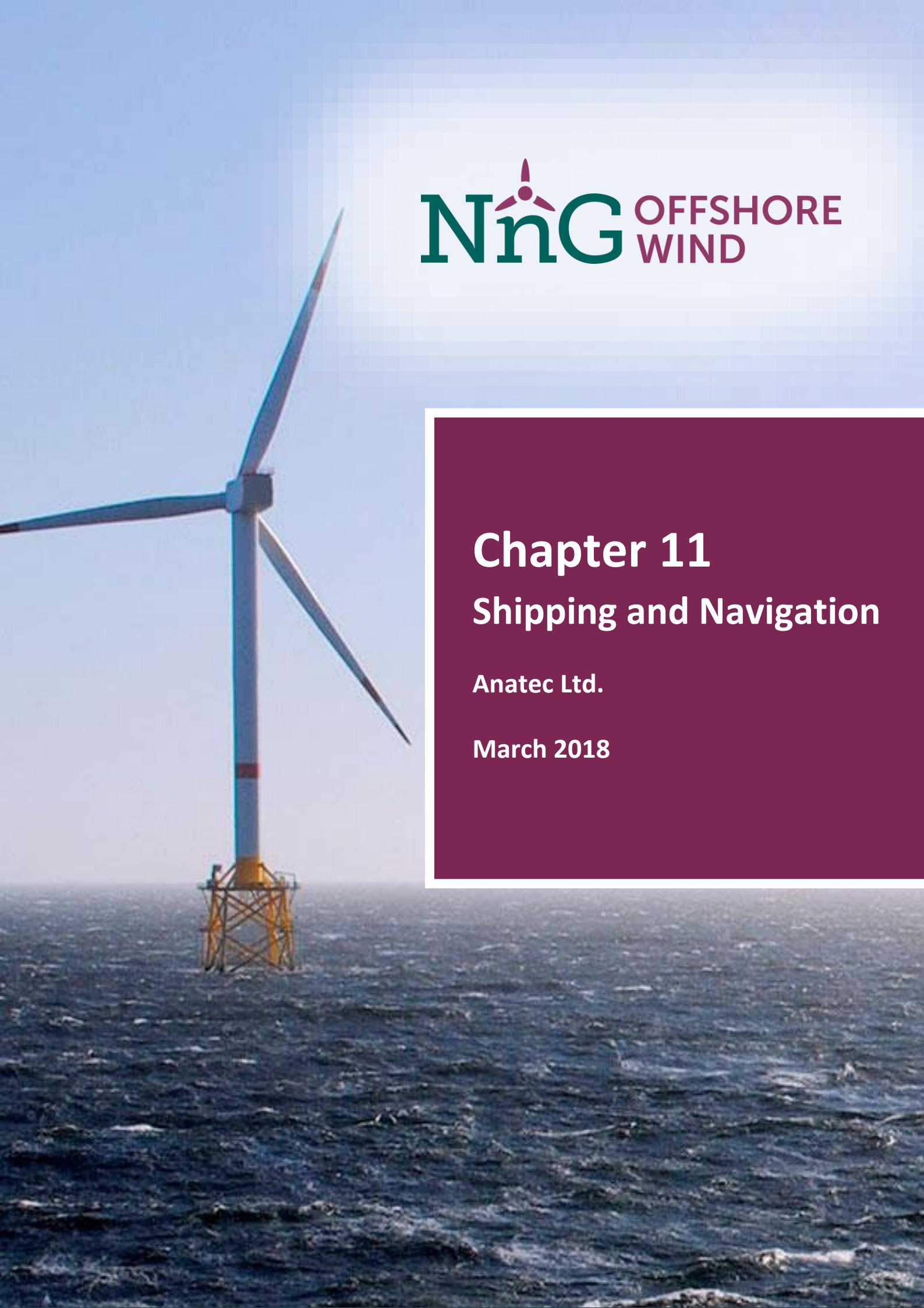

NnG OFFSHORE WIND

Chapter 11

Shipping and Navigation

Anatec Ltd.

March 2018

Table of Contents

11 Shipping and Navigation 3
11.1 Introduction 3
11.2 Policy, Guidance and Legislation 3
11.3 Data Sources 4
11.4 Relevant Consultations 5
11.5 Impact Assessment Methodology 12
11.6 Baseline Description 14
11.7 Design Envelope – Worst Case Design Scenario 18
11.8 Impact Assessment 22
11.9 Mitigation and Monitoring 28
11.10 Summary of Residual Effects 29
11.11 References 31

Table of Figures

Figure 11-1: Study area ..... Volume 2
Figure 11-2: Navigational features ..... Volume 2
Figure 11-3: MAIB incidents ..... Volume 2
Figure 11-4: RNLI incidents ..... Volume 2
Figure 11-5: Marine traffic ..... Volume 2
Figure 11-6: Fishing ..... Volume 2
Figure 11-7: RYA Coastal atlas ..... Volume 2

Table of Tables

Table 11-1: Data sources used to inform the baseline description – Shipping and Navigation. 4
Table 11-2: Summary of consultation relating to Shipping and Navigation 6
Table 11-3: Sensitivity/ importance of the environment – Shipping and Navigation 12
Table 11-4: Magnitude of the impact – Shipping and Navigation 13
Table 11-5: Significance of potential effects – Shipping and Navigation 13
Table 11-6: Design envelope scenario assessed 18
Table 11-7: Embedded mitigation relating to Shipping and Navigation 19
Table 11-8: Consent conditions for the Originally Consented Project relevant to Shipping and Navigation 21
Table 11-9: Projects for cumulative assessment – shipping and navigation 25
Table 11-10: Cumulative worst case design scenario 26
Table 11-11: Summary of predicted impacts of the Project 29

11 Shipping and Navigation

11.1 Introduction

1. This chapter of the EIA Report presents an assessment of the potential impacts upon Shipping and Navigation arising from the construction, operation and decommissioning of the Project, as detailed in Chapter 4: Project Description.
2. The assessment is based upon a combination of the understanding of the Project in terms of the potential for impact and the resultant effects on receptors that were identified within the study area as detailed within Section 11.8.
3. This chapter is comprised of the following elements:

- A summary of relevant policy, guidance and legislation;
- Details of the data sources used to characterise the study area;
- A summary of the relevant consultations with stakeholders;
- A description of the methodology for assessing the impacts of the Project, including details of the study area and approach to the assessment of potential effects;
- A review of the baseline conditions;
- A description of the worst-case design scenario relevant to Shipping and Navigation;
- An assessment of the likely effects for the construction, operation and decommissioning phases of the Project, including cumulative effects;
- Identification of any further mitigation measures or monitoring requirements in respect of any significant effects;
- A summary of the residual impact assessment determinations taking account of any additional mitigation measures identified.

11.2 Policy, Guidance and Legislation

4. The principal guidance documents and information used to inform the assessment of potential impacts on Shipping and Navigation are as follows:

- Maritime and Coastguard Agency (MCA) Marine Guidance Note (MGN) 543 - Safety of Navigation: Offshore Renewable Energy Installations – Guidance on UK Navigational Practise, Safety, and Emergency Response (MCA 2016);
- MCA Methodology for Assessing Marine Navigational Risk (MCA, 2015);
- International Maritime Organisation (IMO) Formal Safety Assessment (FSA) Process (IMO 2002);
- MCA MGN 372 (MGN 372 M+F) Guidance to Mariners Operating in the Vicinity of UK Offshore Renewable Energy Installations (OREIs) (MCA, 2008);
- International Association of Lighthouse Authorities (IALA) Recommendations O-139 on the Marking of Man-Made Structures (IALA 2013);
- The Royal Yachting Association's (RYA) Position on Offshore Renewable Energy Developments: Paper 1 – Wind Energy (RYA, 2013); and
- The Recreational Craft Regulations 2017 which gives guidance on what vessels are considered recreational craft.

11.3 Data Sources

5. The assessment undertaken considers the potential interaction between the Project, as described in Chapter 4: Project Description, and Shipping and Navigation receptors within the study area.

6. The study area comprises a 10 nautical mile (NM) buffer of the Wind Farm Area (the Wind Farm Study Area), as shown in Figure 11.1, Volume 2. This was chosen to encompass relevant passing traffic, while still remaining site-specific to the Wind Farm Area.

7. Baseline characterisation data has been collated combining a thorough desk-based study of extant data supplemented with site-specific marine traffic survey data. Marine traffic survey data was first collected in 2010 and 2011, however given the time elapsed since these initial surveys, they have been validated using updated data collected during 2016. The 2016 data is presented within this chapter. This approach was agreed with the MCA, and further details are provided in Section 11.5.

8. Table 11-1 details the data sources used to inform the baseline characterisation within the study area.

Table 11-1: Data sources used to inform the baseline description – Shipping and Navigation.

Data Source	Study/Data Name	Overview
NnGOWL	Marine Traffic Survey Data, Anatec Ltd, 2016.	Total of 28 days of Automatic Identification System (AIS) data collected from coastal receivers for the purpose of validating the original data collected in 2010 and 2011. It is noted that this data only accounts for vessels required to broadcast via AIS.
NnGOWL	Marine Traffic Survey Data, Anatec Ltd, 2010/11.	Two marine traffic surveys undertaken as follows: ▪ 29 days of AIS and radar data collected between August and October 2010 by the geotechnical survey vessel *Ocean Discovery.* ▪ AIS recorded from coastal receivers during July 2011.
United Kingdom Hydrographic Office (UKHO)	Admiralty Nautical Navigational Charts, UKHO, 2017. Admiralty Sailing Directions – North Sea (West) Pilot – NP54, UKHO, 2016	Charts and pilots used to establish the baseline conditions in the context of relevant navigational features within the study area.
The Crown Estate	Marine Aggregate Dredging Areas, The Crown Estate, 2017.	Geographic Information System (GIS) files displaying the aggregate dredging areas within UK waters.
RYA	UK Coastal Atlas of Recreational Boating, RYA, 2016	Recreational vessel intensity grid and route markers based on input AIS data. Data set also includes positions of boating areas and other recreational facilities. This data set is used at the request of the RYA.

Data Source	Study/Data Name	Overview
Marine Accident Investigation Branch (MAIB)	Marine Incident Data, MAIB, 2005 to 2014.	Data set providing details of marine incidents investigated by the MAIB between 2005 and 2014. Data covers all incidents involving commercial UK vessels or non-UK commercial vessels within UK 12 NM territorial waters.
Royal National Lifeboat Institution (RNLI)	Marine Incident Data, RNLI, 2005 to 2014.	Data covers all incidents responded to by the RNLI excluding cases of a hoax or false alarm.
Marine Scotland	Fishing Sightings Surveillance Data, Marine Scotland, 2015 to 2016	Data recorded manually via visual surveillance.
Marine Scotland	Fishing Satellite Surveillance Data, Marine Scotland, 2015 to 2016	Fishing vessel data recorded via satellite. Covers all vessels of 12 metres (m) and above for all EU countries (and selected other countries, e.g., Norway) within UK waters.

9. The following technical appendices to this EIA Report should also be read in conjunction with this chapter.

- Appendix 11.1: Navigational Risk Assessment (NRA) (2012).
- Appendix 11.2: AIS Traffic Validation Study (2017).
- Appendix 11.3: MGN543 Checklist (2017)

11.4 Relevant Consultations

10. As part of the EIA process, NnGOWL has consulted with various statutory and non-statutory stakeholders. A formal scoping opinion was requested from MS-LOT following submission of the Scoping Report. Ongoing consultation with stakeholders continued post-scoping and responses have been used to develop an appropriate methodology and parameters for assessment.

11. In response to NnGOWL's request, MS-LOT issued a Scoping Opinion identifying a number of potential impacts that could not be scoped out of the assessment at this stage following review of the Scoping Report. The issues to be considered further within this EIA in respect of Shipping and Navigation are summarised in Table 11-2.

Table 11-2: Summary of consultation relating to Shipping and Navigation

Date and consultation phase / type	Consultation and key issues raised	Section where comment addressed
08/09/17 Scoping Opinion – MS-LOT Summary	The Scottish Ministers agreed that the shipping baseline assessment requires updating with marine traffic survey data (in line with MGN 543) but recommend that NnGOWL have on-going discussions with the MCA and the RYA to agree these requirements. The Scottish Ministers recommended that NnGOWL discuss and agree the specific requirements for an updated NRA with the MCA.	A traffic validation was undertaken using AIS data collected during 2016, as summarised in Section 11.6. Appendix 11.2 includes the full assessment. No significant changes in traffic were observed, and therefore an updated NRA has not been undertaken. This approach has been agreed with the MCA. The updated UK Coastal Atlas has been considered within the establishment of the baseline presented in Section 11.6.
	The Scottish Ministers noted the MCA's requirement for an NRA update and advised NnGOWL to discuss and agree the specific requirements for an updated NRA with the MCA. The outcomes of these discussions would determine whether the previous NRA remains representative of the baseline. If so, the Scottish Ministers agreed that the conclusions of the Original EIA remain valid.	A traffic validation was undertaken using AIS data collected during 2016, as summarised in Section 11.6. Appendix 11.2 includes the full assessment. No significant changes in traffic were observed, and therefore an updated NRA has not been undertaken. This approach has been agreed with the MCA.
	The Scottish Ministers agreed that the embedded mitigation from the Originally Consented Project and additional measures detailed in The Consents are appropriate to the potential level of the effect from the Project.	Embedded mitigation is listed in Section 11.7.1.and anticipated consent conditions commitments are in Section 11.7.2 where they relate to Shipping and Navigation. Table 11-8.
	The Scottish Ministers agreed that the Project EIA should only focus on those receptors considered to be significantly affected by the Project as reported within the Scoping Report, and subject to agreement with the MCA.	The baseline assessment (Section 11.6) has been used to identify those receptors which potentially may be significantly affected by the Project. The subsequent impact assessment is presented in Section 11.8.
	The Scottish Ministers recommended that NnGOWL confirms with the MCA which receptors should be included in the NRA (if required, see above) to ensure the requirements the MCA outline in their consultation response are taken into account.	As agreed with the MCA (and as summarised in Section 11.5), an updated NRA is not required. The baseline assessment (Section 11.6) has been used to identify those receptors which potentially may be significantly affected by the Project. The subsequent impact assessment is presented in Section 11.8.

Date and consultation phase / type	Consultation and key issues raised	Section where comment addressed
	The Scottish Ministers agreed that the following should be included in the cumulative impact assessment and advise that NnGOWL confirm with the MCA that this is appropriate: ▪ Worst case scenario of Inch Cape (2014 as consented) or Inch Cape (2017 scoping report) ▪ Worst case scenario of Seagreen Alpha and Bravo (2014 as consented) or Seagreen (2017 scoping report)	The cumulative assessment is presented in Section 11.8.4, based on a worst case approach as required.
08/09/17 Scoping Response from the East Lothian Council (ELC)	ELC asked for reassurance that the potential for a vessel carrying a polluting load being involved in a collision or allision incident as a result of the project, with subsequent discharge of the polluting load into the sea, had been considered within the EIA Report. If any significant risk of pollution from this source would be created, an indication of its likelihood, and potential impacts should be included. ELC acknowledged that this may be better assessed under "Water Quality", however noted the clear link to shipping and navigation.	Collision (vessel to vessel) and allision (vessel to structure) impacts are assessed in Section 11.8.2. Appendix 11.1 also details likely pollution resulting from any base case and future case allision or collision incidents. All were found to be within acceptable parameters. Embedded mitigation includes an Emergency Response and Cooperation Plan (ERCoP) which would include details of cooperation with the Coastguard in the event of pollution incidents. Additionally, the Marine Pollution Contingency Plan (MCMP) will set out relevant management measures to mitigate risk of accidental spills, as per Table 11-8.
08/09/17 Scoping Response from the MCA	The MCA noted that an NRA update will need to be submitted in accordance with MGN 543 and the MCA Methodology for Assessing the Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations.	Following agreement with the MCA, Appendix 11.3 has been undertaken in order to demonstrate that navigational safety impacts have been addressed satisfactorily without any updates required to the NRA.
	The MCA noted that traffic studies were carried out in 2010 and 2012, however in line with the requirement that traffic studies be completed within 24 months prior to the Environmental Statement submission, an expectation that a new traffic study be undertaken was stated.	A traffic validation was undertaken using AIS data collected during 2016, as summarised in Section 11.6. Appendix 11.2 includes the full assessment. This approach has been agreed with the MCA.

Date and consultation phase / type	Consultation and key issues raised	Section where comment addressed
	The MCA stated that particular attention should be paid to cabling routes and where appropriate burial depth for which a Burial Protection Index study should be completed and, subject to traffic volumes, an anchor penetration study may be necessary. If cable protection were to be required e.g. rock bags, concrete mattresses, the MCA would be willing to accept a 5% reduction in surrounding depths referenced to Chart Datum. This will be particularly relevant where depths are decreasing towards shore and potential impacts on navigable water increase.	Embedded mitigations (section 11.7.1) states: *"Cables will be protected appropriately taking into account fishing and anchoring practices. Positions of the cable routes notified to Kingfisher Information Services – Offshore Renewables Cable Awareness (KIS - ORCA) for inclusion in cable awareness charts and plotters for the fishing industry".* In addition it is anticipated that a Cable Plan (which will include a Cable Burial Risk Assessment) will be required as a condition of any future consents for the Project as detailed in Section 11.7.2, Table 11-8
	The MCA stated that any application for safety zones will need to be carefully assessed and additionally supported by experience from the development and construction stages.	A successful application for safety zones are assumed as embedded mitigation, as described in Section 11.7.1. The application will be submitted with a supporting safety case, providing justification of the need for safety zones, and an assessment of the likely impacts arising from their use.
	The MCA stated that particular consideration will need to be given to the implications of the site size and location on Search and Rescue (SAR) resources and ERCoP. Attention should be paid to the level of radar surveillance, AIS and shore-based Very High Frequency (VHF) radio coverage and give due consideration for appropriate mitigation measures such as radar, AIS receivers and in-field, Marine Band VHF radio communications aerial(s) (VHF voice with Digital Selective Calling (DSC)) that can cover the entire wind farm sites and their surrounding areas.	It is anticipated that a Navigational Safety Plan (NSP) will be required as a condition of any future consents granted for the Project, for approval, which will include an ERCoP as described in Section 11.7.1 Similarly, it is anticipated that a Development Specification and Layout Plan (DSLP) will be required as a condition of any future consents which will require a final layout to be submitted for approval by MS-LOT, subject to consultation with the MCA (See Section 11.7.2).
08/09/2107 Scoping Response from the Northern Lighthouse Board (NLB)	The NLB are content with the topics to be included in the EIA and those sections requiring updated data, as detailed in the Scoping Report.	This EIA has followed the methodology outlined within the Scoping Report, as agreed with the MCA.

Date and consultation phase / type	Consultation and key issues raised	Section where comment addressed
08/09/17 Scoping Response from RYA Scotland	RYA Scotland stated that should a traffic validation exercise against recent AIS data confirm that there has been no significant change in the Shipping and Navigation baseline, the NRA for the Original EIA will remain valid. RYA Scotland requested that the new edition of the UK Coastal Atlas of Recreational Boating be used to inform the assessment, and considered this data set to provide good representation of reactional activity within the area.	A traffic validation exercise of AIS data collected in 2016 showed an increase in recreational activity when compared to the original assessment; however the change was not considered significant. The updated 2016 data has been used as the primary input to the assessment of impacts to recreational traffic (Section 11.8 and Appendix 11.1). The updated UK Coastal Atlas has been considered within the establishment of the baseline presented in Section 11.6.
08/09/17 Scoping Response from the Under 10m Association	The Under 10m Association noted that since the original scoping consultation, additional consents have been granted to other companies for wind farms in the area and the cumulative effect of these and the impact for displacement of the fishing vessels should be considered.	Fishing vessel displacement has been considered cumulatively in Section 11.8.4. This includes consideration of the Seagreen and Inch Cape wind farms. Further assessment is provided in Chapter 10: Commercial Fisheries.
	The Under 10m Association stated that the impact on all inshore fishing vessels must be considered regardless of their size.	See Chapter 10: Commercial Fisheries
	The Under 10m Association stated it was imperative that cables are buried to a minimum depth of 1-1.5 m. The potential for the laying of cables to disturb large clumps of material, which are subsequently brought to the surface and hence become a snagging hazard for trawlers was noted. Such a situation must be considered and mitigation measures put in place.	A cable burial assessment will be undertaken post consent to mitigate the risk of cable snagging. It is currently expected that additional cable protection may be required over approximately 20% of the inter-array cable and 15% of the export cable lengths, in locations where desired burial depths are difficult to achieve. Where cable protection is required over-trawlability surveys will be completed to confirm the condition of the seabed (see Chapter 10: Commercial Fisheries). Section 11.7.1 (embedded mitigation) states: *"Cables will be protected appropriately taking into account fishing and anchoring practices. Positions of the cable routes notified to KIS - ORCA for inclusion in cable awareness charts and plotters for the fishing industry"*. In addition it is anticipated that a Cable Plan (which will include a Cable Burial Risk Assessment) will be required as a condition of any future consents for the Project as detailed in Section 11.7.2,

Date and consultation phase / type	Consultation and key issues raised	Section where comment addressed
18/10/2017 Post-scoping Responses from MCA on proposed EIA methodology	The MCA is content that the traffic validation (Appendix 11.2) met the requirements for marine traffic survey data for the Project. It was agreed that the EIA Report would be submitted with the existing NRA, the traffic validation report, and the MGN543 checklist as appendices.	This chapter has followed the methodology detailed in Section 11.5, as agreed with the MCA.
	The MCA is content with the indicative Project layout, however noted a preference for two lines of orientation across the whole Wind Farm Area for SAR purposes.	It is anticipated that as stated in Section 11.7.1 (embedded mitigation) the wind farm layout will be agreed with the MCA prior to finalisation via approval of the Development Specification and Layout Plan (DSLP), which will be required as a condition of any future consents which will require a final layout be submitted for approval by MS-LOT, subject to consultation with the MCA (See Section 11.7.2).
07/12/2017 – Email correspondence[1] from MCA confirming EIA methodology approach	The MCA is content with an updated EIA, with the original NRA, a completed MGN543 checklist, and the traffic validation report as appendices. There will be aspects such as the SAR Checklist which will need to be discussed and agreed going forward (post-consent / pre-construction).	This methodology has been followed in this chapter.
	The MCA is content with the impacts carried through to the EIA. Those scoped out were already assessed as part of the original EIA, and on the understanding that there are no potential changes in traffic to result in a different significance ranking upon re-assessment, then the MCA is content with this approach.	As agreed with the MCA, only impacts where there is potential for changes in traffic to effect ranking upon re-assessment have been carried forward to the EIA.
	The MCA is content with the embedded mitigation in place for the Project.	Embedded mitigation is listed in Section 11.7.1.
	The MCA is content with the list of Projects to be scoped into the cumulative assessment.	Projects considered cumulatively are listed in Section 11.8.4.

12. In line with the proposed methodology set out in the Scoping Report, the impacts listed below have been scoped in to the EIA Report for shipping and navigation as set out in Section 11.8:

[1] This email correspondence followed a telephone call with the MCA on the 7 December 2017, undertaken for the purpose of finalising the approach to EIA followed in this chapter.

- Physical presence of structures within the Wind Farm Area leading to a loss of navigable sea room and deviations around structures resulting in an increased collision risk (vessel-to-vessel) (**during operation and maintenance**);
- Physical presence of structures within the Wind Farm Area leading to a loss of navigable sea room and deviations around structures resulting in an increased allision risk (vessel-to-structure) (**during operation and maintenance**);
- Physical presence of structures within the Wind Farm Area leading to a loss of navigable sea room and deviations around structures resulting in an increased collision risk (vessel-to-vessel) (**cumulative with other developments**); and
- Physical presence of structures within the Wind Farm Area leading to a loss of navigable sea room and deviations around structures resulting in an increased allision risk (vessel-to-structure) (**cumulative with other developments**).

13. It is noted that the MCA has agreed and approved the justification for the scoping in and out of impacts, as set out in the Scoping Report. In line with the Scoping Report, and as agreed with the MCA, the following impacts have been scoped out of the EIA for shipping and navigation, and are therefore not assessed in Section 11.8. It is noted that impacts during the decommissioning phase have been considered to be the same as those identified for construction, on the basis that these phases present similar scenarios (e.g. increased Project vessel presence, use of safety zones).

- Physical presence of Offshore Wind Farm structures leading to a loss of navigable sea room and deviations around structures resulting in an increased collision risk (vessel-to-vessel[2] and vessel-to-structure) (**during construction/decommissioning**);
- Physical presence of Offshore Wind Farm structures and inter-array and Offshore Export Cables and presence of operation/maintenance vessels leading to an increase in the number of SAR incidents (**during operation**);
- Physical presence of Offshore Wind Farm structures causing radar interference to nearby traffic (**during operation**);
- Physical presence of inter-array and Offshore Export Cables, leading to a risk of hostile anchor interaction and vessel grounding (**during operation**);
- Physical presence of inter-array and Offshore Export Cables leading to a risk of fishing gear interaction (snagging) (**during operation**);
- Physical presence of inter-array and Offshore Export Cables leading to interference on small vessel navigation equipment (**during operation**);
- Physical presence of Offshore Wind Farm structures and inter-array and Offshore Export Cables leading to a depletion of SAR Resources (**cumulative with other developments**);
- Physical presence of Offshore Wind Farm structures causing radar interference to nearby traffic (**cumulative with other developments**);
- Physical presence of inter-array and Offshore Export Cables leading to a risk of hostile anchor interaction and vessel grounding (**cumulative with other developments**);
- Physical presence of inter-array and Offshore Export Cables leading to a risk of fishing gear interaction (snagging) (**cumulative with other developments**); and
- Physical presence of inter-array and Offshore Export Cables leading to interference on small vessel navigation equipment (**cumulative with other developments**).

14. For clarity, and as per the Scoping Report, all construction and decommissioning impacts have been scoped out, as have impacts associated with the subsea cables (both the Offshore Export Cable and the inter-array cables). It is noted that impacts associated with vessels engaged in active fishing (as opposed to being in transit) are considered in Chapter 10: Commercial Fisheries.

[2] This includes both collisions involving a Project associated vessel, and collisions involving only third party vessels arising from displacement issues.

11.5 Impact Assessment Methodology

15. This assessment considers the potential impacts of the Project and the effects on Shipping and Navigation, as scoped into the EIA. The impact assessment process and methodology follows the principles and general approach outlined in Chapter 6: EIA Methodology. The methodology and parameters assessed have also taken into account issues identified through consultation with stakeholders as detailed in Section 11.4 and the understanding of baseline conditions informed by the data sources referenced in Section 11.3 and as described in Section 11.6.

16. The Project Description (Chapter 4) and the relevant project activities have been assessed against the environmental baseline to identify the potential interactions between the Project and the environment (in line with the requirements of the scoping opinion). These are known as the potential impacts and are then assessed to determine a level of significance of effect upon the receiving environment.

17. It is noted that the NRA undertaken for the Originally Consented Project provided an FSA on all of the potential impacts identified, based on the design parameters presented in the Original ES (the NRA is provided as Appendix 11.1 to this EIA Report).

18. For the purposes of the current application and this EIA Report, it was agreed with the MCA that if a traffic validation report showed no significant changes to the baseline, then an updated NRA was not necessary provided an MGN543 Checklist was completed to demonstrate compliance of the Project with the current MCA guidance.

19. A traffic validation report was therefore undertaken using marine traffic survey data collected during 2016, which showed no significant changes in traffic since the original NRA. The validation report was subsequently approved by the MCA, and is presented in Appendix 11.2.

20. The MGN543 checklist is presented in Appendix 11.3. The results of the NRA and the traffic validation have both been used as input to this assessment.

11.5.1 Assessment and Assignment of Significance

21. The sensitivities of Shipping and Navigation receptors are defined by both their potential vulnerability to an impact from the Project, their recoverability and value, or importance of the receptor. The definitions of terms relating to Shipping and Navigation receptor sensitivity are detailed in Table 11-3.

Table 11-3: Sensitivity/ importance of the environment – Shipping and Navigation

Receptor sensitivity	Definition
High	Feature of international importance e.g. IMO Routeing Measure such as a Traffic Separation Scheme (TSS) or Deep Water Route (DWR).
Medium	Feature of national importance, e.g., busy shipping lanes and port approach routes/channels, such as Firth of Forth and River Tay, used by a range of ships, including medium/large size vessels.
Low	Feature of local or regional importance, i.e. notable navigable channels used by small to medium sized vessels, such as coastal routes east/west of Bell Rock and off the Fife coast.
Negligible	Negligible impact in terms of shipping and navigation.

22. The magnitude of impact is defined by a series of factors including the spatial extent of any interaction, the likelihood, duration, frequency and reversibility of a potential impact. The definitions of the levels of magnitude used in this assessment in respect of Shipping and Navigation are described

in Table 11-4 (note that only adverse impacts are considered and, therefore, no definitions for potentially beneficial impacts are presented).

Table 11-4: Magnitude of the impact – Shipping and Navigation

Magnitude	Description (adverse effects)
High	Total loss or very major alteration to internationally important shipping lanes, i.e. IMO routeing measures.
Medium	Major alteration or loss of strategically important shipping lanes and navigational port approaches, i.e. shipping routes used by vessels headed in/out of Firth of Forth and River Tay.
Low	Minor shift from baseline conditions leading to a partial loss or alteration to lower use navigational routes from baseline conditions, i.e. shipping routes and channels used by small and medium sized vessels using coastal routes.
Negligible	Very slight change from baseline shipping and navigation routeing.
No Change	No loss or alteration or characteristics, features or elements; no observable impact in either direction.

23. The magnitude of the impact is correlated against the sensitivity of the receptor to provide a level of significance. For the purposes of this assessment, any effect that is considered moderate or major is considered to be significant in EIA terms.

Table 11-5: Significance of potential effects – Shipping and Navigation

		Magnitude			
		High	**Medium**	**Low**	**Negligible**
Sensitivity	**High**	Major	Major	Moderate	Minor
	Medium	Major	Moderate	Minor	Negligible
	Low	Moderate	Minor	Minor	Negligible
	Negligible	Minor	Negligible	Negligible	Negligible

11.5.2 Uncertainty and Technical Difficulties Encountered

24. The primary input to this assessment is the marine traffic survey data collected during 2016, as described in Section 11.3. This data set was collected for the purpose of validating the marine traffic survey data collected in 2010 and 2011 (see Appendix 11.2, which presents both the 2016 and 2010/11 data sets), and to identify any key changes in traffic patterns. As the 2016 data comprised AIS only, vessels not required to broadcast via AIS are likely to be underrepresented, most notably fishing vessels under 15 m, and recreational vessels.

25. As indicated in Table 11-2, the RYA are content with the use of AIS data alone for assessment of recreational traffic, as it should provide a fair indication of the overall activity so long as it was considered alongside the new RYA Coastal Atlas. Therefore the updated RYA Coastal Atlas of Recreational Boating (2016) has also been included within the assessment and the recreational vessel baseline has been validated using the Coastal Atlas and the 2016 AIS data.

26. As noted above, fishing vessels under 15 m may be underrepresented within the 2016 data used to assess the baseline as AIS transmission is not compulsory for such vessels. However it was observed that a significant proportion of fishing vessels recorded within the 2016 AIS data were less than 15m (approximately 60% based on a count of unique vessels per day) and were therefore voluntarily carrying AIS transmitters and allowing consideration of their activity. It is noted that further detailed information on fishing activity is provided within Chapter 10: Commercial Fisheries.
27. A worst case scenario for each impact in terms of the Project parameters has been assumed within the assessment, as discussed in Section 11.7.
28. For the impacts assessed, the worst case scenario from a Shipping and Navigation perspective was considered to be a maximum build out scenario, i.e. the maximum number of turbines and OSPs built within the Wind Farm Area.

11.6 Baseline Description

11.6.1 Wind Farm Study Area

11.6.1.1 Existing Data

29. Navigational features within the study area have been identified based on a review of Admiralty Charts and the Pilot Book (UKHO, 2016).

11.6.1.1.1 Aids to Navigation

30. Aids to Navigation (AtoNs) within the area are shown relative to the Project in Figure 11.2, Volume 2. The Bell Rock lighthouse is located approximately 7 NM north-west of the Wind Farm Area, and is fitted with a Racon transmitter. While not strictly an Aid to Navigation, the Inch Cape Met Mast transmits via AIS, and is also positioned north of the Wind Farm Area. AtoNs to the west of the wind farm include the Fife Ness Lighthouse (which transmits via AIS), the North Carr Buoy (also transmitting via AIS), and a light marking Crail Harbour.
31. The Isle of May is marked with a coastal light, and by two buoys east of the island. It is noted that a note on Admiralty Charts states that there are two buoys marking the island, however only one is charted.

11.6.1.1.2 Ports and Harbours

32. There is only one harbour within the Wind Farm Study Area, located at Crail. The harbour is mainly used by small fishing and recreational vessels. It is noted that significant commercial traffic routes associated with other ports do pass through the Wind Farm Study Area. Fishing activity associated with other ports was also recorded within the Wind Farm Study Area during the marine traffic surveys (see Chapter 10: Commercial Fisheries for further details of fishing ports within the area). Assessments of this traffic are presented in Section 11.6.1.2.1 and Section 11.6.1.2.3, respectively, and a summary of the key commercial ports is presented below.
    - Grangemouth, a commercial port located within the Firth of Forth, can handle all types of vessels (tankers up to 10.7 m draught, other vessels up to 7.4 m);
    - Methil, a commercial port within the Firth of Forth, accommodating vessels up to 5.5 m draught;
    - Leith, berths within the Firth of Forth handling cruise liners, general cargoes and dry bulk;
    - Rosyth, a commercial port within the Firth of Forth handling general cargo and cruise liners;
    - Dundee, at the mouth of the Firth of Tay handling general cargoes; and

- Perth, commercial port in the Firth of Tay handling agricultural products, timber, and chemical salts.

33. As shown in Figure 11.2, Volume 2, the Forth Ports authority limit is positioned at the mouth of the Forth and intersects the Wind Farm Study Area. The Forth vessel traffic service is operated from Grangemouth, and covers the area within the ports limit.

11.6.1.1.3 Anchorage

34. There is one charted anchorage within the Wind Farm Study Area, located approximately 9.5 NM west of the Wind Farm Area, off Crail. It is noted that vessels at anchor here are extremely unlikely to interact with the Offshore Wind Farm. There are no charted anchorages within the Wind Farm Area itself, though it is noted that with the exception of the military wrecks mentioned below, there are currently no restrictions on anchoring within the Wind Farm Area. Anchoring activity observed within the marine traffic survey data is summarised in Section 11.6.1.2.2.

11.6.1.1.4 Marine Environmental High Risk Areas

35. The Isle of May (located approximately 8 NM west of the Wind Farm Area) is designated as a Marine Environmental High Risk Area (MEHRA) as shown in Figure 11.2, Volume 2. The designation was based on a high concentration of vulnerable seabirds, and the high density of traffic passing the island. It is noted that sections of the coast on either side of the mouth of the Forth are also designated as MEHRAs; however, these areas lie outside the Wind Farm Study Area.

11.6.1.1.5 Military Practice and Military Wrecks

36. The Wind Farm Area intersects a military practice area (UKHO-PEXA-X5641) which is designated as an area used for general practice, however it is noted that Admiralty Charts indicate that the area south of the Wind Farm Area is available for submarine practice. Further areas intersect the Wind Farm Study Area as shown in Figure 11.2, Volume 2. Within the Wind Farm Area itself, military wrecks lay on the seabed, with a note on Admiralty Charts stating that these should not be interfered with by an unauthorised party.

37. Two ammunition dumping grounds are positioned within the study area, approximately 1 NM east of the Isle of May; however, neither is in use.

11.6.1.1.6 Marine Incidents

38. Locations of marine incidents recorded by the MAIB and the RNLI are presented in Figure 11.3, Volume 2, and Figure 11.4, Volume 2, respectively.

39. A review of the incidents recorded by the MAIB between 2005 and 2014 showed a total of 85 incidents within the Wind Farm Study Area, two of which occurred within the Wind Farm Area itself:

- An 'Accident to person' on a survey/research vessel leading to an injury to one crew member in September 2010; and
- A 'Fire/Explosion' on a fishing vessel in June 2011.

40. The majority of vessels involved in recorded incidents (approximately 72%) were fishing vessels, with the remainder largely made up of commercial vessels. No incidents of a vessel-to-vessel collision were reported. However a total of nine incidents, listed as either 'Hazardous Incident' or 'Machinery Failure', involved two vessels, and it should be considered that these may have been collision or near miss incidents. Of these nine, five were recorded at the mouth of the Forth, and three to the south of the Wind Farm Area.

41. The RNLI data showed a total of 79 incidents occurring within the Wind Farm Study Area, with one recorded within the Wind Farm Area. The details provided with this incident (date and time, incident location, vessel type, incident type) indicate it is the same 'Fire/Explosion' incident described within the MAIB data above.

42. As with the MAIB data, no incidents classified as a 'collision' were recorded, however there were a high density of incidents recorded within the mouth of the Forth, including one incident of a fishing vessel snagging gear on a subsurface obstruction.

11.6.1.2 Wind Farm Study Area Survey Results

43. This section summarises the key findings of the marine traffic survey data collected during 2016 from onshore AIS receivers. Any changes observed from the data collected during 2010 and 2011 have been highlighted, and, as the 2016 data is AIS only, details of the traffic recorded via radar in 2010 have been referenced where necessary. The 2016 marine traffic data is presented in Figure 11.5, Volume 2.

44. It was estimated from the 2016 data that 22 unique vessels per day passed within the Wind Farm Study Area, with approximately three of these intersecting the Wind Farm Area itself per day.

45. A review of the marine traffic survey data collected in 2016 (for the purpose of validating the pre-existing data) showed the majority of traffic within the Wind Farm Study Area was from fishing vessels, and commercial vessels (cargo and tanker). Further details are provided below.

46. It is noted that the below analysis is primarily based on the 2016 marine traffic survey data, although reference has also been made to the 2010/11 data where appropriate (noting that no radar data was collected within the 2016 data; as agreed with MCA and NLB (Table 11-2). As stated in Appendix 11.2, there have been no significant changes in traffic since the 2010/11 surveys that would impact the outcomes of any assessment undertaken.

11.6.1.2.1 Commercial Traffic

47. Most commercial traffic in the area was observed on routes passing south of the Wind Farm Area, between the Firth of Forth and other European ports, including Eemshaven (Netherlands), Rotterdam (Netherlands), and Immingham (UK). Commercial traffic passing through the Wind Farm Area was largely comprised of tankers running between Lerwick (UK) and Immingham (UK).

48. Two regular commercial routes were observed intersecting the Wind Farm Area. One runs between the Humber estuary, and various northern Scottish and island ports including Aberdeen, Peterhead, and Lerwick. The other is associated with the Firth of Tay, with destination / origin ports including both southern UK and mainland European ports.

49. It was estimated that 13 unique commercial vessels per day passed within the Wind Farm Study Area, with two of these per day intersecting the Wind Farm Area.

11.6.1.2.2 Anchoring Vessels

50. The marine traffic survey data showed anchoring from tankers immediately south-east of the Wind Farm Area, and also towards the southern boundary of the Wind Farm Study Area. Additionally, one cargo vessel was also recorded at anchor, in the area immediately south-east of the Wind Farm Area. The information transmitted via AIS by these vessels suggested they were anchoring while awaiting orders, on occasion for a period of more than one week.

51. No anchoring was recorded within the Wind Farm Area itself.

11.6.1.2.3 Fishing Vessels

52. The majority of fishing within the Wind Farm Study Area was observed to be associated with the Firth of Forth and to the south west of the Wind Farm Area, largely from beam trawlers and dredgers. Potting activity was also recorded off Fife Ness, and to the north, east, and south-east of the Wind Farm Area. Only three unique fishing vessels were recorded within the Wind Farm Area, and their behaviour suggested they were in transit at the time rather than actively engaged in fishing. Fishing vessel activity is presented in Figure 11.6, Volume 2.

53. Non-AIS vessels accounted for approximately 80% of fishing vessel tracks recorded during the 2010/11 marine traffic surveys, including vessels recorded within the Wind Farm Area. It is noted that stricter

AIS carriage requirements were in place during the 2016 data period (all fishing vessels of length 15 m and above) than those active during 2010/11 (only fishing vessels above 45 m), and the percentage of non-AIS fishing vessel traffic is therefore expected to be significantly lower in 2016 (approximately 65% of fishing vessel activity was from vessels less than 15 m in length within the 2016 data). Further information on fishing activity is contained within Chapter 10: Commercial Fisheries.

54. Longer term satellite and sighting surveillance data recorded from January 2015 to December 2016 was used to validate the findings of the AIS analysis, and to assess fishing activity over a longer period. As observed in the AIS data, the satellite data showed the majority of fishing activity occurred to the south-west of the Wind Farm Area, within and around the Firth of Forth. It is noted that the satellite data showed activity from vessels within the Wind Farm Area itself at speeds suggesting they may have been engaged in fishing at the time. However levels here were limited when compared to areas of the Firth of Forth to the south-west. Gear type information is not provided with the satellite data, and further analysis into types of fishing (based on the satellite data) was therefore not possible.

55. The sightings data showed two key forms of fishing: demersal trawling occurring mainly to the south-west of the Wind Farm Area, and scallop dredging largely concentrated to the north-east. No vessels were sighted within the Wind Farm Area itself.

11.6.1.2.4 Recreational Vessels

56. Approximately one recreational vessel per day was recorded during the summer 2016 survey period, none of which intersected the Wind Farm Area (no recreational vessels were recorded during winter). It is noted that during the vessel based survey undertaken in 2010, a recreational vessel not broadcasting on AIS was recorded within the Wind Farm Area via radar, and that vessels not broadcasting on AIS are not accounted for within the AIS data. A general upwards trend in voluntary AIS broadcast by recreational vessels has been observed since 2010/11; however, it is nonetheless considered likely that the AIS data alone still underrepresents actual traffic levels.

57. The RYA Coastal Atlas (RYA, 2016), shows the Wind Farm Area to be of low recreational density when compared to coastal areas, as shown in Figure 11.7, Volume 2. This correlates well with the findings of the marine traffic surveys. The Coastal Atlas also notes a general boating area associated with the Firth of Tay located approximately 6 NM to the northwest of the Wind Farm Area.

11.6.2 Development of Baseline Conditions without the Project

11.6.2.1 Commercial Traffic

58. The main, established routes within the study areas are those associated with the Firth of Forth. Based on the navigable sea area in which vessels can transit within the Forth, and the presence of the Isle of May within its entrance, significant changes to the positions (mean or percentile) of these routes within the study areas are not considered likely. Vessel levels may vary depending on import/export demand.

11.6.2.2 Anchoring Vessels

59. Established anchoring activity by tankers within the study areas can be expected to continue. As the tankers are not using a charted anchorage, but rather a known preferred anchoring area, there is the potential for these vessels to anchor in different positions within the general vicinity; however, significant changes are not expected. It should be noted that vessels may anchor where they choose, assuming there are no charted restrictions.

11.6.2.3 Fishing Vessels

60. Fishing activity can vary on both a seasonal and annual basis and is dependent on a number of factors, including weather, fish migration, and quota fulfilment. For this reason it is difficult to predict future

fishing patterns within the study areas, however it can be assumed that if fish are available within the study areas, then fishing will continue to occur.

11.6.2.4 Recreational Vessels

61. Significant changes to recreational activity are not anticipated, however it should be noted that there is a general upwards trend in the uptake of voluntary AIS broadcast from small recreational vessels. Any future marine traffic surveys may therefore show increased recreational activity to that observed within the (AIS only) 2016 marine traffic survey.

11.7 Design Envelope – Worst Case Design Scenario

62. The Application is for the construction, operation and decommissioning of an offshore wind farm with a maximum output of 450 MW, comprising a maximum of 54 turbines. The assessment scenarios identified in respect of Shipping and Navigation, for those issues scoped into the assessment, have been selected as those having potential to represent the greatest effect on an identified receptor based on the Design Envelope described in Chapter 4: Project Description. The worst case design scenarios are set out in Table 11-6.

Table 11-6: Design envelope scenario assessed

Potential Impact	Worst Case Design Scenario	Justification
Operation and Maintenance		
Physical presence of Offshore Wind Farm structures leading to a loss of navigable sea room and deviations around structures resulting in an increased collision risk (vessel-to-vessel)	Maximum number of turbines installed (54) Maximum number of OSPs installed (2) 800m minimum spacing Minimum blade clearance of 35 m above lowest astronomical tide (LAT) which is in excess of the 22m above Mean High Water Springs (MHWS) required for marine regulators.	The maximum number of structures will create the largest area from which vessels may be displaced. It is noted that while commercial vessels are likely to avoid travelling through the Wind Farm Area, and hence are only impacted by the periphery turbines, smaller vessels (e.g., fishing, recreation) could be impacted by the structures.
Physical presence of Offshore Wind Farm structures leading to a loss of navigable sea room and deviations around structures resulting in an increased allision risk (vessel-to-structure)	Maximum number of turbines installed (54) Maximum number of OSPs installed (2) 800m minimum spacing Minimum blade clearance of 35 m above lowest astronomical tide (LAT) which is in excess of the 22m above MHWS required for marine regulators.	The maximum number of structures will create the largest surface area into which a vessel could allide.

11.7.1 Embedded Mitigation

63. Embedded mitigation measures to minimise the potential effects on shipping and navigation are captured within the Project design envelope. The scoping of the assessment of effects on shipping and navigation, has taken account of the embedded mitigation measures set out in Table 11-7.

64. In the event that further mitigation is required that cannot be embedded into the Project, this has been included as additional mitigation and is set out in Section 11.9.

65. It is noted that construction and decommissioning impacts have been scoped out of the EIA (see Section 11.4). However, as the embedded mitigation formed a key assumption within the scoping process (combined with impacts already assessed as being of minor significance within the Original ES), the embedded mitigation within these phases has been included in the table.

Table 11-7: Embedded mitigation relating to Shipping and Navigation

Parameter	Embedded Mitigation
Construction	
Information Circulation	Appropriate liaison to ensure information on the construction of the Offshore Wind Farm is circulated in Notice to Mariners, Kingfisher Bulletin, Navigation Information Broadcasts and other appropriate media. As part of the Notice to Mariners process the information will be supplied to Imray publications.
Navigational Chart Marking	While construction work is in progress, Admiralty Charts will provide a note over the Wind Farm Area stating as such including position of construction buoyage.
Lighting and Marking	The Project construction works will be marked in line with IALA-O136, and as agreed with NLB, MCA and the Civil Aviation Authority (CAA).
Compliance with relevant MCA Guidance (MGN 543 and Annexes)	The Project will be designed in compliance with MGN543. Annex 5 (Requirements, Guidance and Operational Considerations for Search and Rescue) specifies *"Standards and procedures for generator shutdown and other operational requirements in the event of a SAR, counter pollution or salvage incident in or around an OREI."*
Formulation of an ERCoP as per MCA template	Creation of an ERCoP based on the MCA template and Project Safety Management Systems (SMS), in consultation with the MCA. Procedures will be followed in the event of an emergency situation during the construction phase.
Onshore Operations Base	The onshore operations base will also serve as a Marine Control Centre that will monitor vessel activity (AIS and non-AIS) and record the movements of vessels around the Wind Farm Area as well as infield (company) vessels working at the Offshore Wind Farm. Possible errant vessels identified in construction areas or safety zones will be identified and contacted.
Safety zones and guard vessels	Construction safety zones of 500 m around major activities will be in place to exclude vessels not associated with the construction works for the Offshore Wind Farm. Guard vessels, or another nominated vessel, will be used to monitor passing traffic and contact vessels, which could infringe the safety zones. 50 m pre-commissioning safety zones may also be included. Minimum safe passing distance may be requested by vessels where safety zones are not applicable.
Operation and Maintenance	
Marked on Admiralty Charts	The Project will be charted by the UKHO using the magenta turbine tower chart symbol found in the publication NP5011 - *Symbols and Abbreviations used in Admiralty Charts* (UKHO, 2016a). The buried, subsea cables associated with the Project will also be charted on the appropriate scale charts. Offshore Export Cables will be charted by the UK Hydrographic Office on the appropriate scale charts who may provide a note on the charts to state no anchorage areas over charted cables.
Information Circulation	Appropriate liaison to ensure information on any major maintenance of the wind farm is circulated in Notice to Mariners, Kingfisher Bulletin, Navigation Information Broadcasts and other appropriate media.

Parameter	Embedded Mitigation
Lighting and Marking	During the operational phase, the Project will be marked in line with IALA-O136, and as agreed with NLB, MCA and CAA.
Turbine Air Draught	Lowest point of rotor sweep is a minimum of 35m above LAT which is in line with the MCA and RYA recommendation of 22 m above MHWS.
Cable protection (inter-array and Offshore Export Cable)	Cables will be protected appropriately taking into account fishing and anchoring practices. Positions of the cable routes notified to Kingfisher Information Services – Offshore Renewables Cable Awareness (KIS - ORCA) for inclusion in cable awareness charts and plotters for the fishing industry.
Compliance with relevant MCA Guidance (MGN 543 and Annexes)	The Project will be operated as required in MGN543. Annex 5 (Requirements, Guidance and Operational Considerations for Search and Rescue) specifies *Standards and procedures for generator shutdown and other operational requirements in the event of a SAR, counter pollution or salvage incident in or around an OREI*.
Formulation of an Emergency Response Co-operation Plan as per MCA template	Creation of an ERCoP based on the MCA template and Project SMS, in consultation with the MCA. Procedures will be the followed in the event of an emergency situation during the operational phase.
Subsea surveys of cables and burial depths	Periodic and planned surveys of cable to monitor burial depths/protection and seabed mobility (cable movement).
Safety zones and guard vessels	Safety zones of 500 m around major maintenance activities to exclude vessels not associated with the works from the offshore site. Guard vessels, or another nominated vessel, will be used to monitor passing traffic and contact vessels, which could infringe the safety zones. Minimum safe passing distance may be requested by vessels where safety zones are not applicable.
Decommissioning	
Information Circulation	Appropriate liaison to ensure information on the decommissioning of the Offshore Wind Farm is circulated in Notice to Mariners, Kingfisher Bulletin, Navigation Information Broadcasts and other appropriate media.
Lighting and Marking	During the decommissioning phase, all structures will be lit and marked in agreement with NLB. Should any structures be left in situ, consideration will be given to lighting and marking, again in agreement with NLB.
Cable Protection and Monitoring	Cable protection and monitoring of any cables left in situ will be agreed in advance of decommissioning taking place.
Safety Zones and Guard Vessels	Safety zones of 500 m around certain decommissioning activities (where necessary) to exclude vessels not associated with the works from the Development Area. Guard vessels or another nominated vessel will be used to monitor passing traffic and contact vessels, which could infringe the safety zones.

11.7.2 Anticipated Consent Conditions Commitments

66. A number of consent conditions were attached to The Consents to manage the environmental risk associated with the Originally Consented Project. NnGOWL anticipate that any future consents issued to the Project may incorporate similar conditions to manage the risk to shipping and navigation commensurate with the Project design envelope where it remains necessary to do so. Table 11-8 sets out the conditions attached to The Consents for the Originally Consented Project which have some relevance to the management of effects on shipping and navigation.

Table 11-8: Consent conditions for the Originally Consented Project relevant to Shipping and Navigation

Original Consent Requirement	Relevance to shipping and navigation	Relevant project phase
Construction Method Statement	Requires the final construction methods to be set out for approval to ensure that they remain consistent with the methods assessed in the Project ES and to ensure appropriate construction management taking into account mitigation measures to protect the environment and other users of the marine area.	Construction
Development Specification and Layout Plan	Setting out, for approval, the final design and layout of the Project to ensure it remains consistent with the design assessed in the ES as relevant to shipping and navigation.	Construction
Vessel Management Plan	Setting out, for approval, the number and types of vessels, vessel management practices, port and harbour locations, and transit routes relevant to the Project.	Construction and Operation and Maintenance
Navigational Safety Plan	Setting out, for approval, the navigational safety measures to mitigate navigational risk of other marine users operating in the area.	Construction and Operation and Maintenance
Cable Plan	Setting out, for approval, the location and installation methods for the cables (including burial) to ensure they remain consistent with the installation process assessed in the ES, as relevant to Shipping and Navigation.	Construction and Operation and Maintenance
Lighting and Marking Plan	Setting out, for approval, the navigational lighting strategy to be installed at the site to ensure safe marking of the structures and Development Area to mitigate the navigational risk to other marine users.	Construction and Operation and Maintenance
Navigational Safety (Construction)	Notify the UKHO prior to the commencement of construction to facilitate the promulgation of maritime safety information and updating of nautical charts and publications through the national Notice to Mariners System. Issue local Notice to Mariners to ensure local mariners, fishermen's organisations and HM coastguard are aware of the Licensable Marine Activity. Consult with local harbour masters as appropriate. Ensure that details of the works are promulgated in the Kingfisher Fortnightly Bulletin [KIS-ORCA], prior to the commencement of the works to inform the Sea Fish industry of vessel routes, timings and the locations of Project Activities.	Construction
Markings, lighting and signals of the Works	Ensure that the Project is lit in accordance with the requirements of the relevant statutory stakeholders including marking of the site with appropriate construction buoyage during construction and continued lighting of the site following completion of construction as required by the MCA and NLB.	Construction and Operation and Maintenance
Markings, lighting and signals of the Works	Ensure that any vessels engaging in the work are marked in accordance with the International Rules for the Prevention of Collisions at Sea if under way and in accordance with the UK Standard Marking Schedule for Offshore Installations if secured to the seabed.	Construction
Navigational Safety (Operation)	Ensure appropriate notifications are made following completion of the works to all relevant stakeholders including UKHO, the Maritime Rescue and Coordination Centre Aberdeen and all mariners and fishermen's organisations. Ensure appropriate notifications are made through the Kingfisher Fortnightly Bulletin to inform the Sea Fish Industry.	Operation and Maintenance

Original Consent Requirement	Relevance to shipping and navigation	Relevant project phase
Marine Pollution Contingency Plan	Setting out, for approval, relevant management measures to mitigate risk of accidental spills and subsequent remedial action, response measures relating to spills and collision incidents and practices used to refuel vessels at sea if relevant.	Construction and Operation and Maintenance

11.8 Impact Assessment

11.8.1 Construction Phase Impacts

67. All impacts relevant to the construction phase have been scoped out of this EIA Report (see Section 11.4).

11.8.2 Operational and Maintenance Phase Impacts

68. The impacts resulting from the operation and maintenance of the Project have been assessed on Shipping and Navigation receptors identified within the study areas and for those issues scoped into the assessment. A discussion of the likely significance of each effect resulting from each of the impacts scoped into the EIA is presented below.

11.8.2.1 Physical presence of Offshore Wind Farm structures leading to a loss of navigable sea room and deviations around structures resulting in an increased collision risk (vessel-to-vessel)

69. The physical presence of the structures within the Wind Farm Area may displace any pre-existing vessel activity, including commercial vessels, recreational activity, and fishing activity. This could increase vessel density in the surrounding area, leading to an increase in vessel-to-vessel collision risk.

11.8.2.1.1 Commercial Traffic

70. Past experience has shown that commercial vessels will not transit through and between offshore wind turbines, instead choosing to deviate in advance to avoid the structures altogether. This may lead to an increase in vessel density inshore of the Wind Farm Area from traffic either accessing or exiting the Firths of Forth Tay, which may increase the risk of a collision. It should be considered that the sea room in this inshore area is limited by the shore, and that there may be pre-existing marine activity in these coastal areas (e.g. fishing or recreational), which may further increase the collision risk.

71. Vessels using the area for transit only (i.e. those vessels whose destination and origin ports both lie elsewhere) are considered likely to pass east of the Wind Farm Area, rather than inshore, where there is ample sea room for safe navigation and where fishing and recreational activity would be expected to be less than those areas inshore of the Wind Farm Area. Any rise in collision risk associated with these commercial vessels is therefore anticipated to be minimal.

72. Two commercial routes were identified as intersecting the Wind Farm Area and both will therefore be required to re-route. However, as shown in Appendix 11.2, neither deviation is expected to be significant.

73. Within the modelling undertaken in the NRA (Appendix 11.1), vessel to vessel collision rates were estimated at approximately one collision per 900 years. It is also noted that no 'Collision' incidents were recorded within the MAIB or RNLI incident data assessed as part of the baseline. However, 'Hazardous Incidents' involving two vessels were recorded.

74. With the embedded mitigation in place such as promulgation of information via notice to mariners and the marking of the structures on Admiralty Charts, it is assumed that commercial vessels will be aware of the presence of the Project by the operational and maintenance phase (noting that during the

construction phase displacement impacts will be managed by the embedded mitigation listed in Table 11-7), and hence be able to effectively passage plan. This will ensure they passage plan in advance and are able to avoid the Wind Farm Area safely, taking into account the limited sea room inshore of the Wind Farm Area and any pre-existing activity.

75. On this basis, and taking into account the collision modelling undertaken in the NRA, the magnitude is considered to be **low** given the limited number of routes impacted and minor shift in baseline conditions, and sensitivity is considered to be **low** due to the available navigable sea room. This impact is therefore estimated to be of **minor significance** to commercial vessels, and not significant in EIA terms.

11.8.2.1.2 Fishing Vessels

76. Based on the marine traffic surveys, fishing activity was observed within the Wind Farm Study Area; however (based purely on the available marine traffic data), fishing vessels within the Wind Farm Area were considered likely to be in transit, rather than actively fishing. It should be noted that fishing is highly seasonal and can also vary on an annual basis and fishing will therefore occur within the Wind Farm Area during other periods of the year. Chapter 10: Commercial Fisheries provides a more detailed long term assessment of fishing activity and discusses the extent to which fishing takes place within the Wind Farm Area.

77. During the operational phase there will be no restrictions on fishing vessels entering into the Wind Farm Area (except during periods of major maintenance, when localised safety zones may be employed) and fishing vessels may therefore continue to transit the Wind Farm Area if they choose. Fishing vessel activity was observed to be busiest to the south-west of the Wind Farm Area and notable activity was also observed to the west of Fife Ness. These areas may see a small increase in commercial traffic density from those vessels deviating inshore of the Wind Farm Area (as discussed in section11.8.2.1.1), which may increase the risk of a collision.

78. As information on the Project will be promulgated to relevant stakeholders (including through Kingfisher Bulletins aimed at fishermen), it has been assumed that both fishing vessels and commercial traffic will be aware of the potential for increased traffic inshore of the Wind Farm Area. It is also assumed that by the operational phase, regular fishing users of the area will be aware of how commercial traffic patterns have adapted as a result of the construction phase of the Project and vice versa (noting that embedded mitigation will manage displacement risks to fishing vessels during the construction phase).

79. The magnitude is considered to be **low** given the limited number of fishing vessel transits and the sensitivity is considered to be **low** given the available navigable sea room. The impact to fishing vessels is therefore assessed to be of **minor significance** and not significant in EIA terms.

11.8.2.1.3 Recreational Vessels

80. As with fishing vessels, recreational vessels may still freely transit the Wind Farm Area post-construction, (except during periods of major maintenance, when localised safety zones may be employed). No significant displacement impact is therefore anticipated. However, there may be an increased collision risk to recreational vessels using the area inshore of the Wind Farm Area, arising from an increase in commercial vessels created by commercial traffic deviating to avoid the Wind Farm Area.

81. The prospect of a recreational user being unfamiliar with the area is more likely than an unfamiliar fishing user, and it should also be considered that some recreational users may lack marine experience. However based on the findings of the marine traffic survey, the majority of recreational activity in the area is expected to be coastal, and unaffected by the Wind Farm Area.

82. The magnitude is considered to be **low** given the limited number of recreational routes affected, and the sensitivity is considered to be **low** given the available navigable sea room. The impact to recreational vessels is therefore assessed to be **minor significance** and not significant in EIA terms.

11.8.2.2 Physical presence of Offshore Wind Farm structures leading to a loss of navigable sea room and deviations around structures resulting in an increased allision risk (vessel-to-structure)

83. The physical presence of the structures within the Wind Farm Area create an allision risk (vessel-to-structure) to passing traffic, including commercial vessels, fishing vessels and recreational vessels.

11.8.2.2.1 Commercial Vessels

84. Commercial vessels are unlikely to choose to transit through the Wind Farm Area and will instead passage plan in advance to avoid the structures altogether. Therefore, any allision risk from commercial traffic is anticipated to be from vessels outside of the Wind Farm Area. This could be from a vessel under power at the time entering the Wind Farm Area unintentionally, or from a drifting vessel (engine failure) not under command. An allision between a vessel and a turbine or substation could lead to damage to both the vessel and the structure, and there is also the potential for a pollution spill (either fuel or cargo).

85. Allision modelling was undertaken as part of the NRA (Appendix 11.1) to estimate the likelihood of a vessel allision with a structure. Powered allision rates were estimated at one per 7,700 years, while an allision from a vessel not under command (i.e. a drifting vessel) was estimated to occur once every 31,000 years.

86. Based on this, and the embedded mitigation in place (lighting and marking, marking on charts, information circulation), the magnitude is considered to be **low** given the small number of routes impacted, and sensitivity is considered to be **low** given the available navigable sea room. The impact is therefore assessed to be of **minor significance** to commercial vessels, and not significant in EIA terms.

11.8.2.2.2 Fishing Vessels

87. Fishing vessels may choose to transit the Wind Farm Area during the operational phase, and there is therefore an increased risk of an allision from a vessel with the structures themselves. Based on the relatively small size of a fishing vessel, when compared to a commercial vessel, the primary concern in an allision situation would be for the safety of the vessel and crew, rather than damage to the structure, which would likely be superficial. However, it is considered likely that any fishing vessel within the Wind Farm Area would be transiting at a speed unlikely to result in a serious allision, with minor damage to the vessel and structure considered to be the most likely outcome.

88. Fishing vessel specific allision modelling undertaken in the NRA (Appendix 11.1) estimated a fishing vessel would contact a structure once every 53 years.

89. Based on this relatively high frequency, the magnitude is considered to be **medium** given the number of fishing transit impacts, with sensitivity assessed as **low** given the minor change in baseline conditions. The impact to fishing vessels is therefore assessed to be of **minor significance** and not significant in EIA terms.

11.8.2.2.3 Recreational Vessels

90. An allision scenario for a recreational vessel is likely to be similar to that of a fishing vessel, based on the relatively small hull size when compared to a commercial vessel. However, it should be considered that recreational users may be inexperienced, or even if they are experienced, may choose to approach the structures within the Wind Farm Area out of curiosity.

91. However, with embedded mitigation in place (notably that blade clearance will exceed the 22m above MHWS requirement of the MCA and RYA), and the likelihood that any contact between a recreational vessel and wind farm structure is likely to be a low speed interaction, the magnitude is assessed to be **low** given the number of routes impacts, with sensitivity assessed as **low** given the minor change compared to baseline conditions. The impact to recreational vessels is therefore assessed to be of **minor significance** and not significant in EIA terms.

11.8.3 Decommissioning Phase Impacts

92. Impacts from decommissioning are anticipated to be similar to those assessed during construction during the period that infrastructure is removed from the seabed at the end of the Project's operational life. Effects resulting from decommissioning activities on Shipping and Navigation receptors would therefore be expected to be no greater than during the construction phase which have been scoped out of the EIA.

11.8.4 Cumulative Impacts

93. Cumulative effects refer to effects upon receptors arising from the Project when considered alongside other proposed developments, activities and any other reasonably foreseeable project(s) proposals. In this context, the term 'projects' is considered to refer to any project with comparable effects and is not limited to offshore wind projects.

94. Projects and activities considered within the shipping and navigation cumulative impact assessment are set out in Table 11-9[3]. There may be an element of uncertainty associated with the design envelope of proposed projects; therefore, a judgement is made on the confidence associated with the latest available design envelope.

95. In assessing the cumulative impacts for the Project, two scenarios are considered to take into account the consented design envelopes of the Inch Cape Offshore Wind Farm and the Seagreen Offshore Wind Farm Projects (Table 11-10).

96. Scenario one incorporates the design envelopes for the proposed Inch Cape and Seagreen projects as detailed in the Scoping Reports submitted to MS-LOT (ICOL, 2017; Seagreen, 2017). Scenario two incorporates the consented design envelopes as detailed in the respective project consents.

Table 11-9: Projects for cumulative assessment – shipping and navigation

Development Type	Project	Status	Data Confidence Assessment / Phase
Offshore Wind Farm	Inch Cape Offshore Wind Farm	Consented	High – Consented project details available.
Offshore Wind Farm	Inch Cape Offshore Wind Farm - revised design	Proposed	High – project details in the Scoping Report and additional information provided by the Developer.
Offshore Wind Farm	Seagreen Alpha and Bravo	Consented	High – Consented project details available.
Offshore Wind Farm	Seagreen Phase 1- revised design	Proposed	High – project details in the Scoping Report and additional information provided by the Developer.
Offshore Wind Farm	Kincardine Offshore Wind Farm	Consented	High – Consented project details available.
Offshore Wind Farm	European Offshore Wind Deployment Centre	Under construction	High – final development within public domain.

[3] It is noted that the Scoping Opinion states only the Seagreen and Inch Cape developments are required to be considered in the cumulative section. However, given the potential for vessel routeing to be cumulatively affected by developments further afield, the additional wind farm projects presented in the table have also been included as per the methodology agreed for Shipping and Navigation.

Development Type	Project	Status	Data Confidence Assessment / Phase
Offshore Wind Farm	Hywind Pilot Park	Operational	High – wind farm is commissioned and operational.
Offshore Wind Farm	Blyth Offshore Demonstrator Wind Farm	Construction / Pre- commissioning	High – final development within public domain.
Offshore Wind Farm	Beatrice Offshore Wind Farm	Under Construction	High - final development within public domain.
Offshore Wind Farm	Moray East	Consented	High - final development within public domain.
Offshore Wind Farm	Moray West	Planned	Medium – proposed, scoping opinion requested. Published project information available in the public domain.

Table 11-10: Cumulative worst case design scenario

Impact	Worst Case Design Scenario	Justification
Physical presence of Offshore Wind Farm structures leading to a loss of navigable sea room and deviations around structures resulting in an increased collision risk (vessel-to-vessel)	9 offshore wind farm developments, assuming maximum build out in each Development Area.	The outcome of the cumulative assessment will be greatest when the greatest number of other schemes, present or planned, are considered. The assessment is based on deviation around the development areas of the respective projects as the worst case scenario.
Physical presence of Offshore Wind Farm structures leading to a loss of navigable sea room and deviations around structures resulting in an increased allision risk (vessel-to-structure)		

11.8.4.1 Cumulative Impacts – Operational Phase

11.8.4.1.1 Physical presence of Offshore Wind Farm structures leading to a loss of navigable sea room and deviations around structures resulting in an increased collision risk (vessel-to-vessel)

97. The key cumulative impact of wind farms on Shipping and Navigation receptors is the displacement of established vessel routeing. The reduction in sea room resulting from the presence of multiple offshore wind farms may lead to increases in vessel density as multiple vessel routes are displaced into similar transit patterns to avoid the multiple developments. These areas of increased density may increase the risk of a vessel-to-vessel collision, particularly if the routes are displaced into areas of pre-existing vessel activity (for example fishing or recreation).

Commercial Traffic

98. The marine traffic survey identified two routes, which will be displaced by the presence of the Wind Farm Area (see Appendix 11.2). It has been assumed that the Firth of Tay route will pass south of the

Wind Farm Area post construction (and therefore also south of both the Inch Cape and Seagreen projects), and is not expected to be significantly impacted on a cumulative basis. The route between the Humber and Northern Scottish ports is likely to pass in between Inch Cape and Seagreen, and to the east of the Wind Farm Area.

99. The results of the hazard workshop (Appendix 11.1) indicated that smaller commercial vessels and tankers in the area are likely to be on tight time schedules and will seek the fastest route to transit the area. It is assumed that the majority of such vessel masters will be familiar with the Project during the operational phase (including through promulgation of information and nautical chart updates) and will be able to passage plan in advance, accommodating the offshore wind farms in the Firth of Forth and Tay region.

100. The presence of multiple wind farms will lead to an increase in the length of deviations, create a reduction in the available sea room and therefore increase commercial vessel density between and surrounding the arrays. The collision risk within these areas are therefore expected to rise, particularly in cases where there is pre-existing vessel activity (e.g., fishing or recreational).

Fishing Vessels

101. Based on the marine traffic survey data, and the additional assessment provided in Chapter 10: Commercial Fisheries, fishing vessels both transit and actively fish within the Wind Farm Area, and the surrounding waters. Once the Forth and Tay wind farms are operational, fishing vessels will be able to transit through the array structures (as per their own passage plans taking into accounts conditions) and there is therefore not expected to be a significant displacement impact to fishing vessels in transit from a cumulative perspective (see Chapter 10: Commercial Fisheries for impacts to vessels engaged in active fishing).

Recreational Vessels

102. Similarly to fishing vessels, recreational vessels will be free to transit through operational wind farms (as per their on passage plans taking into accounts conditions) and therefore no significant displacement impact is expected (particularly as recreational traffic was observed to be largely coastal in the baseline).

Significance

103. Based on the potential for reduced sea room and subsequent increased collision risk associated with displacement and routeing associated with all the cumulative developments, the magnitude of this impact is assessed to be **medium**. This is due to the size of the alterations when considered against those associated with the project in isolation. The sensitivity assessed as **medium** given the potential for the loss or reduction in key navigational routes within the area (Firth of Forth and Firth of Tay routes) used by a variety of vessel types and sizes. The cumulative displacement and collision impact is therefore assessed to be, with embedded mitigation in place, of **moderate significance** and significant in EIA terms.

11.8.4.1.2 Physical presence of Offshore Wind Farm structures leading to a loss of navigable sea room and deviations around structures resulting in an increased allision risk (vessel-to-structure)

104. The presence of multiple offshore wind farms along the Scottish East coast will increase the risk of a vessel-to-structure allision. In particular, the arrangement of the offshore wind farms in the Firth of Forth and Tay region creates situations where vessels may transit in between two sets of turbines associated with separate projects (such as those between the Project and Inch Cape, or between Inch Cape and Seagreen). Should a vessel suffer engine failure within one of these 'corridors', or if a vessel is required to take avoidance action to avoid a collision, then there will be allision risks either side of the vessel and thus an increase in allision risk.

Commercial Vessels

105. As commercial vessels will avoid entering into wind farm arrays, any allision risk is expected to be from commercial traffic passing outside of the structures. High risk areas are therefore the aforementioned 'corridors' between wind farms, as allision risks border both sides of the corridor. It is also noted that commercial vessels will have less ability to manoeuvre within such corridors in an emergency situation than that of smaller vessels (such as fishing or recreational vessels).

Fishing Vessels

106. It is likely that fishing vessels will transit through wind farm arrays once operational (as per their on passage plans taking into account conditions), and there will therefore be an increased allision risk to such vessels once multiple wind farms are active within the Forth Zone. Fishing vessels navigating within the arrays or between projects will be subject to a small increase in cumulative allision risk associated with exposure to turbines on either side.

Recreational Vessels

107. The cumulative allision risk for recreational vessels is considered similar to that of fishing vessels, with allision scenarios most likely for those vessels transiting through wind farm arrays or between projects.

Significance

108. The magnitude is assessed to be **medium** given that all vessel types and sizes will be affected, with sensitivity also assessed as **medium** given that the increased risk is associated with key routes and activities located within the Firth of Forth and Tay area. The allision impact is therefore assessed, with embedded mitigation in place, to be of **moderate significance** (and significant in EIA terms) when considered on a cumulative basis.

11.8.5 Inter-relationships

11.8.5.1 Commercial Fisheries

109. The assessment in this chapter considers allision and collision risk to fishing vessels in transit (as opposed to fishing vessels engaged in fishing) during the operational phase of the Project. Impacts associated with fishing vessels actively engaged in fishing are considered in Chapter 10: Commercial Fisheries.

11.9 Mitigation and Monitoring

110. The assessment of impacts, in isolation, on Shipping and Navigation receptors as a result of the construction, operation and decommissioning of the Project are predicted to be of minor significance (noting that construction and decommissioning impacts were scoped out of this assessment on the basis that they were already assessed as part of the Original ES). Based on the predicted effects it is concluded that no specific additional mitigation is required beyond the embedded mitigation set out in Section 11.7.1 for the Project alone or cumulatively.

111. The assessment of impacts, cumulatively with other Forth and Tay wind farm projects determined that there is potential for significant effects during operation as a result of reduction in navigable sea room leading to greater risk of vessel to vessel collision or vessel to structure allision. The assessment assumes maximum build out scenarios of the Inch Cape and Seagreen projects. NnGOWL propose to consult with the MCA and NLB and other stakeholders to identify appropriate further mitigation as required. Further mitigation may include additional aids to navigation to assist internal navigation and additional means of communication to assist third parties throughout the operational phase of the Project, such as, marine coordination facilities, offshore VHF aerials and AIS transceivers/receivers.

11.9.1 Monitoring

1.1.1.1 Traffic Monitoring

112. Appendix 11.2 provides an indication of the rerouting that may occur as a result of the Project. However, it is recommended that marine traffic is monitored via AIS post-construction to ensure actual changes in shipping behaviour resulting from the Wind Farm Area can be fully understood. This will serve to confirm deviated routeing, and will also provide an indication of any vessel activity occurring within the Wind Farm Area.

11.10 Summary of Residual Effects

113. This chapter has assessed the potential effects on Shipping and Navigation of the construction, operation and decommissioning of the Project, both in isolation and cumulatively and for those impacts scoped into this EIA. No effects greater than minor significance were identified for the Project alone, whilst cumulative effects were predicted to be of moderate significance

114. Table 11-11 summarises the impact determinations discussed in this chapter and presents the post-mitigation residual significance.

Table 11-11: Summary of predicted impacts of the Project

Potential Impact	Significance of Effect	Mitigation Measures	Residual Significance of Effect
Operation			
Physical presence of Offshore Wind Farm structures leading to a loss of navigable sea room and deviations around structures resulting in an increased collision risk (vessel-to-vessel)	*Commercial Vessels:* **Minor Significance** *Fishing Vessels:* **Minor Significance** *Recreational Vessels:* **Minor Significance**	n/a	*Commercial Vessels:* **Minor Significance** *Fishing Vessels:* **Minor Significance** *Recreational Vessels:* **Minor Significance**
Physical presence of Offshore Wind Farm structures leading to a loss of navigable sea room and deviations around structures resulting in an increased allision risk (vessel-to-structure)	Commercial Vessels: **Minor Significance** Fishing Vessels: **Minor Significance** Recreational Vessels: **Minor Significance**	n/a	Commercial Vessels: **Minor Significance** Fishing Vessels: **Minor Significance** Recreational Vessels: **Minor Significance**
Cumulative Effects			
Physical presence of Offshore Wind Farm structures leading to a loss of navigable sea room and deviations around structures resulting in an increased collision risk (vessel-to-vessel)	**Moderate Significance** for all vessel types.	To be considered in consultation with MCA and NLB. May include additional aids to navigation to assist with navigation and additional means of communication to assist third parties.	**Moderate Significance**
Physical presence of Offshore Wind Farm structures leading to a loss of navigable sea	**Moderate Significance** for all vessel types.	To be considered in consultation with MCA and NLB.	**Moderate Significance**

Potential Impact	Significance of Effect	Mitigation Measures	Residual Significance of Effect
room and deviations around structures resulting in an increased allision risk (vessel-to-structure)		May include additional aids to navigation to assist with navigation and additional means of communication to assist third parties.	

11.11 References

- IALA (2013) *Recommendations O-139 on the Marking of Man-Made Structures*. Edition 2. December 2013.
- ICOL (2017) *Revised Design Scoping Report*.
- IMO, (2002) *Formal Safety Assessment Process*.
- MCA (2008) *MGN372 (M+F) Guidance to Mariners Operating in the Vicinity of United Kingdom (UK) Offshore Renewable Energy Installations*.
- MCA (2015) *Methodology for Assessment Marine Navigational Risk.*
- MCA (2016) *MGN543 (M+F) Safety of Navigation: Offshore Renewable Energy Installations – Guidance on UK Navigational Practise, Safety, and Emergency Response*. 2016
- RYA (2013) *The RYA's Position on Offshore Renewable Energy Developments: Paper 1 – Wind Energy*. 2013
- RYA (2016) *Coastal Atlas*.
- Seagreen (2017) *Revised Design Scoping Report.*
- UKHO (2016a) *Admiralty Sailing Directions, North Sea (West) Pilot, NP54*. 10th Edition. 2016
- UKHO (2016b) *Symbols and Abbreviations used on Admiralty Paper Charts, NP5011*. 6th Edition. 2016