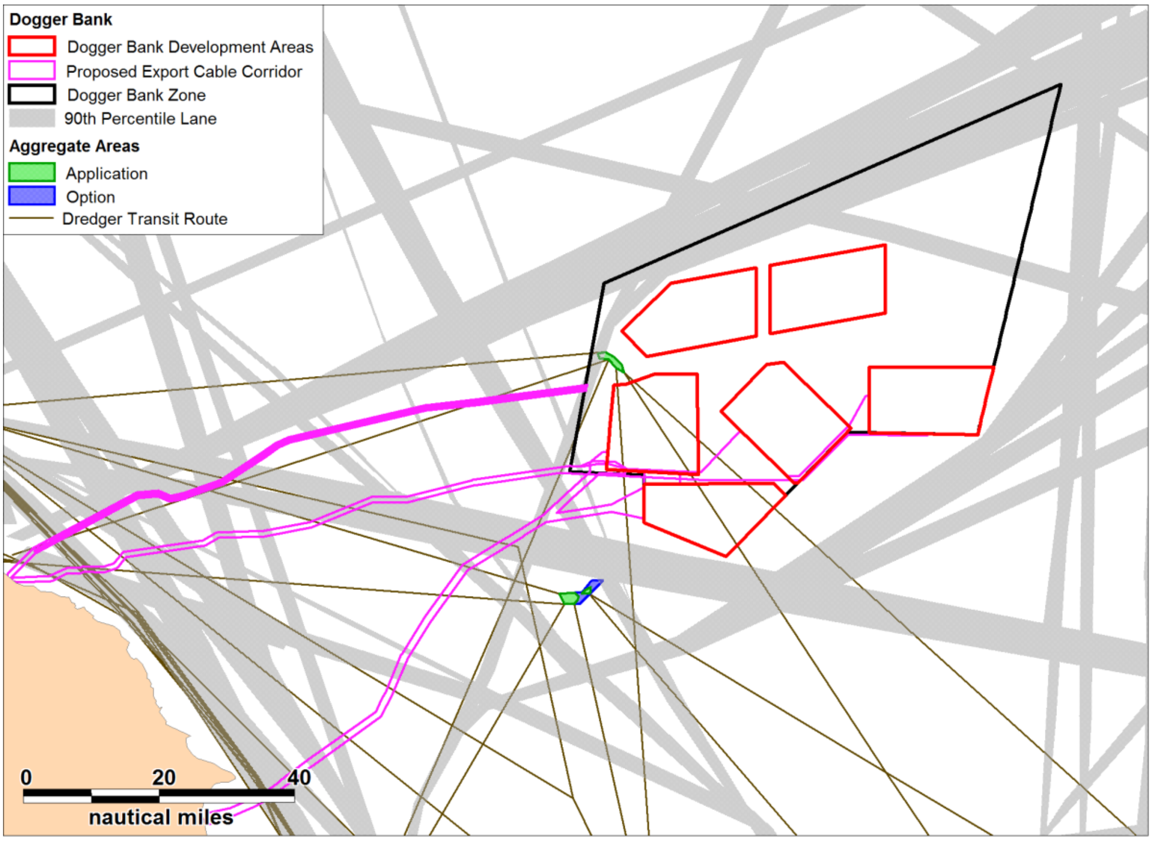

Figure 29.15 Aggregate Areas Relative to the Dogger Bank Development Zone (Anatec, 2013)

The following figures show overviews of oil and gas activity and infrastructure relative to the Dogger Bank Zone. The most recent data presented in this section was obtained from the UK Deal website (UK Deal, 2013).

Figure 29.16 presents oil and gas pipelines in vicinity of the Dogger Bank Development Zone.

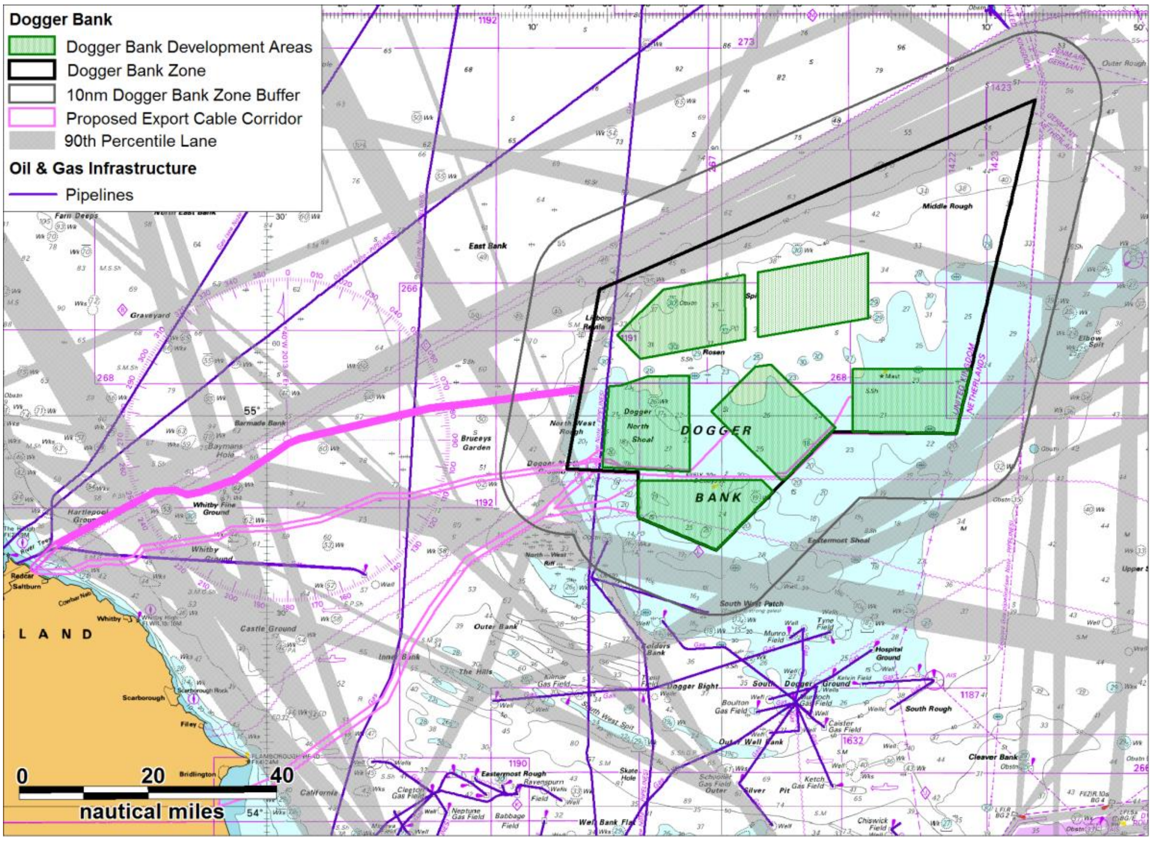

Figure 29.16 Oil and Gas Pipelines in proximity to the Dogger Bank Zone (Anatec, 2013)

There is only one pipeline passing though the Dogger Bank development zone, running adjacent to the western boundary of Dogger Bank Creyke Beck B. Three other pipelines in vicinity of the Dogger Bank Zone intersect the Export Cable Corridor.

Oil and gas platforms located in proximity of the Dogger Bank wind farms are plotted in Figure 29.17.

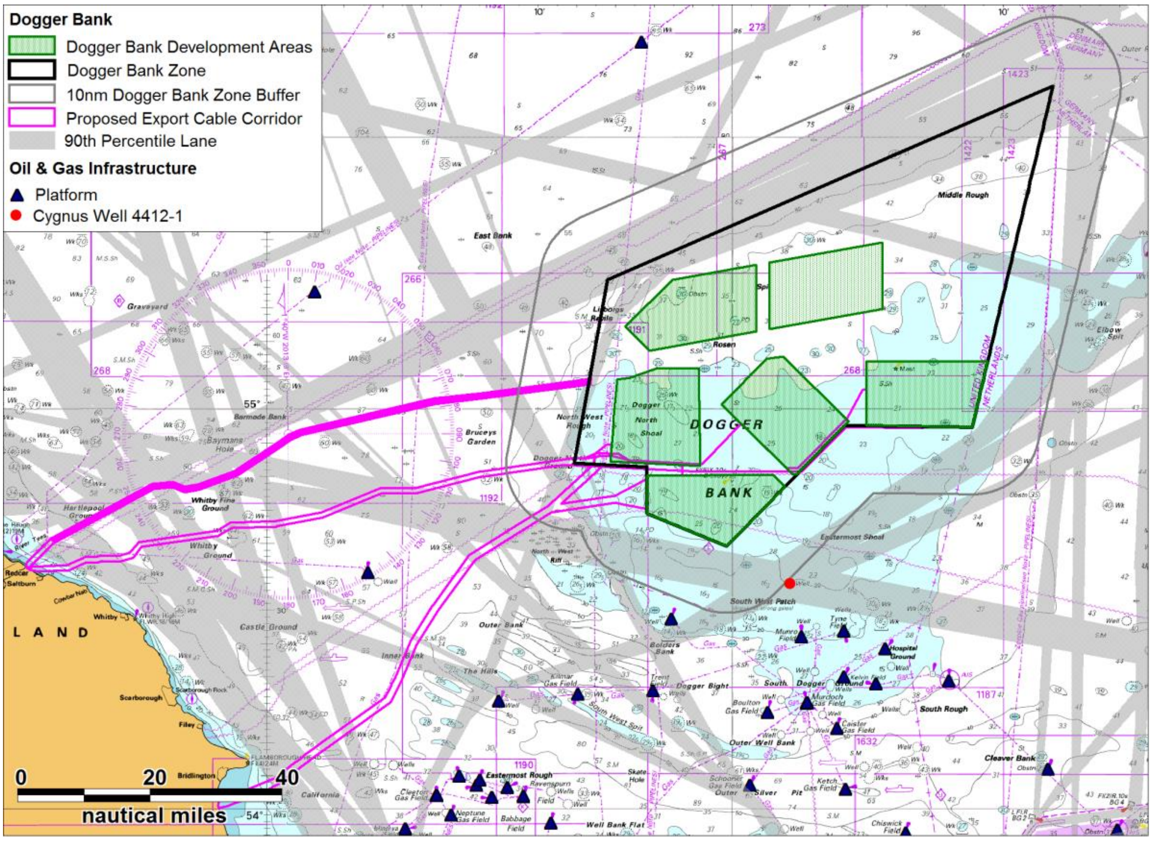

Figure 29.17 Oil and Gas Platforms in proximity to the Dogger Bank Zone (Anatec, 2013)

The majority of oil and gas activity in vicinity of the Dogger Bank Zone is concentrated south of the Zone. There are no platforms within the Dogger Bank Zone or 10nm buffer around it. The majority of supply and standby vessels for oil and gas industry in the Southern North Sea are based in Great Yarmouth and Lowestoft.

It is noted that additional platforms to the south of the Dogger Bank Zone, named Cygnus, are currently in the planning process. The co-ordinates of the proposed platforms are not available at the time of writing. Therefore, the well that the development will be connected to is shown on the above figure.

Most recent well locations data (4th July 2013) obtained from the UK Deal website, colour-coded by the well status is presented in Figure 29.18.

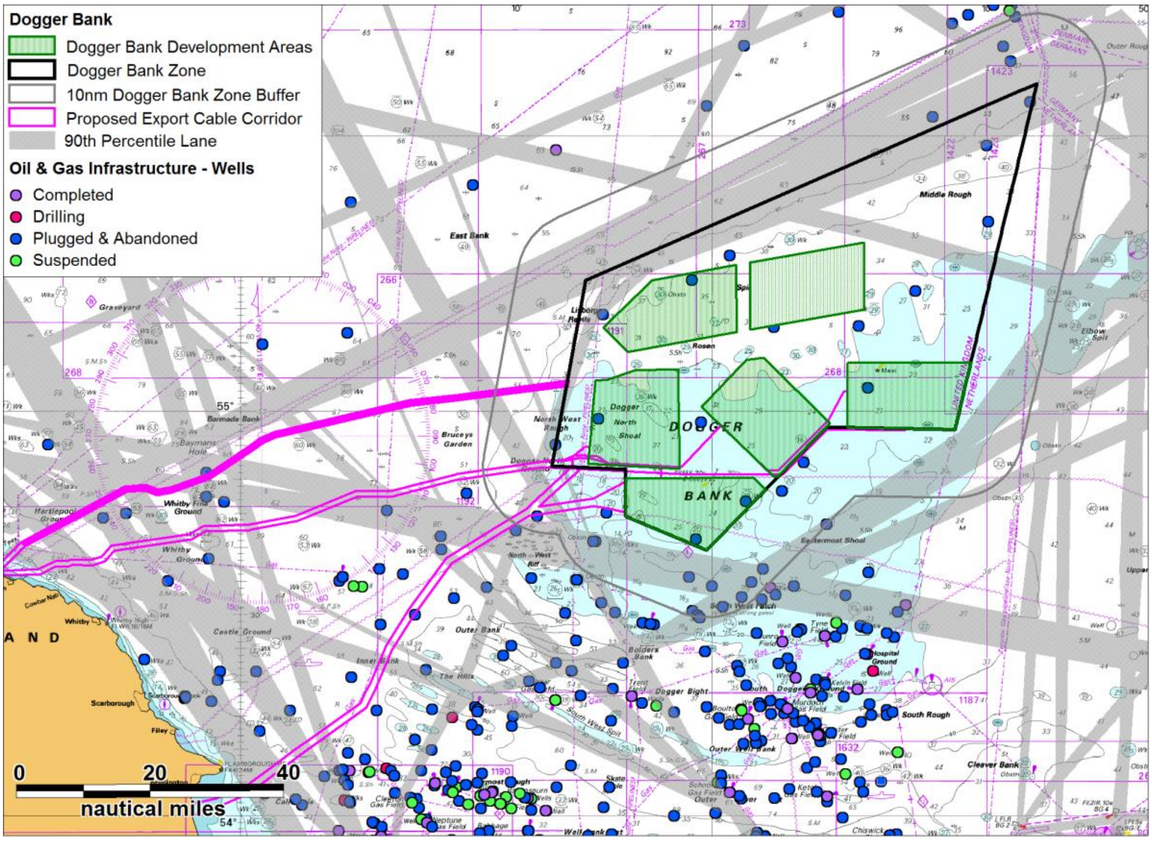

Figure 29.18 Oil and Gas Wells in proximity to the Dogger Bank Zone (Anatec, 2013)

Oil and gas activity within 10nm of the Dogger Bank zone is minor; all wells located in the vicinity were plugged and abandoned.

The initial tranche of offers in 27th license round in the North Sea was announced in 2012 and included 167 Production License's covering 330 blocks. A new Notice in the Official Journal of the European Union regarding the 28th Seaward Licensing Round will be published in January 2014 detailing new terms and blocks on offer.

Figure 29.19 presents all 27th Round conditional and provisional award licence blocks relative to the study area.

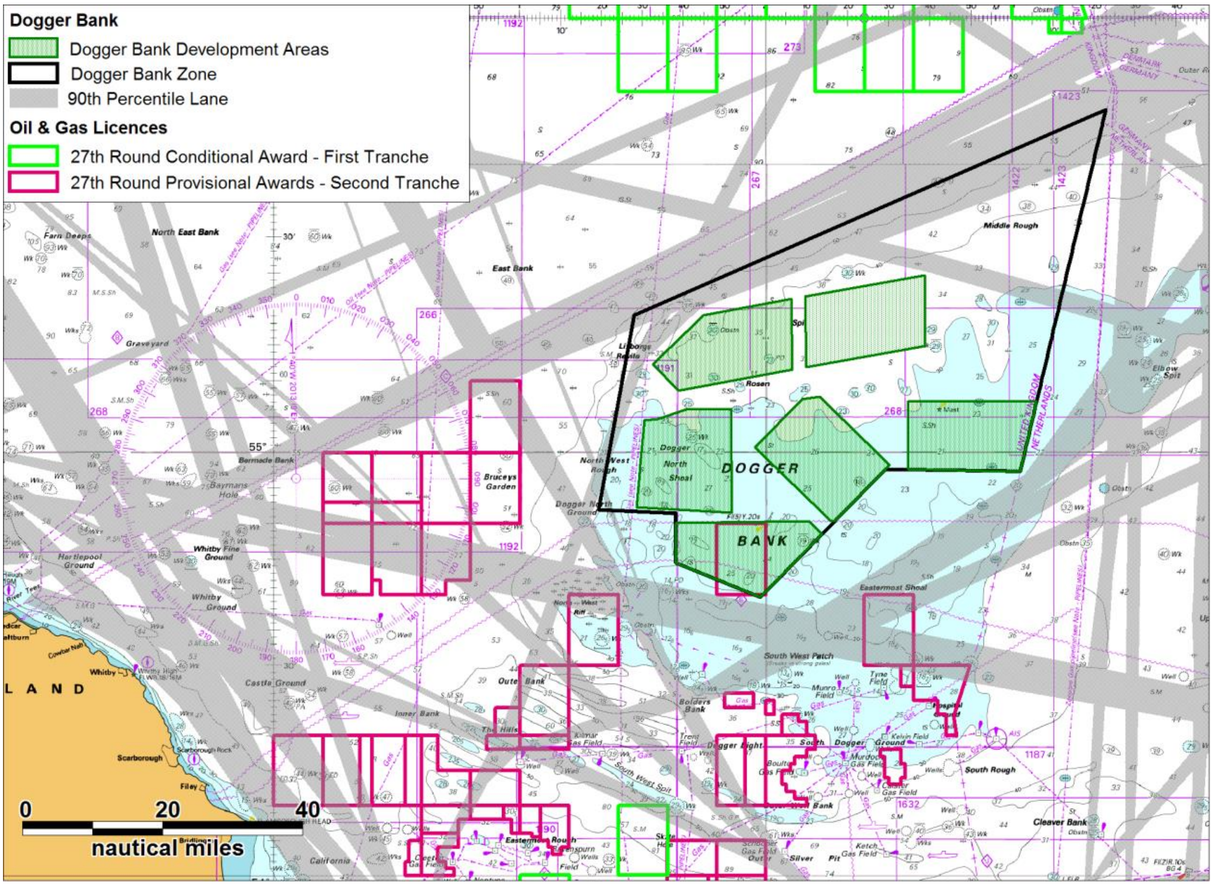

Figure 29.19 Conditional Award Licence Blocks in proximity to the Dogger Bank Zone (Anatec, 2013)

29.1.8 SNSOWF Summary

Figure 29.20 presents a comparison of 2011 and 2013 90th Percentile Lanes in vicinity of the Dogger Bank Zone within the SNSOWF study area.

Figure 29.20 Changes in Anticipated Re-routeing of Shipping Routes in Vicinity of the Dogger Bank Zone: Comparison of 2011 and 2013 90th Percentile Lines. (Anatec, 2013)

Due to the German shipping priority areas, a number of routeing options became aligned east and south-east of the Dogger Bank Zone. An additional shipping transit route has been introduced within the Dogger Bank Development Zone, in the northern part of the area, clear of the 6 existing wind farms. Generally, the 2013 routeing remains consistent with the 2011 one, however it can be noted that the traffic density and amount of shipping lanes has increased north of the Dogger Bank Zone.

The SNSOWF report has identified 32 commercial routes operating within the SNSOWF buffer, 9 of which are impacted by the Dogger Bank Development Zone, resulting in distance increases of 0.2 to 14.3nm

Other in-combination activities have also been considered but due to the smaller footprint of these activities they are not expected to significantly affect the re-routeing options shown.

Cumulative receptors identified for the for the southern North Sea area included;

- Commercial vessels including regular ferry routes

- Oil and Gas operations; and
- Marine Aggregate dredgers.

It is noted that emergency responders and commercial fishing activity have not been considered as receptors as part of the scope; but it is a recommendation (as per section 13) that they are considered at a project level.

29.2 *Visual confusion due to alignment of structures*

The Crown Estate Report (TCE, 2012) on cumulative effects identified that turbine alignment (including non-linear boundaries, irregular turbine layouts and peripheral turbines) could potentially hinder a vessel's ability to navigate safely, for example when passing through wind farm developments. Non-linear boundaries and peripheral turbines can have impacts on marine Radar and visual navigation by obscuring or impacting on a vessel's navigation passage.

Layout rules identified in section 10.3 take into consideration the potential for visual confusion and these are included to provide clear examples of layouts which are compatible with the layout rules, and which could be implemented within final project designs.

29.2.1 Cumulative Issues – Impact of Navigation between Projects

Site layout within the Dogger Bank zone has been optimised to consider a variarty of factors including requirements from commercial fishing stakeholders. This has included measures such as reducing the developable area to avoid the principle sandeel fishery on the western boundary of the Dogger Bank zone and maintaining large areas of fishing grounds between wind farms, for example the area between Dogger Bank Creyke Beck B and Dogger Bank Teesside B, to support the continuation of fishing. The area between Dogger Bank Creyke Beck B and Dogger Bank Teesside B has been designed with consideration of trawling and seine netting, maintaining an unobstructed area of appoximately 90 nm². The overall zonal design has therefore left accessable spaces between wind farms; however these are not intended for navigational transit purposes but will allow fishing vessels to access key areas of fishing grounds, wind farm support craft to visit structures and where required allow third parties to access other infrastructure. Although these spaces are not intened for navigational purposes, Figure 29.21 shows that the space between wind farms is adequate to allow for vessels to enter or exit between wind farms with a minumum distance of 1.3nm between Dogger Bank Creyke Beck A and Dogger Bank Creyke Beck B and upto 3.1nm between Dogger Bank Teesside B and Dogger Bank Creyke Beck B.

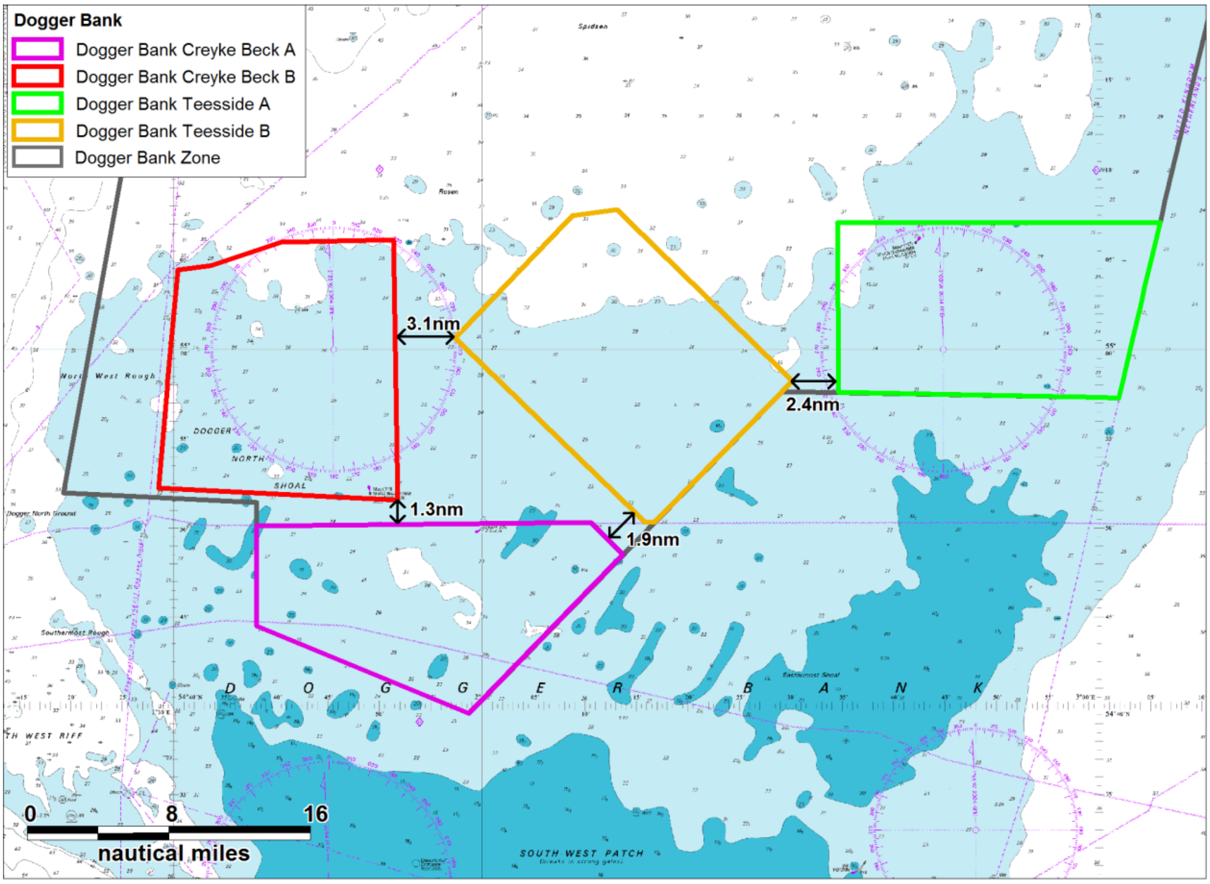

Figure 29.21 Defence Activities Relative to Dogger Bank

Vessels within this area are likely to be wind farm support vessels that will be monitored by Marine Traffic Control and/or commercial fishing vessels that will be familiar with navigating within the array and between wind farms. Larger commercial vessels are likely to choose alternate transit routes to the north and south of the development which as shown within future case routeing assessments do not adversely affect distances and therefore timings.

The orientation and marking of the scheme was highlighted in consultation with THLS (July 2012) as of particular concern for on-going development, in particular vessel's ability to navigate out of areas 'enclosed' by different wind farms within the overall Dogger Bank Zone. In order to mitigate risk associated with visual navigation between wind farms, Forewind are committed to working closely with THLS to investigate alternative marking schemes for the wind farms going forward. This could include the use of buoyage (such as cardinal marks or lateral) or synchronised lighting to assist vessels in navigating within the areas between wind farms. It is noted by IALA (2008) that in order to avoid confusion from a proliferation of Aids to Navigation in a high-density wind farm, full consideration should be given to the use of synchronised lighting, different light characters and varied light ranges. Mitigation will also include consultation with UKHO to define charting for the area that will clearly show mariners structures within the area. Forewind have also developed a 3D model in order to assist stakeholders with the consideration of additional mitigation such as lighting and marking.

29.3 *Adverse Weather*

Adverse weather routes are considered to be significant course adjustments to mitigate vessel movement in adverse conditions. Additionally, in such conditions, vessels may opt to increase CPA to navigational hazards such as shallow waters.

There is the potential for adverse weather routes to be impacted due to the presence of wind farms, their proximity to the coast and/or in-combination effects from other activities. If vessels are unable to follow safe adverse weather routes, this could have health and safety implications.

However due to the availability of open sea areas and the development of the wind farms on Dogger Bank, which is avoided by vessels in adverse weather due to the unusual tidal conditions, the impact on vessels adverse weather routeing is expected to be minor. It is also noted that during adverse weather and tidal conditions vessels already avoid crossing Dogger Bank.

29.4 *Reduction in Available Sea Room for Defence Activities*

Offshore wind farms in-combination with other marine users may restrict and impact the navigational elements of Ministry of Defence training exercises in defined areas. Defence activities that occur in the area are limited to Submarine Exercise Areas and therefore are not expected to be impacted by the development of the wind park. It is noted that the MOD have not expressed any concerns over the development of the proposed Dogger Bank Teesside A & B from a navigation perspective.

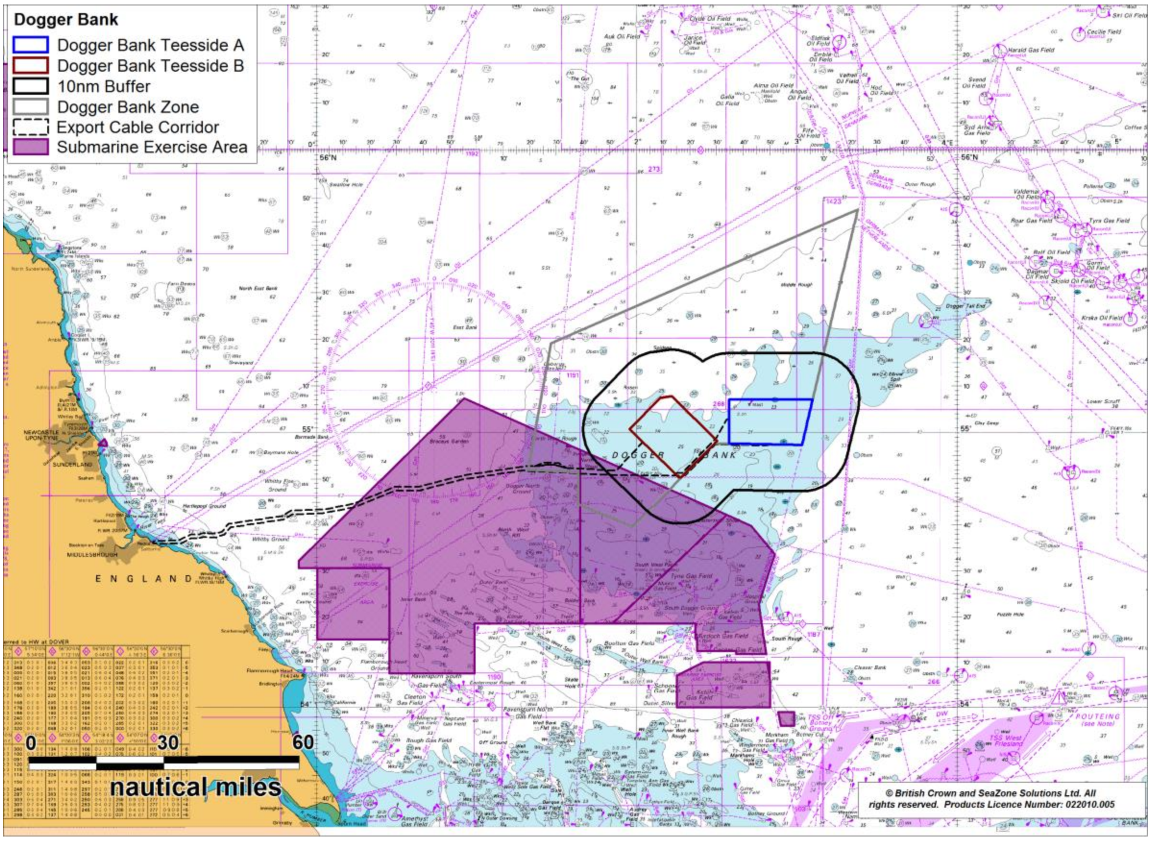

Figure 29.22 Defence Activities Relative to Dogger Bank

29.5 *Increase in Fishing Activities Associated with the Aggregation of Fishing around Structures*

It is noted that wind farm structures could create an environment attractive to marine life. Should this occur, additional consideration should be given to the navigational safety hazards associated with additional fishing activity within the site.

29.6 *Increasing or Diminishing Emergency Response.*

Offshore emergencies can include search and rescue as well as pollution and salvage control and response. The UK's current SAR and Counter Pollution response includes a variety of vessel response facilities. Navigational elements include both the transit routes to the site and the maneuverability once on site. As the development increases in size there will also be an increase in the number of vessels and personnel on site and an increased distance from the existing emergency response facilities. Figure 29.23 shows the distance from shore to the closest point of the Dogger Bank Zone and to the furthest away point to indicate the potential distance from emergency response facilities.

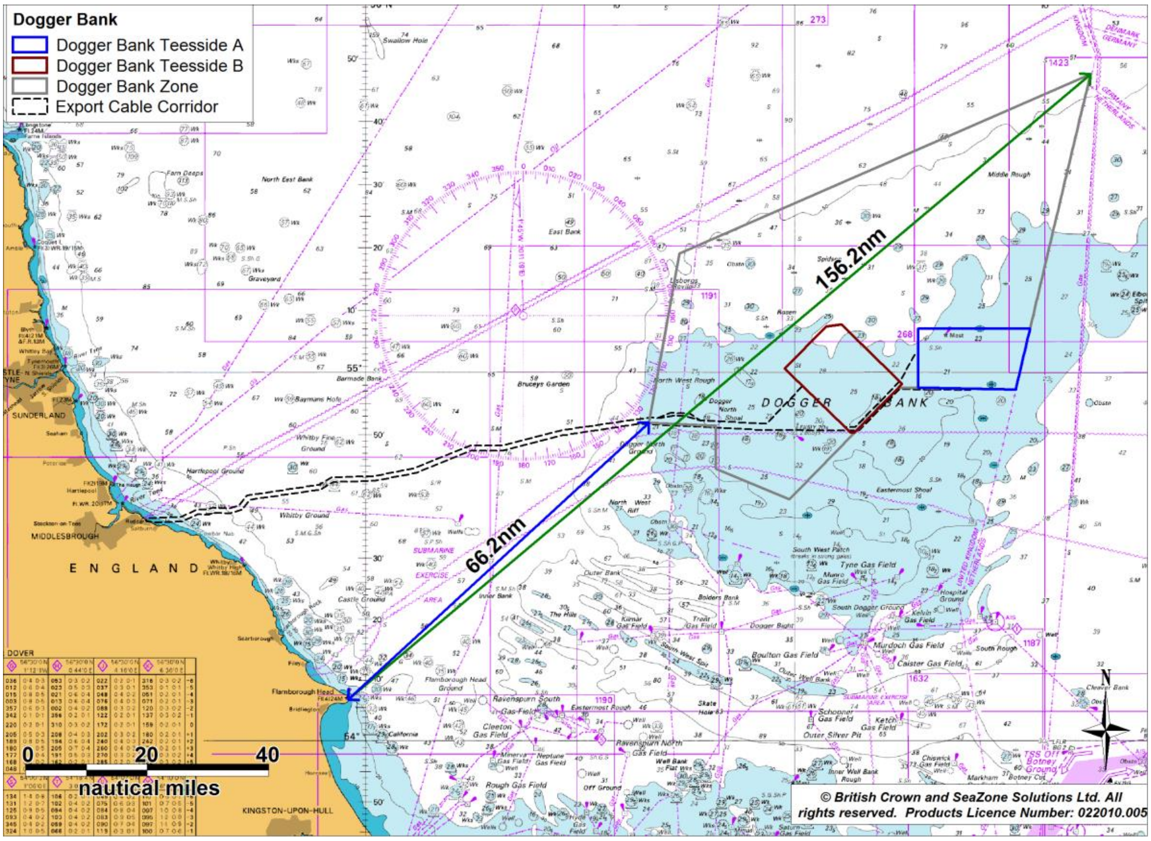

Figure 29.23 Dogger Bank Zone Distance from Shore

Therefore, as the development of the Dogger Bank Zone continues, the availability of self-help facilities will need to develop. With consideration of the following mitigations it expected that this impact can be reduced to ALARP:

- Inclusion of self-help facilities such as pollution control;
- Site design with consideration for search and rescue; and
- Development of joint response plans.

30. Cost Benefit Analysis

The FSA Guidelines require a process of Cost Benefit Assessment (CBA) to rank proposed risk control options in terms of risk benefit related to life cycle costs. This will be considered in terms of **gross cost of averting a fatality (GCAF).** This is a cost effectiveness measure in terms of ratio of marginal (additional) cost of the risk control option to the reduction in risk to personnel in terms of the fatalities averted. GCAF can be calculated as:

$$\frac{\textbf{\textit{COST}}}{\textbf{\textit{RISK}}}$$

Until mitigation measures are defined, a review of cost benefit analysis cannot be undertaken. However, Forewind are committed to implementing mitigation measures that show a reduction in the Potential Loss of Life (PLL) value.

31. Through Life Safety Management

31.1 *Safety Policy and Safety Management Systems (SMS)*

QHSE documentation including a policy statement and SMS will be in place for Dogger Bank Teesside A & B and will be continually updated throughout the development process. The following sections provide an overview of documentation and how it will be maintained and reviewed with reference, where required, to specific marine documentation.

Monitoring, reviewing and auditing will be carried out on all procedures and activities and feedback actively sought. The Designated Person (identified in QHSE documentation), managers and supervisors are to maintain continuous monitoring of all marine operations and determine if all required procedures and processes are being correctly implemented.

31.2 *Incident Reporting*

After any incidents, including near misses, an incident report form will be completed in line with the operator's SMS. This will then be assessed for relevant outcomes and reviewed for possible changes required to operations.

The operator shall maintain records of investigations and analyse incidents in order to:

- Determine underlying deficiencies and other factors that might be causing or contributing to the occurrence of incidents;
- Identify the need for corrective action;
- Identify opportunities for preventive action;
- Identify opportunities for continual improvement; and
- Communicate the results of such investigations.

All investigations shall be performed in a timely manner.

A database (lessons learnt) of all marine incidents will be developed. It will include the outcomes of investigations and any resulting actions. The operator will promote awareness of their potential occurrence and provide information to assist monitoring, inspection and auditing of documentation.

When appropriate, the designated person should inform the MCA of any exercise or incidents including any implications on emergency response. If required, the MCA should be invited to take part in incident debriefs.

31.3 *Review of Documentation*

The operator will be responsible for reviewing and updating all documentation including the risk assessments, SAR ERCoP and Active Safety Management Systems (ASMS) and, if required, the operator will convene a review panel of stakeholders.

Reviews of the risk register should be made after any of the following occurrences:

- Changes to the project, conditions of operation and prior to decommissioning;
- Planned reviews; and
- Following an incident or exercise.

A review of potential risks should be carried out annually. A review of the response charts should be carried out annually to ensure that response procedures are up to date and should include any amendments from audits/incident reports/deficiencies.

31.4 *Inspection of Resources*

All vessels, facilities, and equipment necessary for marine operations are to be subject to appropriate inspection and testing to determine fitness for purpose and availability in relation to their performance standards. This will include monitoring and inspection of all Aids to Navigation to determine compliance with the performance standards specified by THLS.

31.5 *Audit Performance*

Auditing and performance review are the final steps in safety management systems. The feedback loop enables an organisation to reinforce, maintain and develop its ability to reduce risks to the fullest extent and to ensure that continued effectiveness of the system. The operator will carry out audits and periodically evaluate the efficiency of the marine safety documentation.

The audits and possible corrective actions should be carried out in accordance with standard procedures and results of the audits and reviews should be brought to the attention of all personnel having responsibility in the area involved.

31.6 *Future Monitoring*

The operator has a commitment to manage the risks associated with the activities undertaken at Dogger Bank Teesside A & B. It will establish an integrated management system which ensures that the safety and environmental impacts of those activities are tolerable.

31.7 *Future monitoring of marine traffic*

Whilst no Radar monitoring of vessel movements has been proposed for the site, AIS data will be available to record the movements of vessels around Dogger Bank Teesside A & B, associated export cables to shore and works vessels on site. There will be vessels regularly operating in the site, including during maintenance, which can monitor any third party vessel activity both visually and on Radar, although this will not be their primary function.

31.8 *Decommissioning Plan*

A decommissioning plan in line with standard requirements 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 wind farm) 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.

32. Summary

Following a review of the base case environment, a Navigational Risk Assessment for Dogger Bank Teesside A & B and the export cable route has been undertaken. The assessment has included collision risk modelling and a formal safety assessment for all phases of the developments as well as an assessment of cumulative effects.

32.1 *Consultation*

Consultation has been undertaken with the following regulators and stakeholders:

- Maritime and Coastguard Agency;
- Trinity House Lighthouse Services; and
- Chamber of Shipping.

Regular operators that would be required to deviate following the development of Dogger Bank were identified and consulted via electronic or hardcopy mail, initially in June 2011 and July 2012, and then again with Dogger Bank Teesside A & B updates in 2013. In addition to this, European Shipping Associations were also contacted with information about the development and invited to provide comments and feedback.

32.2 *Marine Traffic*

An analysis of the vessel types recorded passing within 10nm of Dogger Bank Teesside A & B showed that the majority of tracks were fishing vessels (32% in winter and 35% in spring/summer) and cargo vessels (49% in winter and 39% in spring/summer). 90th percentiles were identified by principles set out in MCA guidance MGN 371 (MCA, 2008a) and from these ten main routes were identified as operating in the vicinity of the Dogger Bank Zone, seven of which are within 10nm of Dogger Bank Teesside A & B. Three routes directly passing through the proposed Dogger Bank Teesside A and Two through Dogger Bank Teesside B.

Deviations for the identified main routes were considered with the most significant being an increase of 14.5 minutes for Route 6 (equating to 0.75% of total journey time) when Dogger Bank Teesside A is built in isolation, 14.5 minutes for Routes 4 (equating to 0.52% of total journey time) when Dogger Bank Teesside B is built in isolation and 14.5 minutes for Route 4 and 6 (equating to 0.52% and 0.75% respectively of total journey time) when Dogger Bank Teesside A & B are built together.

In terms of recreational vessel activity, there are two medium use cruising routes crossing the Dogger Bank zone, one of which intersects Dogger Bank Teesside B. Levels of recreational craft within Dogger Bank Teesside were noted as being very low.

There is a relatively high level of fishing vessel activity within the vicinity of Dogger Bank Teesside. In particular, high levels of beam trawling in Dogger Bank Teesside B with up to 11 unique vessels being recorded within one day. Fishing vessels were mainly from Denmark, Germany, United Kingdom and Norway with bottom seiners and beam trawlers identified.

There were an average of 73 vessels per day recorded within 5nm of the export cable corridor, with the majority of vessels being cargo vessels (39%), tankers (35%), fishing vessels (7%) and tugs (7%).

The water depth decreases close to the shore where the cable makes landfall. The entrance to Teesport is encompassed by the export cable corridor 5nm buffer, meaning that a number of vessels tracked within the study area are entering or exiting Teesport.

A study of anchoring data shows vessels to be anchoring close to the Teesport entrance, but within the export cable corridor.

32.3 *Collision Risk Modelling*

An assessment of current vessel to vessel encounters was carried out by replaying at high-speed 56 days of AIS data from the survey vessels over the combined survey periods. There was an extreme high of 72 encounters (vessels passing within 1nm of each other) during the 56 day period within 10nm of Dogger Bank Teesside A and 114 within 10nm of Dogger Bank Teesside B. In all cases the majority of encounters involved fishing vessels. Average encounter numbers were 1 per day for Dogger Bank Teesside A and 2 per day Dogger Bank Teesside B.

For Dogger Bank Teesside A in isolation, the baseline vessel-to-vessel collision risk level pre-wind farm development is in the order of 1 major collision in approximately 949 years and the level with the wind farm present is approximately 1 major collision in every 769 years, which is an increase of 23.38% on the pre-wind farm outcome.

For Dogger Bank Teesside B in isolation, the baseline vessel-to-vessel collision risk level pre-wind farm development is in the order of 1 major collision in approximately 1360 years and the level with the wind farm present is approximately 1 major collision in every 762 years, which is an increase of 78.32% on the pre-wind farm outcome.

For Dogger Bank Teesside A & B together, the baseline vessel-to-vessel collision risk level pre-wind farm development is in the order of 1 major collision in approximately 454 years and the level with the wind farm present is approximately 1 major collision in every 352 years, which is an increase of 29.06% on the pre-wind farm outcome.

The frequency of passing powered allisions has been assessed to be 1 every 693 years for Dogger Bank Teesside A, 1 every 2786 years for Dogger Bank Teesside B and 1 every 643 years for Dogger Bank Teesside A & B together. These allision frequencies can be compared to the historical average of 5.3×10^{-4} per installation-year for offshore installations on the UKCS (1 in 1,900 years). The risk to Dogger Bank Teesside B is estimated to be lower than the historical average when built in isolation. The risks to Dogger Bank Teesside A in isolation, and Dogger Bank Teesside A and Dogger Bank Teesside B when built together, are estimated to be approximately 3 times higher than the historical average.

In order to mitigate blade, mast and keel collision for recreational craft the development of Dogger Bank Teesside A & B will adhere to the RYA's guidance on the construction of wind turbines including;

- A minimum rotor height clearance above MHWS of at least 22m; and
- A minimum underwater clearance of 4m below chart datum.

These guideline measurements mean that whilst the collision risk cannot be completely eliminated, it will be reduced to a level as low as reasonably practicable.

With regards to cable interaction for anchoring and trawling all the subsea cables (export and inter array) will be buried or trenched where seabed conditions allow, providing protection from all forms of hostile seabed interaction, such as fishing activity, dragging of anchors and dropped objects. Cables will be protected by other means when burial is not possible. There will be periodic inspections and surveys to ensure they do not become exposed over time. The cables will 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.

32.4 *Formal Safety Assessment*

In order to provide expert opinion and local knowledge, a hazard workshop was undertaken to create a hazard log that was project and site specific. The hazard log identified the hazards caused or changed by the introduction of Dogger Bank Teesside A & B, the risk associated with the hazard, the controls put in place and the tolerability of the residual risk. The log also includes both industry standard and additional mitigation measures required to show that the hazards associated with Dogger Bank Teesside A & B are Broadly Acceptable or Tolerable on the basis of As Low As Reasonably Practicable (ALARP) declarations. For the most likely outcome, 23 of the risks were broadly acceptable, 13 were in the tolerable region and none were ranked as unacceptable. When worst case consequences were assessed, there were no risks which were ranked as broadly acceptable. All risks were ranked in the tolerable region.

Those hazards which were ranked as unacceptable for the worst case scenario are listed below:

32.5 *Mitigation Measures*

Mitigation and safety measures will be applied to Dogger Bank Teesside A & B appropriate to the level and type of risk determined during the Environmental Impact Assessment (EIA). The specific measures to be employed will be selected in consultation with the MCA Navigation Safety Branch and other relevant statutory stakeholders where required.

33. Conclusion

This NRA has presented an assessment of the baseline environment for the proposed Dogger Bank Teesside A & B, by analysing AIS and Radar marine traffic data, historical incident data and emergency response facilities, as well as presenting results of collision risk modelling and an assessment of the impacts on receptors for all phases of the project.

Impacts on shipping and navigation receptors (commercial vessels, marine aggregate dredgers, commercial fishing vessels, recreational craft (2.5-24 m), military vessels, wind park craft, ports and emergency responders) have been assessed by evaluating the frequency of occurrence and the severity of consequences. The assessment has been separated into impacts arising from the proposed wind farm and impacts arising from export cable and also split up by phase to recognise that the effects will be different during construction/installation works compared to during times of operation and maintenance. The impacts associated with the decommissioning phase of Dogger Bank Teesside A & B are considered to be similar in nature to those associated with the construction phase. The following section identifies the EIA impact assessment process.

34. Next Steps - Impact Assessment for EIA

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. This impact assessment screens the identified impacts from the NRA with effective pathways. The impact assessment can be found in ES Chapter 16 Shipping and Navigation. The following sections provide more information about the methodology and inputs for the impact assessment.

34.1 *Assessment Methodology*

Shipping and navigation is assessed in accordance with guidance provided by regulators. The primary guidance documents used when assessing impacts are listed in Section 3.

The MCA require that their methodology is used as a template for undertaking impact assessments. It is in line with the IMO Formal Safety Assessment (FSA), centred on risk management and requires a submission that shows that sufficient controls are, or will be, in place for the assessed risk (base case and future case) to be judged as broadly acceptable or tolerable.

The following sections provide an overview of the process of assessing the risk to navigational receptors and how the outputs of the Navigational Risk Assessment were then carried forward to assess the effect on receptors.

Although fishing impacts will be considered in more detail within Chapter 15 Commercial Fisheries of the Environmental Statement, there are risks to navigational safety that have been identified and therefore considered within this section. It is noted that the CPD contains numerous foundation types and project layouts that will have varying levels of navigational safety risk; again this has been covered within more detail in Chapter 15 Commercial Fisheries.

34.2 *Hazard Workshop*

In order to provide expert opinion and local knowledge, a hazard workshop was undertaken to create a hazard log that was area specific for Dogger Bank. The hazard log identified direct or indirect hazards relating to the introduction of Dogger Bank Teesside A & B (several layout scenarios shown) and the export cable corridor, the level of risk associated with the hazard, the controls put in place and the tolerability of the residual risk.

The hazard log also identified standard and additional mitigation measures required to show that the hazards associated with the wind farm are Broadly Acceptable or Tolerable on the basis of As Low As Reasonably Practicable (ALARP) declarations in line with regulatory requirements. This information was then fed into the Formal Safety Assessment process to identify impacts associated with the development.

34.3 *Formal Safety Assessment Process*

The IMO Formal Safety Assessment process (IMO 2002) is the process that has been applied to the NRA. This is a structured and systematic methodology based on risk. As part of the Formal Safety Assessment, the impact of Dogger Bank Teesside was considered against the baseline data sets identified.

There are five basic steps within this process, as follows:

- Identification of hazards (a list of all relevant accident scenarios with potential causes and outcomes);
- Assessment of risks (evaluation of risk factors);
- Risk control options (devising regulatory measures to control and reduce the identified risks);
- Cost benefit analysis (determining cost effectiveness of risk control measures); and
- Recommendations for decision-making (information about the hazards, their associated risks and the cost effectiveness of alternative risk control measures).

34.4 *Impact Assessment*

The following section identifies the parameters assessed to identify magnitude, sensitivity and overall impact.

34.4.1 Magnitude

Determining the overall magnitude of shipping and navigation impacts incorporated a degree of subjectivity as decisions were based on expert opinion in combination with baseline data and assessments already undertaken in the NRA including:

- Consultation feedback from stakeholders and regular operators;
- Outputs of the hazard workshop, in particular where intolerable and major ranked impacts were identified;
- Lessons learnt or research from previous developments, especially impacts associated with navigation and communication where physical modelling is not available;
- Results of collision risk modelling in comparison with UK averages; and
- Analysis of baseline data where low confidence in data availability or clear evidence of impact (i.e. deviations) have been identified.

34.4.2 Sensitivity

A shipping and navigation receptor can only be sensitive if there is a pathway through which an impact can be transmitted between the source activity and the receptor. When a receptor is exposed to an impact, the overall sensitivity of the receptor is determined and the process incorporates a degree of subjectivity. Sensitivity assessments for shipping and navigation receptors used the following baseline data, in line with expert opinion, to assess;

- Outputs of the hazard workshop;
- Level of Stakeholder concern;
- Time and/or distance of deviation;
- Number of transits of specific vessel and/or vessel type; and
- Lessons learnt from existing developments.

34.5 *Identification of Receptors*

The following methods have been used to identify receptors in the existing environment study:

- Stakeholder consultation;
- Expert opinion;
- Hazard workshop outcomes;
- Lessons learnt from previous developments;
- Desktop study of existing environment data;
- Collision risk modelling undertaken including known methodologies and probabilities; and
- Regular operator consultation.

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