Kincardine Offshore Windfarm

Environmental Statement

March 2016

Plan Design Enable

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Glossary

Biodiversity	-	The amount of diversity between different plants, animals and other species in a given habitat at a particular time.
Catenary Moorings	-	Where the mooring line arrives on the seabed horizontally.
	-	The curve of an anchor cable from the seabed to the vessel; it should be horizontal at the anchor.
Conduit	-	A structure containing ducts for electrical conductors or cables.
Development Area	-	The windfarm area including the Wind Turbine Generators (WTG) and inter-array cables.
Directionally Drilled	-	A steerable trenchless method of installing underground pipes, conduits and cables in a shallow arc along a prescribed bore path by using a surface-launched drilling rig, with minimal impact on the surrounding area
Drag Embedment Anchor	-	The drag anchor is dragged along the seabed until it reaches the required depth. As it penetrates the seabed, it uses soil resistance to hold the anchor in place.
Effect	-	The physical change in the environment as a result of a particular activity or activities related to the development (e.g. the placement of anchors, trenching, and cable burial). Effects are usually measurable (e.g. area, weight, length, time, volume) and include a range of physical changes to the environment (e.g. sediment removal, elevated turbidity, noise, etc.).
Impact	-	The consequence of the physical change in the environment and are defined as the way in which sensitive receptors are affected or 'impacted' by the change in the environment. The significance of an impact is directly related to the magnitude of the effect and the vulnerability of the receptor.
Inshore Waters	-	Marine Waters within 12nm.
Inter-array Cables	-	Inter-array cabling connects the turbines to allow the power generated at each turbine to be collected and sent on to shore
Offshore Export Cable Corridor	-	The area within which the proposed Offshore Export Cables will be laid, from the perimeter of the Development Area to the onshore area at Mean High Water Spring (MHWS).
Onshore Area	-	The onshore area above Mean High Water Spring (MHWS) including the underground cables connecting to the onshore substation at Redmoss.
Rochdale Envelope	-	Enables a meaningful EIA to take place through defining a 'realistic worst case' scenario which decision makers may consider when determining the acceptability, or otherwise, of the environmental impacts from a project.
Stakeholder	-	Regulators and statutory consultees such as Marine Scotland, Scottish Natural Heritage.

Acronyms

AA	-	Appropriate Assessment
AfL	-	Agreement for Lease
CAR	-	Controlled Activity Regulations
DECC	-	Department of Environment and Climate Change
EC	-	European Commission
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Plan
EPS	-	European Protected Species
ES	-	Environmental Statement
FPSO	-	Floating Production, Storage and Offloading
FEPA	-	Food and Environment Protection Act 1985
GES	-	Good Environmental Status
GRP	-	Glass Reinforced Plastic
HRA	-	Habitats Regulations Appraisal
IMO	-	International Maritime Organisation
IROPI	-	Imperative Reasons of Overriding Public Interest
KOWL	-	Kincardine Offshore Windfarm Ltd
KV	-	Kilovolts
MCAA	-	Marine and Coastal Access Act 2009
MCA	-	Marine Coastguard Agency
MHWS	-	Mean High Water Spring
MPA	-	Marine Protected Area
MS LOT	-	Marine Scotland Licensing Operations Team
MSFD	-	Marine Strategy Framework Directive
MW	-	Megawatt
N2K	-	Natura 2000 Sites
NE3	-	North East 3 (taken from the MS RGL – to be changed to OWNE1 (Offshore Wind North East 1) in updated RGL Floating offshore document)

NLB	-	Northern Lighthouse Board
NG	-	National Grid
nm	-	Nautical Mile
NPF	-	National Planning Framework
NRA	-	Navigation Risk Assessment
NTS	-	Non-Technical Summary
O&M	-	Operation and Maintenance
OMR	-	Offshore Marine Regulations
OSP	-	Offshore Substation Platform
OSPAR	-	Convention for the Protection of the Marine Environment in the North East Atlantic
OWNE 1	-	Offshore Wind North East (RGL reference)
PAN	-	Planning Advice Note
PEMP	-	Project Environmental Management Plan
PHA	-	Preliminary Hazard Analysis
PORL	-	Pilot Offshore Renewable Energy Ltd
RAM	-	Restricted in their Ability to Manoeuvre
RLG	-	Regional Location Guidance
RNLI	-	Royal National Lifeboat Institute
RYA	-	Royal Yachting Association
SACs	-	Special Areas of Conservation
SAR	-	Search and Rescue
SCI	-	Sites of Community Interest
SEPA	-	Scottish Environment Protection Agency
SFF	-	Scottish Fishing Federation
SNH	-	Scottish Natural Heritage
SPAs	-	Special Protection Areas
SPP	-	Scottish Planning Policy
SSSI	-	Sites of Special Scientific Interest
SRYA	-	Scottish Royal Yachting Association

TCE	-	The Crown Estate
UK	-	United Kingdom
WANE	-	Wildlife and Natural Environment (Scotland) Act 2011
WFD	-	Water Framework Directive
WTG	-	Wind Turbine Generator

1. Introduction

1.1. Introduction

1. This Environmental Statement (ES) has been prepared by Atkins Limited (Atkins) on behalf of Kincardine Offshore Windfarm Limited (KOWL) to accompany an application to construct and operate the Kincardine Floating Offshore Windfarm. Once constructed and installed the operational windfarm is anticipated to have an 'operational' - generating lifespan of 25 years. The consents associated with this Environmental Statement are requested to span a 30 year period to cover pre and post installation activities, construction/installation, operation and maintenance of the Project.

2. The aim is to develop a pilot-scale offshore windfarm utilising floating foundation technology, which will demonstrate the technological and commercial feasibility of floating offshore wind. KOWL is currently negotiating an Agreement for Lease (AfL) under The Crown Estate Floating Foundation Demonstrator round. The proposed site is located south-east of Aberdeen approximately 8nm (15km) from the Scottish coastline and provides suitable water depth for a floating offshore wind demonstrator development (approximately 60-80m) (Figure 1-1).

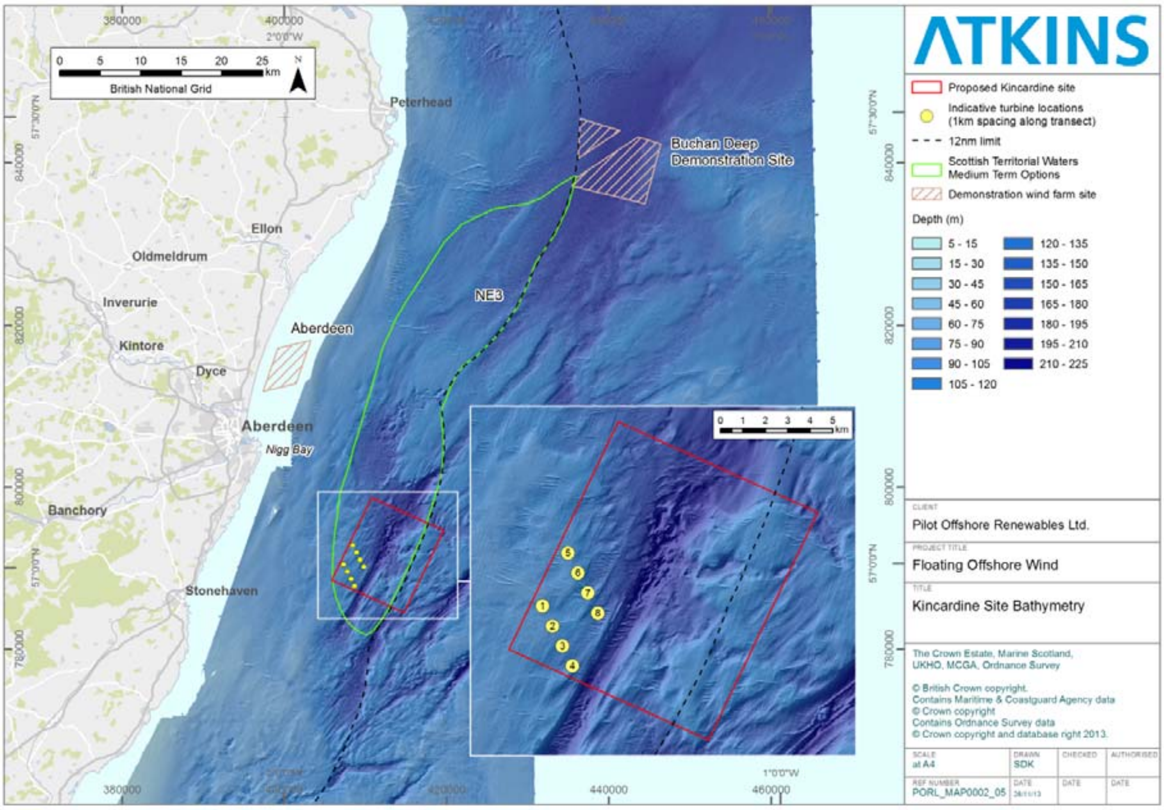

Figure 1-1 Location of the Kincardine Floating Offshore Windfarm

3. Kincardine Offshore Windfarm Limited (KOWL) is a new company formed by Pilot Offshore Renewable Energy (PORL) and Atkins Ltd. PORL is an Aberdeen based joint venture between MacAskill Associates Limited and Renewable Energy Ventures (Offshore) Limited. Both are Scottish companies with extensive experience in the wind industry. KOWL has been established in order to develop, finance, construct, operate, maintain and decommission the Kincardine Offshore Windfarm. KOWL is applying for the consents required for the windfarm and for the associated transmission works.

1.2. Terminology

4. Definitions used in this ES are included in the Glossary at the beginning of this document and at the start of a chapter where relevant.

1.2.1. Project Component Definitions

5. For the purpose of this ES the components of the Kincardine Offshore windfarm are separated into three areas. These areas are defined as:

- The Development Area – the windfarm area including the Wind Turbine Generators (WTG) and inter-array cables.
- The Offshore Export Cable Corridor – the area within which the proposed export cables will be laid, from the perimeter of the Development Area to the onshore area at Mean High Water Spring (MHWS).
- The Onshore Area – the onshore area above Mean High Water Spring (MHWS) including the underground cables connecting to the onshore substation at Redmoss.

6. The EIA focuses on the impacts associated with the offshore elements only as part of the Marine Licence and Section 36 Consent applications to Marine Scotland. The Development Area and the Offshore Cable Corridor combined are referred to as the Project for the remainder of this document.

7. The onshore area is subject to a separate planning permission application to Aberdeen City Council. An overview of the onshore elements of the Project; and the potential impacts to the onshore area has been considered in Chapter 16, however, this is not to the same level of detail as the offshore elements. Separate documentation will be produced to assess the potential environmental impacts of the onshore components to fulfil any requirements of the Aberdeen City Council when planning permission is applied for.

1.2.2. Clarification of Effects vs Impacts

8. The terms ‘effects’ and ‘impacts’ are often used interchangeably. However, for the purpose of this assessment they have different meanings as described below.

9. Effects are the physical change in the environment as a result of a particular activity or activities related to the development (e.g. the placement of anchors, trenching, and cable burial). Effects are usually measurable (e.g. area, weight, length, time, volume) and include a range of physical changes to the environment (e.g. sediment removal, elevated turbidity, noise, etc.).

10. Impacts are the consequence of this change and are defined as the way in which sensitive receptors are affected or ‘impacted’ by the change in the environment. The significance of an impact is directly related to the magnitude of the effect and the vulnerability of the receptor.

1.3. The Purpose of the ES

11. The purpose of this ES is to describe significant environmental impacts which are likely to arise as a result of the Project. This ES meets the requirements of the relevant Environmental Impact Assessment (EIA) Regulations (the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 (as amended) and the Marine Works (Environmental Impact Assessments) Regulations 2007 (as amended) (Great Britain Parliament). The information contained in this ES facilitates the consideration of the application.

12. This ES also reports the findings of the EIA process with each specialist chapter reporting impacts for the Development Area and Offshore Export Cable Corridor. This approach ensures that similar activities and effects are considered together and that an appropriate level of information is clearly presented to allow determination of all relevant applications. Each chapter will consider the combined and cumulative effects of the Project in line with other proposals.

13. This ES includes a description of the legal and policy background, consultation involved and assessments which have been included as part of the overall Project, definition of the Design Envelope and detailed assessments of the potential impacts of the development.

1.4. Structure of the ES

14. The following section outlines the structure of the ES:

- Non-Technical Summary (issued additionally as a separate document).
- Chapter 1: Introduction including relevant policy and legislative context, EIA process and subsequent methodology and stakeholder engagement.
- Chapter 2: Describes the overall Project including the construction, installation, operation and maintenance and decommissioning for the Project.
- Chapter 3: Description of the existing physical environment and implications of the Project.
- Chapter 4-7: Description of the existing biological environment, assessments and conclusions carried out in line with the methodology described in Chapter 1.
- Chapter 8-15: Description of the existing human environment, assessments and conclusions carried out in line with the methodology described in Chapter 1.
- Chapter 16: Description of existing onshore biological and human environment, high level assessment and conclusions.

1.5. Project Overview

15. The Project is considered a commercial demonstrator site, which will utilise floating foundation technology, rather than conventional fixed substructure foundations used the majority of Scottish offshore windfarm developments. It will be the world's first array of floating wind turbines utilising the semi-submersible foundation technology. It has been included within the Survey, Deploy and Monitoring scheme for offshore renewable systems (similar to wave and tidal devices). This will establish a leading position for Scotland in the development and deployment of this novel technology within a global perspective. Floating foundations open the possibility for future offshore windfarms to be located further from shore in deeper waters, reducing impacts to sea bird populations and minimising visual impacts whilst accessing hitherto untapped wind resources that can be found in offshore locations.

16. Floating structures also offer benefits over conventional fixed foundations in terms of reduced construction and installation costs, as extensive piling operations are not required and significant construction activities (in the case of KOWL) can be undertaken within the construction port (up to 95% of total build programme). This also minimises potential noise impacts upon sea mammals during construction and installation as the period for onsite construction is significantly lower than for other floating systems and dramatically smaller when compared to fixed installation approaches. The provisional site has an area of approximately 110km^2 and currently KOWL intend to install between six and eight turbines, each with a capacity of between 6 to 8MW. The number and capacity of turbines chosen will not exceed the 50MW cap for the demonstrator site. For example, if six turbines were installed these could be of 8MW capacity and remain within the 50MW cap, however if eight turbines were installed these would be of a lower capacity e.g. 6.2MW each to remain within the overall 50MW cap for the Project. An Offshore Export Cable Corridor has been identified, however routing of the cable(s) within this corridor will be subject to further site investigation.

17. The semi-submersible substructure has been selected as the preferred option for the Kincardine Offshore Wind project due to its suitability for the water depths off the Scottish coast and its proven track record as a prototype design. There are prototypes in operation off the coast of Portugal and off the coast of Japan at Fukushima with turbines of 2MW capacity. KOWL would seek to demonstrate the principal advantage that floating structures bring to the offshore renewable wind industry: the ability to significantly reduce offshore construction activities by pre-fabricating the substructure/WTG assembly in port and utilising catenary moorings to maintain the structures in place on location and also to significantly lower operation and maintenance (O&M) costs by undertaking large mid-life systems replacement work (i.e. blade or gearbox replacement) within local port environments as the systems can be towed back to port, rather than using large offshore construction vessels to undertake the work.

18. Up to eight substructures will be deployed, connected by inter-array cables with the resultant power being exported directly to the onshore grid by two transmission lines (one being used for redundancy). These will then connect into the National Grid at Redmoss onshore substation, subject to final agreement with the operator (SSE).

19. Inter-array cables will connect the structures within the field, to gather generated power for onward export to shore. There will be no Offshore Substation Platform (OSP) and the power will be exported by 33KV twin export (transmission lines) from the offshore site to the landing point ashore. Due to transmission losses from the offshore WTGs to the onshore substation the export cable has been positioned to reduce the length of cable and this means the cable route runs direct to shore from the site.

20. The transmission cables will come ashore via directionally drilled conduit(s) for connection to land cable and onward transmission of the power, via an onshore substation, to the Grid connection point. Directional drilling locations have been identified to allow drilling to negate the possible impacts on the East Coast mainline.

21. The operational Kincardine Offshore Windfarm will be comprised of the following components, each of which will be discussed further in Section 1.7.1.3, Chapter 2, and where necessary in individual chapters:

- Turbines (tower, nacelle, rotors and hub);
- Floating sub-structure (semi-submersible);
- Anchors and moorings;
- Inter-array electricity cables;
- Export cables to shore;
- Possible onshore substation; and
- Onshore connection to the National Grid.

1.6. Legislation and Policy

22. This section describes the legislation and policies which regulate the consenting, construction, operation and decommissioning of the Kincardine offshore windfarm and ancillary infrastructure. It also describes the requirements to undertake an EIA and Habitats Regulations Appraisal (HRA).

1.6.1. EU Legislation

1.6.1.1. Environmental Impact Assessment (EIA) Directive

23. The EIA Directive (85/337/EEC) as amended by Directives 97/11/EC, 2003/35/EC, 2009/31/EC and 2014/52/EU, introduced a procedure across Europe in order to ensure that the environmental consequences of projects are identified and assessed before consent for the project is given. It ensures that the consenting authorities have all the necessary environmental information on which they can base their decision. In Scotland the EIA Directive is transposed into Scots law through a number of Scottish Statutory Instruments.

24. The transposing regulations for the EIA Directive relevant to the Project are the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 (as amended), and the Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended). These regulations require the applicant to undertake an EIA of relevant electricity generating installations and marine projects.

25. From the initial screening stage the Project was identified as being '*an installation for the harnessing of wind power for energy production (windfarms)'* under Annex II of the EIA Directive.

26. The process by which an EIA is undertaken is discussed in detail below. It is a requirement of the assessment to take account of potential impacts as a result of construction, operation and decommissioning.

1.6.1.2. Habitats Regulations

27. The Habitats Directive (Council Directive 92/43/EEC) and the Birds Directive (Directive 2009/147/EC) form the cornerstone of Europe's nature conservation legislation. Under the directives, European member states have the power and responsibility to classify Special Areas of Conservation (SACs) for the conservation of natural habitats, fauna and flora and Special Protection Areas (SPAs) for the protection of all wild birds, their nests, eggs and habitats within the European Community. SACs and SPAs together form a network commonly referred to as Natura 2000 sites (N2K). These sites are internationally important for threatened habitats and species.

28. Annex IV of the Habitats Directive lists certain species of European Community interest and in need of strict protection. The protective measures are outlined in Articles 12 to 16 of the Directive and are transposed into Scottish Law through:

- Regulation 39 (1) and (2) and 43 of the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended): (Scottish inshore waters within 12nm);
- Regulation 39 (1) and 43 of the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 applies (Offshore Marine Regulations); and
- The Wildlife and Natural Environment (Scotland) Act (2011) (WANE).

29. Species listed in Annex IV are known as European Protected Species (EPS). Marine EPS whose natural range includes any inshore and offshore area of Scottish Waters include all cetaceans (whales, dolphins and porpoises), pinnipeds (seals), five species of turtle, and the common sturgeon. Further EPS which may be impacted include otters and migratory fish which whilst not strictly marine utilise the coastal regions of Scotland. Consideration of WANE/EPS will be included as part of the marine licence application process to understand the potential effects the Project might have on the EPS and any mitigation or further licences required.

30. In Scotland, the Habitats Directive is implemented through the following legislation:

- The Conservation (Natural Habitats, &c.) Regulations 1994 ;
- The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2004;
- The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2007;
- The Conservation (Natural Habitats, &c.) Amendment (No. 2) (Scotland) Regulations 2007;
- The Conservation of Habitats and Species Regulations 2010 which replace the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) in England and Wales (and to a limited degree in Scotland - as regards reserved matters); and
- The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 and associated amendments.

31. The regulations are collectively termed the Habitats Regulations and give protection to SACs and SPAs.

32. Where a plan or project may affect a Natura site (whether the plan or project is in the site or not), the Habitats Regulations require the competent authority to undertake a Habitats Regulations Appraisal (HRA) (see KOWL HRA). The HRA includes an Appropriate Assessment which is required when a plan or project affecting a Natura site:

- Is not connected with management if the site for nature conservation;
- Is likely to have a significant effect on the site (either alone or in combination with other plans or projects).

33. This applies to any plan or project which has the potential to affect a Natura 2000 site, no matter how far away from that site.

34. In Scotland, the Scottish Planning Policy Document (Scottish Government, 2014a) states that Ramsar sites designated under the Ramsar Convention (The Convention on Wetlands (Ramsar, Iran, 1971)) are also Natura 2000 sites and/or Sites of Special Scientific Interest protected under the relevant statutory regimes. However, where the interests of Ramsar sites correspond with overlapping SACs and SPAs, there is no need to consider them separately. Sites protected either by law under the Habitats Regulations / Offshore Marine Regulations (OMR) or by Government policy are referred to throughout the HRA process as European sites. Candidate SACs (cSACs), potential SPAs (pSPAs) and Sites of Community Interest (SCIs) are also considered in this process as if they were designated sites.

1.6.1.3. Marine Strategy Framework Directive

35. The European Marine Strategy Framework Directive (MSFD) (2008/56/EC) requires that Member States prepare national strategies in order to manage their seas in order to achieve or maintain Good Environmental Status (GES) by 2020. The MSFD outlines a transparent, legislative framework for an ecosystem-based approach to the management of human activities which supports the sustainable use of marine goods and services. In Scotland this is implemented through the Marine (Scotland) Act 2010.

1.6.1.4. Water Framework Directive

36. The Water Framework Directive (WFD) was introduced in 2000 in order to establish a framework to manage the water environment. The WFD applies to the water environment encompassing rivers, lochs, estuaries, coastal and underground water. The WFD (for ecology and water quality) extends to all freshwater bodies and seawards for 1nm from baselines (3nm in Scotland). Water Chemistry is protected up to 12nm from baselines. Under the WFD EU member states are required to protect and improve their inland and coastal waters. In Scotland this is implemented through the Water Environment and Water Services (Scotland) Act 2003.

1.6.2. UK Legislation

1.6.2.1. Electricity Act 1989

37. Consent is required by Scottish Ministers under Section 36 of the Electricity Act 1989 for the construction, extension and operation of an offshore windfarm development which has a generating capacity of greater than 1MW.

38. The Electricity Act 1989 is applicable for all offshore energy developments within Scottish territorial waters (within 12nm). It is currently planned that all the WTGs (eight) will be located within the 12nm limit.

39. The Project will have a maximum capacity of 50MW and therefore the Project will require consent under Section 36 of the Electricity Act.

40. Under the Electricity Act, you can also apply to remove the public rights of navigation that pass through the generating station, a section 36A declaration. KOWL intend to apply to Scottish Ministers for this declaration at the same time as an application for section 36 consent.

41. The statutory consultees are:

- Local Authority;
- Scottish Natural Heritage (SNH) (within 12nm)/ Joint Nature Conservation Committee (JNCC) (outside 12nm);
- Scottish Environment Protection Agency (SEPA).

1.6.2.2. Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000

42. The EIA Directive (85/337/EEC) introduced a procedure whereby all environmental consequences of projects must be identified and assessed before consent is given. All likely significant environmental effects and all associated necessary environmental information must be made available to consenting authorities in order for them to have all the facts in the consideration of

granting consent. The regulations transpose the Directive in relation to electricity generation developments.

1.6.2.3. Energy Act 2004

43. Decommissioning schemes for offshore wind and marine energy installations are established in sections 105-114 of the Energy Act 2004 which incorporates the requirements of the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention). Under the terms of OSPAR Decision 98/3 there is a prohibition on the dumping of and leaving offshore installations wholly or partly in place unless further consents are granted. The future decommissioning of the windfarm will need to comply with the requirements of the Energy Act and include measures to remove the windfarm at the end of its functional life.

1.6.2.4. Marine (Scotland) Act

44. The Marine (Scotland) Act provides a framework to help balance competing demands on Scotland's seas. It introduces a duty to protect and enhance the marine environment and includes measures to help boost economic investment and growth in areas such as marine renewables. These measures include:

- **Marine planning**: a statutory marine planning system to sustainably manage the increasing, and often conflicting, demands on our seas
- **Marine licensing**: a simpler licensing system, minimising the number of licences required for development in the marine environment to cut bureaucracy and encourage economic investment
- **Marine conservation**: improved marine nature and historic conservation with new powers to protect and manage areas of importance for marine wildlife, habitats and historic monuments
- **Seal conservation**: much improved protection for seals and a new comprehensive licence system to ensure appropriate management when necessary
- **Enforcement**: a range of enhanced powers of marine conservation and licensing

45. In April 2011, Marine Scotland, under the Marine (Scotland) Act 2010, initiated a one-stop-shop for offshore wind, wave and tidal developers to obtain consents and licences for marine renewable developments in Scottish waters, overseen by Marine Scotland's Licensing Operations Team (MS-LOT). Marine Licensing under the Marine (Scotland) Act is applicable to the Scottish inshore region from 0-12nm.

46. Within the Marine (Scotland) Act there are provisions which state that Scottish Ministers are able to prescribe that certain classes of licensable marine activity are subject to a pre-application consultation procedure alongside the Marine Licensing (Pre-application Consultation) (Scotland) Regulations 2013. Since April 2014 applicants for marine licences for activities such as the Project are required to undertake Pre-Application Consultation. The purpose of pre-application consultation allows other interested parties to comment on proposed marine developments from an early stage.

47. Scotland adpted its first National Marine Plan in 2015. The Plan covers the management of both Scottish inshore waters (out to 12 nautical miles) and offshore waters (12 to 200 nautical miles). It also applies to the exercise of both reserved and devolved functions.

48. A key feature of the marine licensing system is that decisions will be taken in accordance with the UK Marine Policy Statement and the Scottish National Marine Plan.

1.6.2.5. Marine and Coastal Access Act 2009

49. The Marine and Coastal Access Act 2009 provides the legal mechanism to help ensure clean, healthy, safe, productive and biologically diverse oceans and seas by putting in place a system for improved management and protection of the marine and coastal environment.

50. The Marine and Coastal Access Act, which mainly affects England and Wales, comprises eight key elements:

- Establishment of the Marine Management Organisation

- A strategic planning system
- A streamlined Marine Licensing system
- Marine nature conservation
- Fisheries management and enforcement
- Migratory and freshwater fisheries
- Coastal access
- Coastal and estuarine management

51. In Scottish waters, under the Marine and Coastal Access Act (MCAA) 2009 Scottish Ministers have responsibility for licensing and enforcement in the Scottish offshore region from 12-200 NM. Under the Marine (Scotland) Act 2010, Scottish Ministers are responsible for the marine licensing system and enforcement in the Scottish inshore region from 0-12 NM. The Marine & Coastal Access Act also provides executive devolution to Scottish Ministers of marine planning and conservation powers in the offshore region (12-200 nautical miles), coinciding with the devolution of marine licensing.

1.6.3. UK Policy

1.6.3.1. National Renewable Energy Action Plan for the UK

52. The National Renewable Energy Plan provides information on the measures which will enable the UK to meet its 2020 target for renewable energy generation. It is produced under Article 4 of the European Renewable Energy Directive (2009/28/EC). The Scottish Renewables Action Plan, which has stemmed from the National Renewable Energy Action Plan for the UK drives the development of renewable energy and capitalisation of Scotland's natural resources for maximum economic benefit (Scottish Government, 2011).

1.6.3.2. National Planning Framework (NPF)

53. The National Planning Framework (NPF) states the context for development planning in Scotland, providing a framework for the spatial development of Scotland. The NPF outlines the Government's development priorities for the next 20-30 years while identifying national developments that support the development strategy. Scotland's third NPF was laid in Scottish Parliament on 23rd June 2014 including a framework for the spatial development of Scotland. The NPF is a long term strategy for Scotland and is often referred to in conjunction with the Scottish Planning Policy (SPP) which describes how nationally important land use planning matters should be addressed across the country. Part of the NPF visions is to be 'A low carbon place' and to be a world leader in low carbon energy generation both onshore and offshore (Scottish Government, 2014b).

1.6.3.3. UK Marine Policy Statement

54. The UK Marine Policy Statement provides the framework for preparing Marine Plans and taking decisions affecting the marine environment. The policy statement assumes that a significant part of the renewable energy required to meet targets and objectives will come from marine sources. Of these sources, offshore wind energy is expected to provide the largest single renewable energy contribution towards 2020 targets (Her Majesty's Government, 2011).

1.6.3.4. Marine Protected Area (MPA) Network

55. There are a number of international policy drivers for the creation of the UK MPA network based on the OSPAR Convention, World Summit on Sustainable Development and the Convention on Biological Diversity with additional links to the Marine Strategy Framework Directive, EC Birds Directive and Habitats Directive (Seafish, 2013).

56. The MPA network aims to protect both biodiversity and geodiversity and contribute to the UK's agreement with international partners in order to create an ecologically coherent network of well managed MPAs. These agreements for Scotland include:

- The Marine (Scotland) Act 2010 (Nature Conservation MPAs);
- The Marine and Coastal Access Act 2009
- Convention on Wildlife (Ramsar Sites);
- Wildlife and Countryside Act (SSSIs);

- Birds Directive (SPAs); and
- Habitats Directive (SACs).

57. The Scottish MPA project is a joint project between Marine Scotland, SNH, JNCC, Historic Scotland and SEPA to recommend Nature Conservation MPAs to Scottish Government. 30 MPAs around Scotland were designated under the Marine (Scotland) Act and UK Marine and Coastal Access Act on 24th July 2014 (Scottish Government, 2015).

1.6.3.5. Blue Seas – Green Energy: A Sectoral Marine Plan for Offshore Wind Energy in Scottish Territorial Waters

58. This plan is the strategic planning document for the development of offshore wind energy in Scottish Territorial Waters containing proposals for development at the regional level up to 2020, 2030 and into the future (Marine Scotland, 2011). The Plan confirms a number of offshore wind areas for development for identified regions around Scotland of which the Kincardine Site lies within area NE3 and is described further in Section 2.1.

1.6.4. Additional Legislation and Policy

59. There is legislation which concerns specific receptors or topic areas such as legislation relating specifically to commercial fisheries or safety and navigation. Legislation for these topic areas and legislation relevant to assessing potential environmental impacts is referred to in individual chapters of this ES.

1.6.5. Town and Country Planning (Scotland) Act

60. It has been determined that the onshore components of the windfarm (including the cable route from the shoreline to the substation and all associated works incorporated within such operations) does not require a Statutory ES under the Town and Country Planning (Environmental Assessment (Scotland) Regulations 2011. Specific environmental studies required to support the planning application will be agreed with Aberdeen City Council.

1.7. Overview of EIA Procedure and Methodologies

61. This ES meets the requirements of the EIA Directive, Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 (as amended) and the Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended).

1.7.1. The EIA Process

62. The EIA follows an indicative process that will identify the potential environmental impacts that a development could introduce and the possible mitigation measures that could be used to offset or reduce these impacts. Feedback in the form of continuous on-going consultation and engagement with stakeholders has the potential to guide the impact assessment process and thus ultimately influence the output of the project.

63. The EIA process follows these steps:

- Site selection and initial project assessment;
- Screening – is an EIA required?
- Pre-application discussions with relevant stakeholders;
- Scoping – consultation on proposed scope and methodology;
- Environmental baseline studies;
- Assessment of effects – determine possible effects;
- Mitigation of possible impacts and assess residual impact;
- Undertake Pre-application Consultation (per the Marine Licensing (Pre-application Consultation) (Scotland) Reg 2013);
- Prepare and submit Environmental Statement, information for HRA (and AA), Marine Licence application and Section 36 application;
- Consideration of application and environmental information by MS-LOT (for Scottish Ministers);
- Submission by MS-LOT to Scottish Ministers for granting/refusing consent (with or without conditions); and
- Implementation and monitoring.

64. Consultation, including pre-application consultation has been undertaken with relevant stakeholders for the Project which, along with recognised best practice has informed the methodology for the assessment for this ES. The Pre-application Consultation Report (submitted as a separate document) includes all details of the public and stakeholder meetings which have been held prior to the submittal of the ES.

65. One of the first steps after screening is preparation and submission of the Scoping Report to the Scottish Government. As mentioned above, the Project was identified during screening as being 'an installation for the harnessing of wind power for energy production (windfarms)' under Annex II of the EIA Directive.

66. A Scoping Report for the Kincardine Offshore Windfarm (KOWL, 2014) was submitted to Marine Scotland and distributed to relevant statutory consultees in April 2014. This identified the areas of focus for the EIA and set out the proposed methods for the assessment. Details of the consultation undertaken is included in Section 1.11 and 1.12. Responses to the Scoping Report are presented in the Scoping Opinion (Marine Scotland, 2014). Responses relating to specific technical elements are referenced in each technical chapter.

67. Following receipt of the Scoping Opinion the collection and collation of baseline information continues. The baseline describes the current environmental and social conditions of the proposed Development Area. It provides a level against which the impact assessment is based with information gathered through a combination of desk studies and limited field surveys.

68. Once the baseline information has been collected, collated and defined, impacts arising as a result of the development either alone or cumulatively are assessed. Cumulative and in-combination effects are discussed in more detail within individual chapters.

69. Once the impacts of the development have been assessed and their significance quantified, mitigation measures are applied with long term monitoring measures considered if necessary. Following the application of mitigation, residual impacts are assessed.

70. On submission of the consent applications and supporting documentation (including this ES), the applications are considered by Scottish Ministers who have the authority to grant or deny applications with or without conditions.

1.7.2. Impact Assessment

71. Table 1-1 and Table 1-2 below provide a summary of where specific information required by the EIA regulations can be located within this ES.

Table 1-1 Aspects for inclusion in Environmental Statements as Required by Schedule 4, Part 1 & 2 of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000

Requirement	Location of Information in this ES
Description of the development, including: • A description of the physical characteristics of the whole Project and the land-use requirements during construction and operation; • An estimate by type and quantity of residues and emissions such as water air, soil pollution, noise, vibration, light, heat and radiation etc. resulting from the operational phases of the Project; • A description of the main characteristics of the production process such as nature and quantity	Chapters 1 and 2
Description of the aspects of the environment likely to be significantly affected by the development including: • Population • Fauna and flora • Soil/substrate • Water • Air and climatic factors • Material assets, including architectural and archaeological heritage • Landscape and seascape • Any inter-relationship between above mentioned factors	Chapters 3-15
Description of the likely significant effects of the Project on the environment covering direct effects, indirect effects, cumulative effects, short, medium and long term effects as well as any temporary or permanent effects resulting from: • The developments existence • Use of natural resources • Emission of pollutants and elimination of wastes	Chapters 3-15
Description of the forecasting methods used to assess the environmental effects	Chapter 1
Description of measures envisaged to prevent, reduce and whenever possible offset any significant adverse effects on the environment.	Chapters 3-15
The main alternatives studied by the applicant and the main reasons for his choice, taking into account the environmental effects	Chapter 2 (sections 2.1 and 2.2)
Non-technical summary (Non-Technical Summary)	Non-Technical Summary
Indication of any difficulties encountered in compiling relevant information	Chapters 3-15 where relevant

Table 1-2 Aspects for Inclusion in the Environmental Statement as Required by Schedule 3 of the Marine Works (Environmental Impact Assessment) Regulations 2007

Requirement and Location in the ES	Location of Information in this ES
A description of the project and of the proposed activity including details on: • Location, size and nature of the project • Quantity, nature and source of materials to be used in the course of the project • Quantity, natures and source of materials to be deposited at sea during the course of the project • Working methods to be used in the course of the project	Chapters 1 and 2
Description of the aspects of the environment which are likely to be significantly affected by the project including: • Humans, flora and fauna • Soil, water, air, climate and landscape • Material assets including cultural heritage • Interaction between multiple aspects of the project	Chapters 3-15
Description of likely significant effects of the project on the environment resulting from: • Nature of activities which are to be carried out and the manner they are to be carried out • Use of natural resource • Emission of pollutants • Creation of nuisances • Elimination of waste	Chapters 3-15 where relevant
The description should cover each of the following categories of effect: • Direct and indirect effects • Secondary effects • Cumulative effects • Short, medium and long-term effects • Temporary and permanent effects • Positive and negative effects	Chapters 3-15
Forecasting methods used by the applicant to assess main effects of the project which are likely to have an effect on the environment	Chapter 1
Description of measures envisaged to prevent, reduce and offset any significant adverse effects of the Project	Chapters 3-15
An outline of the main alternatives studied by the applicant and an indication of the main reasons for the applicant's choice, taking into account the environmental effects of those alternatives and the project as proposed.	Chapter 2 (sections 2.1 and 2.2)
Non-technical Summary	Non-Technical Summary

Any difficulties encountered such as data gaps or technical deficiencies	Chapters 3-15 where relevant

1.7.3. Impact Assessment Approach

1.7.3.1. Design Envelope

72. In order to assist with technical uncertainty in the consent application process it is common practice to define what has become known as the ‘Rochdale Envelope’. This is named after two legal cases relating to a proposed business park in Rochdale. The adoption of the Rochdale Envelope approach enables a meaningful EIA to take place through defining a ‘realistic worst case’ scenario which decision makers may consider when determining the acceptability, or otherwise, of the environmental impacts from a project.

73. As long as the technical and engineering parameters of a development fall within the limits of the envelope, and the EIA process has considered the impacts of that envelope and provides robust and justifiable conclusions, then flexibility within those parameters is deemed to be permissible within the terms of any consent granted.

74. The principle of the Rochdale Envelope permits the developer or applicant to provide broad or alternative project engineering and construction parameters, of which one or a selection of parameters or scenarios will be constructed.

75. The ‘realistic worst case scenario’ assumes that one or other of the parameters will have a more significant adverse effect than the alternative. Where a range is provided, i.e. turbine outputs or blade tip heights, the most detrimental is assessed in each case.

76. The design which may result in the most significant impact may be different for each receptor type. Understanding the cause and effects specific to each receptor leads to the definition of the appropriate Rochdale parameter for that receptor and therefore identifies the ‘realistic worst case’. In using this it can be assumed that if no significant impact is demonstrated at the ‘realistic worst case’ then no significant impact is likely for any scenario.

77. The full Rochdale Envelope as shown below in Table 1-3 is used in the preliminary assessment of each receptor, but only those parameters which would have an effect on the given topic are assessed. Further details of the Project components can be found in Chapter 2.

Table 1-3 Rochdale Envelope for installation, construction and maintenance of the offshore elements of the Project

Project Component	Parameter	Worst Case Value
Site	Area of Project	110km^2
	Water depth	60-80m
	Development Area size	5.5nm^2
	Distance to shore from closet WTG	8nm/14.8km
Turbine	Number of turbines	8
	Rated capacity	up to 8MW for each turbine and maximum 50MW for the total array
	Design	Three-bladed horizontal-axis
	WTG Hub Height (to centreline of hub)	Lowest Astronomical tide (LAT) +100m
	WTG Blade Length (to centreline of hub)	76m
	Effective Tip Height	176m
	Rotor diameter	152m
	Max blade width	4.5m
	Rotation speed	6.4-10.1.5 rpm
	Operational wind speed	3.5m/s - 30 m/s
	Derived mean rotation speed at site	9.3 rpm for 6mw
	Average pitch	15°
	Blade clearance	22m maintained at all tidal states (floating sub structure rather than fixed)
	Colour	Pale grey
Substructure	Shape of substructure	Floating turbine (semi-submersible structure) anchored to seabed. Symmetrical in shape, comprising of vertical tubular sections, at each corner; connected by horizontal and vertical diagonal members above and below the water line.
	Geometry	Equilateral 3 sided
	Elevation above waterline	12m
	Horizontal Face length	70m
	Diameter of vertical columns	12m
	Access Points	2 boat-landings
	Electrical Cable Access	3 J-tubes
	Mooring Points	4 point mooring
Foundations	Number of anchors	4 per WTG totalling 32
	Type of anchor	Drag embedment (Stevpris Mk 6)
	Weight of anchor	20 tonnes
	Maximum seabed displacement	10 x 10m per anchor 3200m^2 total array
	Actual dimensions on seabed	6.8 x 7.6m
	Depth of max penetration into seabed	1.6m

Project Component	Parameter	Worst Case Value
	Height above seabed	3.2m
	Mooring type	Catenary
	Number of mooring lines	4 per WTG 32 total array
	Mooring line radius	9 x water depth and touchdown within 250m
	Clump weights	Steel or reinforced concentre approx. 25 tonnes
	Buoys	Temporary surface buoys during construction and Permanent submersible buoys at seabed for ROV recovery. 1 per mooring lines, 32 total array
Interarray Cables	Number	12
	Length	2.5km each total 30km
	Cable outer diameter	180mm
	Total area of seabed coverage	5400m^2
	Rated capacity	33kv
	Installation	Laid on seabed
	Burial	None anticipated, burial during installation if deemed necessary post further surveys prior to installation. Max 10% of total length buried considered for EIA 3km (540m^2)
	Scour protection	None considered
Export Cable	Number	2
	Length	19km
	Length offshore	15km
	Cable outer diameter	180mm
	Installation method offshore	Trenching, laying and burial
	Trench width per cable	3m
	Trench depth	1.5m
	Separation distance between cables	500m
	Rated capacity	33kv
	Burial at landfall	HDD
	Burial offshore if 1.5m depth not achieved	Rock dumping in trench to bury cable if the sediment removed from trench does not provide sufficient material to bury cable. Max anticipated 10% of cable length 1.5km each cable 3km total
	Scour protection	None considered – to be monitored during operational phase
Pre Installation	Survey requirements	Single and multibeam bathymetry, Side Scan Sonar, Sub Bottom Profiler, Magnetometer, Sparker or Boomer array, vibrocores, CPT. Metocean buoys.
Construction and Installation (does not include weather downtime)	WTG and Substructure construction	Onshore/port area
	Installation of mooring lines	2 vessels, 1 day transit, 13 days of operations each = 14 days
	Installation of interarrray cables	1 vessel, 1 day transit, 13 day of operations = 14 days
	Installation of export cables	1 vessel, 2 days transit and 3 days of operations = 5 days total for both cables

Project Component	Parameter	Worst Case Value
	Guard vessel	1 vessel present on site between installation of moorings and WTGs/Substructures being towed to site
	Towing of WTGs to site and positioning	1 vessel, 5 days transit and 28 days of operations = 33 days + 2 standby days
	WTG installation/hook-up to interarray cables	1 vessel, 3 days of transit and 2.5 days of operation per turbine resulting in approximately 20 days of onsite operations = 23 days + 8 standby days
	Safety zone	500m rolling safety zones during construction
	WTG spacing	Minimum of 1,000m (NNW / SSE orientation) and 2,200m (north / south orientation)
Operations and Maintenance	Safety zone	50m around each turbine + guard boat
	Maintenance vessel	Winter: 1 vessel 5 days a week – emergency cover only at weekends Summer: 2 vessel 5 days a week – emergency cover only at weekends
Design Life	Operational duration of the windfarm	25 years
Decommissioning	All	All components of removed at end of design life, with the exception of the export cables which are to be left in situ

1.7.3.2. Identification of Impacts

78. The assessment process used is a methodology recommended by The Institute of Environmental Management and Assessment (IEMA, 2004) and The Institute of Ecology and Environmental Management (IEEM, 2010) and supported by Wilhelmsson *et al.* (2010). A variety of potential significant environmental impacts were identified during the scoping process using the following methodology:

- Identification of potential receptors and description of baseline conditions through a combination of consultation, desk studies and field surveys;
- Prediction of activities which may result in potential environmental impacts during different stages of the development;
- Assessment of the sensitivity of receptors and magnitude of potential impacts;
- Cumulative impacts assessment; and
- Assessment of whether residual effects (after mitigation) are significant.

1.7.3.3. Assessment of Impacts

79. For the purposes of this assessment, the level of significance has been assigned from correlating the magnitude of the change arising from the development while considering the sensitivity of the receptor.

1.7.3.3.1. Magnitude of Effect

80. A critical step in the assessment process is predicting physical effects of windfarm construction, operation and decommissioning activities. It involves determining the magnitude of the potential physical changes and comparing them to the baseline conditions. Magnitude of effect is quantified where possible, and based on the following four characteristics:

- Spatial Extent (the geographical range of the effect);
- Duration (how long the effect lasts);
- Frequency (how often the effect occurs); and
- Severity (the degree of change).

Table 1-4 Magnitude of Effects

Magnitude	Description
Positive	Positive change from baseline conditions
Negligible	Very slight change from baseline conditions
Low	Slight minor change from features of the baseline conditions
Moderate	Partial loss or changes to one or more of the key features of baseline conditions
High	Complete loss or very major changes to key features of baseline conditions

1.7.3.3.2. Receptor Sensitivity

81. For the EIA the level of sensitivity of the resource or the receptor must be defined. The sensitivity may be defined in terms of quality, value, rarity or importance of the receptor which is being assessed. The scale of sensitivity is classed as high, moderate and low with specific scales of increasing sensitivity defined where this is appropriate. Guidance is also taken for the value of a receptor through protection under law or through specific designation.

82. Receptor sensitivity of a given receptor to a change in a baseline condition is quantified using the following four factors:

- Adaptability (how well a receptor can avoid or adapt to an effect). High adaptability results in low sensitivity.
- Tolerance (the ability of a receptor to be either affected or unaffected). High tolerance results in low sensitivity.
- Recoverability (a temporal measure of how well a receptor recovers following exposure to an effect). High recoverability results in low sensitivity.
- Value (the scale of importance e.g. level of conservation status and keystone species, rarity e.g. how much of it exists relative to the potential area impacted, and worth e.g. its socio-economic, cultural and amenity value). High value results in high sensitivity.

83. The determination of each factor of sensitivity of each receptor will vary according to the specific receptor and will be defined on a receptor by receptor basis using industry best practice. Expert judgement is used in order to determine the overall sensitivity of the receptor. Sensitivity is attributed to receptors on a topic by topic basis within individual ES Chapters using best practice guidelines and industry standards.

1.7.3.3.3. Significance of Impacts

84. Considering the magnitude of the potential impact and the sensitivity upon the receptor will determine an expression for the significance of the positive or negative effects (See Table 1-5 below). Significance results from the interaction between the magnitude of an impact and the value of the resource or number / sensitivity of the potentially effected receptor.

85. All impacts will have a level of significance but not necessarily a high significance.

Table 1-5 Significance of Impact

Magnitude of Effect	Sensitivity of Resource / Receptor		
	Low	**Moderate**	**High**
Positive	Minor	Moderate	Major
Negligible	Negligible / Minor	Minor	Minor / Moderate
Low	Minor	Minor / Moderate	Moderate
Moderate	Minor / Moderate	Moderate	Moderate / Major
High	Moderate	Moderate / Major	Major

86. For this EIA any positive or negative effects which are indicated as 'Major' and 'Moderate/Major' are considered as significant.

1.7.3.3.4. Information Gaps and Data Limitations

87. Due to limitations in data availability for the assessment, assumptions are sometimes needed. Any assumptions that have been made are outlined in each topic chapter and are based on best available evidence and guidance from industry standards, consultation and professional expertise.

1.8. Mitigation and Monitoring

88. Mitigation is an important part of the ES with the EIA Regulations (the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000) Schedule 4 Part 1 (4) stating that the ES must provide:

89. '*A description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment'.*

90. Within the ES mitigation is considered separately and defined in the specific technical chapters.

1.8.1. Embedded Mitigation

91. Embedded mitigation includes all mitigation assumed to be in place during construction, operation and decommissioning. Embedded mitigation is generally regarded as industry standard or best practice. For the assessment, significance has been assessed with embedded mitigation in place.

92. Additional mitigation is classed as any mitigation which has been identified that is over and above industry best practice or industry standards. Any additional mitigation measures that have been considered necessary are discussed in the individual chapter.

1.8.2. Assessment of Residual Effects

93. Following consideration of the effectiveness of mitigation a further assessment is undertaken and any remaining significant effects are identified.

1.8.3. Monitoring

94. A monitoring plan will be developed and agreed with the regulatory bodies after consent has been granted, and will be detailed in a Project Environmental Management Plan (PEMP). Monitoring is required in order to demonstrate the environmental performance of the Project and forms part of the survey, deploy and monitor policy for floating offshore wind projects.

1.9. Cumulative Impact Assessment

95. A cumulative assessment of all the elements of the Project must be undertaken. Separate consideration of the Project with other relevant projects is also required. Each technical chapter will discuss relevant cumulative effects within each chapter.

96. European Commission (EC) Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions (1999) provides a definition of cumulative and in-combination effects which is used in this ES.

97. 'Cumulative impacts are impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project.'

98. The identified relevant projects which have been considered as part of the cumulative impact assessment are listed below (following discussions with Marine Scotland):

- Beatrice Offshore Windfarm (Beatrice Offshore Wind Limited)
- Moray Firth R3 Zone 1 (Eastern Development Area) (Moray Offshore Renewables Limited)
- Seagreen Alpha Offshore Windfarm and Seagreen Bravo Offshore Windfarm (Firth of Forth Phase 1)
- Inch Cape Offshore Windfarm
- Neart ne Gaoithe Offshore Windfarm
- Hywind Demonstration Site
- European Offshore Wind Deployment Centre (Aberdeen)

99. Other sites which have been considered as part of the cumulative impact assessment are listed below:

- Eastern High Voltage Direct Current Subsea Link (Eastern HVDV Link) from north Aberdeen to Newcastle upon Tyne
- Aberdeen Harbour Expansion (Nigg Bay)

1.10. Habitats Regulations Appraisal

100. This ES presents the findings of the information provided to inform the HRA for the Project (see separate HRA report).

101. If it cannot be ascertained beyond reasonable scientific doubt after the HRA has been completed that the proposed development will not have any adverse effects on the integrity of the European site the proposal for development can only proceed if:

- There are no alternative solutions;
- There are Imperative Reasons of Overriding Public Interest (IROPI) for doing so; and
- Any necessary compensatory measures are taken to secure the coherence of the Natura 2000 site network which is introduced in the HRA.

1.11. Stakeholder Consultation

102. Stakeholder consultation has been undertaken, according to industry best practice, forming the dynamic process of dialogue between individuals or groups and the developer. Stakeholder engagement is an important part of the EIA process whereby better plans, decisions and more satisfactory outcomes may be achieved (Scottish Government, 2010).

103. Throughout the EIA process there has been ongoing engagement with regulators and statutory consultees. All consultation is fully described in the pre-application consultation report. Consultation was undertaken early in the scoping process which is described in the Scoping Report, and consultation has continued throughout the EIA process in order to inform the content and approach of the ES.

104. Consultations have been predominantly on a topic basis, for example specific advice on addressing potential impacts on biological receptors from regulators such as SNH and Marine Scotland. In addition to topic specific consultation, broader engagement has occurred via meetings with Marine Scotland.

105. Specific consultation responses for each topic area are discussed in each technical chapter.

1.12. Public Consultation

106. Legislative requirements and industry best practice dictate that the submission of applications must be advertised and that this ES is made publically available. Stakeholder consultation/ engagement will be continued into the determination phase. Formal responses received will be recorded as representations to the consent applications and will be considered by Marine Scotland during the determination phase.

107. Public consultation is a requirement under The Marine (Scotland) Act 2010, The Marine and Coastal Access Act 2009, The Electricity Act 1989 and the EIA Regulations. KOWL public engagement is guided by the Scottish Government's Planning Advice Note (PAN) 3/2010 Community Engagement. This document provides guidance on effectively engaging and consulting with stakeholders and links with the National Standards for Community Engagement (Communities Scotland, 2009).

108. The public consultation event was held on the 18/12/2014 at the Bettridge Centre, Coastal Park, Newtonhill, Aberdeenshire between 1300 and 1900. After the event a total of 16 people provided feedback. The public consultation event was advertised in the Press and Journal 3/11/2014 in accordance with the requirements for public consultation (six weeks before the event). The feedback comments from the event are available in the separate Pre-application Consultation Report.

109. A copy of the application, respective plans, together with a copy of this ES are available at Pilot Offshore (http://pilot-renewables.com).

1.13. References

Communities Scotland (2009). *National Standards for Community Engagement*. Available Online: http://www.scotland.gov.uk/Resource/Doc/94257/0084550.pdf [Accessed: April 2015]

European Commission. (1999). Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions. Available Online: http://ec.europa.eu/environment/archives/eia/eia-studies-and-reports/pdf/guidel.pdf [Accessed: April 2015]

European Union. (2010). Marine Strategy Framework Directive. Available Online: http://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/marine-strategy-framework-directive/index_en.htm [Accessed: March 2015]

European Union. (2015). The EU Water Framework Directive. Available Online: http://ec.europa.eu/environment/water/water-framework/index_en.html [Accessed: April 2015]

Her Majesty's Government. (1989). Electricity Act. Available Online: http://www.legislation.gov.uk/ukpga/1989/29/contents [Accessed: March 2015]

Her Majesty's Government. (2004). Energy Act. Available Online: http://www.legislation.gov.uk/ukpga/2004/20/contents [Accessed: April 2015]

Her Majesty's Government. (2009). National Renewable Energy Action Plan for the United Kingdom. Article 4 of the Renewable Energy Directive 2009/28/EC. Available Online: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47871/25-nat-ren-energy-action-plan.pdf [Accessed: April 2015]

Her Majesty's Government. (2011). UK Marine Policy Statement. Available Online: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69322/pb3654-marine-policy-statement-110316.pdf [Accessed: March 2015]

IEEM. (2010). Guidelines for Ecological Impact Assessment in Britain and Ireland, marine and Coastal. Institute of Ecology and Environmental Management. Available Online: http://www.cieem.net/data/files/Resource_Library/Technical_Guidance_Series/EcIA_Guidelines/Final_EcIA_Marine_01_Dec_2010.pdf [Accessed: April 2015]

Marine Scotland. (2011). Blue Seas - Green Energy: A Sectoral Marine Plan for Offshore Wind Energy in Scottish Territorial Waters: Part A The Plan. Available Online. http://www.gov.scot/Resource/Doc/346375/0115264.pdf [Accessed: March 2015]

Marine Scotland. (2013). Guidance on Marine Licensable Activities subject to Pre-application Consultation. Available Online: http://www.gov.scot/Resource/0043/00439649.pdf [Accessed: April 2015]

Marine Scotland (2014) Kincardine Offshore Windfarm South East of Aberdeen Scoping Opinion

OSPAR (1998a). Convention for the protection of the marine environment of the north-east Atlantic (OSPAR Convention). Available Online: http://www.ospar.org/html_documents/ospar/html/ospar_convention_e_updated_text_2007.pdf [Accessed: April 2015]

Ramsar Convention (1971). Convention of Wetlands of International Importance especially as Waterfowl Habitat. Available Online: http://www.ramsar.org/sites/default/files/documents/library/current_convention_text_e.pdf [Accessed: April 2015]

SNH. Habitats Regulations Appraisal including appropriate assessment. Available Online: http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/international-designations/natura-sites/habitats-regulations-appraisal/ [Accessed: April 2015]

Scottish Parliament (1997). Town and Country Planning (Scotland) Act 1997. Available Online: http://www.legislation.gov.uk/ukpga/1997/8 [Accessed: April 2015]

Scottish Government (2009). Renewables Action Plan. Available Online: http://www.gov.scot/Resource/Doc/278424/0083663.pdf [Accessed; March 2015]

Scottish Government (2009). *National Planning Framework for Scotland 2*. Available Online: http://www.scotland.gov.uk/Resource/Doc/278232/0083591.pdf [Accessed: April 2015]

Scottish Government (2010). Marine (Scotland) Act. Available Online: http://www.legislation.gov.uk/asp/2010/5/contents [Accessed: March 2015]

Scottish Government (2010). *Planning Advice Note 3/2010 Community Engagement*. Available Online: http://www.scotland.gov.uk/Publications/2010/08/30094454/2 [Accessed: April 2015]

Scottish Government (2012). Offshore Regional Locational Guidance. Available Online: http://www.gov.scot/Topics/marine/marineenergy/Planning/windrlg [Accessed: April 2015]

Scottish Government. (2014a). Scottish Planning Policy. Available Online: http://www.pkc.gov.uk/CHttpHandler.ashx?id=28666&p=0 [Accessed: April 2015]

Scottish Government (2014b). National Planning Framework 3. Available Online: http://www.gov.scot/Publications/2014/06/3539 [Accessed: April 2015]

Scottish Government (2015). Marine Protected Areas. Available Online: http://www.gov.scot/Topics/marine/marine-environment/mpanetwork [Accessed: March 2015]

Scottish Parliament (2000). The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000. Available Online: http://www.legislation.gov.uk/ssi/2000/320/contents/made [Accessed: April 2015]

Scottish Parliament (2010). Marine (Scotland) Act 2010. Available Online: http://www.legislation.gov.uk/asp/2010/5/pdfs/asp_20100005_en.pdf [Accessed: March 2015]

Seafish. (2013). The Seafish Guide To Marine Protected Areas (MPAs). Available Online: http://www.seafish.org/media/789780/seafishguidetompas_201301.pdf [Accessed: April 2015]

The Council of the European Communities (1992). *Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) as amended*. Available Online: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1992L0043:20070101:EN:HTML [Accessed: April 2015]

Wilhelmsson, D., Malm, T., Thompson, R., Tchou, J., Sarantakos, G., McCormick, N., Luitjens, S., Gullstrom, M., Patterson Edwards, J.K., Amir, O and Dubi, A. (eds.) (2010). Greening Blue Energy: Identifying and Managing the Biodiversity Risks and opportunities of Offshore renewable Energy. IUCN, Gland, Switzerland. 102pp.

2. Project Description

1. The main alternatives considered for this project, including both windfarm design and site selection, and the main reasons for the chosen option are outlined below, taking into account the environmental effects.

2.1. Floating Offshore Wind – Technology Overview

2. The floating substructure provides a base for the installation of the wind turbine. The substructure as defined here has three key components: (1) the mooring system, which anchors the structure to the seabed; (2) the substructure, a floating structure that supports the wind turbine; and (3) the transition, which provides the connection from the substructure to the wind turbine tower. Substructures are typically made of tubular steel columns.

3. Conventional fixed substructures are less suitable for deeper waters (>50m), and floating substructures, where water depth presents less of an issue, could be a viable option.

4. In addition to allowing turbines to be installed in deeper waters further from shore, floating structures offer benefits in that their construction is largely yard based, with significantly less offshore construction activity, therefore reducing the impacts of offshore construction, the cost and scheduling uncertainties traditionally associated with more conventional windfarm construction. The substructure is constructed and the turbine installed in a dry dock or inshore (tension leg/submersible only), thus reducing the high costs of assembly and installation at sea. Once the machine is complete it is towed to site where it is attached to the pre-installed moorings and interarray cables. The substructure is then fully ballasted (water), moorings are picked up and tensioned, the electrical cable head pulled-in and the machine commissioned.

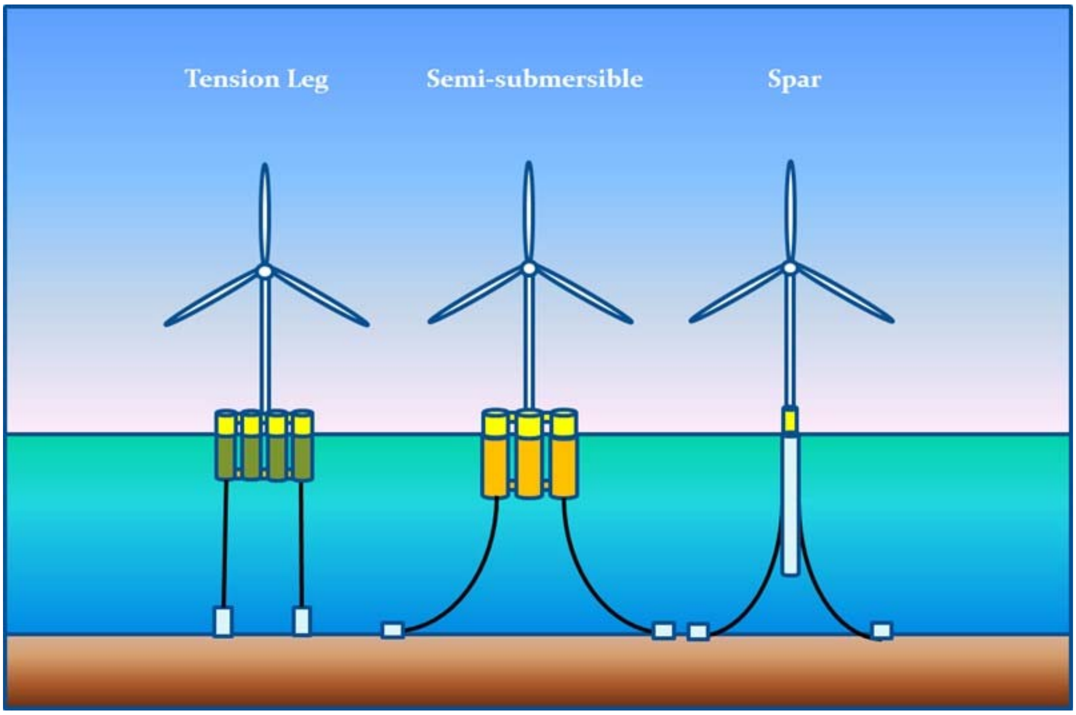

Figure 2-1 Types of floating offshore windfarm systems – Tension leg, Semi-sub and Spare Buoy

5. Tension leg platform (TLP): A semi-submerged buoyant structure, anchored to the seabed with tensioned mooring lines, which provide stability. The shallow draft and tension stability allows for a smaller and lighter structure, but this design increases stresses on the tendon and anchor system. There are also challenges with the installation process and increased operational risks if a tendon fails. Examples: PelaStar (by Glosten); Blue H TLP (by Blue H Group); Eco TLP (by DBD Systems); GICON-SOF (by GICON).

6. Semi-submersible platform: Buoyancy stabilised platform which floats semi-submerged on the surface of the ocean whilst anchored to the seabed with catenary mooring lines. Often requires a large and heavy structure to maintain stability, but a low draft allows for more flexible application and simpler installation. Examples: WindFloat (by Principle Power); Damping Pool (by IDEOL); SeaReed (by DCNS).

7. Spar-buoy: A cylindrical ballast-stabilised structure which gains its stability from having the centre of gravity lower in the water than the centre of buoyancy. Thus, while the lower parts of the structure are heavy, the upper parts are usually lighter, thereby raising the centre of buoyancy. The simple structure of the spar-buoy is typically fairly easy to fabricate and provides good stability, but the large draft requirement can create logistical challenges during assembly, transportation, and installation (and decommissioning), and can constrain deployment to waters >100m depth. Examples: Hywind (by Statoil); Sway (by Sway); Advanced Spar (by Japan Marine United).

8. Currently the selection of the floating substructure is defined by the water depths that each substructure requires for safe operation and the suitable construction ports/locations where the proposed development is located. The Carbon Trust (2015) document highlights the key strengths of each system (Table 2-1):

Table 2-1 Key strengths and weaknesses of each substructure type

Technology	Strengths	Weaknesses
Tension Leg (Water depth +100 m)	Low Structural mass Onshore turbine assembly Few moving parts (no active ballast required) Stability	High loads on the mooring and anchoring system Challenging installation process Bespoke installation barge often required
Semi-submersible (Water depth +40 m)	Flexible application due to the ability to operate in shallow water depths Low vessel requirement- only basic tug boats required Onshore turbine assembly Amendable to port-side major repairs	High structural mass to provide sufficient buoyancy and stability Complex steel structures with many welded joint can be difficult to fabricate Potentially costly active ballast systems
Spar Buoy (Water depth +120 m)	Simple design is amenable to serial fabrication processes Few moving parts (No active ballast required) Excellent stability	High loads on the mooring and anchoring system Challenging installation process Bespoke installation barge often required.

9. KOWL plan to use a semi-submersible sub-structure for the Project. This option was chosen for a variety of reasons, but primarily because it is seen as the most applicable floating solution for use in the waters off the UK coast, and more particularly off Scotland. Other technologies such as Spar and Tension Leg systems require either deeper water, which limits its application in UK waters, or the technology remains unproven at this time, rendering it unsuitable for selection.

10. The Windfloat semi-submersible prototype, designed by Principle Power, was installed and grid connected in October 2011 in the Atlantic Ocean approximately 2.2nm (4km) offshore of Aguçadoura, Portugal in approximately 45m of water. The Windfloat design involves a tri-column triangular platform with the WTG installed on one of the three corners of the platform. The triangular platform is moored using four catenary lines, two of which are connected to the column supporting the turbine, thus creating an asymmetric mooring. The semi-submersible foundation provides improved dynamic stability via a secondary hull-trim system that moves ballast water between each of the three cylindrical columns, allowing the substructure to maintain an even keel without having to de-power the WTG in higher wind speeds or wave heights. Its shallow draft allows for depth-

independent siting and wet tow; the turbine and substructure was fully commissioned onshore prior to the unit being towed over 215nm (400km) by tugs from the manufacturing site to its deployment location. The prototype in Portugal employs a 2.0 MW wind turbine, and was the first offshore wind turbine to be deployed without the use of any offshore heavy lift vessels.

11. A demonstration project employing semi-submersible designs with two 2.0MW turbines was deployed in 2013 approximately 10.8nm (20km) off the coast of Fukushima, Japan, in a project led by the Marubeni Corporation, and began generating power in autumn 2013.

12. The semi-submersible sub-structures will be symmetrical in shape, comprising of vertical tubular sections, up to 12m in diameter, at each corner; connected by horizontal and vertical diagonal members above and below the water line. The maximum length of each face of the structure will be around 55m from the centrelines of the 12m columns. This will effectively give a maximum 67m overall length.

2.1.1. Detailed Site Selection

13. During the initial period of site selection by KOWL, two potential sites were identified for the installation of a demonstrator floating offshore windfarm development within Scottish Territorial waters:

- Forth Array (Firth of Forth, north of St Abbs Head) – a Round 2 development site;
- NE3 – Aberdeen (To be renamed Offshore Wind North East OWNE1 within updated Regional Guidance Location (RGL) guidance).

14. A review of both sites was undertaken based upon resource availability (wind), depth, grid connectivity, distance from coast, potential for expansion, and wave action.

2.1.1.1. Forth Array

15. Overview of the key advantages and disadvantages of the Forth Array site for the possible development of floating offshore wind:

16. Key advantages for the Forth Array Site

- Significant work undertaken by Fred Olsen Renewables Ltd on the site on initial site selection and surveys;
- Suitable water depth for floating semi-submersible systems;
- Distance to shore (within 12nm);
- Area identified for offshore renewables; and
- Close to Operation & Maintenance (O&M) ports

17. Key Disadvantages:

- Due to the cumulative impact of other offshore windfarm developments in the Firth of Forth on bird movements (discussions with MS-LOT), the possible additional (very limited) impact that a floating offshore demonstrator development would have on key bird species was considered to be a potential issue. This was concluded following an initial aerial bird and sea mammal survey undertaken at this location in May 2013.
- Following discussions with the relevant grid connection company, it was apparent that there was limited grid capacity at the onshore substation location and any additional installation at this location would be cost prohibitive.

2.1.1.2. OWNE1

18. The OWNE1 site is located south-east of Aberdeen and provides suitable water depth for a floating offshore wind demonstrator development. The deep channel located within the southern part of this potential Development Area allowed a technology neutral approach (all types of floating offshore systems could be considered) to be taken forward into the initial project development. Grid connection and capacity was also available at this location at a limited cost impact (when compared to the Forth Array site). Therefore this site was selected for the purposes of this project and will be referred to within the ES as the Kincardine Offshore Windfarm 'site'.

19. The Project site overlaps with the western half of site OWNE1 (the floating offshore wind Development Area identified by the Scottish Government), but the site boundaries have been slightly modified by the current project developers to move slightly south-eastwards and also over the 12nm limit to the west to allow greater flexibility in locating the floating offshore turbines during the initial site optimisation phase to allow all floating systems to be considered for the site. This would have allowed KOWL to take greater advantage of the area of deep water known on some charts as the "Dog Hole". The site is rectangular with a width of 9.8km and a length of 11.3km (5.2 by 6.1nm), representing an area of 110km^2.

20. Following a detailed review of bathymetry of the site the south west corner was selected as the most suitable location to locate the demonstrator turbines. This involved the technical issues associated with locating the site above the trench and to the east of the trench (cable laying and water depth), distance to the onshore substation and suitable mooring locations for the anchors and environmental issues including minimising the impact on commercial fishing and disturbance of the sea bed.

21. It should be noted that the draft RGL for floating offshore wind has amended the previous site name (NE3) into OWNE1 and the size and area has been modified in this draft document (Figure 2-2).

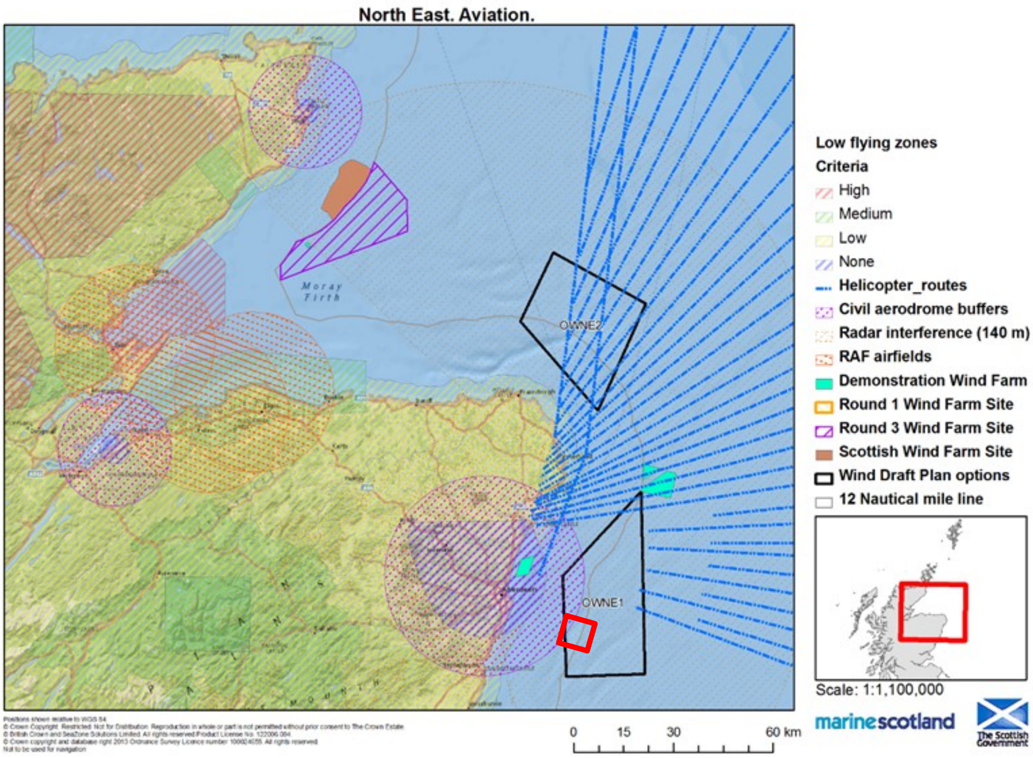

Figure 2-2 Offshore Floating Wind map and updated RGL area OWNE1 (draft)

22. Key advantages for the OWNE1 site:

- The water depths at the site are suitable for deployment of floating wind turbine substructures fitted with the next generation large-scale turbines (6MW and larger);
- The location is representative of typical operating conditions for offshore wind turbines in the UK and northern Europe, thus representing an attractive test site for manufacturers wanting to demonstrate their technology;
- The Scottish Government Draft RLG document indicated that the site has an average depth of 96 m (Scottish Government 2013);
- A mean annual wind speed of 9.33ms^{-1}, ranging from 7.3ms^{-1} in summer to a mean of 11.3ms^{-1} in winter;
- Wave significant height at the site has a mean annual height of 1.54m, a summer mean significant height of 1.05m and a winter mean significant height of 1.94m;
- The RLG suggested that connectivity options are numerous with electrical substations available in the vicinity of Aberdeen city. The closest (at Redmoss, near Altens) is

approximately 17km (9.2nm) from the site with four others from 24-28km (13 to 15nm) from the site. All of the available substations run at 132V. A 275V substation is situated north west of Aberdeen at approximately 30km (16.2nm); and

- Fishing activity at the site is limited, although some scallop dredging occurs at the site according to the 2007-2011 amalgamated fishing intensity data (MS-LOT data).

23. The RLG noted that the site lies within strategic search area OWNE1 as recognized through the scoping study for offshore wind, and that constraints generated by other users of the sea have been deemed of an acceptable level for developments to go ahead within this area.

24. Furthermore, the RLG notes that the site is readily accessible from harbour facilities at Aberdeen (although the current developing consortium believes that the site could also be readily accessed from other harbour facilities elsewhere on the east coast of Scotland, e.g. Dundee). The RLG suggested that shipping is of low intensity at this site despite its proximity to Aberdeen Harbour. Recreational sailing data from the Royal Yachting Association shows some light use sailing tracks cross through this area.

25. The site is located within range of two different radar systems (MOD search radar and Aberdeen Airport) and therefore the installation of offshore turbines could impact on the radar returns for each system, unless suitable upgrades are undertaken on each system to remove/mitigate the impacts. The extent of potential radar interference (calculated at 140m height) extends over the site. Constraints potentially exist from aviation as the 30km (16.1nm) buffer zone for civil aviation aerodromes overlaps the western half of the original site. A Radar Impact Study has been undertaken in support of the EIA and to inform the ES. Further details can be found in Chapter 10.

2.1.2. Total Project Area – Kincardine Offshore Windfarm

26. The larger development site (OWNE1) was initially assessed against the initial site selection criteria (close to shore (within 15nm), water depth >40m, within a designated windfarm development location and access to an onshore substation to allow power to be transferred to the grid), which has reviewed the technical, environmental, social, economic and political constraints that may impact the site location. Following this review the most suitable location for the KOWL demonstrator turbines within OWNE1 was assessed to be on the western edge of the area and within the 12nm territorial limits.

27. The north western section of the site is suitable for the deployment of floating offshore turbines, but the area encroaches into restricted air space used by Aberdeen Airport and could impact on the Nigg Bay Port Development therefore this area is less optimal than the south west section (Figure 2-2).

28. The south western section of the site is predominantly used for non-quota fishing effort (squid) by the local fishing community and is therefore considered by the Project to be of low impact to this stakeholder. This south western section of the site offers a number of significant technical advantages, and overall development cost and complexity:

- Closer to shore and grid connection location;
- No cable laying through trench system;
- Higher wind resource value (from OWNE1 RGL)
- Uniform sea bed and suitable anchoring location (initial data review); and
- Limited impact to fishing industry.

29. These factors indicate that the location of the floating offshore turbines in the south west section of the site would be the optimum location for the demonstrator site. However, this location does bring the turbines closer to the shoreline and will therefore be more visible from the Aberdeenshire coastline. The visual impacts on the landscape and seascape have been considered as part of the EIA and are presented in Chapter 11.

30. The provisional site has an area of approximately 110km^2. Currently KOWL intend to install between six and eight turbines, each with a capacity of between 6 to 8MW. The number and capacity of turbines chosen will not exceed in total the 50MW cap for the demonstrator site. The precise arrangement and positioning of the WTG will be determined during the environmental and engineering scoping process, in order to maximise the use of the available wind resource at the site whilst minimising potential environmental impacts.

31. The Development Area is shown in Figure 1-1 Chapter 1. Coordinates for the proposed locations of the WTGs are detailed in the table below.

Table 2-2 Indicative locations for WTGs at the Project area (eight 6MW devices)

Map ID	Longitude (WGS84)	Latitude (WGS84)
1	-1.881151	57.005315
2	-1.873794	56.997279
3	-1.866440	56.989242
4	-1.859090	56.981205
5	-1.862377	57.026615
6	-1.855020	57.018577
7	-1.847666	57.010540
8	-1.840316	57.002501

32. The Offshore Export Cable Corridor has been identified, however routing of the cable(s) within this corridor will be subject to further site investigation and clarification of the cable landing option to be adopted.

2.1.3. Wind Turbine Generators (WTGs)

33. WTGs are typically three-bladed horizontal-axis type (Figure 2-3), with yaw-controlled upwind rotors with diameters of 120–170m. For the Project there is a commitment to use second generation WTGs with a minimum 6MW capacity with the option to use up to 8MW WTGs also being considered within the scope of this ES. The outline specifications and sizes are tabulated in Table 2-3 below.

34. The final choice of turbines for the site will be based upon an options appraisal of available turbine designs, but for indicative purposes, if 6MW turbines are chosen for the project, then eight turbines would give a combined capacity of up to 48MW.

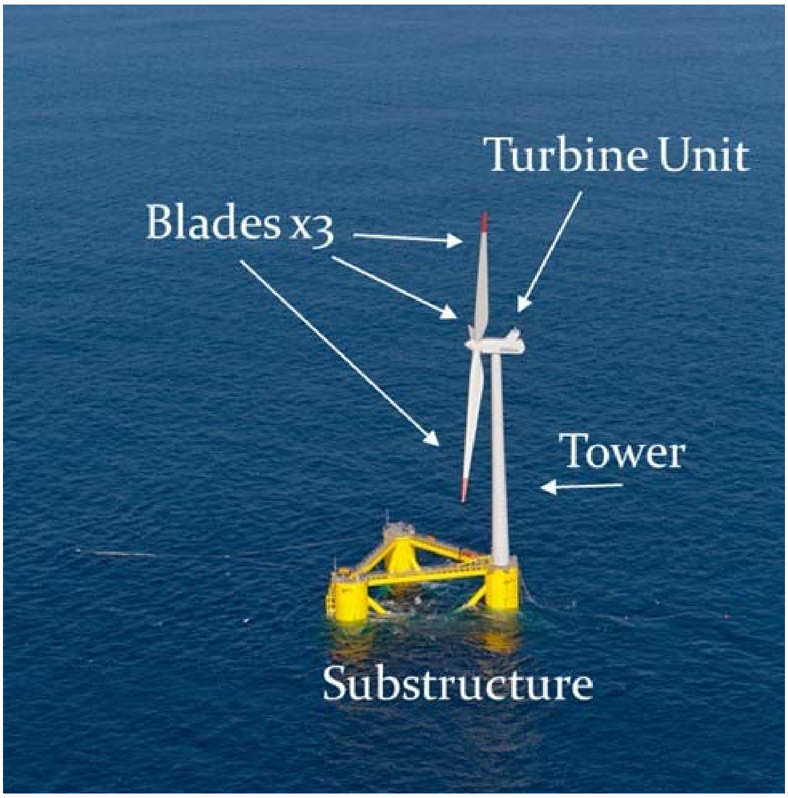

Figure 2-3 Overview of a floating offshore WTG (Windfloat)

Table 2-3 Summary of WTG options

Type / Option	Possible Requirements
WTG Nameplate Capacity	6MW to 8MW
Development Size	Under 50MW
WTG Hub Height (to centreline of hub)	Lowest Astronomical tide (LAT) +100m
WTG Blade Length (to centreline of hub)	76m
Effective Tip Height	176m
Colour	Matt light grey/off white
Navigation Lighting	As required by CAA, MCA etc.

2.1.4. KOWL Design

35. The Windfloat-type design involves a tri-column triangular platform with the WTG installed on one of the three corners of the platform. The triangular platform is moored using four catenary lines (Long steel chains and/or wires/synthetic fibres whose weight and curved shape holds the floating platform in place). The lower section of the mooring chain rest on the seafloor supporting the anchor and acting as a counterweight in stormy conditions, two of which are connected to the column supporting the turbine, thus creating an asymmetric mooring. The semi-submersible foundation provides improved dynamic stability via a secondary hull-trim system that moves ballast water (active ballast) between each of the three cylindrical columns (Figure 2-4), allowing the substructure to maintain an even keel without having to de-power the WTG in higher wind speeds or wave heights. Its shallow draft allows for depth-independent siting and wet tow.

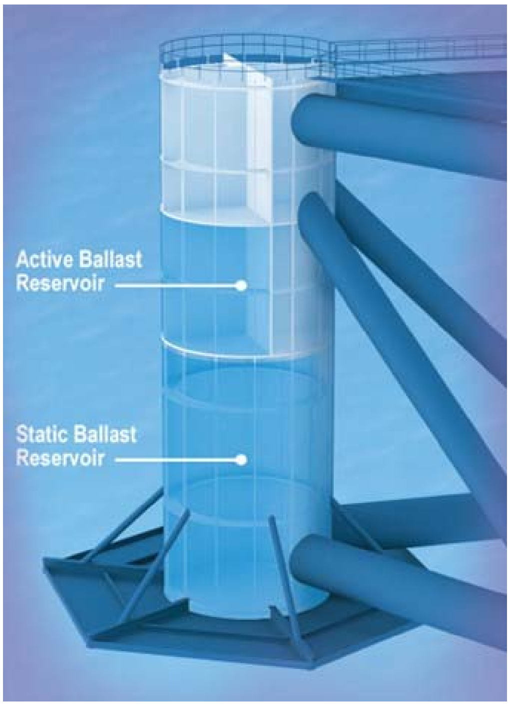

Figure 2-4 Ballast water system in Floating offshore systems (ASME, 2011)

36. The semi-submersible sub-structures will be symmetrical in shape, comprising of vertical tubular sections, up to 12m in diameter, at each corner; connected by horizontal and vertical diagonal members above and below the water line. The maximum length of each face of the structure will be around 55m from the centrelines of the 12m columns (Figure 2-3). This will effectively give a maximum 67m overall length.

37. The WTG will be attached via a transition piece mounted on the upper surface of the substructure. The deck level of the sub-structure will be at approximately 12m above the waterline, the centreline of the nacelle hub (turbine generator) of the WTG will be no higher than 100m above the water surface and the maximum blade tip will be approximately 176m above the waterline.

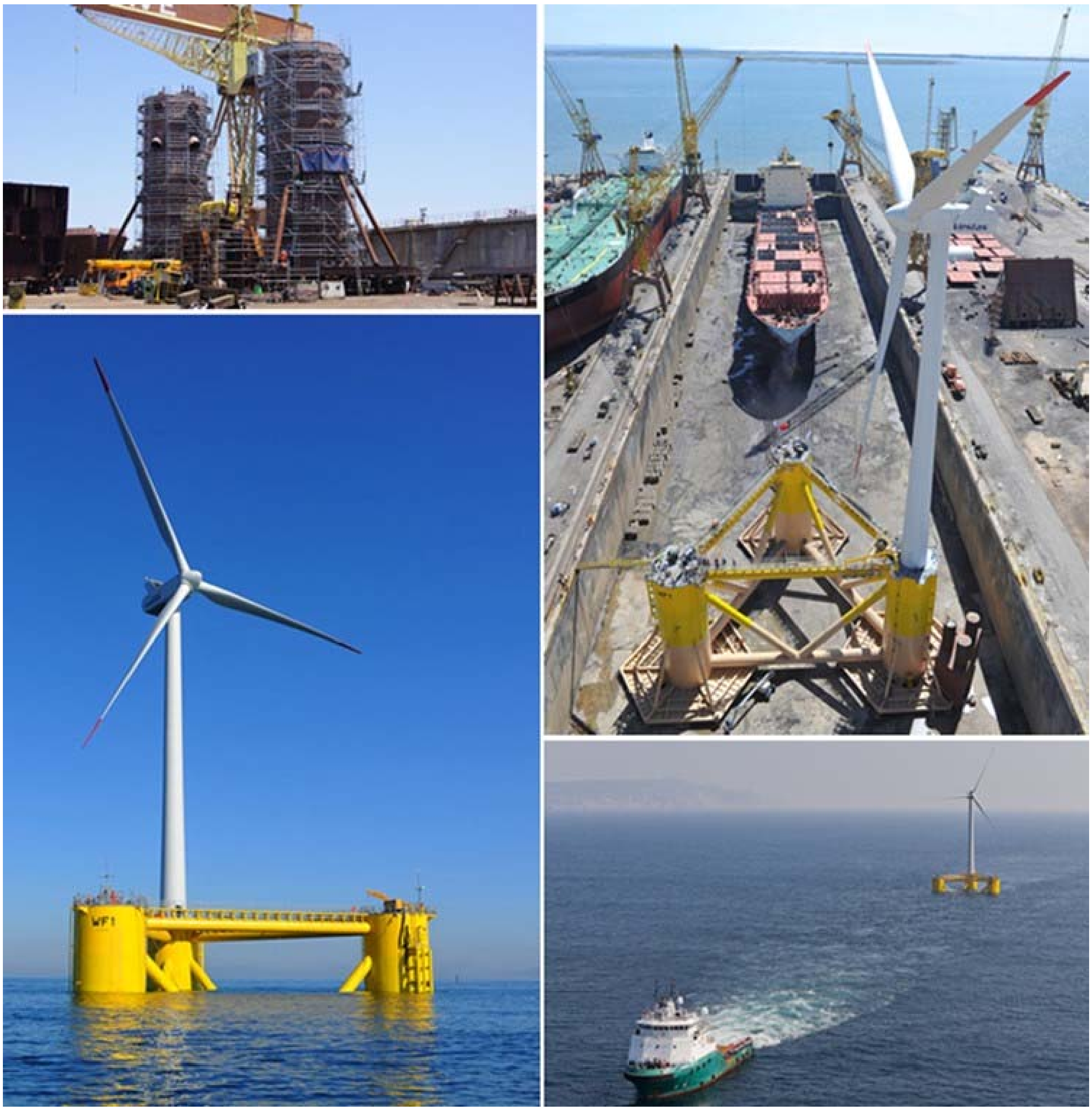

Figure 2-5 Construction montage of the Windfloat design proposed for the Project based on the 2MW structure installed in Portugal (Source: EDP, 2012)

2.1.5. Windfarm Layout

38. The wind turbines will be placed in a layout which gives the best utilisation of the wind resource available while at the same time offering the most harmonic visual impression, whilst fitting any navigation and environmental constraints. The visual impact for the Project is expected to be minimal as the minimum distance to the coastline is 15km, however this is reviewed in detail in Chapter 11. The final turbine model would not be selected until after all of the statutory consents are in place, however, the turbines will be of one type; three bladed WTG positioned on a floating semi-submersible support.

39. The rotor blades would start to turn in wind speeds of between 2 and 5ms^{-1} and optimum power output is generally achieved at around 12-18ms^{-1}. Turbines would generally shut down once wind speeds exceed 25ms^{-1} for safety reasons. Power is controlled automatically as wind speed varies. All rotor blades on the wind turbines within the windfarm would rotate in the same direction, i.e. clockwise when viewed from the windward direction. The turbines would have tubular steel towers assembled from two to three sections. The nacelle placed on top of the tower would contain a variable speed gearbox, a brake, and a generator generating electricity at 690V. There would be a transformer stepping this up to 33kv located either within the base of the tower or on top of the nacelle. The final turbine colour would be decided in consultation with the regulatory authorities.

40. Technical, environmental and human use considerations, determined through the baseline site assessment would guide the final layout of the windfarm components including cable and array design. Results of surveys and consultation may highlight constraints on the site that will influence

the overall site layout. In particular, design considerations for the final layout would be influenced by seabed characteristics (avoiding rock where possible), benthic communities (none currently identified), geotechnical conditions, metocean conditions determined through modelling, and foundation and installation options. Constraints highlighted through site studies including designated areas, visual effects, energy yield etc. will also influence final site design.

41. The preliminary arrangement of the turbines in the Kincardine Offshore Windfarm is given in Figure 2-6 below. However, is should be noted that the design layout may change marginally depending on the findings of the geophysical survey and the optimisation of the site lay out for achieving maximum power output.

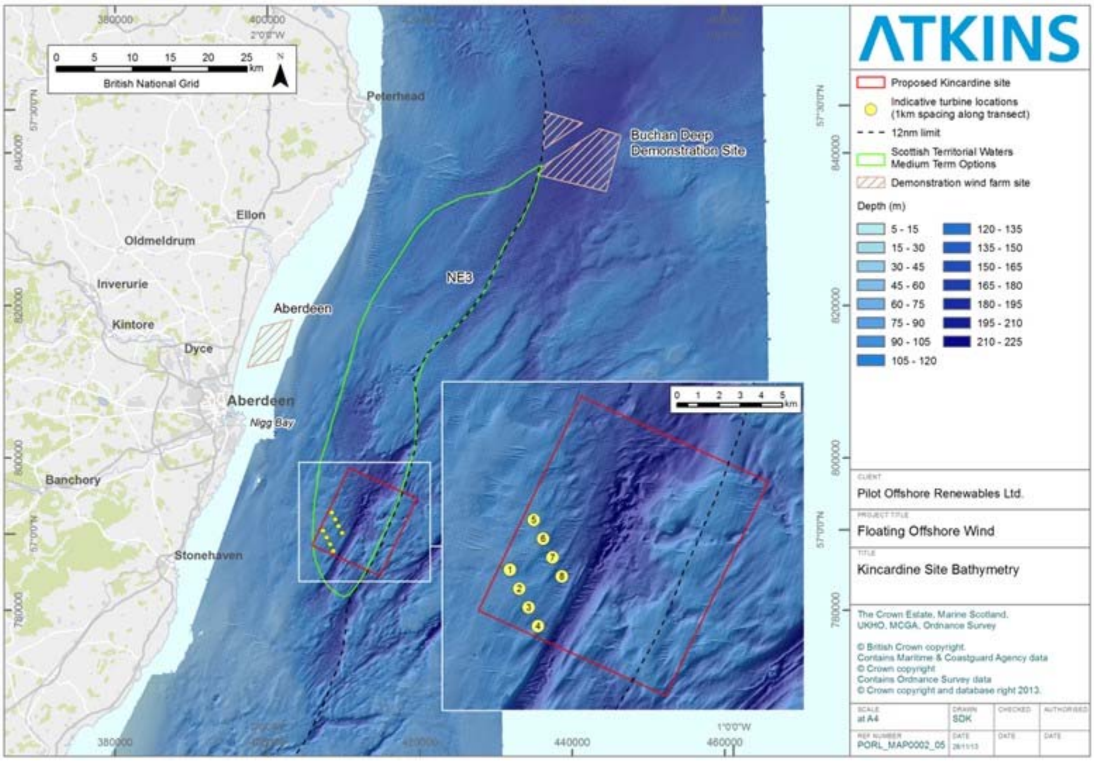

Figure 2-6 Indicative layout of Kincardine Offshore Windfarm turbine array

2.2. Construction

2.2.1. Overview

42. The construction profile for a floating offshore windfarm development varies significantly from conventional fixed windfarm installation methods and this results in avoidance of a number of key environment impacts associated with fixed offshore windfarm construction activities. These include the following key points:

- Over 95% of the construction is expected to be undertaken within a construction port;
- Very limited site activity for construction vessels (only cabling laying and anchor handling vessels);
- No heavy lift vessels required;
- No piling required for foundations;
- Use of numerous local vessel (Aberdeen) significantly reduces CO_2 emission due to short vessel transit times; and
- Significant economic input into the local area (national construction and regional O&M activities).

43. In addition, this is a demonstrator project with a limited number of turbines being installed and therefore the construction profile for the development will be limited due to the construction approach and number of WTGs being installed.

2.2.2. Site Access

44. The construction phases for the project will include both onshore and offshore works. These are outlined below:

Onshore Activities (Aberdeenshire Coastline)

- Onshore cable from cable pit (where offshore cable comes ashore) to Redmoss substation;
- Construction of a substation at the cable landing point to supply Redmoss substation with suitable power; and
- Base for directional drill

Offshore activities

- Installation of export cable from site to onshore cable pit (via directional drilling at coast);
- Installation of inter-array cables (connecting WTGs together at site);
- Installation of mooring systems; and
- Installation of WTGs (towed complete from construction port).

45. It is expected that most of the offshore construction work will be undertaken using 24-hour operations; however with the use of a floating offshore wind turbine the site construction activities will be significantly shorter than a traditional offshore windfarm development. Due to the site being located a significant distance offshore there is limited impact to the local community (noise and light) as the presence of marine vessels in this area (or transit of) is common inshore of the site and therefore there will be insignificant impacts from 24 hour working on site from the work in the Development Area. The only exception to this will be the installation of the export cable as this will come ashore (via directional drilling), but it is currently understood that works close to the cable landing point are likely to be undertaken during daylight hours due to marine safety issues. Currently the use onshore directional drilling from an isolated onshore location (expected to be located within or near to the industrial zone south of Nigg Bay) will limit the onshore activities and it is currently expected that the noise associated from such activities will be limited to the local environment surrounding the cable pit location.

2.2.3. Pre-Construction activity

46. The following activities are anticipated at the pre-construction stage of the development:

- Site geophysical and geotechnical surveys;

47. Although floating offshore wind substructures potentially impact the seabed significantly less than fixed foundations (no piling or drilling required), the need for seabed survey remains a high priority. Geophysical and geotechnical surveys (subject to separate Marine Licence covering these activities being approved by MS LOT) are closely related in that the geophysical survey, based on survey techniques that are generally conducted from moving vessels and have minimal contact with the seabed, inform the more static seabed sampling methodologies that for the geotechnical campaign. Geophysical surveys can include the following sensors:

1. Single and multibeam bathymetry;
2. Side Scan Sonar;
3. Sub Bottom Profiler;
4. Magnetometer; and
5. Sparker or Boomer array.

48. The intent is to provide detail of the seabed: its depth, contours, sediment cover, obstructions or rock outcropping and the depth of the various sediment layers that exist below seabed level. These help in the micro-siting of the structures within the site and the transmission cable route.

49. The geotechnical survey draws on the results of the geophysical campaign to identify areas where further definition of the seabed and sub-surface conditions are required. These are usually clarified by taking physical samples (by vibrocore) or penetration tests (Cone Penetration Tests) at specific locations. Onshore sample geotechnical bores may be required to assess ground conditions for the directionally drilled bores required at the transmission cable landing points. These are common processes prior to a wide range of onshore construction activities.

50. It is anticipated that the mooring system of the floating sub-structures will include holding anchors rather than piled fixed points, and the depth to which these investigations will be required is unlikely to extend beyond 5m below seabed.

51. Maximising cable protection, to ensure cable integrity and possible trawl strikes, is a critical aspect of offshore windfarm developments. The most effective way of ensuring cable protection is to bury the cable below the seabed during, or immediately following, cable installation. This requires that the cable route is carefully selected to ensure that obstacles are avoided, the cable is laid along a corridor where seabed sediments exist that will allow cable burial and that the route avoids gradients and heading changes that make installation difficult. These issues are all addressed by ensuring adequate information is collected during the early geophysical and geotechnical survey campaigns.

52. Metocean data and wind resource verification are relatively easily modelled, but are usually confirmed by a comparatively short term deployment of measuring equipment. In the case of the Project these would only be floating, rather than fixed, sensors if required.

53. All pre-construction activities will be subject to the relevant Marine Scotland licence and Notice to Mariners will be issued to cover all such pre-construction activity.

2.2.4. Construction Programme

54. One of the main advantages of floating offshore wind substructures is that a considerable amount of the offshore site construction activity can take place onshore or inshore before the assemblies are towed out to site. This not only substantially reduces the extent of marine operations associated with the project construction but also the requirement for specialist construction vessels during installation operations.

55. The onshore pre-construction activities will focus on the use of suitable fabrication and port facilities to allow final assembly of the sub-structures and installation of the WTGs close to the project site.

56. The mooring arrangements for the sub-structures will be determined during FEED and further refined during detailed design, following inputs from site surveys, sub-structure/WTG design and loadings and metocean data for the site. Pre-installation of the moorings will be conducted prior to arrival of the WTG/substructure on site. This work can be conducted by a suitably equipped anchor handling vessel.

57. By eliminating the use of piled anchors for attachment of the mooring lines to the seabed, the final configuration will include drag embedment anchors, with associated chain, clump weights and wire rope in the arrangement. This arrangement would be readily deployed from a range of vessels available locally in Aberdeen.

58. Each structure will be subject to a full mooring analysis and the pre-tensioned mooring system will be completed for each structure in accordance with the outcome of these studies. Following deployment the pre-installed/tensioned the mooring system, cable ends will be buoyed off temporarily, for later recovery and attachment to the WTG/substructure assembly following its arrival on site. Appropriate notifications will be issued to ensure they are noted on the appropriate marine navigation safety systems (Notice to Mariners, Kingfisher etc.). Additional information can be found in Chapter 9.

59. Following installation and partial commissioning of the WTG on the completed substructure alongside the fabrication facility, each completed unit will be towed out to site by anchor handling tugs. Once on site the pre-installed mooring lines will be recovered and attached to the substructure assembly and tensioned to the pre-engineered levels to maintain the position of each unit in the array.

60. Inter-array cables will be installed between the structures (on the seabed and buried where required) to collect generated power for onward transmission to the grid connection onshore via the export cable(s). These cables will have to be specially designed to withstand fatigue from the dynamic effects of the substructure movement and may require bend restrictors at the exit from the base of the substructure and at the touchdown point to ensure cable survival for the design life of the project. Further engineering will be undertaken to identify these requirements. As the inter-array cables will have to be dynamic it is not proposed at this stage to bury them.

61. The transmission, or export cables will be installed in a pre-defined corridor 1.5km wide, at least 500m apart (Figure 2-7). Selection of these corridors will be based on the criteria identified in the survey section above. Again dynamic cabling will be required at the substructure end to prevent motion-induced fatigue, however, a subsea jointing box will not be necessary as the cable design allows for a change from dynamic to static cable without a jointing box.

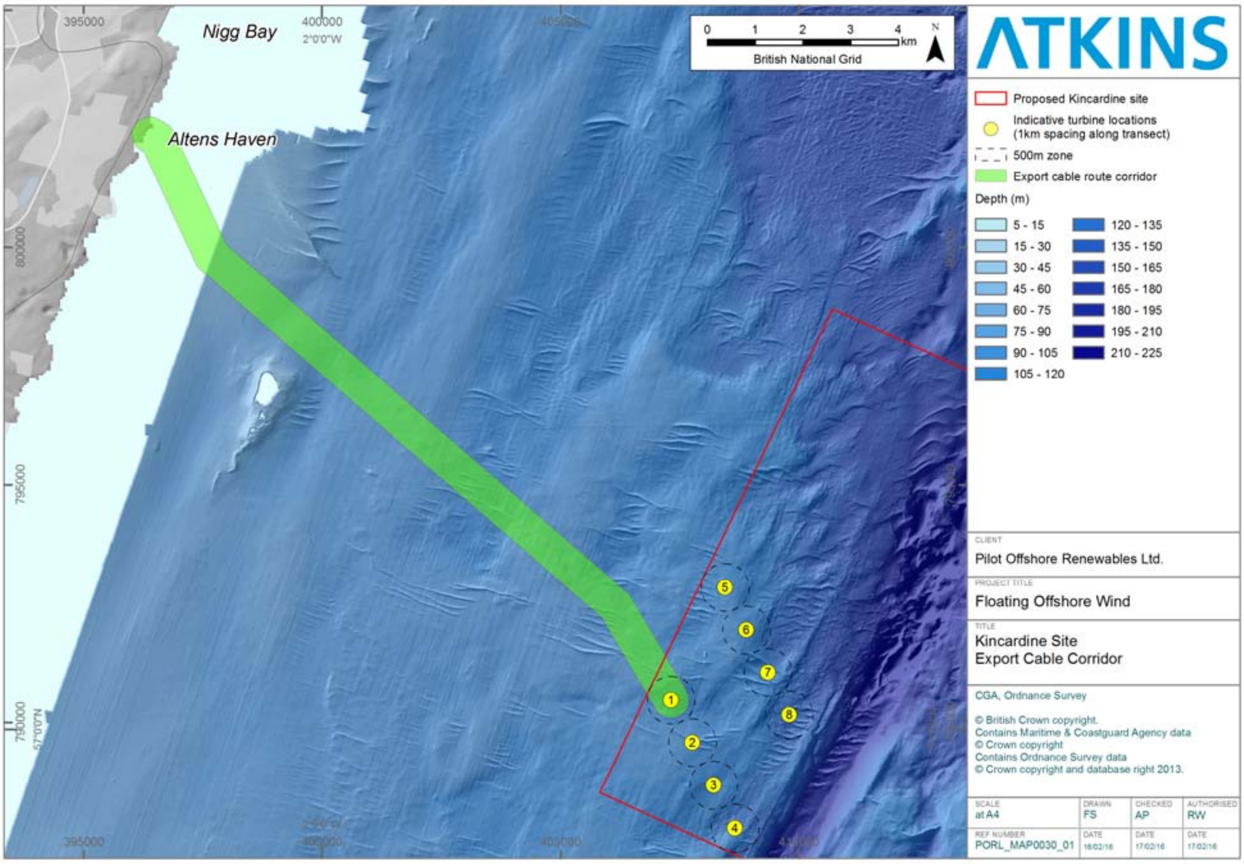

Figure 2-7 Indicative Offshore Export Cable Corridor

62. As above there may be a requirement for additional bend restrictors or stiffeners at the j-tube bell mouth on the substructure or in the seabed touchdown area. The export cables will be initiated at the shore (onshore cable pit) and following the pull-in of the cable (pull the cable through the directional drill hole) end from the offshore location, probably via a directionally drilled conduit, the preferred method of installation would involve the simultaneous lay and burial of the cable from a dedicated cable installation vessel. The cable would be progressively laid and buried by the installation vessel as it moves along the centreline of the approved cable route corridor towards its termination at the nominated offshore substructure. Directional drilling technology will be used to undertake this drilling operation.

63. Cable burial will be based on a target depth of 1.5m, to reduce the environmental impact from electromagnetic fields and also prevent trawl strikes occurring as per industrial standards. As with the inter-array cables there will be a section that remains unburied, with or without the use of a subsea jointing facility, to allow the cable touchdown seabed touchdown point to move in response to any sub-structure excursion within its mooring pattern. In any areas where burial achieved is not considered adequate to provide protection to the cable then post lay jet burial, localised rock dumping or mattressing may be used to provide additional security from trawling activities (to be confirmed by geophysical survey).

64. Throughout the construction phase, subject to discussions with the MCA and other stakeholders, navigational marker buoys may be required to identify the location of the site boundaries or to provide warnings regarding the existence of temporary facilities under the seabed. These temporary measures may be replaced by permanent markings in accordance with agreed requirements, for the lifetime of the project.

65. At the landfall, if cable routing is via a horizontally drilled duct, care will be taken to engineer the arrangement so it conforms to requirements. Drill mud discharge will be kept to a minimum and water based, rather than oil based, lubricants used.

66. The windfarm will be installed and commissioned in a number of phases, but unlike traditional offshore windfarm developments the length and impact of the construction programme is significantly shorter. Also as this is a technology demonstrator site there will be a limited number of floating structures being installed and most of the construction phase is centred around the land construction phase which will see the structure being outfitted and then towed to site for a rapid deployment phase.

67. The construction phases (marine) include:

Table 2-4 Outline offshore construction approach and construction activity location

Construction phase	Activity location	Description	% of Construction activity (approx.)
Sub-structure Fabrication	Scottish supply chain*	Fabrication of all sections of the substructure and transportation of components to the assembly port.	N/A
Substructure assembly (eight units)	Scottish Port	Assemble all sections of the substructure within a suitable dry dock.	45%
Installation of WTG (eight units)	Assembly port	Install the WTG units on to the floating substructures in the assembly port (alongside quay). This will include full system check prior to tow to site	44%
Installation of mooring systems	Site	Install anchor points for all turbines (approximately six hours per anchor). Minimum period of installation eight days. Likely to be longer due to weather delay.	1%
Install Export cable	Site to shore	Laying of export cables from site to directional drill location near to shore.	3%
Install inter-array cables	Site	Install inter-array cables to all turbine locations	2%
Tow units to site	Construction port to site	Tow units to site individual units (time to be confirmed)	3%
Install units at site	Site	Connect anchors and power cable. Assume two days per turbine.	2%

* One of KOWL's fundamental polices is to enable significant Scottish fabrication/manufacturing content were possible within the project structure to enable significant job creation activities where practical across the whole project lifecycle.

Table 2-5 Outline onshore construction activity for the Project

Construction phase	Activity location	Description	Period of Construction activity (approx.)
Directional drilling	Shore	Drilling from cable landing pit to offshore cable.	Weeks (TBC following onsite investigations)

Construction phase	Activity location	Description	Period of Construction activity (approx.)
Construction on onshore substation	Shore	Construction onshore substation at cable landing location	Weeks (TBC following onsite investigations)
Onshore cable to Redmoss	Shore	Cable installation from onshore substation to Redmoss	Weeks (TBC following onsite investigations)

2.2.5. Outline Construction Programme Timelines

68. Figure 2-8 shows the current indicative construction programme for the development and outlines the key construction activities and when these activities are planned to take place and not the actual time onsite. This construction programme indicates a final installation and a full generation date in first half of 2018.

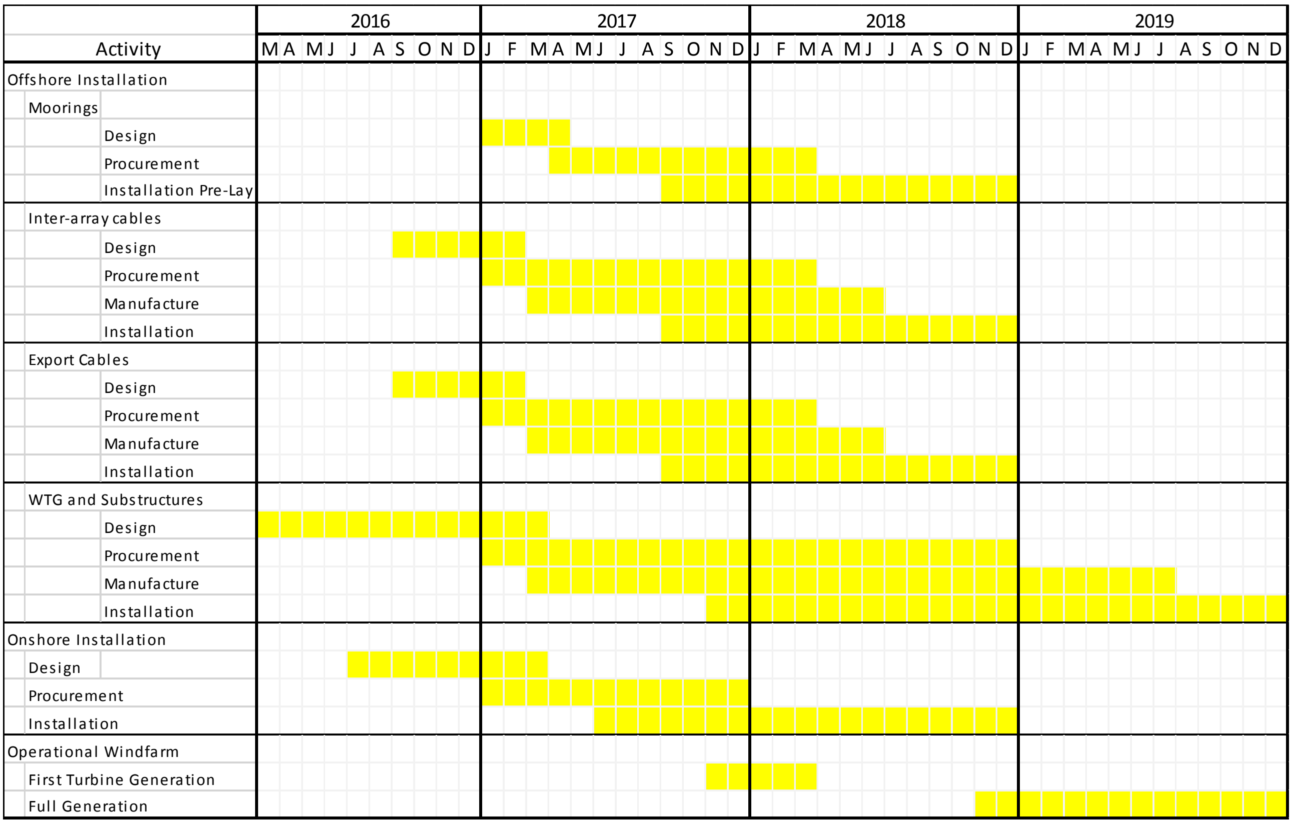

Figure 2-8 KOWL construction programme

2.2.6. Corrosion, Lighting and Marking

69. A temporary exclusion zone will be established around the area where construction activities are underway, in compliance with the International Lighthouse Authority Maritime Buoyage System and Northern Lighthouse Board (body responsible for marking within the Scottish sector). Marine warning lights, mounted on temporary buoys will mark this area. In accordance with the relevant regulations, the project developers will issue a Notice to Mariners and arrange for Radio Navigational Warnings to be issued by the Maritime and Coastguard Agency (MCA). An offshore Health and Safety Officer will be responsible for informing, in advance, fishing vessel operators and other marine users, of construction works associated with the offshore cable and windfarm site.

70. The floating sub-structure elements exposed above sea level will be painted matt light grey / off-white to limit visual impacts from shore, whilst consideration will be given to the requirements of the MCA, the Northern Lighthouse Board and others with regard to identification of the structures as potential navigational hazards to vessels in transit. The substructures will require protection

against corrosion, either via a polyurethane or epoxy coating, and/or the use of sacrificial aluminium anodes. The final design will incorporate recommendations arising from experience of corrosion protection in existing offshore windfarms as well as current industry best practice.

71. The Project will also consider the use of a guard vessel during the construction phase. Such a vessel is often engaged during marine operations of this type to provide protection, emergency response, rescue, towing and other duties on a standby basis.

Table 2-6 Summary of corrosion, marking and navigational aids options

Type	Possible Requirements
Sub-structure type	Semi-submersible
Elevation above waterline	Max 12m
Geometry	Equilateral 3 or 4 sided
Horizontal Face length	Max 70m
Diameter of vertical columns	Max 12m
Access Points	Two boat-landings
Electrical Cable Access	Up to three J-tubes
Mooring Points	4 point mooring
Colour	Matt light grey/off white
Navigation Lighting	As required by CAA, MCA etc.

2.2.7. Anchors and Moorings

72. The identified Windfloat substructure discussed in Section 2.1.4 above requires mooring to anchors embedded in the seabed in order to maintain position over the lifetime of the development. The type and number of anchors and moorings employed at the Kincardine Offshore Windfarm will depend upon the type of substructure, loads imposed on the mooring system by the substructure/WTG assembly in the metocean conditions prevailing on site, in addition to geotechnical and environmental considerations. These issues will be closely evaluated in the FEED engineering phase of the project.

73. The significant advantage of floating offshore wind substructures is the reduction and possible elimination of subsea piling operations, which are known to have an adverse impact upon marine mammals (SNH, 2008). Although the Kincardine project area is not known as an area that has a high population of marine mammals, and indeed the surveys of the site have encountered low numbers of marine mammals, it is the intention to develop the windfarm without use of piled anchors.

74. The current mooring system options are detailed in Table 2-7. At the time of writing the preferred option for the anchor type is the drag embedment anchor (Figure 2-9).

Figure 2-9 Example of a singular drag embedment anchor (Source: SMI Offshore)

Table 2-7 Summary of mooring system options

Type / Option	Possible Requirements
Sub-structure type	Semi-submersible
Number of Mooring lines	4
Mooring type	Catenary Anchor
Anchor Type	Drag embedment anchors, Torpedo Anchors, Gravity Based Anchors
Anchor mass	Steel circa 20 tonnes in weight
Mooring lines	Anchor chain, Mooring cables, polyester mooring lines
Pennant Wires/Buoys	Temporary surface buoys during construction
Pennant Wires/Buoys	Permanent submersible buoys at seabed for ROV recovery
Mooring Line Radius	Max Approx. 9 x Water Depth (dependent upon configuration and Engineering Analysis)

2.2.8. Export and Inter-array cables

75. Power generated by the WTGs will be collected by a series of inter-array cables for export via the offshore export cable to the onshore grid.

76. The arrangement of the cables, connecting the turbines into an array, is determined by the layout of the windfarm, which is usually optimised for production of power given the prevailing wind direction on site. A priority of the array cabling is to provide redundancy, in the case of cable failure or breakdown, whilst seeking to ensure cable integrity. Further onsite assessments will be required to optimise the cable array once the turbine and foundation type have been confirmed.

77. Inter-array cabling is usually surface laid and, where required, post lay buried to provide protection from external damage and wear. Given that the Project are using floating sub-structures to support the turbines, a focus of the early stage engineering will be ensuring that all inter-array and export cable options to the structures are properly addressed to ensure the longevity of the assets.

78. An assessment of possible post lay burial / protection will be undertaken following a review of the site lay out and mooring design for the floating structures as part of the detailed design work following the onsite geotechnical investigations. The anchoring systems associated with floating offshore structures may require an exclusion zone extending to an appropriate distance from the

anchor points, which may result in a fishing exclusion zone that covers most of the Development Area. It is currently proposed that the inter-array cables are not buried.

79. The decision to limit the Project to less than 50MW means that the Project will not require an offshore substation platform. Power will be gathered at 33kv, via the inter-array cabling, and then exported to shore via dedicated 33kv export cable(s). At present KOWL would like to retain the option to install two export cables, as this maintains our philosophy to provide redundancy in the system. Export cables are often a point of vulnerability for offshore wind as failure in the transmission asset can render the entire farm inoperative. Damage, once in operation, usually arises from external damage originating from fishing operations or vessel anchoring. To overcome this and to provide security during installation, cables are usually separated by a distance that is a function of water depth. In the water depths envisaged along the export route from the site to shore we would expect this separation to be a minimum of 500m, converging locally at the beach landing point, and diverging at the offshore site to terminate at different substructure locations.

80. Cable corridor engineering is very important to ensure the integrity of the export cable systems. Cables need to be routed through areas where there is sufficient sediment to allow for burial, whilst avoiding side slopes and variable seabed conditions. It is usual to lay and bury export cables in a single operation feeding the cable through a cable plough that buries the cable via a depressor into the seabed as the vessel tracks along the defined cable corridor. Often export cable installation is undertaken from an anchored vessel and therefore the proposed cable separation provides a measure of safety for the second of the two cables installed in parallel routes. The separation also helps ensure that should a cable be caught by fishing or anchor operations during its operation, then only one cable is impacted in any ‘damage event’. Cable burial/armouring will be assessed following the completion of the side scan and sub bottom profiling survey work as this will determine the requirements of the export cable route.

81. Should any sections of the marine cable require additional protection following combined lay / burial operation, then this will be provided by post lay jet burial, engineered, localised rock dumping or concrete mattressing. Sections of cable may also be fitted with additional cast iron or synthetic external cladding to provide localised protection in certain areas.

Table 2-1 Summary of export cable options

Type	Possible Requirements
Export Cable No.	Max 2
Export Cable Length	Max 15km each
Export Cable OD	Max 180mm
Export Cable Burial	Target depth 1.5m
Inter-array Cable	Max 12
Inter-array Cable lengths	Max 2.5km each
Inter-array Cable OD	180mm
Interarray Cable Burial	Buried is necessary (max 10%)
Cable Protection	None proposed
Bend restrictors	Localised as required

2.2.8.1. Environmental Management System – Construction

82. An Environmental Management System (EMS) compliant with the ISO 14001 standard will be developed and implemented prior to the installation of the windfarm at the site. The aim of the EMS is to prevent and eliminate pollution and to protect the environment against potential impacts. The findings from the EIA will be used to help inform the EMS, for example contributing to the register of aspects and impacts and providing the baseline information against which environmental improvement can be measured.

83. KOWL will formulate an environmental policy specific to the Project which will set out environmental targets for the construction phase of the Project. The policy will be included in tender documents as a requirement on contractors who should be able to demonstrate a track record and proven ability to meet the environmental standards. A Project Environmental Management Plan (PEMP) will be developed to provide a framework to protect the environment before, during and after installation to ensure that all legislative and regulatory requirements are met. This will include details of environmental monitoring, auditing and reporting systems to be employed during installation.

84. The EMS developed for the installation of the windfarm will be used to develop an operational EMS ensuring the maintenance and consistency of environmental policy procedures moving into the operational period.

2.2.8.2. Health and Safety – Construction

85. A Construction Stage Health and Safety Plan and Construction Phase Plan would be put in place under the requirements of the Construction (Design and Management) Regulations, 2015 (CDM Regulations). The CDM Regulations are aimed at improving the management and co-ordination of health, safety and welfare throughout all stages of construction projects to reduce the potential for serious accidents.

86. Since the issue of the KOWL Scoping Report the CDM Regulations have been updated from the 2007 regulations to 2015 as of April 2015 (CITB, 2015). Under the new regulations, KOWL will appoint a CDM Principle Designer with key responsibilities in overseeing the safe design and construction of the windfarm. The Principle Designer will remain in place until the windfarm is handed over to operational management. During construction there will always be an appointed Principal Contractor, who is tasked with the day-to-day management of safety on site, both for their own personnel and those of other contractors.

87. KOWL will make clear their Health and Safety expectations to contractors via the Health and Safety Policy and the Performance Standards that support it. These Performance Standards cover both health and safety management aspects (e.g. the selection and retention of suppliers) as well as key risk aspects of the work in hand (e.g. crane operations). All contractors will be subject to a program of inspection and audit against these and legal requirements during construction. Many of the requirements can be met by application of the best practice guidance, offered by Renewable UK, HSE, DNV and others, which will be used as reference in providing assurance reports as part of the project's health and safety governance.

2.3. Operation & Maintenance

2.3.1. Overview

88. The operation and maintenance period of the Project represents the largest period of time for the project. It is currently expected that the windfarm will generate electricity for 25 years and therefore the O&M phase will last 25 years or the lifespan of the Project deployment at site. However, due to the small number of turbines on site and the limited amount of O&M activity this will produce over a yearly period it is expected that this activity will create limited impact on the local area and will provide a significant, long-term job opportunity for the local port selected for the O&M activities. It is currently expected that large scale O&M activities (gear box/blades) would require a port visit and this will mean the units would be towed to a local port, rather than employing a large offshore construction vessel, which is significant advantage for semi-submersible floating offshore wind WTGs.

2.3.2. Site Access

89. Operation and maintenance of the windfarm could be required every day, 365 days a year to ensure the safe and effective operation of the turbines and the substructures. However, given the number of turbines in the development it is unlikely that operations and maintenance activities will take place every day, but on a risk based programme.

2.3.3. Lighting and Marking

90. The lighting and marking of the windfarm will be agreed in consultation with the relevant authorities. These consist of NLB, The General Lighthouse Authority for Scotland and the Isle of Man, MCA, CAA and MOD.

91. The position of all turbines, subsea cables and ancillary structures will be notified to the UKHO so that their location can be incorporated onto the relevant Admiralty Charts.

2.3.4. Operation – Radar Interference

92. KOWL consider the following to be key considerations associated with the operation phase:

- Wind Energy and Aviation Interests – Interim Guidelines 2002;
- Impact on MOD search radar systems;
- Mitigating the impacts of wind turbines on NATS En-Route Ltd (NERL) operations 2008;
- CAP 764: CAA Policy and Guidelines on Wind Turbines 2010; and
- Investigation into the interference impacts of wind turbines on the PAR system 2009.

93. Aberdeen International Airport (AIA) serves more than three million travellers a year and is the world’s busiest heliport, transporting more than 500,000 passengers in support of the North Sea oil and gas industry.

94. The north western corner of the proposed site falls within the NERL consultation zone for secondary surveillance radar. Data available from National Air Traffic Services (NATS) also indicates that turbines with a blade tip height of 200m would be in line-of-sight of at least one of the primary surveillance radar operated by NERL. The site also falls within the 30km (16.2nm) safeguarding zone of AIA and the windfarm application must be assessed by AIA’s Safeguarding Team to ensure that there will be no technical effect on safe airport operations.

95. The closest Military base is RAF Buchan ASACS 74km (39.9nm) 410531,840357. A radar impact study has been undertaken and this is further detailed in Chapter 10.

2.3.5. Windfarm Control

96. On completion of the construction phase the Project will move into operational mode, where a strict planned maintenance regime will be set up to monitor and maintain the WTG’s and the sub-structure on site. For routine operations small dedicated craft will support the transfer of specialised personnel out to the sub-structures to perform these tasks.

97. Periodically, the condition of the substructure itself and the marine cables will be surveyed, in situ. The frequency of these surveys will be determined following detailed discussions with Marine Warranty Surveyors and or insurance companies.

98. Should more extensive work be required the entire substructure and WTG assembly can be unmoored and returned to port where major works can be undertaken in a more controlled environment before being returned to the offshore location.

99. A windfarm control centre and service base will be established, probably in Aberdeen. This would be responsible for management of the windfarm, operation and control of the turbine and a maintenance compound to hold spares and equipment.

100. Information relating to on-site conditions, turbine status and generated output would be held within a SCADA System, linked to each individual turbine. They would be monitored and controlled remotely allowing any turbine or group of turbines to be shut down immediately, if required for maritime safety operations.

2.3.6. Windfarm Inspection and Maintenance

101. The windfarm will be serviced and maintained throughout its life from Aberdeen or another suitable port on the NE coast. Offshore windfarm maintenance can be split into three categories:

a) Periodic Overhauls: These will be carried out in accordance with the manufacturer's warranty. They are planned and scheduled to occur during the periods of the year with the best conditions, preferably in summer. They are carried out according to the supplier's specifications and typically include function and safety tests, visual inspections, analysis of oil samples, changes of filters, lubrication, bolt checks, replacement of brake pads, oil changes on the gearbox and hydraulic systems etc.
b) Scheduled Maintenance: This applies primarily to inspections and work on parts susceptible to failure or deterioration between periodic overhauls. A scheduled inspection of each turbine and substructure is likely to occur every six to 12 months. The task will typically include inspection and minor fault rectification.
c) Unscheduled Maintenance: This applies to sudden defects, ranging from minor failures to complete failure or breakdown of main components.

102. Workboats will take personnel, tools and equipment to the site to undertake most of the offshore work programme. However, in the event of catastrophic failure of major components, then the turbine may be disconnected from the windfarm and taken to port for repairs or a major overhaul (a key advantage of this floating offshore windfarm demonstrator). Events that require the turbine to be returned to port will be rare and will only apply to failure of major components.

103. Inspection and maintenance of the substructures and subsea cables will be performed on a regular basis, as with ad-hoc visits for surveillance purposes.

2.3.7. Remote Shutdown

104. The turbines will be monitored and controlled remotely allowing any turbine or group of turbines to be shut down immediately, if required.

2.3.8. Operation Management – Environmental

105. The windfarm will be designed and constructed and operated to a high standard incorporating appropriate levels of environmental control. Effective environmental management will minimise the impact of the development on the local environment.

106. KOWL will require the contractors responsible for operation of the Project to operate an Environmental Management System in accordance with ISO 14001.

2.3.8.1. Health and Safety – Operation

107. An evolving Health and Safety Plan will be put in place during the operational period that meets the new operational requirements of a floating offshore wind turbine system. Turbines will be remotely monitored and controlled remotely allowing any turbine or group of turbines to be shut down immediately, if required.

108. Whilst all unauthorised vessels will be deterred from making fast to turbine bases, the floating structures will remain accessible as refuges for seafarers in distress. There will, however, be a prohibition of the windfarm site as an anchorage in order to safeguard inter-array cabling and the mooring cables for the individual structures. Clearly visible signage on the floating structures will make it clear that unauthorised boats may not tie up to the substructures. In addition, information boards showing the layout, latitudes and longitudes of the turbines would be placed at all local ports and slipways on the coastline. The location of the windfarm will also be registered with the UK Hydrographic Office (UKHO) to allow the site to be clearly marked for all seafarers and will be marked as per the Northern Lighthouse Board (NLB) requirements. The same information would be given to local sailing clubs and fishermen's groups for distribution to members, and the site would be clearly marked by a series of cardinal buoys to aid navigation by all marine users.

109. Due to the spread of the possible mooring layout and the distances between turbines there could be a requirement to obtain a “Operational Safety Zone” around the demonstrator site to restrict vessel traffic and fishing within the site boundary and this assessment will be undertaken with consultation with DECC, together with Marine Scotland and the Coastguard Agency.

110. An operational centre will be set up to monitor set radar feeds, AIS, tidal and meteorological data. This information would assist in safe vessel management within the windfarm site and enable regulation of personnel movements and personnel tracking. There are a number of vessel management products on the market which perform this function. Through the control centre, KOWL will instigate the Work Order System which exerts control over the moments of personnel and the activities in which they are engaged to safeguard those individuals and the assets of the windfarm.

111. The control room will also communicate regularly with the coastguard and lifeboats. KOWL will investigate the use of Closed Circuit TV (CCTV) to visually monitor the windfarm site which could be associated with any observational research undertaken on the floating offshore structures.

112. In addition to the above best practice working procedures, KOWL also commit to:

- Undertaking best practice for equipment required for, and methods utilised, for personnel movements on and off turbines safely;
- Application of the BWEA/Renewable UK Wind Turbine Safety Rules in their latest revision as a means to mitigate the risks from electricity and rotating equipment during operation;
- Providing the necessary fixed system for working at height, with personnel equipment and training provided to minimise the risk of falling and the risk from dropped objects when working at height;
- KOWL would intend to maximise the use of the site during the lease period from the Crown Estate. Wind turbines typically have a design life of 25 years, while the foundations and electrical equipment may have significantly longer lives. KOWL could seek to re-power the site after the design life of the original turbines, utilising the foundations and grid infrastructure that is already in place. Any re-powering of the site would be subject to The Crown Estate consent and would be at their sole discretion; and
- Design considerations for all offshore constructions will ensure that the ability to decommission safely and efficiently is addressed as part of the design process.

2.4. Decommissioning

2.4.1. Decommissioning Approach

113. The windfarm would be decommissioned at the end of commercial operation, which may be 40 years if re-powering takes place. The Crown Estate lease and expected planning approval conditions will require a decommissioning plan that will be updated periodically throughout the operational life of the Kincardine Offshore windfarm. This decommissioning plan will be drawn up with regards to the requirements of the Energy Act 2004 (revised 2011) and the UK’s obligations under the OSPAR Convention for the Marine Environment of the North East Atlantic, or other legislation in place at the time of decommissioning.

114. Under current legislation, decommissioning of the offshore windfarm would require the removal of the following offshore structures:

- Above water structures (WTGs); and
- Substructures (floating foundations, mooring lines and anchors)

115. The decommissioning of the assets will essentially be a reverse of the installation procedure. The inter-array cables will be recovered, the sub-structures released from their moorings and towed back to port for full decommissioning and the anchor configurations retrieved and returned back to port. Essentially all assets deployed will be recovered with the possible exception of the export cable(s) which may, subject to agreement with the relevant authorities be cut and left buried on the seabed.

2.4.1.1. Site Access

116. It is envisaged that site access requirements during the decommissioning phase will be similar to the requirements for the construction phase, including vessel activity and temporary exclusion zones set up around decommissioning vessels to ensure safety.

2.4.1.2. Post Decommissioning Monitoring

117. Requirements for post decommissioning monitoring will be agreed between the Project and Marine Scotland in consultation with other Scottish Government Departments and stakeholders. Details of post decommissioning monitoring would be included in a Decommissioning Plan which will be produced as part of the consent requirements.

118. It is envisaged that the turbines will either remain in place as part of a commercial windfarm, or be removed entirely and disposed of onshore. The presence of any windfarm structures that are not fully recovered or buried would be subject to monitoring for the duration, at suitable intervals, as specified in the Decommissioning Plan. The presence of any remains would be notified to mariners and would be marked on the relevant Admiralty Charts.

2.5. References

ASME 2011 Wind Power Floats on Innovation https://www.asme.org/engineering-topics/articles/renewable-energy/wind-power-floats-on-innovation.

Carbon Trust 2015. Floating Offshore Wind: Market and Technology Review Scottish Government June 2015

Fred Olsen Renewables Ltd. (2010). Scoping Report – Forth Array Offshore Windfarm Site, Firth of Forth. Available Online: www.eastlothian.gov.uk/download/.../eia_scoping_request_forth_array [Accessed: April 2015]

EDP. (2012). Available Online: http://www.edp.pt/pt/media/noticias/2012/Pages/inauguracaoWindfloat.aspx. [Accessed: April: 2015]

Scottish Government 2013 Potential Scottish Test Sites for Deep Water Floating Wind Technologies http://www.gov.scot/Resource/0044/00444873.pdf

SMI Offshore. Available Online: http://www.smi-offshore.com/equipment/offshore-anchors/ [Accessed: March 2015]

CITB. (2015). Changes to health and safety regs: Construction (Design and Management) Regulations 2015. Available Online: https://www.citb.co.uk/cdmregs?gclid=CIqe__6w18QCFYcSwwodahAAdg [Accessed: April 2015]

3. The Physical Environment

3.1. Introduction

1. This chapter of the ES is an assessment of the potential effects of construction, operation and decommissioning of the Project on key coastal processes within the physical environmental.

2. As described in Chapter 1, the Project is made up of three components (Development Area, Offshore Export Cable Corridor and Onshore Area). This chapter only makes reference to the Development Area and the Offshore Export Cable Corridor as defined below.

   - The Development Area – the windfarm area including the WTG, floating substructures and inter-array cables.
   - The Offshore Export Cable Corridor – the area within which the proposed export cables will be laid, from the perimeter of the Development Area to the Onshore Area at MHWS.
   - These areas combined are referred to as the Project.

3. For the purpose of this assessment, coastal processes is a generic term that refers to the physical processes affecting the form and evolution of the coastal environment. The main processes of interest are, suspended sediment concentration (SSC), sediment erosion (most notably scour), sediment transport and deposition.

4. A brief overview of the metocean conditions is also included in this chapter to inform the baseline conditions from which the coastal processes assessment has been made. Metocean refers to meteorology and oceanography; the main processes of interest are water levels, currents and waves.

5. An assessment of the potential effects of the Project on metocean conditions has not been carried out. Due to the limited scale of the Project (maximum eight turbines), effects on tidal currents and waves is expected to be negligible. Similarly, the distance from the shoreline of the Project eliminates any potential impacts of changes to metocean conditions affecting the shoreline. This approach has been agreed with Scottish Natural Heritage (SNH), Scottish Environment Protection Agency (SEPA) and Marine Scotland (MS).

6. Similarly, water and sediment quality have not been considered as part of this impact assessment as there are no known issues in the proximity of the Development Area or the Offshore Export Cable Corridor. In terms of water quality, the closest bathing water beaches are located to the north of Aberdeen (Aberdeen) and to the south at Stonehaven; and a long sea outfall (Scottish Water) is located to the south of Nigg Bay but this extends out approximately 300m offshore. In terms of sediment quality, there is a localised dredge disposal site for the Port of Aberdeen, but this has been avoided in the design of the Project; and currently MS are not aware of any other disposal locations within the planned Offshore Export Cable Corridor or on-shore landing site, therefore there is a very low risk of remobilisation of contaminated sediments.

7. This chapter is supported by the following appendices:

   - Appendix A Analytical Report on the Particle Size Distribution of Samples

8. This chapter shares linkages with the following chapters:

   - Chapter 4: Benthic Ecology

3.1.1. Policy and Regulations

9. The following guidance and legislation has been taken into consideration when describing aspects of metocean and coastal processes in relation to the Project:

- Marine (Scotland) Act 2010;
- COWRIE – Coastal Processes Modelling for Offshore Windfarm Environmental Impact Assessment: Best Practice Guide (Lambkin *et al.,* 2009);
- Strategic Environmental Assessment (SEA) of draft Plan for offshore wind energy in Scottish Territorial Waters: Volume 1 Environmental Report;
- The UK Marine Policy Statement (HM Government, 2011) and Scotland's National Marine Plan – Pre-consultation Draft (The Scottish Government, 2011) outline the objectives and issues associated with offshore windfarm developments (amongst other marine related issues). These policies note that offshore windfarm foundation designs are likely to have an effect on hydrodynamics and consequent sediment movement; and
- The Marine Renewable Energy and Natural Heritage: An Overview and Policy Statement (Scottish Natural Heritage, 2008) also provides high level guidance on the potential issues and appropriate mitigation measures for a range of developments, including offshore windfarms. With regard to metocean and coastal processes, it suggests that windfarms may attenuate waves and tides during the operational phase, and that these effects should be understood by undertaking modelling-based assessments at the design stage.

3.1.2. Stakeholder Consultation

10. The consultation process is outlined below:

- The Scoping Report for the Kincardine Offshore Windfarm was developed by Atkins and submitted for review in April 2014 (Atkins, 2014a).
- The Scoping Opinion was produced by MS (2014) in response to the Scoping Report. This collated responses from Marine Scotland, Statutory consultees and non-statutory consultees.

11. In addition to the formal Scoping Opinion, further informal consultation has been undertaken in relation to the assessment of the impacts of the windfarm with relevant stakeholders (MS and SNH). The information received through this consultation and the formal Scoping Opinion has informed the methodology and scope for the assessment of the impacts on coastal processes presented in this chapter.

12. A summary of the comments to the Environmental Scoping Opinion in relation to coastal processes and water/sediment quality can be viewed in Table 3-1 and Table 3-2 along with the Project response which outlines the action(s) to be taken/not taken in reply to the comments. For example, comments regarding water quality have been included below, however, the Project response was to continue to scope this out of the EIA due to the low risk the Project poses.

Table 3-1 Consultation Summary Responses related to Coastal Processes

Consultee	Comment	Project Response
MS-LOT	MS-LOT recommends an assessment of the extent and degree of damage likely to be expected on the seabed during installation of the anchor structures and laying of the cables.	Temporary increases of SSC during cable laying and anchor installation have been considered as part of the EIA. Limited damage is expected to the seabed during anchor installation as piling is not to be used. Additional review is also undertaken within the Chapter 5 Benthic Ecology.
MS-LOT	Increases in suspended sediment and changes to seabed morphology must be scoped in and assessed in the EIS.	Likely temporary increases to SSC during installation of the cables (mainly the export cable) and anchors have been assessed as part of this EIA. Scour erosion around the anchors and cable protection areas has also been considered. Seabed stability has also been considered as a positive impact.
SEPA	There may be a need to address the cumulative effects of devices on	Degree of change to coastal processes is minimal from the floating structure, and the

Consultee	Comment	Project Response
	coastal processes depending upon density and location with respect to existing renewable and coastal developments.	small scale of the Project, however scour erosion around the anchors has been assessed for as a possible impact. Cumulative impacts with other offshore windfarms including Aberdeen Bay, Statoil, Inch Cape, Neart Na Gaithe and Forth have therefore not been considered, as there is limited scope of impact to the immediate site (impacts are restricted to <100m). Landfall at Nigg Bay is no longer an option under consideration, and therefore cumulative impacts with the expansion of Aberdeen Harbour has been discussed but no cumulative impacts are expected.
SEPA	Depending upon the scale and nature of the works, there may be a need to carry out hydrodynamic modelling to predict impacts of construction activities on water quality, as well as coastal processes in the longer term. Any potential impacts from suspended sediment should be compared to natural background levels and water quality standards. Any proposed mitigation should also be detailed in the ES.	Any increases to SSC will be of a limited nature during construction only. There are no known water quality/SSC issues in the area at the present, and construction of the floating structure is likely to only cause temporary increases to SSC. A review of the possible impact area has been undertaken looking at the settling velocity profiles of the bed material. Embedded mitigation measures have also been considered.
SEPA	The baseline assessment for coastal processes should identify the following features and processes in the environment: Sediment (composition, contaminants and particle size) Hydrodynamics (waves and tidal flows) Sedimentary environment (sediment resuspension, sediment transport pathways, patterns and rates, and sediment deposition) Sedimentary structures (protected banks) Typical suspended sediment concentrations	The following information has been ascertained for the assessment; Drop down video analysis and particle size analysis to determine sediment compositions and particle size. There are no known sediment quality issues in the vicinity of the Project site (cable routes will avoid Aberdeen Harbour dredge disposal area) and therefore chemical contaminants within the sediments have not been analysed. Hydrodynamics, including waves and tidal flows have been considered and outlined in this chapter, however, no impacts have been scoped into this assessment due to the limited size of the Project. Assessment of seabed mobility has been assessed (through video analysis and empirical formulae) and determined that the bed is 'active'. However, a sediment budget and/or sediment transport pathways have not been determined. There are no sedimentary structures that have been identified from the bathymetry surveys that have been conducted to date. Additional geophysical and geotechnical surveys are planned for the future and if any are identified they will be assessed for possible impact as part of the detailed design phase. Baseline SSC has not been directly measured, however, analysis of the drop down videos and stills have shown there is

Consultee	Comment	Project Response
		some turbidity close to the seabed in both the Development Area and Offshore Export Cable Corridor, increasing with decreasing water depth. Empirical formulae have been used to determine if the bed is active, and under what conditions, to use this as a baseline to assess potential impacts.
SEPA	The magnitude and significance of any changes to the natural processes identified in the baseline assessment should be demonstrated in the ES. It would be helpful to see a series of contour plots showing the magnitude and spatial extent of +(ve) and –(ve) changes in current velocities between 'pre development' and 'post development' scenarios. The assessment should also identify and quantify the relative importance of high energy low frequency events e.g. storms, versus low energy high frequency processes. Any changes to the existing processes can then be used to infer the extent of any changes to sediment transport processes and potential impacts on the marine ecology.	Due to the scale of this demonstrator Project, there are no predicted/anticipated changes to current metocean conditions or coastal processes, therefore, there is limited need to present the magnitude of change in the way described here. It is not currently possible to model the exceptionally small changes to the current velocities from the floating structures and therefore this has not been undertaken as part of this assessment.
SNH	Impact (to hydrodynamics processes) is not completely removed. Changes will occur at the bases of the tethers and associated with the cabling. These still require consideration and many have impacts on benthic interests. We also agree, from a coastal processes view point, with the items scoped in and out within Table 10-12.	Scour erosion and increased SSC at the base of the anchors have been assessed.
Aberdeen Harbour Board	Whilst we do not think any effect would be significant, the ES should refer to the long established and licenced spoil ground to the north west of the KOWL site. Any assessment of changes to sediment movement in the area should consider the potential to disrupt or alter the effective dispersal of spoil deposited at the site. A deleterious effect would have both environmental as well as socio-economic impacts.	The potential impacts from the Project are expected to be localised (See Section 3.4); therefore there are no anticipated impacts to the disposal area to be considered. The export cable route will not pass through the licensed disposal area. Any SSC increases from the installation of the export cable(s) will be localised and temporary, and therefore the impact is not considered to be significant.

Table 3-2 Consultation Summary Responses for Water and Sediment Quality

Consultee	Comment	Project Response
MS-LOT	Pollution due to leaks and spills at the site from vessel/WTGs. An Environmental Risk Assessment covering all aspects of the design and operation of the array should be undertaken as part of the EIA process.	An Environmental Risk Assessment will be undertaken as part of the Emergency Action Plan and issued as a separate report as a consent condition if consent is granted.
SEPA	Development out to 3 nautical miles will require to be considered under the WFD. This will require water quality, quantity and morphology to be considered.	A high level review of the possible WFD sites has been undertaken and there no impact has been identified.

3.2. Baseline Environment

13. Although water levels, tidal currents and wave heights have been scoped out of this assessment (KOWL 2014), metocean parameters that are relevant to the assessment of sediment transport include water levels, tidal currents, wind direction and wave height. The baseline metocean conditions at the Project site are described in Section 3.2.1. A description of the baseline seabed characteristics is also provided in Section 3.2.2.

14. The data that were sourced and detailed below includes:

- Kincardine Floating Offshore Wind Metocean Assessment (Atkins, 2014b);
- British Geological Survey (BGS) seabed map;
- Marine Scotland video and still photograph survey data (see Chapter 4); and
- PSD data from 10 seabed grab samples from along the Offshore Export Cable Corridor and within the Development Area.

3.2.1. Metocean

15. An assessment of the metocean conditions at the Project site has been completed by Atkins (Atkins, 2014b) as part of the feasibility assessment of the area as a site for an offshore windfarm. Boundary conditions and site specific data were sourced from the European Centre for Medium Range Forecasting (ECMWF) and Bundesamt für Seeschiffahrt und Hydrographie (BSH) and SeaZone.

16. The wave data (obtained from ECMWF) was used in conjunction with a bespoke spectral wave model of the area using DHI's MIKE 21 SW software, validated against data measured in a separate campaign in the Aberdeen Bay area for a nearby offshore renewable project. No site data is available to test the model at the Project site. Current data obtained from the BSH was defined at a point coinciding with the Project site and was used 'as is'. The locations of the numerical model output nodes and Development Area boundary are shown in Figure 3-1.

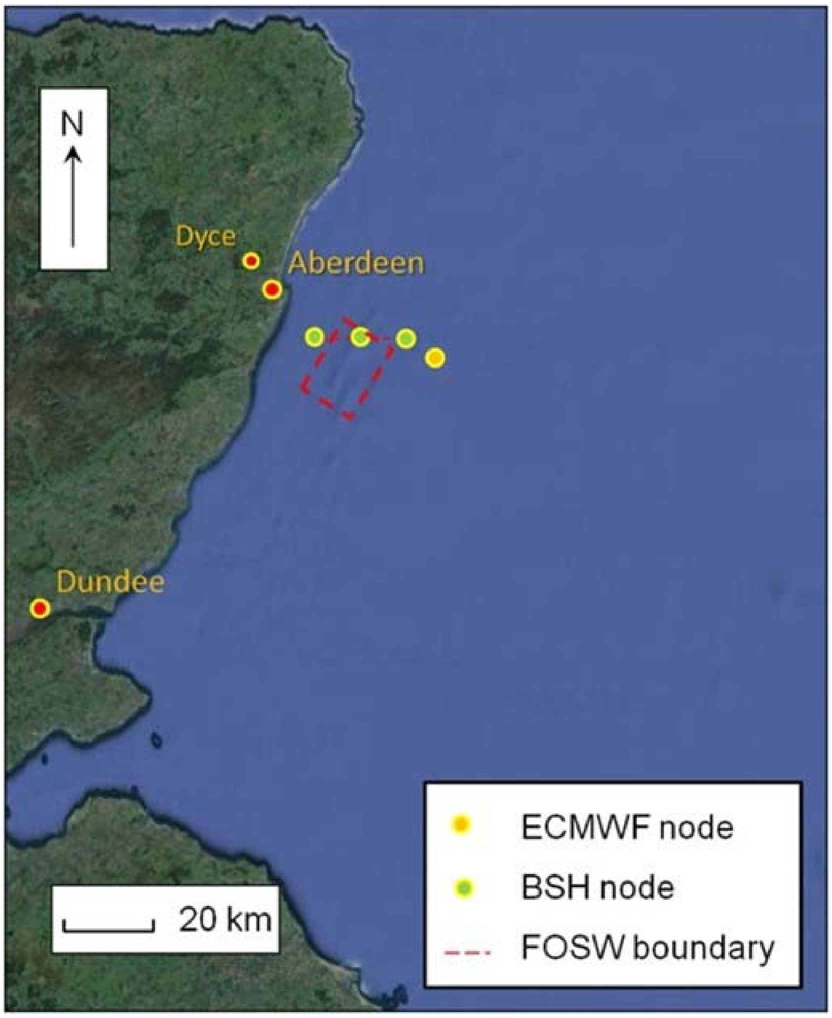

Figure 3-1 Approximate numerical model output node locations and KOWL (Floating offshore windfarm -FOSW) boundary (Atkins, 2014)

3.2.1.1. Wind Data

17. Wind data was sourced from ECMFW. The characteristics of the operational wind (those that can be expected on a day to day basis) at 10m (vertical height) for the Project indicate that wind direction is predominantly SSE-WSW as shown in Figure 3-2 and monthly wind speed statistics for a 10 minute average over the same period (January 1979 to January 2013) in Table 3-3.

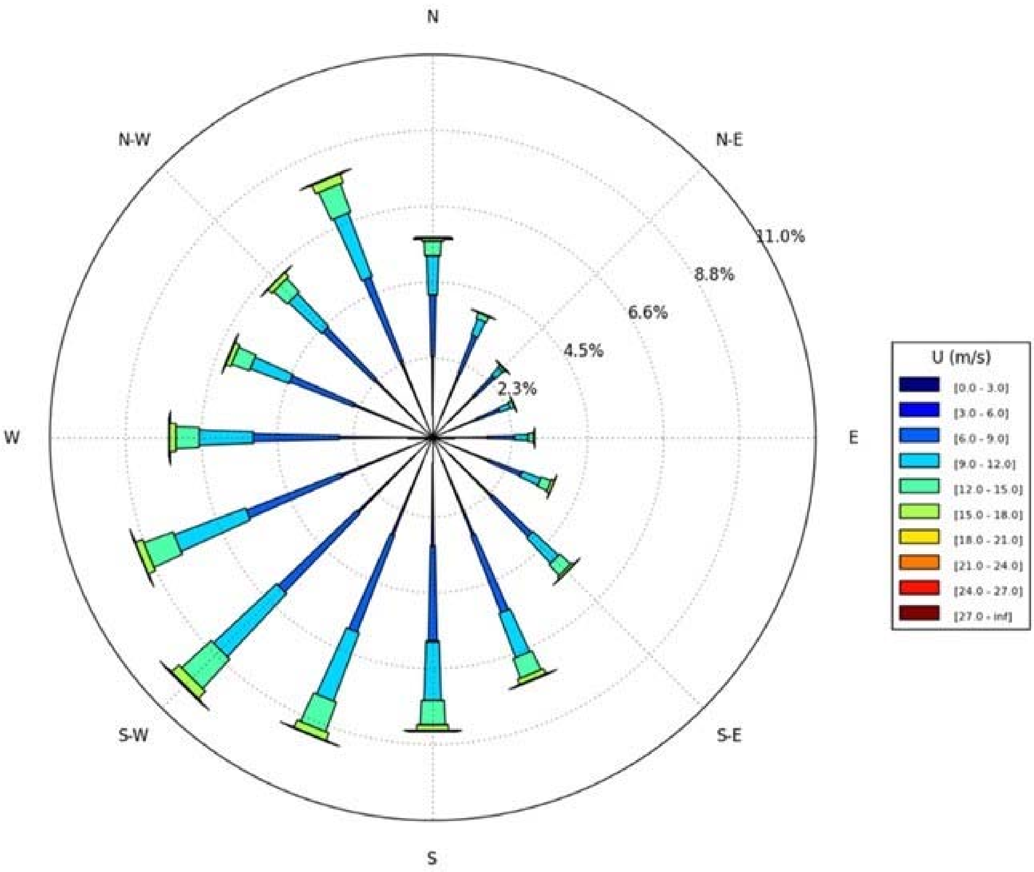

Figure 3-2 Operational 10m wind rose for period Jan 1979 to Jan 2013

Table 3-3 10 minute, 10m wind speed statistics (minimum, maximum, average and standard deviation) by month for the period January 1979 to January 2013

M	J	F	M	A	M	J	J	A	S	O	N	D
Min.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Max.	2	2	2	2	2	1	1	1	1	2	2	2
Avg.	9.	8.	8.	6.	6.	5.	5.	5.	7.	8.	8.	8.
St.	3.	3.	3.	3.	2.	2.	2.	2.	3.	3.	3.	3.

18. Operational winds speeds at the hub height (107m) were estimated from those measured at 10m using the power law (DNV, 2015) and the wind speed statistics for a 10 minute average are presented in Table 3-4.

Table 3-4 10 minute, 107m wind speed statistics (minimum, maximum, average and standard deviation) by month for the period January 1979 to January 2013

M	J	F	M	A	M	J	J	A	S	O	N	D
Min.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Max.	3	3	3	2	2	2	2	2	2	3	3	3
Avg.	1	1	1	9.	8.	7.	7.	8.	9.	1	1	1
St.	5.	5.	4.	4.	3.	3.	3.	3.	4.	4.	4.	5.

3.2.1.2. Waves

19. Operational waves (those that can be expected on a day to day basis) were derived from a 34 year hindcast. The results show a clear exposure to the NNE direction (Figure 3-3). Joint probability distributions for zero crossing wave period (Tz)/direction and significant wave height (Hs)/Tz were calculated and further confirmed the predominance of waves between 0-2m from a north-north-easterly direction with periods between 3-5s. Monthly wave height statistics calculated from the 34 year hindcast show that maximum wave heights 7.86 and 7.16m, were recorded in December and March respectively. The monthly occurrences distribution for the hindcast period also shows that the larger wave heights (1.5-7m) are experienced during November to March, whereas the smaller wave heights (0-1.5m) were recorded predominantly between May and September.

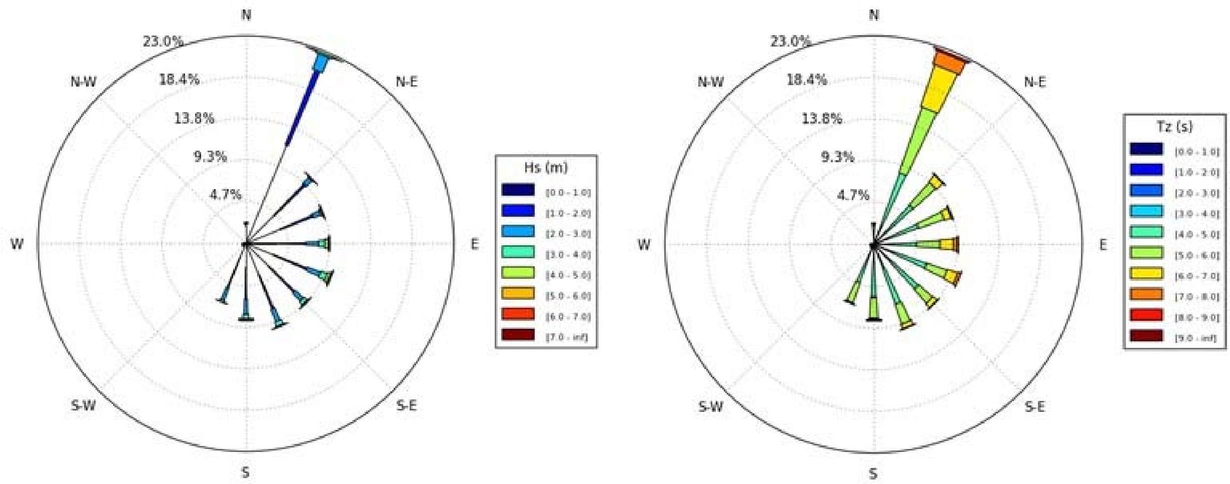

Figure 3-3 Directional wave plots for the predicted Hs and Tz site for the period January 1979 to January 2013

20. For extreme waves (estimated by fitting a Weibull distribution using the L-moment regression routine a list of wave height excursions above a defined threshold) the directional analysis suggests that the largest of extreme events will be incident from the SE quadrant, the NE quadrant is also exposed to large extreme waves. Therefore, the largest extreme waves will originate from within the North Sea basin. For example, for a 100 year return period the maximum extreme height predicted was 8.42m. The data suggests that the extreme waves will come from the SE quadrant and will therefore be wind waves. However, the NNE direction is open to swells origination in the Norwegian Sea and this is a likely origin of long period waves.

3.2.1.3. Currents

21. Operational currents are an indication of the statistics of the entire record of the currents, designed to give an indication of the conditions that could be expected on a day to day basis. Currents for the Project have been predicted by the BSH model. The annual predicted ideal currents distribution over the 13 year hindcast period indicates that the tidal currents flow in an NNE-SSW direction (Figure 3-4); and analysis of the depth averaged currents indicated that current speeds of 0.3ms^{-1} 50% of the time.

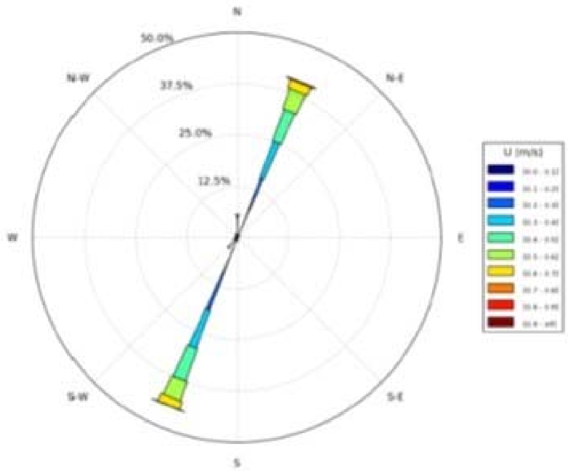

Figure 3-4 Annual current rose for the period January 2000 to October 2013

22. Water level data was obtained from BSH and the statistics were calculated over the 13 year period. The results are shown in Table 3-5. Water levels are also affected by atmospheric conditions such as wind and pressure resulting in surge conditions.

Table 3-5 Tidal Statistics for the period January 2000 – October 2013

Tidal Parameter	Tidal Height Relative to MSL (m)
Highest Astronomical Tide	2.25
Mean High Water Springs	1.76
Mean High Water Neaps	0.87
Mean Sea Level	0.00
Mean Low Water Neaps	-1.09
Mean Low Water Springs	-2.10
Lowest Astronomical Tide	-2.66

3.2.2. Coastal Processes and Seabed Morphology

23. A high level desktop study investigation has been conducted to inform the specification of geophysical surveys that are required in the Development Area and Offshore Export Cable Corridor prior to construction. The main source of data for this was British Geological Survey (BGS) seabed maps provided by MS and presented in the Scoping Assessment (Atkins, 2014a). Subsequently, Marine Scotland Science (MSS) have undertaken a video, still photo and grab sampling survey as part of their support of the offshore renewable sector. Drop-Down Video (DDV) and grab sampling was undertaken at a total of 68 sites in two surveys (Table 3-6 and Figure 3-5).

24. The first 'East of Aberdeen (EAB)' sites were conducted on the 8th and 9th August 2013 taking a total of 18 videos and associated stills, which extended throughout the Development Area. The second, 'Kincardine Sites' (labelled as TV) were conducted between the 12th and 15th August 2014 taking a total of 50 videos and associated stills which extend throughout the Offshore Export Cable Corridor.

Table 3-6 Details of baseline surveys conducted by Marine Scotland Science

Survey	Undertaken By	Date of Survey
Drop down Camera	Marine Scotland (Science)	08/2013 & 07/2014
Drop down video	Marine Scotland (Science)	08/2013 & 07/2014
Grab samples	Marine Scotland (Science)	08/2013 & 07/2014

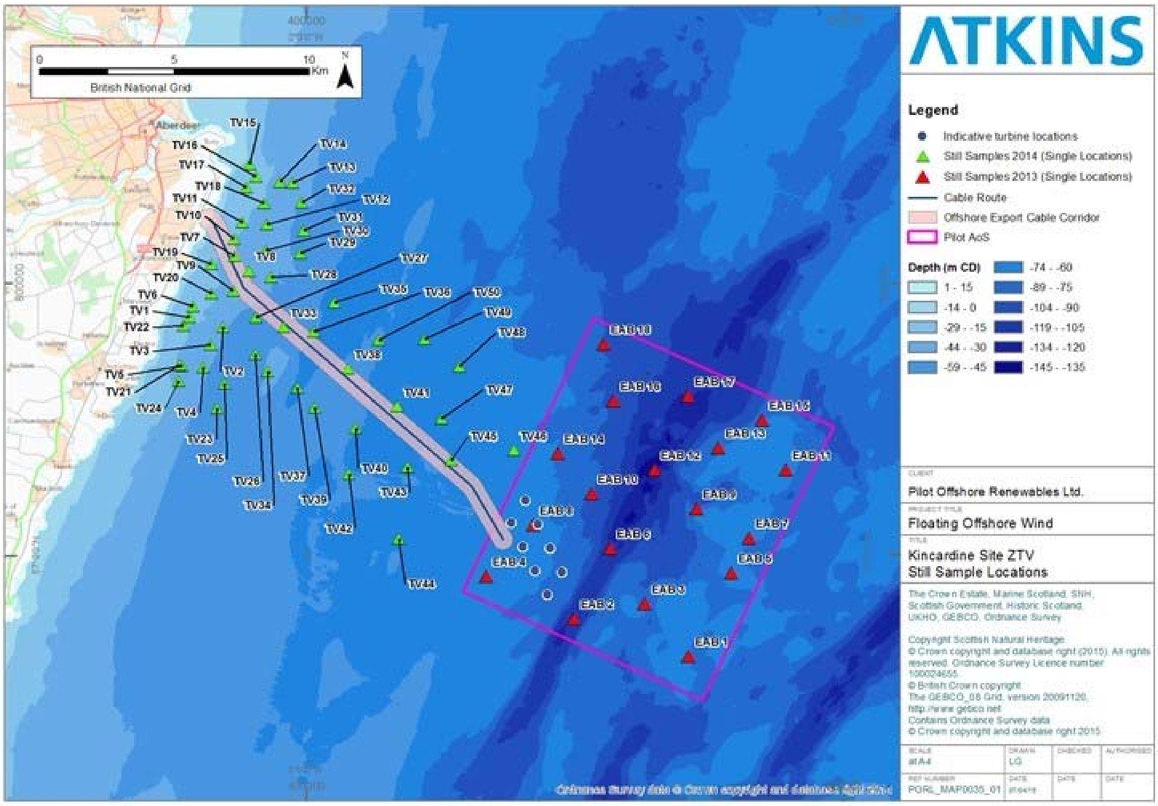

Figure 3-5 Locations of the DDV surveys conducted across the Development (EAB) and Offshore Export Cable Corridor (TV) areas

25. Grab sampling was undertaken for the purposes of Particle Size Analysis (PSA). Sampling was conducted using a standard (0.1m^2) day grab at sites where DDV confirmed that there were no sensitive habitats present, and a successful sample could be obtained. Grab sampling can be challenging in compacted sands as the spring closing mechanism is triggered, however, the grab is not able to penetrate into the sand. This results in a minimal sample or no sample being obtained. It is standard practice not to collect a sample if the grab bucket is less than one third full. Of the samples that were collected, 10 were selected that best represented the Development Area and the Offshore Export Cable Corridor and processed by the Macaulay Scientific Consulting Ltd a UKAS accredited laboratory for PSA. This comprised of two samples from the proposed Development Area in close proximity to the preliminary arrangements of turbines, and eight samples along the proposed Offshore Export Cable Corridor. The locations of the 10 analysed samples are presented in (Figure 3-6).

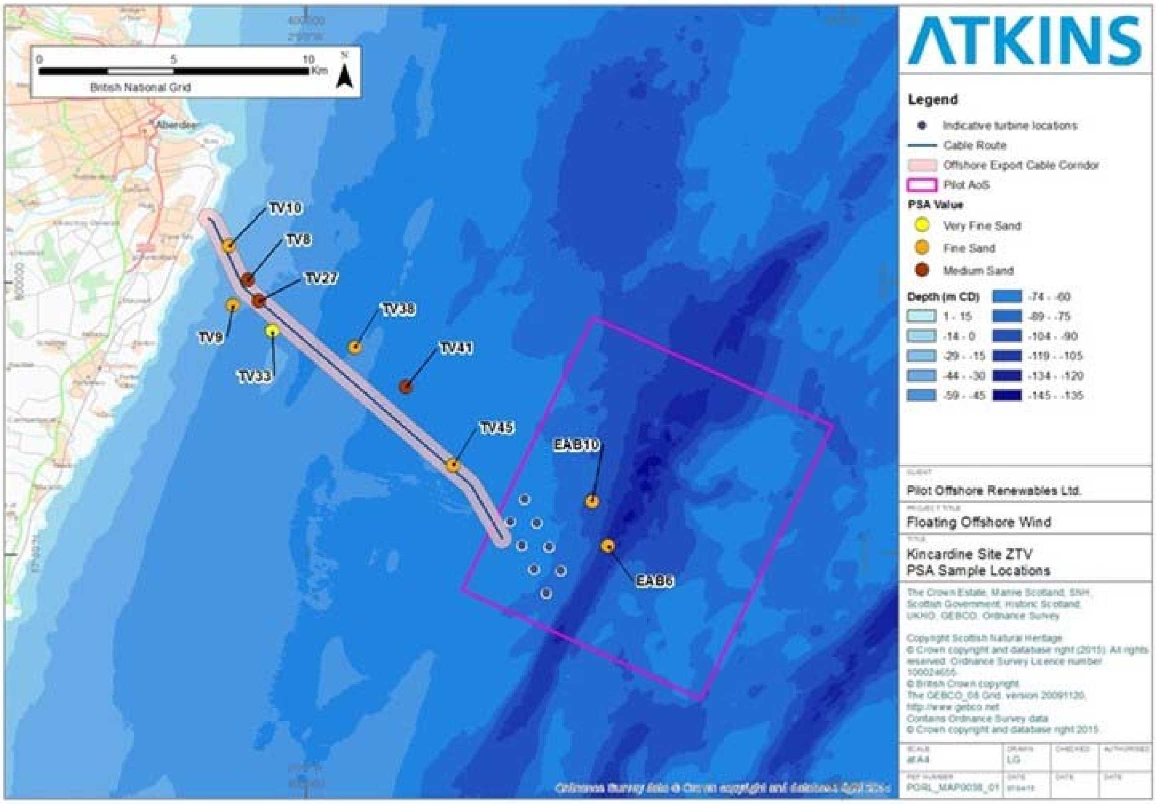

Figure 3-6 Locations and PSA analysis results of the 10 seabed grab samples analysed

26. PSA analysis was conducted using laser diffractometry. Laser diffraction measures particle size distributions (PSD) by measuring the angular variation in intensity of light scattered as a laser beam passes through a dispersed particulate sample. Larger particles scatter light at small angles relative to the laser beam and small particles scatter light at larger angles. The angular scattering intensity data are then analysed to calculate the size of the particles responsible for creating the scattering pattern, using the Mie theory of light scattering. The particle size is reported as a volume equivalent sphere diameter (Malvern, 2015). The results of the PSA are provided in Appendix A. Additional analysis was conducted using Gradistat (KPAL, 2011) to provide further information on the characteristics of the surficial sediments in both the Development Area and the Offshore Cable Corridor.

27. The PSA results are summarised in Table 3-7 and Table 3-8. The results indicate that the surficial sediments in the Development Area and Offshore Export Cable Corridor are predominantly characterised as sand as all the mean (D50) grain sizes of the samples were determined as either very fine, fine or medium sand. Further details are descried in the following sections.

3.2.2.1. Development Area

28. The two samples taken from the Development Area (EAB 6 and EAB 10) presented very similar PSD characteristics, both surficial samples were composed of moderately well sorted fine sand (125-250μm). The proportion of fines in the samples causes a fine skew of the PSD. Kurtosis is a measure of the peakedness of a curve, the samples from the Development Area both show leptokurtic peaks, meaning the distribution curve is very peaked with limited variance of the distribution around the mean grain size. Silt sized sediment was present in the samples, but in both accounted for <10%.

29. Analysis of the DDV and still photographs (see Chapter 5) shows that the seabed in the Development Area exhibits bedform features in the form of ripples. Ripples are formed under sub-critical flow conditions (Fr <1) and occur in relation to hydraulically smooth bed conditions (<600μm). The presence of ripples implies that the seabed across the Development Area is active as ripples form as a result bedload transport, and to some degree suspended load transport.

30. The DDV and stills provide further evidence of the active nature of the seabed within the Development Area. At all locations captured in the survey suspended sediment was evident, although the concentrations in the videos appeared to be lower in the Development Area than the Offshore Export Cable Corridor. This result is expected due to the deeper water depths in the Development Area compared to the Offshore Export Cable Corridor as is depicted in the bathymetry data (Figure 3-6).

Table 3-7 Grain size analysis results for the Development Area samples

Sample ID	Grain Size (D_{50})	Skewness	Sorting	% <63μm (Silt and clay)	% >63μm (Sand)
EAB 6	Fine Sand	Fine Skew	Moderately Well Sorted	5	95
EAB 10	Fine Sand	Fine Skew	Moderately Well Sorted	7	93

3.2.2.2. Offshore Export Cable Corridor

31. The results of the eight samples analysed from along the proposed Offshore Export Cable Corridor are summarised in Table 3-8, starting with the sample closest to the Development Area (TV45) moving then towards the shore (see Figure 3-6).

32. Mean grain sizes for the samples along the Offshore Export Cable Corridor are similar to those identified in the Development Area as they are predominantly medium (250-500μm) and fine sand (125-250μm). Only one sample (TV33) was found to be characterised as very fine sand (63-125μm) with a mean grain size of 89μm. However, what is noticeable in the samples, is that the results from the Offshore Export Cable Corridor display much more symmetrical distribution curves which are descried as having mesokurtic curves. This implies that the distribution has a larger spread of grain sizes around the mean than the samples in the Development Area. The majority of samples within the Offshore Export Cable Corridor are also predominantly moderately well sorted, with the exception of TV 33 which is was poorly sorted. The percentage of silt sized sediments in the samples remains low at <10% in all samples.

33. Analysis of the DDV and stills from the Offshore Export Cable Corridor also show an active bed as ripples were found in all images. Turbidity was also evident along the corridor and concentrations appeared to increase with proximity to the shore as water depths decrease from c. 70m in the Development Area (increasing to >100m in the deepest parts) to 40m at the landfall site. This would indicate a natural background of low to medium turbidity along the Export Cable Corridor, rather than a clear water environment.

Table 3-8 Grain size analysis results for the Offshore Export Cable Corridor area samples

Sample ID	Grain Size (D_{50})	Skewness	Sorting	% <63μm (Silt and clay)	% >63μm (Sand)
TV 45	Fine Sand	Symmetrical	Moderately Well Sorted	4	96
TV 41	Medium Sand	Symmetrical	Moderately Well Sorted	2	98
TV 38	Fine Sand	Fine Skew	Poorly Sorted	8	92
TV 33	Very Fine Sand	Fine Skew	Poorly Sorted	10	90
TV 27	Medium Sand	Symmetrical	Moderately Sorted	4	96
TV 9	Fine Sand	Fine Skew	Moderately Sorted	8	92
TV 8	Medium Sand	Symmetrical	Moderately Well Sorted	2	98
TV 10	Fine Sand	Symmetrical	Moderately Well Sorted	2	98

3.3. Assessment Methodology

34. The assessment of impacts to coastal processes is based on the methodology described in Chapter 1 The process follows the below steps;

- Determination of baseline conditions through analysis of existing data (See Section 3.2);
- Prediction of the activities during the different stages of the project development that may results in potential impacts;
- Characterisation of potential impacts during likelihood of occurrence;
- Assess whether impacts are significant (related back to baseline conditions) and the geographical scale at which they may occur;
- Assessment of cumulative effects of the Project and other developments and activities;
- Propose mitigation if applicable; and
- Assess whether residual impacts (after mitigation) are significant.

35. As also outlined in Chapter 1, the effects and impacts of the Project were assessed in line with the following definitions.

36. Effects are the physical change in the environment as a result of a particular activity or activities related to the development (e.g. the placement of anchors, trenching, and cable burial). Effects are usually measurable (e.g. area, weight, length, time, volume) and include a range of physical changes to the environment (e.g. sediment removal, elevated turbidity, noise, etc.).

37. Impacts are the consequence of this change and are defined as the way in which sensitive receptors are affected or 'impacted' by the change in the environment. The significance of an impact is directly related to the magnitude of the effect and the vulnerability of the receptor.

38. Magnitude of an effect is quantified where possible, and based on the below four characteristics and is defined as either positive, negligible, low, moderate and high (Table 3-9);

- Spatial Extent (the geographical range of the effect);
- Duration (how long the effect lasts);
- Frequency (how often the effect occurs); and
- Severity (the degree of change).

Table 3-9 Definitions of the magnitude of effect

Magnitude	Description
Positive	Positive change from baseline conditions
Negligible	Very slight change from baseline conditions
Low	Slight minor change from features of the baseline conditions
Moderate	Partial loss or changes to one or more of the key features of baseline conditions
High	Complete loss or very major changes to key features of baseline conditions

3.3.1. Design Envelope

39. The Project parameters and scenarios for use in the EIA are defined as a Rochdale Envelope and outlined in Chapter 1.

40. The assessment of potential impacts on coastal processes within this chapter is based on the Rochdale Envelope, with the development methodology and parameters being based upon the worst case scenario.

41. For the assessment, these scenarios include:

- Consideration of the maximum number of WTGs with the largest footprint, therefore the maximum loss of seabed disturbance due to anchors (in this case this is 8 x 6 MW WTGs each with four anchors i.e. 32 anchors) – approximately 10x10m area per anchor;
- Positioning of WTGs in shallowest water depths in the Development Area which would potentially increase the chance of erosion around anchors; and
- One Offshore Export Cable Corridor containing two export cables (cable trench 3m wide, with two trenches in the Offshore Export Cable Corridor).

42. Key parameters for the worst case scenario for each potential impact are detailed in Table 3-10.

Table 3-10 Key parameters for potential impacts

Potential Impact	Worst Case Scenario Assessed in ES
Disturbance of seabed/sediments during anchor deployment causing SSC plume	8 x 6 MW WTGs each with four anchor lines
Sediment disturbance and SSC plume generation from inter-array cabling installation (if burial is required)	Maximum 12 cables Cable length 2.5km each Cable overall diameter 180mm Cables will be laid on seabed Burial is not anticipated, however, if it is deemed necessary then burial during installation. Max 10% of total length buried considered for EIA (3km)
Sediment disturbance and SSC plume generation during dredging and burial of export cables	Maximum 2 cables Cable length 15km each Cable overall diameter 180mm Cable to be buried to target depth of 1.5m Trench expected to be 3m wide Where the target burial depth is not reached, remedial cable protection, e.g. concrete mattressing or rock dumping, may be required
Seabed scour erosion around anchor structures during operational phase	Maximum 32 anchors (10 x 10m per anchor maximum area of disturbance)

3.3.2. Embedded Mitigation

43. A range of embedded mitigation measures to minimise environmental effects are captured within the outline Design Envelope. The assessment of the effects on coastal processes has taken into account the following Embedded Mitigation measures:

- To reduce sediment disturbance and SSC plume generation during all phases, construction, maintenance and decommissioning, activities should be limited to 'normal'/calm tidal current and wave conditions. Increases in wave energy and tidal currents have the potential to transport suspended sediments further than under normal conditions. Limiting activities to calm conditions will reduce the footprint over which plumes can have a potential impact, as well as reduce other risks (e.g. vessel collisions) during activities.
- Similarly, it is anticipated that construction will take place during summer months when wave energy is lower than during winter months. See Section 3.2.1.2 for further details on wave heights and occurrence.
- Works vessel(s) co-ordination to ensure that disturbances to the seabed are for as limited a period as possible.

- Although water quality is not considered a potential impact, it is worth noting here that all vessels and plant equipment relating to construction, operation and maintenance and decommissioning activities will follow best practice and guidance for pollution at sea, detailed in the final Project Environment Management Plan (PEMP) to reduce and coordinate response to pollution events if they were to occur.

3.4. Impact Assessment

44. Changes to the following processes have not been considered within the assessment as there is limited scope for change due to the size and floating design of the Project;

- Tidal currents; and
- Wave heights.

45. Changes to the following processes have however been considered within the assessment, although the potential for impact remains low;

- Scour erosion;
- Turbid plume generation (due to increased Suspended sediment concentrations (SSC)) and dispersion during construction; and
- Changes to seabed morphology.

46. As no existing sediment transport data exists, some empirical calculations were carried out using the sediment characteristics that were determined through the PSA and current and wave data from the metocean assessment, to determine thresholds at which motion of the sediment should occur. The results of these are show in Table 3-11 and Table 3-12 below and include;

- Current only threshold of motion, calculated by two different equations, Soulsby method and Van Rijn method (Soulsby, 1997) – Table 3-11;
- Wave orbital velocity calculated for minimum, maximum and mean wave periods which were predicted as part of the metocean assessment (Soulsby, 1997) –Table 3-12;
- Threshold bed shear stress (which is perhaps the more precise measure of the threshold of motion (Soulsby, 1997) –Table 3-11;
- And from which the critical grain size can be determined, so anything under that grain size can be assumed to be in motion (Soulsby, 1997) –Table 3-11; and
- Settling velocity of the sediments (Soulsby, 1997) –Table 3-11.

Table 3-11 Results of the empirical formulae for the assessment for the 10 samples collected the Development Area and Offshore Export Cable Corridor for current only threshold of motion, bed shear stress, critical grain size for motion and settling velocity

Site / Parameter	EAB6	EAB6	TV45	TV41	TV38	TV33	TV27	TV9	TV8	TV10
Mean Grain Size (µm)	231	192	244	273	249	89	314	241	295	249
Current Only Threshold of Motion m s^{-1} Soulsby Equation	0.38	0.38	0.38	0.38	0.38	0.38	0.39	0.38	0.38	0.38
Current Only Threshold of Motion m/s Van Rijn Equation	0.39	0.38	0.39	0.39	0.38	0.34	0.38	0.40	0.38	0.40
Threshold Bed Shear Stress N m^{-2}	0.18	0.17	0.19	0.20	0.19	0.14	0.21	0.19	0.20	0.19
Critical Grain Size for motion mm	1.5	1.3	1.5	2	1.5	0.18	1.32	1.5	1.3	1.3
Critical Grain Size for motion µm	1500	1300	1500	2000	1500	180	1320	1500	1300	1300
Settling Velocity m s^{-1}	4.70	3.91	4.97	5.56	5.07	1.81	6.39	4.91	6.01	5.07

Table 3-12 Results of the empirical formulae for the assessment of wave orbital velocity based on the predicted waves statistics for the site

Month	Mean Wave Orbital Velocity m s^{-1}	Minimum Wave Orbital Velocity m s^{-1}	Maximum Wave Orbital Velocity m s^{-1}
January	0.15	0.10	0.19
February	0.15	0.11	0.19
March	0.15	0.11	0.19
April	0.15	0.11	0.20
May	0.14	0.11	0.18
June	0.18	0.11	0.18
July	0.18	0.11	0.17
August	0.18	0.11	0.18
September	0.18	0.11	0.18
October	0.18	0.11	0.19
November	0.18	0.11	0.19
December	0.18	0.11	0.19

47. The above values have been used to assess any impacts the Project may have on coastal processes. The results from these assessments confirm that the seabed in the Development Area and Offshore Export Cable Corridor is active, as the particle size distributions are all below that of the identified critical grain size (i.e. anything under that size is mobile), and the threshold of motion under currents and waves only. This creates a ‘live bed’ situation which means that although scour will occur around structures, there will also be an associated deposition period during lower flow periods that will infill scour pits created by bottom structures (anchors and cables).

48. When considering the significance of identified impacts, the sensitivity of the receptor must be determined as per the methodology described in Chapter 1. For the purposes of this chapter, the receptor is the sediment on the seabed that is susceptible to resuspension and scour erosion. Receptor sensitivity is assessed based on adaptability, tolerance, recoverability and value; for the purposes of this chapter the receptor is considered to have low sensitivity because of its composition and because it is already considered an active bed.

49. Climate change and expected sea level rise have not been considered as part of this assessment, and increasing water depths will decrease current speeds at the bed and increase the available water body in which to disperse SSC. Both of these would result in a reduction of the potential impacts assessed below.

3.4.1. Impact Assessment: Development Area

50. The key risks and potential impacts within the Development Area are summarised in Table 3-13.

Table 3-13 Summary of the potential risks and impacts to the Development Area during construction, operation and decommissioning

Activity	Risk	Potential Impact	Construction	Operation	Decommissioning
Deployment/removal of inter-array cables on/off seabed and during burial if needed	Temporary disturbance of seabed	• Increased SSC	X		X
Inter-array cables	Possible localised scour of sea bed around cables	• Increased SSC		X	
Deployment/removal of anchors	Temporary disturbance of seabed	• Increased SSC	X		X
Presence of four anchors per substructure (32 in total)	Possible localised scour of sea bed around anchors	• Increased SSC		X	
Operational windfarm	Changes to seabed morphology	• Stability of seabed as fishing activities will be removed from the area		X	

3.4.1.1. Increases SSC due to Deployment and Removal of the Inter-array Cables

Overview of Impact

51. During the laying and decommissioning of the inter-array cables in the Development Area there is the potential for increased suspended sediments in the water column as the seabed is disturbed by potential vessel movement, equipment and as the cables are placed and removed.

52. Worst Case Scenario for inter-array cables is defined in Table 3-14.

Table 3-14 Rochdale Envelope for inter-array cable assessment

Component	Dimensions
Number of Inter-array Cables	Max 12
Inter-array Cable Length	2.5km each/ 30km total
Inter-array Cable Diameter	180mm
Total Area of Inter-array Cables	5,400m^2
Total Volume of Potential Sediment Displacement if placed on seabed	972m^3
Total Volume of Potential Sediment Displacement if 10% is buried to 1m and 90% laid on seabed	3,785m^3
Cable burial up to 10% of cable length	3km

Characterisation of the Impact

53. The potential for seabed disturbance is very likely during both the construction and decommissioning phases. However, considering the nature of the sediment (fine to medium sand), the volume that would potentially be displaced, and depths of water (>70m) in the Development Area, any increases in SSC will only impact a very limited area. Possible impacts are also significantly reduced due to the settling velocity of the particles and the temporary nature of the disturbance. For example, if a plume of sediments is generated that extends 5m into the water column, with a settling rate of c. 0.0225m s^{-1} (taken as an average of the two samples in the Development Area), and the maximum current speed 5m from the bed of 0.36m s^{-1} (taken from the metocean assessment), then the sediment in the plume would settle out in 222 seconds covering a distance of 80m in the direction of the tidal current.

54. As there are no sensitive environs within the Development Area, there is no potential detrimental effect that cable laying will have. Any increase in suspended sediment concentrations will be very temporary, and any additional deposition of sediment in areas and will be rapidly remobilised by the bed conditions found at site. Therefore, the magnitude of the effect is considered negligible and the significance of the impact is also considered negligible/minor (Table 3-15).

Table 3-15 Impact assessment of increased SSC due to installation and decommissioning of inter-array cables

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Increased SSC due to installation and decommissioning of inter-array cables	Seabed	Low Medium to fine sand No conservative zones with Development Area Active nature of seabed	Negligible Temporary nature of disturbance Limited volume of sediment that will be displaced Limited extent of suspended sediment plume and fast settling velocity of sand	Negligible/ Minor

3.4.1.2. Increased SSC due to Scour Erosion around Inter-array Cables

Overview of Impact

55. The presence of the inter-array cables on the sea bed around the structures (if laid on the surface) could induce localised scour around them following installation and during the operational phase of the Project. However, due to the small diameter of the cables (180mm) and target cable burial depth it is not anticipated that scour erosion will be an issue from an engineering perspective around the interarray cables and therefore a scour assessment will not be conducted at detailed design.

Characterisation of Impact

56. If any scour around the inter-array cables did occur it is likely to only impact the seabed in the very close proximity of the cables (within five metres), therefore, the magnitude of the effect is considered negligible and the significance of the impact is also considered negligible/minor (Table 3-16).

Table 3-16 Impact assessment of increased SSC due to scour erosion around the inter-array cables

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Increased SSC due to scour erosion around inter-array cables	Seabed	Low Medium to fine sand No conservative zones with Development Area Active nature of seabed	Negligible Amount of sediment that would scour would be very minimal around the small diameter of the inter-array cables	Negligible/ Minor

3.4.1.3. Deployment and Removal of Anchors

Overview of Impact

57. During the laying and decommissioning of the drag embedment anchors (32) in the Development Area there is the potential for increased suspended sediments in the water column as the seabed is disturbed by potential vessel movement and equipment and as the anchors are placed and removed.

58. Worst Case Scenario for inter-array cables is defined in Table 3-17.

Table 3-17 Rochdale Envelope for drag embedment anchor assessment

Component	Dimensions
Number of anchors	Max 32
Length	7.6m
Width	6.8m
Area	51.68m^2
Max footprint	10 x 10m
Height into water column	3.2m
Depth of penetration	1.6m
Volume of sediment displaced per turbine	160m^3
Total volume of sediment displaced over windfarm	5,120m^3

59. During the deployment and removal of the anchors (worst case scenario 32 anchors), there is also the potential for sediments to be re-suspended increasing the SSC in the Development Area. The maximum footprint of spatial impact from the emplacement and tensioning of each anchor point will not exceed 10m^2, with penetration into the seabed of 1.6m. This would result in a maximum amount of sediment displaced of 5,120m^3. This will generate a localised re-suspension of sediment around the anchor point, however, this is likely to be a limited impact above natural SSC levels as with the installation of the interarray cables. During the decommissioning phase the anchors will be removed and there will be a second limited phase of SSC being created, but this will rapidly disperse and settle following removal.

Characterisation of Impact

60. As with the inter-array cable laying the potential for seabed disturbance is very likely during both the construction and decommissioning phases. However, considering the nature of the sediment (fine to medium sand) and depths of water (>70m) in the Development Area, any increases in SSC will only impact a very limited area, will be temporary in nature, will only occur once and will not be considered significant against baseline conditions. Therefore, the magnitude of the impact is considered to be low and the significance of the impact is also considered minor (Table 3-18).

Table 3-18 Impact assessment of increased SSC due to installation and decommissioning of anchors

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Increased SSC due to installation and Decommissioning of anchors	Seabed	Low Medium to fine sand No conservative zones with Development Area Active nature of seabed	Low Temporary nature of disturbance Limited volume of sediment that will be displaced Limited extent of suspended sediment plume and fast settling velocity of sand	Minor

3.4.1.4. Scour Erosion at the Base of the Anchors

Overview of Impact

61. During the operational phase of the Project there is the potential for scour erosion to occur at the base of the anchors. Scour erosion is caused by the presence of a structure which changes the flow pattern (Sumer and Fredsøe, 2000).

62. A scour assessment has not been undertaken as part of the current design of the windfarm, but will be assessed as part of detailed design once geotechnical and geophysical surveys have been undertaken. However, compared to other offshore structures (WTGs and Offshore Transmission Modules OTMs) scour erosion is not expected to occur to the same extent. Scour erosion is the result of disturbance to local flow fields caused by the placement of a structures upon the seabed or coastline. The presence of the structure leads to an increase in both the speed of the flow and turbulence intensity of the flow. In the case of WTGs or OTMs the structures extend through the whole length of the water column from the seabed to the surface (and above), whereas, in the case of the drag embedment anchors the height from the seabed will be 3.2m (Chapter 1 Table 1-3). As a result, the disturbance to local flow field will be greatly reduced compared to larger structures are flows are able to go over the top of the structures as well as around and therefore not cause the same acceleration to the flow if it were only able to go around the structure. Likewise, this will also result in a lesser increase to turbulences in the flow.

Characterisation of Impact

63. For the purpose of this assessment, it has been assumed that scour erosion will occur to a depth half the depth of penetration (1.6m), 0.8m as a worst case scenario, however as noted above, a detailed assessment will be undertaken during detailed design. This would result in a scour hole radius of 1.4m around the anchor (DNV, 2014) (assuming omnidirectional flows and an internal friction angle of 30° taken from DNV-OS-J101 Offshore Standard, 2014), and therefore a worst case scenario volume of 5m^3 of sediment eroded. Per turbine this would equate to 20m^3 and over the whole windfarm (32 anchors) 160m^3. This is significantly less than the amount of sediment that will be put into suspension during the placement of the anchors themselves (5,120m^3).

64. Therefore, the magnitude of the impact is considered to be negligible and the significance of the impact is also considered negligible/minor (Table 3-19).

Table 3-19 Impact assessment of increased SSC due to scour erosion around anchors

Impact	Receptor	Sensitivity of receptor	Magnitude of effect	Significance
Increased SSC due to scour at base of anchors	Seabed	Low Medium to fine sand No conservative zones with Development Area Active nature of seabed	Negligible Amount of sediment that would be disturbed is smaller than compared to installation of anchors Active nature of the seabed	Negligible/ Minor

3.4.1.5. Changes to Seabed Morphology

Overview of Impact

65. Due to the presence of the windfarm, there will be a buffer zone of approximately 500m around the whole development within which trawling activities cannot occur due to safety concerns in regard to the mooring system and the inter-array cables that will be located on the seabed around each WTG location. Therefore, in the long term, after initial disturbance of the seabed during construction, there is potential for the presence of the windfarm to have a positive impact on the seabed.

Characterisation of Impact

66. As a consequence of the fishing exclusion buffer zone around the windfarm development, this would significantly reduce the anthropogenic disturbance to the seabed within the Development Area, as the sea bed is periodically trawled which will disturb the sea bed. Waves and tidal currents would still influence and modify the seabed during the operational phase of the site and it would remain active in nature, but other activities would cease. This could result in localised sea bed achieving a slightly higher stabilisation period that might allow re-colonisation by benthic communities, but due to the dynamic nature of the sea bed at the site location it is unlikely to have a significant impact on the seabed and benthic communities (see Chapter 4). Therefore, the magnitude of the impact is considered to be negligible/low positive and the significance of the impact is also considered negligible/minor (Table 3-20).

Table 3-20 Impact assessment of seabed stability due to presence of windfarm and fishing exclusion zones

Impact	Receptor	Sensitivity of receptor	Magnitude of effect	Significance
Stability of seabed morphology	Seabed	Low Medium to fine sand No conservative zones with Development Area Active nature of seabed	Negligible/Low Positive Seabed would be less disturbed if fishing activities were to be limited due to the presence of the windfarm Active nature of the seabed	Negligible/ Minor

3.4.2. Impact Assessment: Offshore Export Cable Corridor

67. The key risks and potential impacts within the Offshore Export Cable Corridor are summarised in Table 3-21.

Table 3-21 Summary of the potential risks and impacts to the Offshore Export Cable Corridor during construction, operation and decommissioning

Activity	Risk	Potential Impact	Construction	Operation	Decommissioning
Dredging and burial during laying of the export cable	Temporary disturbance of seabed	Increased SSC	X		
Scour around cable protection area (up to 10% of cable length)	Long term disturbance of sea bed	Increase in SSC		X	X

3.4.2.1. Dredging and Burial during Laying of Export Cables

Overview of Impact

68. The cable laying process will likely involve a combined process of dredging (possibly), laying and burial all occurring sequentially along the cable corridor. Therefore the majority of the sediment that is displaced during dredging will be replaced during the burial process. However, there will be some increase in SSC during cable laying. Cable laying is the only process to be considered for the Offshore Export Cable Corridor as the cable will be buried to reduce impact on bed topology and morphology, and currently there are no plans to decommission the cable but leave it in place indefinitely, depending on the market conditions during the decommissioning phase.

Table 3-22 Rochdale Envelope for export cable assessment

Component	Dimensions
Number of Export Cables	Max 2
Export Cable Length	15km
Export Cable Diameter	180mm
Target Burial Depth	1.5m
Total Area per Export Cable to be excavated (and replaced) during cable laying (assuming a 2 m wide trench is ploughed)	45,000m^2 per cable
Total Volume of Potential Sediment Displacement per Cable (assuming a 3m wide trench is ploughed and to a depth of 1.5m)	67,500m^3 per cable

Characterisation of Impact

69. The potential for the increased SSC is high during cable laying, however, as the process occurs very gradually along the corridor (approximately 1km per hour for each of the two cables in the corridor), this reduces the overall significance this impact could have. In total, 67,500m^3 of sediment could be disturbed during the laying of each cable. This equates to only approximately 4,500m^3 per hour being disturbed during the process, which will then settle out before the next 1km section is dredged. Therefore, the magnitude of the impact is considered to be low and the significance of the impact is also considered minor (Table 3-23).

Table 3-23 Impact assessment of increased SSC due to burial of export cable

Impact	Receptor	Sensitivity of receptor	Magnitude of effect	Significance
Increased SSC due to dredging and burial of export cables	Seabed	Low Medium to fine sand No conservative zones with Development Area Active nature of seabed	Low Cable laying will occur at 1km per hour, so impacts limited for each section of the cable No sediment to be removed, dredged sediments will be used to bury the export cables Limited extent of suspended sediment plume and fast settling velocity of sand	Minor

3.4.2.2. Scour Erosion - Export Cables (Rock Dumping/Cable Protection Only)

Overview of Impact

70. During the operational phase of the Project there is the potential for scour erosion to occur at the locations where scour protection has been installed on the export cables. Scour erosion is caused by the presence of a structure which changes the flow pattern (Sumer and Fredsøe, 2000).

71. A scour assessment has not been undertaken as part of the current design of the windfarm, but will be assessed as part of detailed design once geotechnical and geophysical surveys have been undertaken. However, compared to fixed offshore structures (WTGs and Offshore Transmission Modules OTMs) scour erosion is not expected to occur to the same extent for offshore cable protection. Scour erosion is the result of disturbance to local flow fields caused by the placement of a structures upon the seabed or coastline. The presence of the structure leads to an increase in both the speed of the flow and turbulence intensity of the flow. In the case of WTGs or OTMs the structures extend through the whole length of the water column from the seabed to the surface (and above), whereas, in the case of the scour protection the height from the seabed will be 1m. As a result, the disturbance to local flow field from scour protection material will be greatly reduced compared to larger structures are flows are able to go over the top of the structures as well as around and therefore not cause the same acceleration to the flow if it were only able to go around the structure. Likewise, this will also result in a lesser increase to turbulences in the flow.

Characterisation of Impact

72. There is currently insufficient information available to accurately quantity the effect of all of the possible types of protection measure, which will vary greatly in design and scale. However using standard processed identified for other offshore windfarm developments (BOWL ES, 2012) the maximum likely height of protection would be 1m above current sea bed levels. The width of the material is likely to be 7m wide (3m slope sides and 1m flat top). The purpose of cable protection is to stop scour development over the cable and this can lead to either a slight build or a slight removal of sediment from around the structure. The small magnitude of change would therefore be expected to be within the range of naturally occurring variability across the development site and localised to the cable route.

73. Therefore, the magnitude of the impact is considered to be negligible and the significance of the impact is also considered negligible/minor (Table 3-24).

Table 3-24 Impact assessment of increased SSC due to scour erosion around export cable protection

Impact	Receptor	Sensitivity of receptor	Magnitude of effect	Significance
Increased SSC due to Scour erosion around areas where export cable is protected with rock dumping	Seabed	Low Medium to fine sand No conservative zones with Development Area Active nature of seabed	Negligible Limited scour potential if rock dumping is to only 1m above seabed Active nature of the seabed Amount of sediment that would be disturbed is smaller than compared to installation of export cables	Negligible/ Minor

3.5. Mitigation

74. Based on the outputs from this impact assessment, it has been concluded that the embedded mitigation detailed in Section 3.3.2 is appropriate to reduce any potential residual impacts relating directly to coastal processes to an acceptable level. No such additional mitigation should be required in either the Development Area or the Offshore Export Cable Corridor.

75. However as part of the routine maintenance of the site there will be regular ROV surveys of all of the sub-sea assets (anchors, mooring lines and interarray cables) to ensure they are working as designed and that they operate within the expected parameters. This will form part of the survey, deploy and monitor regime that the Project will work within to test and demonstrate the effectiveness of these systems in marine environment.

3.6. Cumulative Impacts

76. To assess the cumulative effect of the Project on coastal processes the combined impacts from within the Development Area and Offshore Export Cable Corridor have been considered.

77. As construction of the windfarm is likely to be a phased approach, there is limited scope for cumulative impacts to occur. The inter-array cables are due to be installed first, followed by the anchors, and then export cables, before the floating structures and WTGs are towed to site. Therefore, any increases in SSC created during installation of the inter-array cables will have decreased back to baseline conditions before the anchors will be installed. Similarly, with the laying of the export cables, this will occur post deployment of the inter-array cables and anchors, and so there will be no cumulative impacts from the Development Area and Offshore Export Cable Corridor resulting from the site development.

78. There is potential for installation of the export cable to occur during the construction of the new Nigg Bay port (Aberdeen). However, as noted above the potential dispersion path for any mobilised bed material is likely to be settle within a maximum distance of 80m from the cable trench, therefore there should be no direct impact of increase SSC from the Project on the development at Nigg Bay which is at least 2km from the closest point in the Export Cable Corridor. Furthermore, the dredge quantities for Nigg Bay are in the region of 2,000,000m^3 (Fugro, 2015) which is significantly larger than for the Project, so additional SSC from the Project would not be discernible above the levels created from Nigg Bay. It is possible that the Nigg Bay operation could impact on the installation of the cable if larger volumes of SSC are generated during the construction of the breakwaters and the dredging operations at Nigg Bay. However it is believed that this is unlikely as this development would be subject to controls on SSC production during the construction phase. Furthermore, the dredging for Nigg Bay is expected to take place over 19 months (up to three barges, 24 hours a day, and seven days a week). The installation of the anchors, and dredging of the cable trenches will occur within this time (between March and November 2017), however, as stated above, even if activities were to occur simultaneously, any increases to SSC generated by the Project will be much lower than those generated by dredging and construction at Nigg Bay, and activities at both sites will be over long time periods further reducing cumulative impacts.

79. As the potential impacts from the Project are considered negligible/minor, and the footprint of impact from increased SSCs is very limited, cumulative impacts with other offshore windfarm developments on the east coast of Scotland have not been considered as they are at least 17km from the site. Table 3-25 details the consented windfarm with a 50km of the Project.

Table 3-25 Details of consented windfarms within 50km of the Kincardine Floating Offshore Windfarm

Project Name	Distance from KOWL	Project Developer	High Level Description	Project Status
European Offshore Wind Deployment Centre (EOWDC)	17km	Aberdeen Offshore Windfarm Ltd	Offshore wind turbine deployment centre for 11 turbines with up to 100 MW capacity	Consented
Seagreen Alpha Offshore Windfarm and Seagreen Bravo Offshore Windfarm	34km	Seagreen Wind Energy Limited	Offshore windfarm and export cabling to be developed in three phases with a total target capacity of 3.5 GW.	Phase 1 Consented Phase 2 and 3 EIA Scoping Opinion issued
Hywind Scotland Pilot Park	45km	Statoil	Pilot project for 5 6MW floating turbines	Environmental Statement submitted April 2015
Inch Cape Offshore Windfarm	47km	Inch Cape Offshore Windfarm Ltd	Offshore windfarm up to 21 turbines covering an area of up to 150km^2 with a capacity of approximately 1,000 MW	Consented

3.7. Summary and Residual Impacts

80. The following tables (Table 3-26 to Table 3-29) summarises the results of the EIA to the physical environment. Overall, there are no significant potential impacts.

Table 3-26 Summary of the residual significance of the identified impacts within the Development Area to the physical environment

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Construction				
Seabed disturbance due to installation and decommissioning of inter-array cables	Seabed	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Installation and Decommissioning of anchors	Seabed	Minor	Embedded Mitigation with no Additional Mitigation	Minor
Operation and Maintenance				
Scour erosion around inter-array cables	Seabed	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Scour at base of anchors	Seabed	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Changes to seabed morphology	Seabed	Minor	Embedded Mitigation with no Additional Mitigation	Minor

Table 3-27 Summary of the residual significance of the identified impacts within the Offshore Export Cable Corridor to the physical environment

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Construction				
Dredging and burial during laying of the export cables	Seabed	Minor	Embedded Mitigation with no Additional Mitigation	Minor
Operation and Maintenance				
Scour erosion around areas where export cable is protected with rock dumping	Seabed	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor

Table 3-28 Summary of the residual significance of the cumulative effects of identified impacts within the Development Area and Offshore Export Cable Corridor to the physical environment

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Construction				
Increased SSC due to installation of inter-array cables, anchors and export cables	Seabed	Minor	Embedded Mitigation with no Additional Mitigation	Minor
Operation and Maintenance				
Increased SSC due to scour erosion along export cables and around anchors	Seabed	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Seabed stability	Seabed	Minor	Embedded Mitigation with no Additional Mitigation	Minor

Table 3-29 Summary of the residual significance of the cumulative effects of identified impacts between the Project and the Nigg Bay Development to the physical environment

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Construction				
Increased SSC due to construction of the Project and Nigg Bay	Seabed	Minor	Embedded Mitigation with no Additional Mitigation	Minor
Operation and Maintenance				
Increased SSC due to scour erosion	Seabed	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Stability of seabed	Seabed	Minor		Minor

3.8. References

Arcus Renewable Energy Consulting Ltd (2012) Beatrice Offshore Wind Farm Environmental Statement. Available Online: http://sse.com/whatwedo/ourprojectsandassets/renewables/Beatrice/ [Last Accessed: January 2016]

Atkins (2014a) Kincardine Offshore Windfarm Environmental Scoping Assessment

Atkins (2014b) Kincardine Floating Offshore Wind, Metocean Assessment (Confidential Document)

DNV (2014) Offshore Standard DNV-OS-J101 Design of Offshore Wind Turbine Structures

Fugro (2015) Aberdeen Harbour Expansion Project Volume 2: Environmental Statement Chapter 3: Description of the Development. Available Online: http://d80a69bd923ff4dc0677-b849429a75dd6216be63404a232a877c.r8.cf3.rackcdn.com/EIA_Volume_2/Volume_2_Environmental_Statement_Ch_3.pdf [Last Accessed January 2016]

Her Majesty's Government. (2011). UK Marine Policy Statement. Available Online: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69322/pb3654-marine-policy-statement-110316.pdf [Last Accessed: March 2015]

KPAL (2011) Gradistat http://www.kpal.co.uk/gradistat.html [Last Accessed April 2015]

Lambkin, D.O., Harris, J.M., Cooper, W.S., Coates T., Coastal Process Modelling for Offshore Windfarm Environmental Impact Assessment: Best Practice Guide, COWRIE

Malvern (2015) Website http://www.malvern.com/en/products/technology/laser-diffraction/ [Last Accessed April 2015]

Marine Scotland (2014) Kincardine Offshore Windfarm South East of Aberdeen Scoping Opinion

Scottish Government (2010). Marine (Scotland) Act. Available Online: http://www.legislation.gov.uk/asp/2010/5/contents [Last Accessed: March 2015]

Scottish Government (2011) Scotland's National Marine Plan Pre Consultation Draft. Available Online: http://www.gov.scot/Resource/Doc/346796/0115349.pdf [Last Accessed: March 2015]

Scottish Government (2013) Strategic Environmental Assessment. Available Online: http://www.gov.scot/Resource/0043/00432344.pdf [Last Accessed: March 2015]

Scottish Natural Heritage (2008) Marine Renewable Energy and the Natural Heritage: An Overview and Policy Statement. Available online http://www.snh.org.uk/pdfs/polstat/mrp.pdf [Last Accessed: March 2015]

Soulsby, R. (1997) *Dynamics of marine sands*, London, Thomas Telford Publications

4. Benthic Ecology

4.1. Introduction

1. This chapter assesses the potential effects of the Project on benthic subtidal ecology. For the purposes of this report subtidal benthic ecology refers to both the epibenthic fauna (living ***in*** the seabed) and benthic fauna (living ***on*** the seabed).

2. As described in Chapter 1, this chapter makes reference to the Development Area and the Offshore Export Cable Corridor as defined below.

- The Development Area – the windfarm area including the Wind Turbine Generators (WTG), floating substructures and inter-array cables.
- The Offshore Export Cable Corridor – the area within which the proposed export cables will be laid, from the perimeter of the Development Area to the Onshore Area at Mean High Water Spring (MHWS).
- These areas combined are referred to as the Project.

3. For this ES, the benthic ecology has been characterised within the Development Area and Offshore Export Cable Corridor up to the Mean Low Water Mark (MLWM), through the evaluation of survey data and desk studies. The benthic communities found have been categorised into biotopes which are detailed in Section 4.2.4 and 4.2.5. Fish and shellfish are subject to separate assessment in the ES under Chapter 5.

4. It should be noted that the demonstrator project is firstly of limited size (maximum of 50MW) and secondly that they are floating structures. Detailed Marine Scotland survey data has been used to assess the benthic habitats (Table 4-4) and species of the site and these will be compared to the wider environment.

5. Post-deployment monitoring of the site will be designed to allow comparison with pre-construction datasets, according to the principles of the Scottish Government's "Survey, Deploy and Monitor" policy.

4.1.1. Legislation and guidance

6. There are a number of different statutes and guidance which are relevant to the assessment of the potential impacts on the benthic ecology. The following legislation and guidance have been considered specifically in this chapter:

- EU Habitats Directive (Directive 92/43/EEC) and associated habitats regulations;
  - Habitats (Scotland) Regulations 1994 (as amended) implements species protection requirements of the Habitats Directive in Scotland, on land and inshore waters up to 12nm;
  - Offshore Marine Conservation (Natural habitats) Regulations 2007 (as amended) implements the requirements of the Habitats Directive in the UK offshore marine area (beyond 12nm);
- UK Marine Policy Statement;
- Scotland's National Marine Plan;
- Marine and Coastal Access Act (2009);
- Marine (Scotland) Act 2010;
- UK Biodiversity Action Plan (UKBAP); and
- The Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR Convention).

4.1.1.1. European Habitats Directive

7. The EU Habitats Directive lists 13 marine habitats and eight marine species in Annexes I and II respectively. Special areas of conservation have been designated in UK waters in order to meet the requirements outlined in Article 3 of the Directive and in order to contribute to the European network of conservation sites.

8. There are currently no designated or identified offshore SACs for the presence of benthic habitats or species within the vicinity of the Development Area and the Offshore Export Cable Corridor. There are a number of SACs which are located within 50km of the Project. These are:

- Buchan Ness to Collieston Coast SAC (27km)
- River Dee SAC (20km)
- South Esk SAC (50km)

9. Potential impacts to these SAC sites are assessed within the Habitats Regulations Appraisal (HRA), with information also contained within Chapter 5.

4.1.1.2. Marine and Coastal Access Act (2009) and Marine (Scotland) Act (2010)

10. The Marine (Scotland) Act (2010) established new powers in order to designate Marine Protected Areas (MPAs) in Scottish Territorial Waters. In addition the Marine and Coastal Access Act (2009) sets out powers for the UK government to designate MPAs. Within these are provisions for Scottish Ministers to designate MPAs in offshore waters adjacent to Scotland.

11. There are no MPAs within the vicinity of the project.

4.1.1.3. Priority Marine Features

12. A Priority list of marine habitats and species in Scotland's seas has been developed jointly by Scottish Natural Heritage (SNH) and the Joint Nature Conservation Committee (JNCC) which are known as Priority Marine Features (PMF). The list has been developed in order to assist in the delivery of Marine Scotland's vision for marine nature conservation which is outlined in the Marine Nature Conservation Strategy (SNH, 2013b). A potential PMFs which may occur in the Project area is identified as 'Offshore subtidal sands and gravels'.

4.1.1.4. UK Biodiversity Action Plan

13. The current UK Biodiversity Action Plan (UKBAP) priority habitats list was published in 2008 following a two year review of the BAP process and priorities, with subsequent updates to some descriptions occurring in 2010 and 2011. The North East Scotland's Local Biodiversity Action Plan (NES LBAP) associated with marine habitats (2013) is currently under review. The main UKBAP habitat which has the potential to occur in the area is *Sabellaria spinulosa* reefs (also known as Ross worm).

4.1.1.5. OSPAR Convention

14. The OSPAR convention is the instrument by which 15 governments of Western Europe work in conjunction to protect the environment of the North East Atlantic. Marine SACs which are designated under the EU Habitats Directive have been submitted as the UK's initial contribution to the OSPAR network. The main marine habitat and species which is on the list of habitats and species considered to be under threat or decline within the north east Atlantic which have the potential to be present in the Project area is *Sabellaria spinulosa* reef.

4.1.1.6. Guidance

15. The following guidance has been considered during the assessment of potential impacts on the benthic ecology in the Project area:

- Guidelines for Environmental Impact Assessment (IEMA, 2004);
- Guidelines for Ecological Impact Assessment in Britain and Ireland – Marine and Coastal Consultation Document (IEEM, 2010);
- A handbook on environmental impact assessment (SNH, 2013a);

- OSPAR Guidance on Environmental Considerations for Offshore Windfarm Development (OSPAR, 2008);
- Guidance on survey and monitoring in relation to marine renewables developments in Scotland. Volume 5. Benthic Habitats (Saunders *et al.,* 2011); and
- Guidelines for the Conduct of Benthic Studies at Marine Aggregate Extraction Sites (2nd Edition). Marine Aggregate Levy Sustainability Fund, 80 pp (Ware & Kenny, 2011).

4.1.2. Stakeholder Consultation

16. Scoping responses which were relevant to the Benthic Ecology Environmental Impact Assessment (EIA) are summarised below in Table 4-1.

Table 4-1 Scoping responses relevant to benthic ecology EIA

Kincardine Offshore Windfarm Environmental Scoping Assessment		
Consultee	**Scoping Response**	**Project Response**
Marine Scotland Science	The developer should provide evidence of the presence or absence of listed habitats or species in the vicinity of the anchor structures and cables. Existing surveys or data may be acceptable if they can provide sufficient detail of the species and habitats present. A proper evaluation of the anchoring system is necessary as it relates directly with the possible existence of Annex 1 reefs as per Habitats Directive (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora	Benthic surveys have been undertaken by MSS with the results analysed and biotopes and species identified as accurately as possible. The results are described in Section 4.2.
	Throughout the document, the authors need to consider benthos, fish and shellfish as separate topics not as one subject.	There are separate chapters within the ES covering benthos (Chapter 4) and fish and shellfish (Chapter 5)
	Video footage and digital stills will need to be collected along the cable routes with, perhaps, sediment and benthic samples as required.	Drop-down video footage and digital stills and grab sampling for PSA have been undertaken for the Kincardine site by MSS.
	Need to see diagrams of mooring systems that are to be used before we can assess potential seabed impacts in O&M phase. Will chains or cables directly interact with the seabed for example? Will there be any movement on the seabed, scraping?	Chains from the mooring system will interact with the sea bed, but will be directionally laid. Diagrams included in Chapter 2.
	What is the "positive effect"? What is meant by "allow stable seabed morphology to establish"?	Due to the presence of the structure demersal trawling will be significantly reduced in the area surrounding the structures and therefore the sea bed will remain undisturbed during the period of the project. There is the potential benefit that fishing exclusion will allow the seabed to return to a semi-natural state which could be viewed as a consequential positive effect which will be assessed (Chapter 14).
	Please explain the statement "potential effects on both marine species including marine ecology" The extent of Marine	Rephrased. Map of the survey area included in Section 4.2, Figure 4-1.

Kincardine Offshore Windfarm Environmental Scoping Assessment		
Consultee	**Scoping Response**	**Project Response**
	Scotland Science surveys should be illustrated here in a figure of some kind.	
	Need to be shown how much of the development site has been covered by the MSS survey. We also need to see the designs for the floating structures to be able to assess potential impact on the seabed.	Map in Section 4.2, Figure 4-1 demonstrates area of survey for site and cable route. Designs of the floating structures are detailed in Chapter 2.
	How will the MSS data be analysed and how will the results be used to compare to the wider environment? A survey of the cable route will be required	The survey data from MSS were collated and analysed to allow biotopes to be determined as accurately as possible. Details on the processes used are described in Section 4.2.3. MSS also carried out a survey along the cable route.
	The authors are discussing both infaunal and epifaunal organisms in extremely vague terms. They also state that cold water reefs are absent from the area without providing any supportive data. Are the reefs referred to cold water corals or Sabellaria? Data are required here	Definitions of terms used are provided in the glossary of each chapter. Data from the survey has confirmed that cold water reefs are absent from the area. A very small patch of *Sabellaria spinulosa* was identified at one location in area TV32 see Figure 4-1.
	Why consult CEFAS for benthic data on this site?	Removed.
	Please provide information to support this statement. No data are available from the cable corridors as yet. (relating to no data gaps have been currently identified)	Cable route data is now available and has been fully assessed within the document in Section 4.2.5.
	Colonisation – this cannot be regarded as a positive effect. This introduces species which were not previously present, for example species associated with hard substrate introduced into area of soft sediment. Changes in biodiversity which may not be beneficial.	Reworded within document.
	Protection of seabed – any effects will be minor. These are relatively mobile sediments therefore so effects will be difficult to detect I suspect.	This is likely, but the presence of the structures will prevent demersal trawling at the site which would decrease anthropogenic impacts and is discussed within Chapter 14.
	Smothering – cable trenching will create sediment plumes we therefore need data not only on the trenching methodology but also on sediment particle size distributions along the cable corridors. Needs to be scoped in to EIA. Will any parts of the transmission cable be rock armoured or mattressed?	PSA analysis has been undertaken and detail regarding the cable trenching techniques has been included. It is presently assumed that no rock dumping is required for the export cable route. PSA is covered in more detail in Chapter 3.
	Seabed scour – scour may impact benthic habitats and fish in particular sandeels, cod and herring (spawning).	Discussed in Chapter 3.

Kincardine Offshore Windfarm Environmental Scoping Assessment		
Consultee	**Scoping Response**	**Project Response**
	This needs to be considered further and scoped in to EIA.	
	Ecology What subjects are covered by this topic? Benthic ecology and marine mammal ecology need to be considered separately given their importance to the development.	Benthic ecology (Chapter 4) and marine mammals (Chapter 6) have been broken into separate chapters.
	Please provide additional information on the MS benthic survey of the site that is planned to be used.	Details of MS survey noted within section 4.2.3.
SEPA	Baseline assessment of existing intertidal and subtidal habitats and species should be submitted. This should include any UK Biodiversity Action Plan habitats and species (e.g. maerl, sea pens, eel grass, and horse mussels). Additional information on the UK Biodiversity Action Plan is available at: www.ukbap.org.uk/UKPlans.aspx?ID=35. Developers will then be able to ascertain if they are required to supplement or quantify the available data with in-field surveys.	No intertidal habitats will be affected as the cable will be directionally drilled into water approximately 20m deep (CD). MSS survey data used to describe the cable route. Data from MSS and the baseline study is sufficient to cover this.
SNH	We recommend that the applicant confirms the availability, quality and coverage of any benthic baseline data collected by Marine Scotland is appropriate for this development. This will establish if survey methods need to be revised and / or if further detailed surveys are required.	The additional data provides suitable coverage of the site and the cable route to shore, see Section 4.2.
	The scoping report does not discuss any intention to conduct a benthic survey of the cable route. We strongly advise that cable route to shore should also be subject to benthic baseline characterisation surveys.	A benthic survey been undertaken by Marine Scotland Science details can be found in Section 4.2.3.
	We recommend that the ES presents clear information on, and identification of, the main biotopes found within the proposed development site. The biotopes / habitat map should be used by the applicant to inform their finalised turbine layout, taking account of likely impacts from the turbine moorings and cables on benthic ecology. Consideration should also be given to indirect impacts on birds, fish and marine mammals, where appropriate.	This has been undertaken and data noted below. Birds are discussed in Chapter 7 and the HRA. Fish are discussed in Chapter 5. Marine mammals are covered in Chapter 6.

17. Information which was received through consultation, in addition to the formal Scoping Opinion and best practice guidelines, has supported the development of the methodology and scope for the assessments of the development impacts upon benthic ecology as presented in this chapter.

4.1.3. Design Envelope

18. The Project's potential development parameters and scenarios are defined as a Rochdale Envelope.

19. The assessment of potential impacts on benthic ecology within this chapter is based on the Rochdale Envelope, with the development methodology and parameters being based on the worst case scenario.

20. For the assessment, these scenarios include:

- Consideration of the maximum number of WTGs with the largest footprint, therefore the maximum loss of area (in this case this is 8 x 6MW WTGs);
- Worst case positioning of WTGs;
- For the Offshore Export Cable Corridor, it is assumed that two export cables will be required and installed at the shore end via Horizontal Directional Drilling (HDD). These will be laid within a 500m corridor outlined in Chapter 2.

21. Key parameters for the worst case scenario for each potential impact are detailed in Table 4-2 and Table 4-3.

Table 4-2 Key parameters for potential Impacts – Development Area

Potential Impact	Worst Case Scenario Assessed in ES
Construction (and Decommissioning)	
Direct temporary disturbance of seabed habitats caused by construction activities	Seabed area disturbed resulting from: Seabed preparation for drag embedment anchors for mooring lines – worst case assumed to be 10 x 10m area per anchor, including pre-tensioning movement. This would give a maximum area (four anchors per WTG = 32 anchors) 3200m^2. Maximum 12 inter-array cables. Inter-array cable length 2.5km each Inter-array cable diameter 180mm. Inter-array cables will not be buried. 4 catenary anchors per substructure. Drag embedment anchors. Trench for start of the Export cable. Remedial cable protection will be installed where required along the Export Cable, e.g. localised burial.
Direct loss of seabed habitat	Instalment of four drag embedment anchors per WTG, totalling 32 anchors. Trench for start of the Export cable. Remedial cable protection will be installed where required along the Export Cable, e.g. localised burial.
Indirect impacts of temporary increases in suspended sediment concentrations (SSC) from construction based activities, and associated deposition	Anticipated worst case SSC, deposition and sediment transportation from energetic means (cable) and anchorage points are detailed in Chapter 3.
Operation	
Changes in tidal regime and associated sediment transportation	No measurable changes to either the hydrodynamic regime of the area or coastal sediment dynamics (other than very short term, localised sediment

Potential Impact	Worst Case Scenario Assessed in ES
Construction (and Decommissioning)	
	movement during the cable burial process) see Chapter 3.
Scour and associated sediment transportation leading to a change in the benthic ecology and/or biodiversity	See Chapter 3.
Responses to electromagnetic fields and thermal emissions	Longest length and no burial is recognised as the worst case in terms of EMF exposure.
Temporary habitat disturbance from operations and maintenance activities (O&M)	Anchorage disturbance from vessel anchorage is expected to take six hours, Section 4.4.1.1, Table 4-12.
Colonisation of structure and seabed features leading to a change in benthic ecology	Introduction of new substrate which is available for colonisation from the anchor stick-up, chains, floating platforms
Temporary habitat disturbance from operation and maintenance	Vessel anchorage disturbance.

Table 4-3 Key parameters for potential Impacts - Offshore Export Cable Corridor

Potential Impact	Worst Case Scenario Assessed in ES
Construction (and Decommissioning)	
Direct temporary disturbance of seabed caused by construction based activities	The worst case scenario for temporary disturbance of seabed disturbed across the Offshore Export Cable Corridor resulting from export cable installation is 0.045 km^2. (15 km cable with two 3m wide cable trenches)
Loss of Original Habitat	Total area of original habitat loss for the Offshore Export Cable Corridor based on 10% of the cables needing to be protected using other means than burial is 0.09km^2. Maximum 2 cables. Cable length 15km each. Cable overall diameter 180mm. Cable to be buried to target depth of 1.5m. If the target burial depth is not reached, remedial cable protection, e.g. concrete mattressing or rock dumping, may be required or if subsequent scour is noted during the regular cable surveys.
Indirect impacts of temporary increases in SSC from construction activities	Any increases in SSC will only impact a very limited area, will be temporary in nature, will only occur once and are not significant compared against baseline conditions See Chapter 3, Section 3.4.1.1.
Indirect impacts of temporary increases in suspended sediment concentrations (SSC) from construction based activities, and associated deposition	Any increases in SSC will only impact a very limited area, will be temporary in nature, will only occur once and are not significant compared against baseline conditions See Chapter 3, Section 3.4.1.1.
Operation	

Potential Impact	Worst Case Scenario Assessed in ES
Construction (and Decommissioning)	
Colonisation of structure and seabed features leading to a change in benthic ecology	Introduction of new substrate which is available for colonisation (limited to anchor tops and possible rock).
Responses to electromagnetic fields (EMF) and thermal emissions	The export cables will be buried to a depth of at least 1.5m (ground conditions dependent) to protect against trawling/anchoring issues as advised by DECC (2011).
Temporary habitat disturbance from operation and maintenance activities	Currently the annual scour estimate is unknown and the potential for remedial cable reburial will be assessed post installation as part of the survey deploy monitor scheme. The total area of temporary direct disturbance caused by the installation of the Offshore Export Cable is only 0.129km^{2}.

4.1.4. Embedded Mitigation

22. Embedded Mitigation measures to minimise environmental effects are captured within the Design Envelope. The assessment looking at the effects of the development on benthic ecology has taken account of the following embedded mitigation measures:

- Vessels and plant relating to construction, decommissioning and operation will follow best practice and guidance for pollution at sea, detailed in the final Project Environmental Management Plan.
- Vessels and equipment during construction, operation and maintenance and decommissioning will follow best practice guidelines for pollution at sea in order to reduce and coordinate the response to pollution events.
- Non-Indigenous Species introduction will be managed through preventative measures by following best practice guidelines such as the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM) and additionally through the Scottish Code of Practice on non-native species.
- Cables will be suitably buried or protected by other means when burial is not practicable.

4.2. Baseline Environment

23. In order to describe the baseline environment to inform this assessment, the following activities were undertaken:

- Initial desk based studies and review of any existing benthic survey data (Marine Scotland Survey data).
- Project specific surveys (see Table 4-4 for survey details) for Drop-Down Video (DDV) and associated grab sampling for PSA.

24. Baseline data from the surveys was used to characterise the marine communities and identify the location of any sensitive marine features present. Sensitive marine features include Annex I and II features of habitat regulations, Priority Marine Features (PMFs) and UKBAP species.

25. Key sources of data are outlined below:

- Marine Scotland – stills and video files from the DDV survey (surveys, figure 1 survey locations)
- 2004 Strategic Environmental Assessment (SEA) for region 5 – Information on benthic environments in the surrounding area (Eleftheriou *et al.,* 2004)
- EUSeaMap-Mapping European Seabed Habitats (MESH, 2012)

Table 4-4 Baseline surveys

Survey	Undertaken By	Date of Survey
Drop down Camera	Marine Scotland (Science)	08/2013 & 07/2014
Drop down video	Marine Scotland (Science)	08/2013 & 07/2014
Grab samples	Marine Scotland (Science)	08/2013 & 07/2014

26. The first 'East of Aberdeen (EAB)' site surveys were conducted on the 8th and 9th August 2013 taking a total of 18 videos and associated stills within the Development Area. The second, 'Kincardine Sites' (KC) were conducted between the 12th and 15th August 2014 taking a total of 50 videos and associated stills along the Offshore Export Cable Corridor and surrounding area. Figure 4-1 illustrates the locations of the DDV survey.

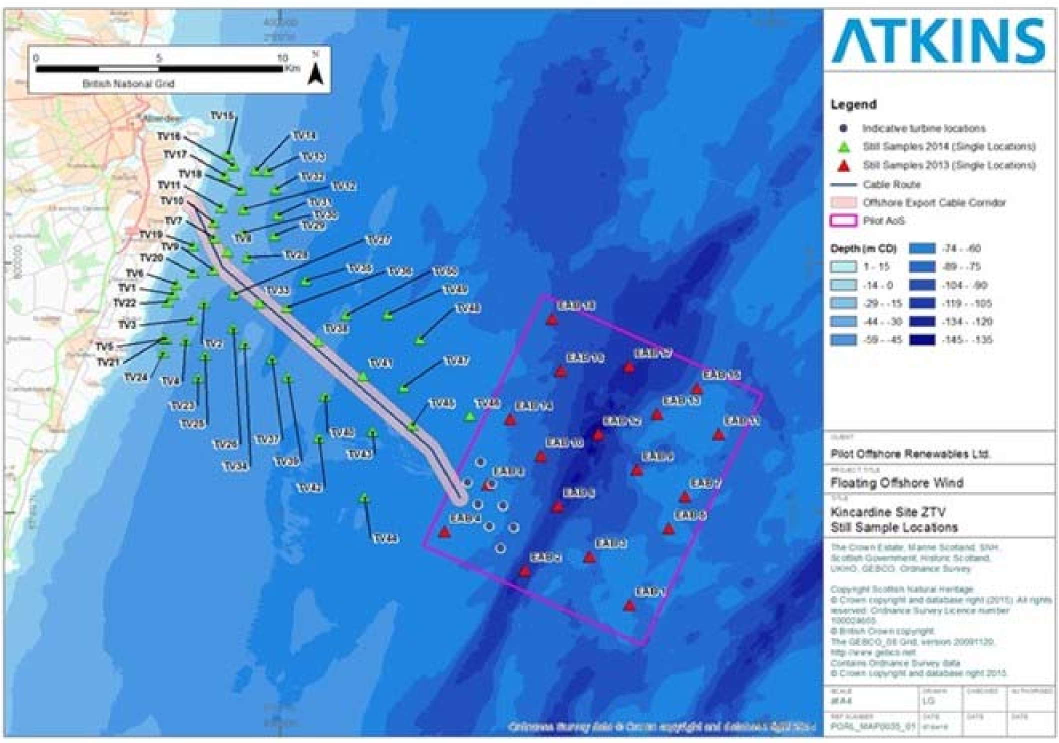

Figure 4-1 Drop-Down Video Survey Locations

27. From the desk based study there is very limited information from previous surveys or peer reviewed journals on the benthic habitats and communities found in the study area. Therefore general background information for the site is restricted and based on a wider view of the North Sea in the region. Predominantly the information relating to the study area is taken from drop-down video survey undertaken for the Project.

28. The survey sampling distribution covers the cable route and surrounding area with sufficient sampling locations and therefore the onsite data obtained by Marine Scotland (drop camera, video and grab sample data) is sufficient to determine the specific benthic ecology of the sea bed at the site and cable route.

4.2.1. Study Area

29. The Study Area used to define the baseline environment encompasses the Kincardine Development Area and the Offshore Export Cable Corridor and adjacent sea bed areas (Figure 4-1). The overall site has an area of approximately 110km^2.

30. Throughout this chapter the identified biotopes are referenced using their classification codes and classification titles. Full descriptions of the biotopes are described in the glossary.

4.2.2. Habitats and Species Overview

31. The benthic characterisation of the broad area surrounding the Kincardine Floating Demonstrator site has been studied in varying levels of detail in areas such as the Firth of Tay to the south of the site and the Moray Firth to the north of the site. The offshore environment in the vicinity of the site has been studied to a much lesser degree with minimal information on the habitat types and associated faunal communities.

32. There are a number of scientific papers and grey literature which describe the composition of benthic communities over larger areas of the North Sea. These papers have been reviewed in the 2004 Strategic Environmental Assessment (SEA) for Region 5 (Eleftheriou *et al.,* 2004). A broad overview of habitats describing the benthic and epibenthic communities found in the North Sea is discussed below.

33. Benthic habitats in the North Sea are known to support a diverse and productive ecosystem with the most common species being various marine worms (polychaetes), bivalve mollusc, amphipods, echinoderms (such as sea urchins and brittlestars) and mobile fauna such as crabs, starfish and fish (Paramor *et al.,* 2009). Studies such as Dyer *et al.,* (1983), describe that the most common organisms found were *Alcyonium digitatum* and *Flustra foliacea* and *Asterias rubens.*

34. A study by Diesing *et al.,* (2013), broadly illustrates that the area of study consists of sand and muddy sand in the circalittoral zone. In addition Lüders' study of sediments of the North Sea states that deposits in the North Sea consist of 60% sand and muddy sand, with coarse sand and clay representing approximately 20%. The north and central North Sea consists predominantly of sand and fine sand with only a few areas of coarse sand. Studies by Eleftheriou *et al.,* 2004 describe the area south of 57˚30'N being predominantly covered with sand. In addition to this, seabed sediments identified on the Marine Scotland National Marine Plan interactive identifies the sediment type as sand (Marine Scotland, 2015).

35. MESH also identifies the Study Area as Circalittoral Sand, this information is further supported by DDV survey data collected by Marine Scotland. Figure 4-2 illustrates the predicted EUNIS classifications by Marine Scotland for the study area. The predicted EUNIS (level 3) habitat for the turbine site is deep circalittoral sand. Along the cable route the predicted habitat types were deep circalittoral sand and circalittoral fine sand. Furthermore these predicted sites are supported by the 2004 Strategic Environmental Assessment (SEA) for region 5 which show the area categorised as 'Intermediate depth sands'.

36. It is unlikely that high energy sites such as in the area around Kincardine, will have any significant build-up of contaminated sediment (Saunders *et al.,* 2011), with the nearest potential contaminated sediment sources likely to be the disposal zones located at the edge of Aberdeen Harbour 13.5km to the north.

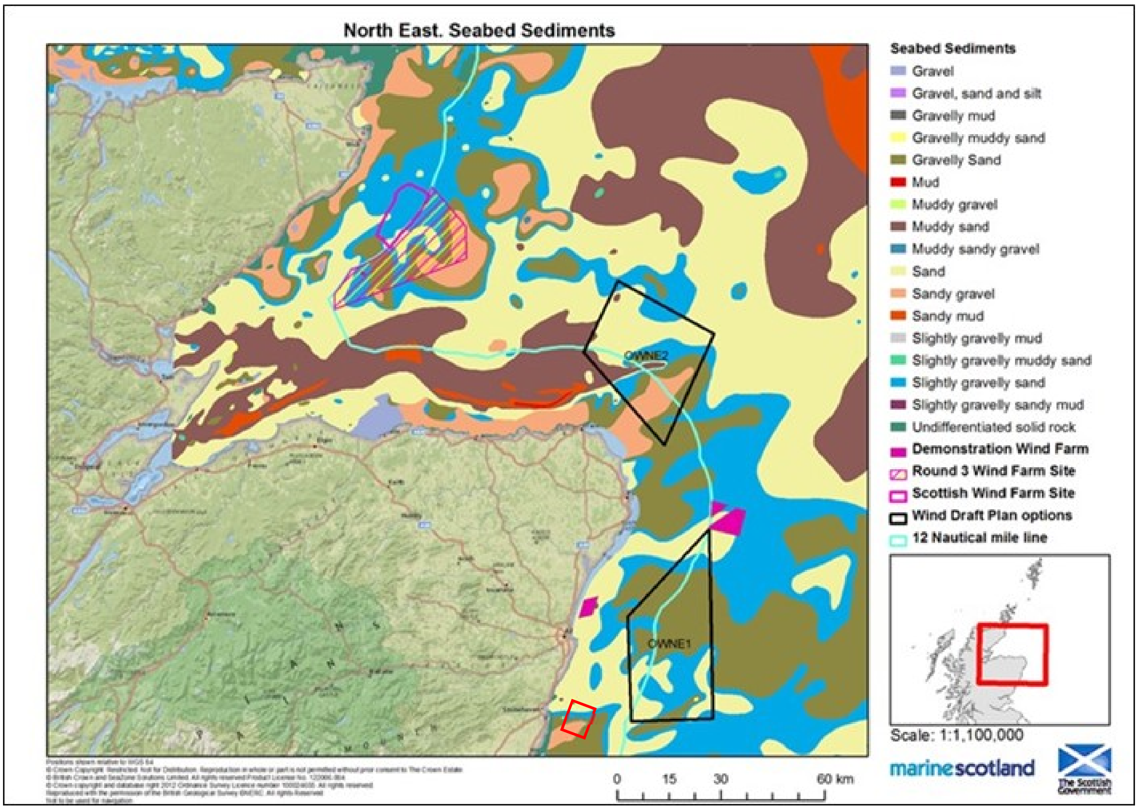

Figure 4-2 Predicted seabed habitats (Source: Marine Scotland)

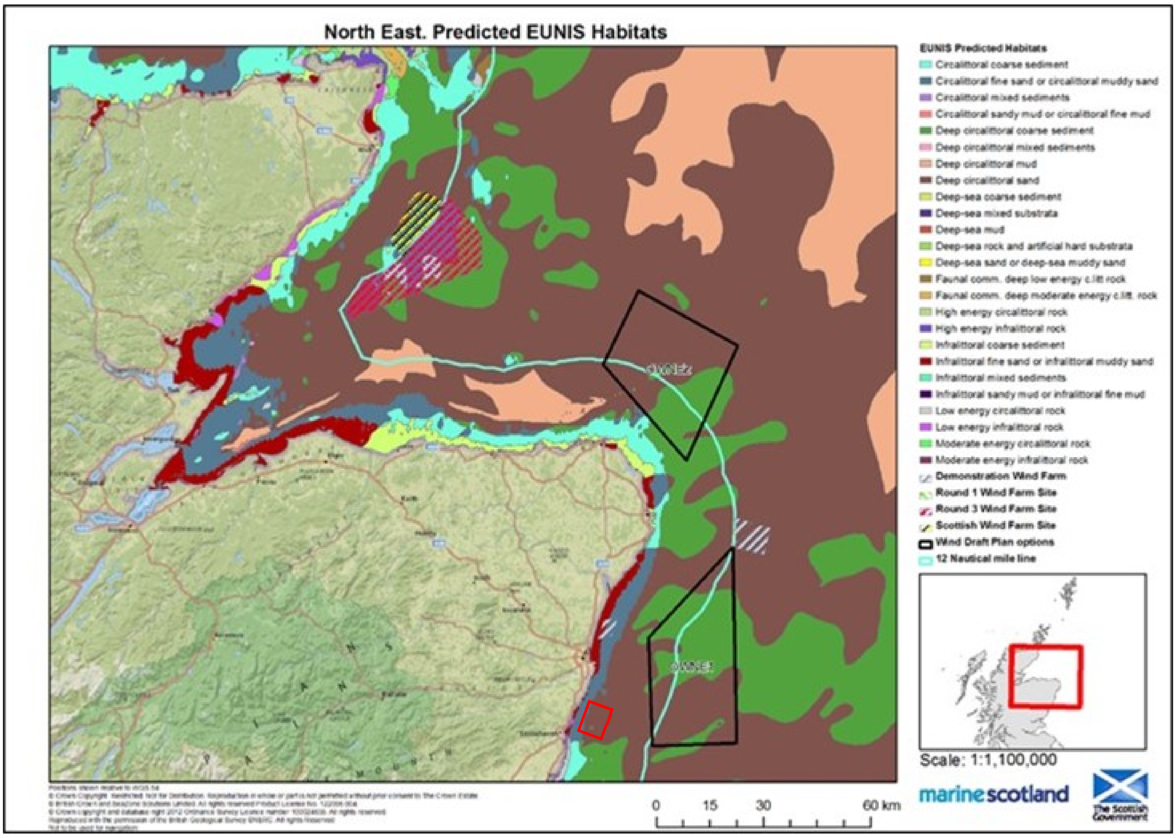

Figure 4-3 Predicted EUNIS habitats (Source: Marine Scotland)

4.2.3. Site Specific Surveys - Methodology

37. The survey area for the benthic assessment encompasses the Offshore Export Cable Corridor and Development Area. DDV and grab sampling was undertaken by Marine Scotland Science in

accordance with Guidelines for the Conduct of Benthic Studies at Marine Aggregate Extraction Sites (Ware and Kenny, 2011) at a total of 68 sites in two surveys carried out in 2013 and 2014 (see Table 4-4).

38. DDV work was carried out when the system was lowered to the seafloor and towed for 1-3 minutes. Each drop was recorded using GPS. DDV provided information on the benthic communities present and enables a relatively non-intrusive method for identification of any potential Annex I habitats such as biogenic reefs (*Sabellaria or Mytilus*).

39. DDV work was undertaken using a drop-frame TV with video (Kongsberg Simrad) and digital still (Canon) capabilities. The drop-frame TV was deployed off the stern of both vessels with a slip ring winch and an armoured cable. When deployed from FRV Scotia the drop-frame was towed whilst using the bow thrusters. FRV Alba towed the drop frame into the wind or tidal current, which ever was the stronger, at a speed of 1 knot. The drop-frame TV was suspended above the sea bed guided by a steel weight attached to the drop-frame with a piece of cable. Maintaining the steel weight just on or above the seabed ensured the correct height for accurate focussing for the video and digital camera. The steel weight is 66 mm in diameter and the lasers, where operational, were set 100mm apart.

40. Video-footage was collected for the duration of the deployment, with digital stills recorded at approximately every sixty seconds. Surveying under normal tidal conditions allows the deployment of the drop-frame TV without restrictions. However, areas of strong tidal current were surveyed during slack water periods when flow conditions were less than 1.5 knots. A log of the sea bed type, macro benthos and evidence of anthropogenic impacts (including litter) was recorded every minute of the deployment on an appropriate form. The location of the drop frame and the digital stills were recorded directly into Arc View format.

41. Grab sampling, using a standard (0.1m^2) day grab, was only undertaken at sites where DDV confirmed that there were no sensitive habitats present (i.e. Annex I). Grab sampling was undertaken for the purposes of Particle Size Analysis (PSA), 10 samples were send to an accredited lab for analysis. Due to the design of the turbine array and the limited interaction with the seabed and that the project fits under the ‘Survey, Deploy, and Monitor Guidance’ for Marine Scotland benthic infaunal and benthic trawl sampling was not undertaken.

42. Of the samples that were collected, 10 were selected that best represented the Development Area and the Offshore Export Cable Corridor and processed by the Macaulay Scientific Consulting Ltd a UKAS accredited laboratory for PSA, comprising of two samples from the proposed Development Area in close proximity to the preliminary arrangements of turbines, and eight samples along the proposed Offshore Export Cable Corridor route. Additional analysis was conducted using Gradistat (KPAL, 2011) to provide further information on the characteristics of the surficial sediments in both the development and the offshore cable route areas.

43. PSA analysis was conducted using laser diffractometry. Laser diffraction measures particle size distributions (PSD) by measuring the angular variation in intensity of light scattered as a laser beam passes through a dispersed particulate sample. Larger particles scatter light at small angles relative to the laser beam and small particles scatter light at larger angles. The angular scattering intensity data is then analysed to calculate the size of the particles responsible for creating the scattering pattern, using the Mie theory of light scattering. The particle size is reported as a volume equivalent sphere diameter (Malvern, 2015).

44. Sediment chemistry analyses were not undertaken for the Project. Contamination analysis of sediments will be undertaken from vibrocore samples which will be undertaken during the detailed cable route assessment.

45. Video runs and photographic stills were reviewed and analysed by staff at Atkins. Video clips have been made available online by Marine Scotland. On average video clips are three minutes long, each clip was observed several times in order to produce an broad habitat description, substrate data including % cover and to gather species data. Substrate and species data was recorded using ExcelTM spreadsheet. Percentage cover of substrate types were recorded, with biotopes defined using the ‘Marine Habitat Classification for Britain and Ireland v.05.05’ (Connor *et al.,* 2004) and assigned MNCR codes with species abundance recorded using the SACFOR scale.

46. The SACFOR scale is a recognised unified system for recording the abundance of marine benthic flora and fauna in biological surveys Definitions: Superabundant (S), Abundant (A), Common, (C), Frequent (F), Occasional (O) and Rare (R).

47. Biota were identified to species level, when this was not possible (e.g. due to either poor visual quality, or where only a glimpse was available), fauna were assigned a higher taxonomic category. The biotopes identified are representative of the physical conditions (habitats) and the species which are identified and characterise those habitats.

4.2.4. Survey Results – Development Area

4.2.4.1. Biotope Classification

48. In the Development Area only one biotope was recorded through DDV undertaken by Marine Scotland Science, this was ‘Offshore (deep) Circalittoral Sediment’ (SS.SSa.OSa) (described in Table 4-5) which was recorded at all 18 locations. The biotope is classed as SS.SSa.OSa due to the station depths being greater than 50m depth.

Table 4-5 Key of identified Biotopes from Drop-Down Video Analysis

Biotope	Biotope Description	Example image
SS.SSa.OSa Offshore (deep, >50m) Circalittoral Sand	Offshore (deep) circalittoral habitats with fine sands or non-cohesive muddy sands. Very little data is available on these habitats however they are likely to be more stable than their shallower counterparts and characterised by a diverse range of polychaetes, amphipods, bivalves and echinoderms.	

49. From the survey results there was no evidence of any Annex 1 biogenic reef features, Priority Marine Features (PMF) or Annex II, UKBAP habitats and species present. In addition there were no identified IUCN red list species or species listed in CITES appendices 1-3 observed during any of the surveys carried out across the Development Area.

4.2.4.2. Species identified through DDV

50. Seabed imagery indicated a very sparse epifaunal community within the Development Area. As mentioned previously where possible biota were identified to species level, when this was not possible fauna were assigned a higher taxonomic category. Species observed most frequently across the 18 stations were *Alcyonium digitatum* and *Asterias rubens*. Table 4-6 states the observed species from the DDV survey.

Table 4-6 Observed species from Drop-Down Video Survey

Frequently observed species*	Occasionally observed species*
Alcyonium digitatum	*Callionymus lyra*
Asterias rubens	*Urticina felina*
Pleuronectidae	*Munida rugosa*
Bryozoa	Crustacea
Flustra foliacea	Ophiuridae (likely *Ophiothrix fragilis*)
Pisces	*Nemertesia anntenina*
	Metridium senile

*As per SACFOR definitions (Connor, 2004)

4.2.4.3. Particle Size Analysis

51. As detailed in Chapter 3, the results indicate that the surficial sediments in the Development Area are predominantly characterised as sand as all the mean grain sizes of the samples were determined as either very fine, fine or medium sand. Further details for both areas are described in Chapter 3.

4.2.5. Survey Results – Offshore Export Cable Corridor

4.2.5.1. Biotope Classification

52. Three different biotopes were recorded in the survey area from DDV undertaken by Marine Scotland Science. The dominant sediment type found in the Offshore Export Cable Corridor was ‘Circalittoral Fine Sand’ (SS.SSa.CFiSa) at 32 stations, followed by ‘Offshore (deep) Circalittoral Sediment’ (SS.SSa.OSa) at 16 stations with ‘Circalittoral Coarse Sediment’ (SS.SCS.CCS) found at 2 stations.

53. Biotopes SS.SSa.CFiSa and SS.SSa.OSa substrate types are very similar, however, according to the JNCC physical comparative tables, stations >50m depth should be classed as SS.SSa.OSa. Observed biotopes similarly match those predicted in Figure 4-3 by Marine Scotland and those identified in the offshore regions in the surrounding areas.

54. The MSS survey was designed to give context to the surrounding area in addition to providing site specific information for the Offshore Export Cable Corridor. Therefore although a very small patch of Sabellaria was observed at site TV32, located at the edge of the Aberdeen harbour spoil zone (does not lie within the corridor) (Figure 4-1), the site has been excluded from the impact assessment.

Table 4-7 Key of identified Biotopes from Drop-Down Video Analysis

Biotope	Biotope Description	Example image
SS.SSa.CFiSa Circalittoral Fine Sand	Clean fine sands with less than 5% silt/clay in deeper water, either on the open coast or in tide-swept channels of marine inlets in depths of over 15-20 m. The habitat may also extend offshore and is characterised by a wide range of echinoderms (in some areas including the pea urchin [*Echinocyamus pusillus*]), polychaetes and bivalves. This habitat is generally more stable than shallower, infralittoral sands	

Biotope	Biotope Description	Example image
	and consequently supports a more diverse community.	
SS.SCS.CCS Circalittoral Coarse Sediment	Tide-swept circalittoral coarse sands, gravel and shingle generally in depths of over 15-20m. This habitat may be found in tidal channels of marine inlets, along exposed coasts and offshore. This habitat, as with shallower coarse sediments, may be characterised by robust infaunal polychaetes, mobile crustacea and bivalves. Certain species of sea cucumber (e.g. [*Neopentadactyla*]) may also be prevalent in these areas along with the lancelet [*Branchiostoma lanceolatum*]	
SS.SSa.OSa Offshore (deep, >50m) Circalittoral Sand	Offshore (deep) circalittoral habitats with fine sands or non-cohesive muddy sands. Very little data is available on these habitats however they are likely to be more stable than their shallower counterparts and characterised by a diverse range of polychaetes, amphipods, bivalves and echinoderms.	

55. From the DDV it can be seen that the area is subject to natural levels of physical disturbance by wave/current action by the ripples on the seabed. The species observed within the site are reflective of a dynamic environment subject to varying levels of natural physical disturbance.

4.2.5.2. Species identified through DDV

56. Biota were identified to species level where possible. When this was not possible fauna were assigned a higher taxonomic category. Species observed most frequently across the 50 stations were *Alcyonium digitatum* and *Asterias rubens* other species observed are stated in Table 4-8. Species frequently identified in the Offshore Export Cable Corridor are similar to those identified within the Development Area. However, species such as Paguridae, *Luidia ciliaris, Echinus esculentus* and Scyphozoa were only present in the Offshore Export Cable Corridor.

Table 4-8 Observed species from Drop-Down Video Survey

Frequently observed species*	Occasionally observed species*
Alcyonium digitatum	*Callionymus lyra*
Flustra foliacea	*Urticina feline*
Asterias rubens	*Munida rugose*
Bryozoa	Crustacea
Luidia ciliaris	Ophiuridae (likely *Ophiothrix fragilis*)
Paguridae	*Nemertesia anntenina*
Pleuronectidae	*Metridium senile*
	Echinus esculentus
	Scyphozoa

* As per SACFOR definitions (Connor, 2004)

4.2.5.3. Particle Size Analysis

57. As detailed in Chapter 3, the results indicate that the surficial sediments in the Offshore Export Cable Corridor are predominantly characterised as sand as all the mean grain sizes of the samples were determined as either very fine, fine or medium sand.

58. Mean grain sizes for the samples along the Offshore Export Cable Corridor are similar to those identified in the Development Area as they are predominantly medium (250-500µm) and fine sand (125-250µm). Only one sample (TV33) was found to be characterised as very fine sand (63-125 mm) with a mean grain size of 89µm. Further details can be found in Chapter 3.

4.2.6. Baseline without the Project

59. There is limited information about the benthic habitat and communities within the Development Area and the Offshore Export Cable Corridor. Literature studies of North Sea sediment habitats and benthic communities along with DDV surveys of the site state that the sediment composition is that of Circalittoral Sand which is colonised by a range of fauna such as common star fish, dead man's fingers and a range of flatfish. Due to the nature of these species and the commonly occurring sediment composition it would suggest that the existing baseline conditions would prevail in the future, should no development occur.

60. Commercial fishing activities such as scallop dredging, demersal trawling and creeling are currently active within the Development Area and the Offshore Export Cable Corridor (Chapter 14). Should no development occur it is thought that the currently levels of fishing activity and current trends, as described in Chapter 14, will continue within the region.

4.3. Assessment Methodology

61. The impact assessment methodology used within this chapter follows the approaches detailed in Chapter 1. Chapter specific assessment parameters are outlined below under magnitude of effects.

4.3.1. Magnitude of Effects

62. The assessment of the magnitude of effects uses a number of criteria, including:

- Scale of the effect;
- Duration of the effect;
- Frequency of the effect occurring;
- Relative scale of the effect alongside documented benchmarks such as those stated by MarLIN (Marine Life Information Network);
- Level of tolerance and the vulnerability of the identified receptor to the effect; and
- Recovery after the impacting activity has ceased.

Table 4-9 Magnitude of Effect

Category	High Level Environmental Indicator	Corresponding Scale of Effect and Receptor Characteristics	
High	Complete loss or major alteration to key elements/features of the baseline environment.	Scale of Effect	>10% of the Development Area or the Offshore Export Cable Corridor is impacted throughout the project lifetime.
		Receptor	Receptor is highly intolerant and will not recover to baseline conditions within the project life time/
Moderate	Partial loss or alteration to one or more of the key elements/features of baseline environment	Scale of Effect	5-10% of the Development Area or the Offshore Export Cable Corridor is impacted throughout the project operation.
		Receptor	The receptor is intolerant and is lost to the impact. Recovery is predicted during the lifetime of the project
Low	Minor shift from the baseline environment	Scale of Effect	1-5% of the Development Area or the Offshore Export Cable Corridor is impacted throughout the project construction.
		Receptor	The receptor is slightly modified but is not lost. Substantial recovery of the receptor is predicted to be within 5 years from the termination of the effect but may take slightly longer.
Negligible	Very small change from the baseline environment.	Scale of Effect	<1% of the Development Area or the Offshore Export Cable Corridor is impacted throughout the project construction.
		Receptor	Localised benthic community effects however any characteristic species present are expected to remain and recovery is expected within 2-3 years after the termination of the effect.
Positive	Beneficial change to baseline conditions	Scale of Effect	>1% of the Development Area or the Offshore Export Cable Corridor is impacted positively throughout the project life cycle.
		Receptor	Receptor is modified in a positive manner.

4.3.2. Receptor Sensitivity

63. Receptor sensitivity has been assessed according to the receptor's conservation importance, relative abundance or extent and its importance to the wider ecological area (see Table 4-10).

Table 4-10 Sensitivity of Receptor

Receptor Sensitivity	Receptor Characteristics
High	Receptor with a high level of conservation importance internationally which provides a key ecological function. In addition it is rare in abundance in the areas.
Moderate	Receptors with a high level of conservation importance internationally but has either a low ecological value or it is in high abundance. Or, the receptor has low conservation importance but has a high ecological value or low abundance.
Low	Receptors with a medium level of conservation importance nationally but with low ecological importance or high abundance. Or Receptors with a low level of conservation importance, with low ecological importance or high abundances.

4.3.3. Consideration of Receptors

64. Receptors considered in this impact assessment have been selected based on the analysis of regional and site specific data, their relative conservation and ecological importance and if it has been highlighted during consultation with stakeholders. Each biotope identified is assessed according to their assigned sensitivity in relation to conservation importance and their ecological niche. Table 4-11 below identifies the different receptors in the Development Area.

Table 4-11 Receptors in the Development Area and Offshore Export Cable Corridor

Receptor	Grouping	Sensitivity	Qualification
SS.SCS.FiSa	Subtidal soft sediments	Low	Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.
SS.SCS.CCS	Subtidal soft sediments	Moderate	CCS is regarded as conservation priority in *the UK Post-2010 Biodiversity Framework*, and is widely distributed around the UK.
SS.SSa.OSa	Offshore soft sediments	Low	Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.

4.3.4. Impact Identification

65. Potential impacts of the Project to benthic ecology have been identified in the Scoping stage and are outlined in the Scoping Report. Stakeholder consultation did not identify additional impacts. Consultation ensured that if there were key elements of concern to stakeholders regarding benthic ecology, these were identified and addressed. Effects encompass both direct and indirect effects defined below:

- *Direct Effects: Effects such as loss and disturbance of habitats from installation of anchors and cable installation.*
- *Indirect effects: Effects such as seabed contamination through accidental spillage of pollutants, effects on seafloor characteristics due to hydrodynamic change and redistribution of fine sediments from construction activities.*

66. Cumulative effects are presented in Section 4.7.

4.3.5. Supporting information

67. This assessment is supported by outputs from the Physical Environment assessment found in Chapter 3, for impacts related to increases in suspended sediment and associated deposition of resuspended sediments.

4.4. Impact Assessment

4.4.1. Development Area - Construction

4.4.1.1. Temporary disturbance of seabed habitats caused by construction activities

68. Direct temporary disturbance of the seabed and associated benthic fauna in the Development Area and offshore export cable route will occur as a result of seabed preparation for substructure anchors, inter-array cable burial, temporary anchoring of vessels and activities associated with the installation (Bonar *et al.,* 2015). The expected area for each activity is noted in Table 4-12.

Table 4-12 Expected sea bed disturbance from subsea activities

Activity	Duration of Construction Activity	Area (km^2)
Anchors (up to 32)	Six hours per anchor installation (192 hours)	0.003
Inter-array cables (up to 16km)	Currently estimated to be 2 weeks	0.036
Export cable (up to 15km)	To be confirmed following detailed cable route survey	0.09
Total		**0.129**

69. Total area of habitat disturbance is estimated to be 0.129km^2.

70. Recovery of both the species and habitats found in the Development Area and the Offshore Export Cable Corridor will vary depending on the relative life cycles of those which are affected. For most benthic communities residing in sand and gravel habitats, full recovery of abundance, biomass and diversity may take up to 2-3 years depending upon the proportion of sand and the level of environmental disturbance present in the region (Newell *et al.,* 1998).

71. Studies by Hiscock *et al.,*2002 suggest that recovery effects in the Development Area may exhibit a shift in species observed to more scavenging species (e.g. starfish), however the majority of species observed in DDV surveys are currently scavengers such as *Asterias rubens. Alcyonium digitatum* were also frequently observed and is widely abundant across the UK (Budd, 2008).

72. Data from the characterisation survey show that within the Development Area the biotope SS.SSa.OSa covers the entire area, extending into the Offshore Export Cable Corridor. This habitat can be considered to be tolerant to substratum loss as the biotope is widely represented in the area and is a naturally turbid environment.

73. It is likely that a decrease in species richness and abundance will occur during the construction phase however due to the small quantity of species observed at the site and the size and scale of the project the impact will be limited.

74. Due to the short term duration of construction, coupled with the small area affected, the magnitude of effect is determined as negligible.

75. The negligible magnitude of effect and low (SS.SSa.OSa.) sensitivity results in a negligible/minor impact.

Table 4-13 Impact summary of Direct Temporary Disturbance to Seabed Habitats Caused by Construction Based Activities

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Direct Temporary Disturbance to Seabed Habitats Caused by Construction Based Activities	SS.SSa.OSa	Low. Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible. Due to the short term duration of construction, coupled with the small area affected	Negligible/minor

4.4.1.2. Loss of Original Habitat

76. The potential area of habitat loss caused by the placement of anchors and inter-array cables is $0.129km^2$. The identified biotope in the Development Area of Offshore Circalittoral Fine Sand (SS.SSa.OSa) is a commonly occurring biotope throughout the Development Area and surrounding area. In addition the size and scale of the project means that a relatively small area of the original habitat for the benthic ecology is lost in the Development Area. The baseline conditions will not change significantly resulting in a low magnitude of effect. In addition the sensitivity of the receptor is classed as low. Based on this information, the impact is concluded to be minor.

Table 4-14: Impact Summary of Loss of Habitat in the Development Area

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Loss of Habitat	SS.SSa.OSa	Low. Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Low Due to the short term duration of construction, coupled with the small area affected	Minor

4.4.2. Development Area - Operation and Maintenance Effects

4.4.2.1. Scour and associated sediment transport changing the seabed habitat

77. Chapter 3 sets out impacts to the seabed as a result of scour. Given the nature of the sediment (fine to medium sand), the potential volume that would potentially be displaced, and depths of water in the Development Area (>70m), any increases in SSC will only impact a very limited area, will be temporary in nature, will only occur once and will not be significant against baseline conditions. In the context of the overall development this is determined as a negligible/minor impact.

Table 4-15 Operation Impacts resulting from Scour

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Scour and associated sediment transport changing the seabed habitat	SS.SSa.OSa	Low. Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible. Chapter 3 outlines that there will be limited scour effects. In addition, any increases in SSC will only impact a very limited area, will be temporary in nature, will only occur once and will not be significant against baseline conditions.	Negligible/minor

4.4.2.2. Colonisation of introduced substrata leading to a change in the benthic ecology

78. The installation of the WTGs and associated anchorage foundations may introduce an artificial reef effect. The anchors, mooring lines, possible rock armour protection for cables and submerged portions of the structures could provide habitat for colonising organisms (U.S. Department of Energy, 2011; Bonar *et al.,* 2015).

79. The presence of the project components both within the water column and the anchors may result in altered use by marine life and result in changes to the local marine community. This introduction will have direct effects on the biodiversity and biomass levels in the Development Area, and indirect effects through changes to food availability to species of a higher trophic level. The structures may also provide a refuge from predation (Reubens *et al.,* 2011; Bonar *et al.,* 2015) (Chapter 5).

80. The anchors provide additional artificial hard substrate in an area which is characterised by soft sandy sediments. This is a change to the original marine environment. Biofouling organisms include algae and sessile invertebrate species, such as barnacles, mussels, bryozoans, tunicates and hydroids. Biological growth can be variable and is dependent on depth, light, temperature and nutrients and fluctuates over the seasons (Kerckhof *et al.,* 2009; Royal Haskoning, 2011; Krone *et al.,* 2013).

81. Biofouling organisms can occur at all depths. It is expected that colonisation of the anchors, mooring lines and portions of the floating substructure below the waterline will occur. The presence of biofouling communities may affect benthic communities beneath the substructures through accumulation of fall-out organic matter (e.g. faecal matter, mortalities and material such as bivalve shells).

82. The floating sub-structures may act as Fish Aggregation Devices (FADs) (U.S. Department of Energy, 2011, Bonar *et al.,* 2015). However this will only impact the area directly around and beneath the structures. The impact of FADs on fish populations/communities is discussed within Chapter 5, Section 5.3.5.1.

83. The WTG units and associated substructures will be installed with antifouling coatings which will inhibit marine biofouling. Maintenance of the structures may also include clearing of biofouling organisms. Inspections of substructures, inter-array and export cables, anchors and moorings may require any biofouling organisms to be removed in order for a clear view of the infrastructure to be obtained. Any impact on the benthic environment from organic matter fall-out is likely to be limited to the area directly beneath the structure and therefore the magnitude of effect is determined as negligible.

84. The sensitivity of the existing benthic communities is considered to be low due to their low conservation importance and only a small amount of the area will change from the baseline conditions, therefore the impact of substrata colonisation to the benthic community is determined as negligible/minor.

Table 4-16: Impact Summary of Colonisation of Introduced Substrata

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Colonisation of Introduced Substrata	SS.SSa.OSa	Low. Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible. Only a small area of the seabed will change from baseline conditions. In addition antifouling coatings and maintenance of the structures will limit the level of colonisation	Negligible/minor

4.4.2.3. Responses to Electromagnetic Fields (EMF) and thermal emissions

85. Electro-magnetic field effects have been studied to various degrees on marine organisms, with fish species such as elasmobranchs and changes in orientation affecting migration as primary concerns (Gill *et al.,* 2005; OSPAR, 2009) (addressed in Chapter 5).

86. Effects of EMF on benthic invertebrates however are poorly understood. Laboratory based studies have demonstrated that magnetic fields do not have significant adverse effects on the survival and reproduction of several commonly occurring benthic animals including isopods, decapods and mussels (*Mytilus edulis*) (Bochert and Zettler, 2004; Bonar *et al.,* 2015). However, BERR (2008) states that the overall effect on benthic ecology is not likely to be significant if the habitat distribution throughout the wider area is homogenous and impacts which may occur are expected to be highly localised and in close proximity to the inter-array cables.

87. Preliminary research by Bonar *et al.,* (2015), within the renewable industry has been undertaken which suggests that thermal radiation from cables may affect microbial activity within soft sediment habitats. Studies suggest however that the ecological impacts of thermal radiation along cables will require long-term study as changes to microbial benthic habitats may occur with time delays (OSPAR, 2009; Bonar *et al.,* 2015).

88. There is evidence that some marine organisms are sensitive to minor increases in ambient temperature. Some species such as *Artica islandica*, show intolerances to increases in temperature (OSPAR, 2009), however these species have not been found within the Project Area and are unlikely to be present. It is thought that the potential rise in temperature resulting from subsea cables is near impossible to detect against natural fluctuations in surrounding sediments (BERR 2008).

89. If the inter-array cables are not buried there is an increased risk of effect from thermal and EMF emissions.

90. Due to the size and scale of the Project and the homogenous nature of the surrounding habitat, the magnitude of EMF and thermal emissions is predicted to be negligible. Combined with the low sensitivity of the receptors in the Development Area the impact is determined to be negligible/minor.

Table 4-17 Impact Summary of Responses to EMF and Thermal Emissions

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
EMF and Thermal Emissions	SS.SSa.OSa	Low. Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible. Due to the size and scale of the Project and the homogenous nature of surrounding habitat	Negligible/minor

4.4.2.4. Direct, Temporary Habitat Disturbance from O&M Activities

91. During the operation and maintenance phase, the use of anchor maintenance vessels will impact benthic communities during the routine recovery and maintenance of the mooring and anchoring systems. This scheduled maintenance period is currently expected to be approximately every five years. The total area of annual disturbance is small, localised and temporary, with minimal impact to communities. Recovery associated with affected communities will be within two years for the majority of infaunal species located in the identified biotopes of Circalittoral Sand with the majority of mobile epifaunal species avoiding anchorage points.

92. As a result of this and due to the small scale of the development, the magnitude of this impact is determined as negligible. The sensitivity of existing benthic communities is low and therefore the impacts are determined as negligible/minor.

Table 4-18 Impact Summary for Direct, Temporary Habitat Disturbance from O&M Activities

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Direct, Temporary Habitat Disturbance	SS.SSa.OSa	Low. Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible. Total area of annual disturbance is small, localised and temporary.	Negligible/minor

4.4.2.5. Protection of benthic habitats within the Development Area due to Restricted Trawling

93. It is predicted that trawling activities which currently take place within the Development Area will be restricted in this area due to the presence of the WTGs and associated substructures. A restriction in fishing activities such as trawling would result in reduced disturbance to the benthic environment within the WTG deployment area which may allow the benthic habitat to stabilise and therefore increase biodiversity locally. Changes would be difficult to predict due to the dynamic nature of the seabed in the area and would be limited to the WTG deployment area.

94. This assessment is closely aligned with Chapter 14, which assesses the impacts of the project on commercial fisheries. There is therefore the potential for a minor positive impact to benthic fish species as a results of exclusion from this area through a resultant increase in populations in the WTG deployment area. This is assessed further within Chapter 5.

95. There is limited trawling activity occurring within the Development Area and the Offshore Export Cable Corridor and based on the species and habitat (SS.SSa.OSa) present and the difficulty in prediction of such an effect the impact is determined as a negligible positive effect.

Table 4-19 Protection of benthic habitats within the Development Area due to restricted trawling

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Protection of benthic habitats due to restricted trawling	SS.SSa.OSa	Low. Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible. Limited trawling activity currently in the Development Area therefore amount of trawling will not be significantly reduced. In addition predicting the positive effect is difficult to predict.	Negligible Positive

4.4.3. Development Area - Decommissioning Effects

96. Potential effects from decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed in the construction phase (Section 4.5.1). The decommissioning approach is described in Chapter 2. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 and subject to approval by the Department of Energy and Climate Change (DECC) prior to implementation.

97. No seabed preparation for cables will be required for the removal of the inter-array cables, mooring lines and anchors causing a minimal amount of material to be suspended in the water column. There will be no other works or structures used, such that the scale of works will be no greater than that of the construction phase. It is predicted that impacts will be no greater than those predicted for the construction phase.

Table 4-20 Impact Summary for Temporary disturbance of Seabed Habitats during Decommissioning

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Direct, Temporary Habitat Disturbance during decommissioning	SS.SSa.OSa	Low. Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible. Total area of annual disturbance is small, localised and temporary. There will be no other works or structures used, such that the scale of works will be no greater than that of the construction phase.	Negligible/minor

4.4.4. Offshore Export Cable Corridor - Construction Effects

4.4.4.1. Temporary disturbance of seabed habitats caused by construction activities

98. During the installation of the Offshore Export Cable disturbance to the seabed will occur, which could potentially lead to changes in the habitat and species. Where cable burial equipment is used, the area of disturbance will be associated with compression of sediment beneath the plant over a width of 5m. Within this area, a 3m wide trench will be excavated. The total area of temporary direct disturbance caused by the installation of the Offshore Export Cable is 0.045km^2.

99. The majority of the seabed in the Offshore Export Cable Corridor is Circalittoral Fine Sand with 16 sites identified as Offshore (Deep) Circalittoral Fine Sand. Although the sediment types are the same for both areas, they are classed as different biotopes due to depth and species associated with the biotopes. Both biotopes area classed as having a low sensitivity.

100. Sandy habitats are known to infill rapidly following disturbance, with burrowing species affected by covering with the infilling sediment. These species are generally adapted to change through natural disturbance, due to the mobility of the substrate in which they live (BERR, 2008). They are adapted to being covered by sediment, as they are naturally burrowing organisms. In addition, a study by Newell *et al.,* 2004) showed that during dredging activities there is little evidence of an impact on community structure outside the immediate boundaries of the dredged area.

101. It is widely accepted that the placement of the Offshore Export Cables are not likely to be detrimental to the overall quality status of the area as the effects are localised and temporary (OSPAR, 2009).

102. Habitat sensitivities, combined with the small area affected by the cable installation, the relatively fast recovery time of the majority of species and temporary nature of works, lead to the conclusion that the magnitude of impact is low. As such the impact of temporary direct disturbance caused by the installation/decommissioning of the Offshore Export Cable Corridor is determined to be minor.

Table 4-21 Impact Summary of Temporary Disturbance of seabed habitat Offshore Cable

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Temporary Disturbance of seabed habitat Offshore Cable	SS.SSa.CFiSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Low Small area of disturbance (0.045km^2) and relatively fast recovery time of species in the area. In addition effects are localised and temporary	Minor
	SS.SSa.OSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Low Small area of disturbance (0.045km^2) and relatively fast recovery time of species in the area. In addition effects are localised and temporary	Minor
	SS.SCS.CCS	Moderate CCS is regarded as conservation priority in *the UK Post-2010 Biodiversity Framework*, and is widely distributed around the UK.	Negligible Small area of disturbance (0.045km^2).and very small area identified as this biotope. In addition effects are localised and temporary	Minor

103. The export cables will be brought ashore via directional drilling (see Chapter 2). As the marine end of the directional drill holes will be located in water depths of approximately 20m CD, there will be no impact on intertidal areas. Onshore impacts are considered in Chapter 16.

4.4.4.2. Loss of Original Habitat

104. Review of the sea bed surveys and high resolution bathymetric data indicates that there will be no requirement for cable protection measures, such as rock dumping. The currently available data (BGS and sediment grab samples – see Chapter 3), suggests that the presence of rock outcropping in the Export Cable route is low. A detailed geophysical campaign will be undertaken to confirm this prior to construction works.

105. During the operational period a cable survey will be undertaken to ensure the cable remains buried and if bridging of the cable (scouring of the sea bed under the cable) has occurred. If the cable becomes uncovered or bridging takes place, it is possible that localised protection will be required. The footprint (2m wide) of such protection would be very limited (to the length of uncovered / bridged cable) and is not considered to be a significant risk of habitat loss to the present sea bed. If the cable is uncovered over large areas, the cable will sag to the seabed and there will be no bridging and it will then be recovered by the mobile sediments. This will be confirmed by regular survey work of the cable route.

106. Due to the sediment types in the area and the limited area affected by the Export Cable protection the magnitude of effects is considered to be negligible. As the sensitivity of receptors is low the impact is determined to be negligible/minor.

Table 4-22: Impact Summary of Loss of Original Habitat during Construction of the Offshore Export Cable Corridor

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Loss of Original Habitat during Construction	SS.SSa.CFiSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible Due to the very small area affected and there is unlikely to be areas of rock dumping. Habitats should recover quickly due to dynamic nature of the seabed	Negligible/Minor
	SS.SSa.OSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible Due to the very small area affected and there is unlikely to be areas of rock dumping. Habitats should recover quickly due to dynamic nature of the seabed	Negligible/Minor
	SS.SCS.CCS	Moderate CCS is regarded as conservation priority in *the UK Post-2010 Biodiversity Framework*, and is widely distributed around the UK.	Negligible Due to the very limited area of SS.SCS.CCS.	Minor

4.4.5. Offshore Export Cable Corridor - Operation and Maintenance Effects

4.4.5.1. Colonisation of introduced substrata leading to a change in the benthic ecology

107. Introduction of new substrate (from Export Cable protection – if required will have direct effects to the overall biodiversity of the site and indirect effects such as increased food availability for species (Section 4.4.2.2) from a higher trophic level such as haddock and mackerel which have been recorded in the area (Chapter 14). These effects are similar to those described within the Development Area.

108. Changes are likely to be throughout the operational phase, however community changes will be associated and localised to the new hard substrate from the Export Cable protection and habitats immediately surrounding the new habitat. Effects are therefore predicted to be of negligible magnitude.

109. Sensitivity of the existing benthic environment is considered to be low from the majority of the surrounding habitat (SS.SSa. CFiSa and SS.SSa.OSa) and as such the significance of the impact

is determined to be negligible/minor. SS.SCS.CCS is found in such a small area that the significance is determined to be minor.

Table 4-23 Colonisation of introduced substrata in the Operation Phase of the Offshore Export Cable Corridor

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Colonisation of introduced substrata	SS.SSa.CFiSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible Community changes will be associated and localised to the new hard substrate from the Export Cable protection and habitats immediately surrounding the new habitat. This area is expected to be very low	Negligible/Minor
	SS.SSa.OSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible Community changes will be associated and localised to the new hard substrate from the Export Cable protection and habitats immediately surrounding the new habitat. This area is expected to be very low	Negligible/Minor
	SS.SCS.CCS	Moderate CCS is regarded as conservation priority in *the UK Post-2010 Biodiversity Framework*, and is widely distributed around the UK.	Negligible Community changes will be associated and localised to the new hard substrate from the Export Cable protection and habitats immediately surrounding the new habitat. This area is expected to be very low. In addition SS.SCS.CCS is found in a very small area of the Export Cable Corridor.	Minor

4.4.5.2. Responses to Electromagnetic Fields (EMF) and Thermal Emissions

110. As mentioned in Section 4.4.2.3 EMF effects have predominantly been explored on fish and marine mammals, with magnetic fields impairing the orientation and affecting migratory behaviour (OSPAR, 2009). Effects of EMF on benthic invertebrates are poorly understood. Effects from EMF and thermal emissions are likely to be restricted to the immediate area of the Export Cable. In addition BERR (2008) states that the overall effect on benthic ecology is not likely to be significant, if the habitat distribution throughout the wider area is homogenous, as is the case in the study area.

111. Thermal radiation from cables may affect microbial activity within soft sediment habitats, however the ecological impacts of thermal radiation along cables will require long-term study as changes to microbial benthic habitats may not occur for some time (OSPAR, 2009; Bonar *et al.,* 2015). It is thought that the potential rise in temperature resulting from subsea cables is near impossible to detect against natural fluctuations in surrounding sediments (BERR 2008).

112. The target burial depth of the Offshore Export Cables is 1.5m below the surface (DECC, 2011), with cable protection where this is not possible. This will reduce the interaction with benthic species. Therefore the magnitude of effects of EMF and thermal emissions are predicted to be negligible.

113. Sensitivity of the receptors is low for the majority of habitats identified along the Offshore Cable Corridor other than the two sites classed as SS.SCS.CCS which is moderate. The resulting impact of EMF and thermal emissions is negligible/minor and minor.

Table 4-24 Responses to Electromagnetic Fields (EMF) and Thermal Emissions in the Operation Phase of the Offshore Export Cable Corridor

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect
SS.SSa.CFiSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible Effects from EMF and thermal emissions are likely to be restricted to the immediate area of the Export Cable. Embedded mitigation measures to bury the cable to a target depth of 1.5m will reduce the interaction with benthic species.	Negligible/Minor
SS.SSa.OSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible Effects from EMF and thermal emissions are likely to be restricted to the immediate area of the Export Cable. Embedded mitigation measures to bury the cable to a target depth of 1.5m will reduce the interaction with benthic species.	Negligible/Minor
SS.SCS.CCS	Moderate CCS is regarded as conservation priority in *the UK Post-2010 Biodiversity Framework*, and is	Negligible Effects from EMF and thermal emissions are likely to be restricted to the immediate area of the Export Cable. The area which is	Minor

	widely distributed around the UK.	classified as SS.SCS.CCS is very small. Embedded mitigation measures to bury the cable to a target depth of 1.5m will reduce the interaction with benthic species.	

4.4.5.3. Direct, Temporary Habitat Disturbance from O&M Activities

114. Currently the annual disturbance estimate for reburial is unknown and the potential for remedial cable reburial will be assessed post installation as part of the survey deploy monitor scheme. The total area of temporary habitat disturbance caused by the installation of the Offshore Export Cable is 0.045km^2 and it is very unlikely that the whole cable will need to be reburied. The area of temporary disturbance is therefore likely to be less than 0.045km^2 which results in a negligible magnitude for this impact. Sensitivity of habitats is considered to be low or moderate and therefore the impact is considered to be negligible/minor/minor respectively.

Table 4-25 Temporary Habitat Disturbance during Operation Phase of the Offshore Export Cable Corridor

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Temporary Habitat Disturbance during Operation Phase	SS.SSa.CFiSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible The total area of temporary habitat disturbance caused by the installation of the Offshore Export Cable is 0.045km^2 and it is very unlikely that the whole cable will need to be reburied. The area of temporary disturbance is therefore likely to be less than 0.045km^2	Negligible/Minor
	SS.SSa.OSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible The total area of temporary habitat disturbance caused by the installation of the Offshore Export Cable is 0.045km^2 and it is very unlikely that the whole cable will need to be reburied. The area of temporary disturbance is therefore likely to	Negligible/Minor

			be less than 0.045km^2	
	SS.SCS.CCS	Moderate CCS is regarded as conservation priority in *the UK Post-2010 Biodiversity Framework*, and is widely distributed around the UK.	Negligible The total area of temporary habitat disturbance caused by the installation of the Offshore Export Cable is 0.045km^2 and it is very unlikely that the whole cable will need to be reburied. The area of temporary disturbance is therefore likely to be less than 0.045km^2	Minor

4.4.6. Offshore Export Cable Corridor - Decommissioning Effects

115. Potential effects from decommissioning are considered to be no greater than the worst case effects assessed in the construction phase (Section 4.4.4). The decommissioning approach is described in Chapter 2. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 and is subject to approval by the Department of Energy and Climate Change (DECC) prior to implementation.

Table 4-26 Impact Summary for Temporary disturbance of Seabed Habitats during Decommissioning

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Temporary disturbance of Seabed Habitats during Decommissioning	SS.SSa.CFiSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible	Negligible/Minor
	SS.SSa.OSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible	Negligible/Minor
	SS.SCS.CCS	Moderate CCS is regarded as conservation priority in *the UK Post-2010 Biodiversity*	Negligible	Minor

		Framework, and is widely distributed around the UK.		

4.5. Mitigation

116. The assessment of the benthic ecology has assessed the worst case scenario impacts of the Project in isolation and cumulatively. This has concluded that changes to the benthic environment within the Regional Study area from project related activities will be of no more than minor impact to the identified receptors.

117. From the results of this impact assessment, it has been concluded that the Embedded Mitigation detailed in Section 4.1.4 is appropriate to reduce any potential impacts relating directly benthic ecology to an acceptable level. As such, no additional mitigation measures are proposed for the Project.

4.6. Monitoring

118. Monitoring of the cable route, inter-array cables and mooring systems will be undertaken on a regular basis during the operational phase (initial surveying occurring twice annually, tailing off during the life cycle of the development if no adverse impacts are identified) of the project to ensure they are operating as per the design specifications. These surveys will use ROVs/vessel mounted sensors (i.e. multibeam sonar) to assess the condition of the assets and a full cable export cable route survey will be undertaken as per the design specifications. This will allow monitoring of the marine benthos to be assessed in line with the survey, deploy and monitor scheme that the development will operate in.

4.7. Cumulative Impacts

4.7.1. Impact Interactions

119. There is the potential for the individual impacts which have been identified through the assessment to interact with one another and create new, or more significant impacts on the benthic ecology.

120. The impact assessment has been based on the worst case scenarios and the impacts are considered to be sequential with the maximum level of each individual effect not occurring simultaneously. As such the potential impacts identified are not predicted to increase beyond that assigned for each effect in isolation.

4.7.2. The Project

121. The impacts assessed as having a potential cumulative effect over the construction, operation, maintenance and decommissioning phases are the same as the Development and Offshore Export Cable Corridor in isolation.

4.7.2.1. Temporary Disturbance of Seabed Habitats caused by Construction Activities

122. The combination of construction activities for the Development Area and the Offshore Export Cable Corridor is considered to be localised and of a small scale in relation to the homogenous habitat type and the geographical context of available habitats. As a result the magnitude of this effect is considered to be low, with a sensitivity assigned to the identified habitats SS.SSa.CFiSa and SS.SSa.OSa. Therefore the impact is determined to be minor. The magnitude of effect for SS.SCS.CCS is determined to be negligible due to very small area of habitat identified and therefore the significance is minor.

Table 4-27 Cumulative Impacts from Development Area and Offshore Export Cable Corridor for Temporary Disturbance Caused By Construction Activities

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Cumulative Impacts from Development Area and Offshore Export Cable Corridor for Temporary Disturbance Caused By Construction Activities	SS.SSa.CFiSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Low Construction activities are localised and small scale in relation to the homogenous habitat and geographical context of available habitats	Minor
	SS.SSa.OSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Low Construction activities are localised and small scale in relation to the homogenous habitat and geographical context of available habitats	Minor
	SS.SCS.CCS	Moderate CCS is regarded as conservation priority in *the UK Post-2010 Biodiversity Framework*, and is widely distributed around the UK.	Low	Minor

4.7.2.2. Loss of Original habitat

123. The combination of the installation within the Development Area and Offshore Export Cable Corridor in relation to loss of original habitat (anchor emplacement locations) is considered to be localised and small scale in relation to the homogenous habitat type and the geographical context of available habitats. Due to this the cumulative impact of this loss is considered to be of negligible magnitude. Identified habitats are considered to be of low or moderate sensitivity and therefore the overall impact is determined to be to be negligible/minor to minor respectively.

Table 4-28 Cumulative Impacts from Development Area and Offshore Export Cable Corridor for Loss of Original habitat

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Cumulative Impacts from Development Area and Offshore Export Cable Corridor for Loss of Original habitat	SS.SSa.CFiSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible Loss of original habitat is considered to be localised and small scale in relation to the homogenous habitat type and the geographical context of available habitats.	Negligible/Minor
	SS.SSa.OSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible Loss of original habitat is considered to be localised and small scale in relation to the homogenous habitat type and the geographical context of available habitats.	Negligible/Minor
	SS.SCS.CCS	Moderate CCS is regarded as conservation priority in *the UK Post-2010 Biodiversity Framework*, and is widely distributed around the UK.	Negligible Loss of original habitat is considered to be localised and small scale in relation to the homogenous habitat type and the geographical context of available habitats.	Minor

4.7.2.3. Scour and associated sediment transport changing the seabed habitat;

124. The potential for scour is limited to the anchor points and is assessed to be localised to each anchor (1-2m from anchor points - see Chapter 3 for more detail). The expected stick up and size of the anchor will limit the spatial extent of scour and, as the bed is considered to be a live bed, (in motion naturally during wave and strong tidal currents), the scour holes are expected to be limited in size and depth. Due to the small scale of the scour the impact on sea bed habitats is determined as negligible/minor to minor respectively.

Table 4-29 Cumulative Impacts from the Development Area and Offshore Export Cable Corridor for Scour

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Cumulative Impacts from the Development Area and Offshore Export Cable Corridor for Scour	SS.SSa.CFiSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible Chapter 3 outlines that there will be limited scour effects. In addition, any increases in SSC will only impact a very limited area, will be temporary in nature, will only occur once and will not be significant against baseline conditions.	Negligible/Minor
	SS.SSa.OSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible Chapter 3 outlines that there will be limited scour effects. In addition, any increases in SSC will only impact a very limited area, will be temporary in nature, will only occur once and will not be significant against baseline conditions.	Negligible/Minor
	SS.SCS.CCS	Moderate CCS is regarded as conservation priority in the *UK Post-2010 Biodiversity Framework*, and is widely distributed around the UK.	Negligible Chapter 3 outlines that there will be limited scour effects. In addition, any increases in SSC will only impact a very limited area, will be temporary in nature, will only occur once and will not be significant against baseline conditions.	Minor

4.7.2.4. Colonisation of introduced substrata leading to a change in the benthic ecology

125. As discussed in Sections 4.4.2.2 and 4.4.5.2, the introduction of new substrates will have direct effects on the overall diversity of the Project area and indirect effects through increased food availability. Benthic community changes in the sediment habitats in the direct areas surrounding the new substrates is expected.

126. Changes are likely through the operation phase for both the Development Area and the Offshore Export Cable Corridor as discussed previously (Sections 4.4.2.2 and 4.4.5.2). However due to the small scale of the project and that community changes will be localised to the new habitat, effects are predicted to be of negligible magnitude. This, combined with the low or moderate sensitivity of identified habitats and communities, results in the impact determined to be negligible/minor to minor respectively

Table 4-30 Cumulative Impacts from Development Area and Offshore Export Cable Corridor for Colonisation of Introduced Substrata

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Cumulative Impacts from Development Area and Offshore Export Cable Corridor for Colonisation of Introduced Substrata	SS.SSa.CFiSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible Due to the small scale of the project and that community changes will be localised to the new habitat	Negligible/Minor
	SS.SSa.OSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible Due to the small scale of the project and that community changes will be localised to the new habitat	Negligible/Minor
	SS.SCS.CCS	Moderate CCS is regarded as conservation priority in *the UK Post-2010 Biodiversity Framework*, and is widely distributed around the UK.	Negligible Due to the small scale of the project and that community changes will be localised to the new habitat	Minor

4.7.2.5. Responses to Electromagnetic Fields (EMF) and Thermal Emissions

127. The effects of EMF and thermal emissions are discussed in more detail in Sections 4.4.2.2 and 4.4.5.2. As discussed, the effects are very localised within the Development Area and the Offshore Export Cable Corridor and do not present a cumulative effect beyond that of the sites assessed individually. As such the magnitude of effect is classed as negligible.

128. The sensitivity of the existing benthic communities is considered to be low or moderate and therefore the impact can be determined as negligible/minor to minor respectively.

Table 4-31 Cumulative Impacts from Development Area and Offshore Export Cable Corridor for Responses to EMF and Thermal Emissions

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Cumulative Impacts from Development Area and Offshore Export Cable Corridor for Responses to EMF and Thermal Emissions	SS.SSa.CFiSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible Effects are very localised within the Development Area and the Offshore Export Cable Corridor and do not present a cumulative effect beyond that of the sites assessed individually	Negligible/Minor
	SS.SSa.OSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible Effects are very localised within the Development Area and the Offshore Export Cable Corridor and do not present a cumulative effect beyond that of the sites assessed individually	Negligible/Minor
	SS.SCS.CCS	Moderate CCS is regarded as conservation priority in the *UK Post-2010 Biodiversity Framework*, and is widely distributed around the UK.	Negligible Effects are very localised within the Development Area and the Offshore Export Cable Corridor and do not present a cumulative effect beyond that of the sites assessed individually	Minor

4.7.2.6. Direct, Temporary Habitat Disturbance from O&M Activities.

129. During the operation and maintenance phase the worst case scenario which is applied to the assessment is a maximum of 10% of the length of each of the Export Cables (annual area of disturbance 0.009km^2) combined with that of the Development Area (0.129km^2). This is a temporary disturbance, with recovery expected within 2-3 years for the majority of species and habitats. This combined with the small annual area of effect, results in a negligible magnitude for this impact.

130. Sensitivity of habitats is considered to be low or moderate and therefore the impact is determined as negligible/minor to minor respectively.

Table 4-32 Cumulative Impacts from Development Area and Offshore Export Cable Corridor for Direct Temporary Habitat Disturbance from O&M Activities

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Cumulative Impacts from Development Area and Offshore Export Cable Corridor for Direct Temporary Habitat Disturbance from O&M Activities	SS.SSa.CFiSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible Due to the temporary nature of the works, small annual area of effect and recovery expected within 2-3 years for the majority of species	Negligible/Minor
	SS.SSa.OSa	Low Widely distributed habitat, not considered as an area of conservation importance or of key ecological importance for species outside of this habitat.	Negligible Due to the temporary nature of the works, small annual area of effect and recovery expected within 2-3 years for the majority of species	Negligible/Minor
	SS.SCS.CCS	Moderate CCS is regarded as conservation priority in the *UK Post-2010 Biodiversity Framework*, and is widely distributed around the UK.	Negligible Due to the temporary nature of the works, small annual area of effect and recovery expected within 2-3 years for the majority of species	Minor

4.7.3. Cumulative Impacts during Decommissioning

131. Potential effects from decommissioning are considered to be no more than the worst case effects assessed in the construction phase (Section 4.4.1). The decommissioning approach is described in Chapter 2. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 and is subject to approval by the Department of Energy and Climate Change (DECC) prior to implementation.

4.7.4. Other Projects

132. Other project included for the cumulative assessment are detailed in the table below:

Table 4-33 Projects Considered for Cumulative Impacts

Project name	Distance from Pilot Park	Project developer	High level description	Project status
Aberdeen Harbour Expansion	15km	Aberdeen Harbour	Expansion and diversification of the capabilities of the existing Aberdeen harbour at Nigg Bay.	Environmental Statement submitted November 2015
European Offshore Wind Deployment Centre (EOWFL)	17km	Aberdeen Offshore Windfarm Ltd	Offshore wind turbine deployment centre for 11 turbines with up to 100 MW capacity.	Consented
Eastern HVDC link from north Aberdeen to Newcastle upon Tyne	30km	National Grid Electricity Transmission and Scottish Hydro Electricity Transmission Ltd	This cable route will go from Sandford Bay Beach, approximately 30km north of Aberdeen to Hawthorn Pit, just south of Newcastle Upon Tyne.	In Planning
Seagreen Alpha Offshore Windfarm and Seagreen Bravo Offshore Windfarm	34km	Seagreen Wind Energy Limited	Offshore windfarm and export cabling to be developed in three Phases with a total target capacity of 3.5 GW. Phase 1: Alpha and Bravo. 1,050 MW, Export Cable to Carnoustie in Angus. Phase 2: Charlie, Delta and Echo. Phase 3: Foxtrot and Golf.	Phase 1 – consented Phase 2 & 3 – EIA Scoping Opinion issued
Hywind Scotland Pilot Park	45km	Statoil	Pilot project for five 6MW floating wind turbines	Consented
Inch Cape Offshore Windfarm	47km	Inch Cape Offshore Windfarm Ltd	Offshore windfarm up to 213 turbines, covering an area of up to 150km2 with capacity of approximately 1,000 MW.	Consented
Neart na Gaoithe Offshore Windfarm	74km	Mainstream Renewable Power	Offshore windfarm, 75 - 125 turbines, 450 MW with 33km Export Cable to shore.	Consented Offshore construction due to begin in 2015 subject to consent
Moray Offshore Renewables Windfarm (eastern Development Area)	125km	Moray Offshore Renewables Ltd (MORL)	A 1,500 MW windfarm over an area of 125km^2 in the outer Moray Firth. Includes an Export Cable approximately 105 km in length offshore to Fraserburgh and 30km onshore to substation.	1.116 MW consented. Construction planned to begin Q3 2015 to full generation in Q3 2020
Beatrice Offshore Windfarm Ltd (BOWL)	150km	SSE	An offshore windfarm with a maximum of 227 offshore turbines, generating up to 1,000 MW in the outer Moray Firth. Includes an electrical transmission cable along a 65km corridor to the shore at Portgordon and 20km of onshore cable to a new substation at Blackhill hock.	Consented

133. No cumulative impacts with respect to the benthic ecology are predicted as the sites are considered to be sufficiently distant to the Project, and as such these projects have been scoped out of the cumulative assessment.

134. No cumulative impacts with onshore windfarms with respect to benthic ecology have been identified and therefore have been scoped out of the cumulative assessment.

4.8. Summary and Residual Impacts

135. A total of three biotope types were recorded within and surrounding the Development Area and the Offshore Export Cable Corridor during the site specific survey. These biotopes are considered to be typical of the region and are widely distributed geographically.

136. No Annex I habitats listed in the EU Habitats Directive (i.e. reefs) were observed at any of the 68 stations. In addition, no Priority Marine Features were observed at any of the 68 sample locations.

137. The potential impacts of the Kincardine Windfarm development were considered in relation to the construction (decommissioning) and Operation and Maintenance phases with regard to the benthic ecology within the Development Area and the Offshore Export Cable Corridor.

138. Cumulative impacts were considered, however due to the location and scale of the projects it was considered they were sufficiently distant to the Project that no cumulative impacts with regard to benthic ecology were predicted.

4.8.1. Development Area

139. All mitigation included in the assessment for the Development Area was embedded mitigation and therefore included in the assessment conclusions, only residual effects have been presented (Table 4-34).

4.8.2. Offshore Export Cable Corridor

140. All mitigation included in the assessment for the Offshore Export Cable Corridor was embedded mitigation and therefore included in the assessment conclusions, only residual effects have been presented (Table 4-35).

4.8.3. Cumulative Impacts from the Project

141. All mitigation included in the assessment for the Cumulative Impacts from the Project was embedded mitigation and therefore included in the assessment conclusions, only residual effects have been presented (Table 4-36).

Table 4-34 Summary of Effects and Mitigation – Development Area

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Construction				
Temporary disturbance of seabed habitats caused by construction activities	SS.SSa.OSa	Negligible/Minor Significance	Embedded Mitigation with no Additional Mitigation	Negligible/Minor Significance
Operation and Maintenance				
Loss of Original Habitat	SS.SSa.OSa	Minor Significance	Embedded Mitigation with no Additional Mitigation	Minor Significance
Colonisation of introduced substrata leading to a change in the benthic ecology	SS.SSa.OSa	Minor Significance	Embedded Mitigation with no Additional Mitigation	Minor Significance
Responses to Electromagnetic Fields (EMF) and thermal emissions	SS.SSa.OSa	Negligible/Minor Significance	Embedded Mitigation with no Additional Mitigation	Negligible/Minor Significance
Direct, Temporary Habitat Disturbance from O&M Activities	SS.SSa.OSa	Negligible/Minor Significance	Embedded Mitigation with no Additional Mitigation	Negligible/Minor Significance

Table 4-35: Summary of Effects and Mitigation – Offshore Export Cable Corridor

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Construction				
Temporary disturbance of seabed habitats caused by construction activities	SS.SSa.CFiSa	Minor Significance	Embedded Mitigation with no Additional Mitigation	Minor Significance
	SS.SCS.CCS	Minor Significance		Minor Significance
	SS.SSa.OSa	Minor Significance		Minor Significance
Operation and Maintenance				
Loss of Original Habitat	SS.SSa.CFiSa	Negligible/Minor Significance	Embedded Mitigation with no Additional Mitigation	Negligible/Minor Significance
	SS.SCS.CCS	Minor Significance		Minor Significance
	SS.SSa.OSa	Negligible/Minor Significance		Negligible/Minor Significance
Colonisation of introduced substrata leading to a change in the benthic ecology	SS.SSa.CFiSa	Negligible/Minor Significance	Embedded Mitigation with no Additional Mitigation	Negligible/Minor Significance
	SS.SCS.CCS	Minor Significance		Minor Significance
	SS.SSa.OSa	Negligible/Minor Significance		Negligible/Minor Significance
Responses to Electromagnetic Fields (EMF) and thermal emissions	SS.SSa.CFiSa	Negligible/Minor Significance	Embedded Mitigation with no Additional Mitigation	Negligible/Minor Significance
	SS.SCS.CCS	Minor Significance		Minor Significance
	SS.SSa.OSa	Negligible/Minor Significance		Negligible/Minor Significance
Direct, Temporary Habitat Disturbance from O&M Activities	SS.SSa.CFiSa	Negligible/Minor Significance	Embedded Mitigation with no Additional Mitigation	Negligible/Minor Significance
	SS.SCS.CCS	Minor Significance		Minor Significance
	SS.SSa.OSa	Negligible/Minor Significance		Negligible/Minor Significance

Table 4-36: Summary of Effects and Mitigation - Cumulative Impacts from the Project

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Construction				
Temporary disturbance of seabed habitats caused by construction activities	SS.SSa.CFiSa	Minor Significance	Embedded Mitigation with no Additional Mitigation	Minor Significance
	SS.SCS.CCS	Minor Significance		Minor Significance
	SS.SSa.OSa	Minor Significance		Minor Significance
Operation and Maintenance				
Loss of Original Habitat	SS.SSa.CFiSa	Minor Significance	Embedded Mitigation with no Additional Mitigation	Minor Significance
	SS.SCS.CCS	Minor Significance		Minor Significance
	SS.SSa.OSa	Minor Significance		Minor Significance
Colonisation of introduced substrata leading to a change in the benthic ecology	SS.SSa.CFiSa	Negligible/Minor Significance	Embedded Mitigation with no Additional Mitigation	Negligible/Minor Significance
	SS.SCS.CCS	Minor Significance		Minor Significance
	SS.SSa.OSa	Negligible/Minor Significance		Negligible/Minor Significance
Responses to Electromagnetic Fields (EMF) and thermal emissions	SS.SSa.CFiSa	Negligible/Minor Significance	Embedded Mitigation with no Additional Mitigation	Negligible/Minor Significance
	SS.SCS.CCS	Minor Significance		Minor Significance
	SS.SSa.OSa	Negligible/Minor Significance		Negligible/Minor Significance
Direct, Temporary Habitat Disturbance from O&M Activities	SS.SSa.CFiSa	Negligible/Minor Significance	Embedded Mitigation with no Additional Mitigation	Negligible/Minor Significance
	SS.SCS.CCS	Minor Significance		Minor Significance
	SS.SSa.OSa	Negligible/Minor Significance		Negligible/Minor Significance

4.9. References

BERR (Department for Business, Enterprise and regulatory Reform. (2008). Review of Cabling Techniques and Environmental Effects Applicable to the Offshore Windfarm Industry. Available Online: http://webarchive.nationalarchives.gov.uk/+/http:/www.berr.gov.uk/files/file43527.pdf [Accessed: April 2015]

Bochert, R. and Zettker, M.L. (2004). Long-Term Exposure of Several Marine Benthic Animals to Static Magnetic Fields. *Bioelectromagnetics.* **25:** pp. 498-502

Bonar, P.A.J., Bryden, I.G. and Borthwick, A.G.L. (2015). Social and Ecological impacts of marine energy development. *Renewable and Sustainable Energy Reviews.***47**:pp. 486-495.

Budd, G. (2008). *Alcyonium digitatum*. Dead man's fingers. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. Available Online: http://www.marlin.ac.uk/speciesfullreview.php?speciesID=2442 [Accessed; March 2015]

Cefas. (2004). Offshore Windfarms: guidance notes for Environmental Impact Assessment in respect of FEPA and CPA requirements. Version 2. Available Online: http://www.offshorewindenergy.org/reports/report_040.pdf [Accessed: February 2015]

Conner, D.A., Allen, J.H., Golding, N., Howell, K.L., Lieberknecht, L.M., Northern, K.O. and Reker, J.B. (2004). The Marine Habitat Classification for Britain and Ireland Version 04.05 JNCC, Peterborough. ISBN 1 861 07561 8 (internet version). Available Online: www.jncc.gov.uk/MarineHabitatClassification. [Accessed: February 2015]

DECC. (2011). National Policy Statement for renewable Energy Infrastructure (EN-3). Available Online: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/37048/1940-nps-renewable-energy-en3.pdf [Accessed: June 2015]

Dyer MF, Fry WG, Fry PD & Cranmer GJ, (1983). Benthic regions within the North Sea. Journal of the Marine Biological Association of the United Kingdom 63: 683–693.

Eleftheriou, A., Basford, D and Moore, D.C. (2004). Synthesis of Information on the Benthos of Area SEA 5. Report for the Department of Trade and Industry. Available Online: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/197380/SEA5_TR_Benthos_Elef.pdf [Accessed: April 2015]

Gill, A.B., Gloyne-Phillips, I., Neal, K.J. and Kimber, J.A. (2005). The potential Effects of Electromagnetic Fields Generated by Sub-sea Power Cables Associated with Offshore Windfarm Developments on Electrically and Magnetically Sensitive Marine Organisms – A Review. Report to Collaborative Offshore Wind Research into the Environment (COWRIE) group, Crown Estates

Hiscock, K., Tyler-Walters, H. and Jones, H. (2002). High Level Environmental Screening Study for Offshore Windfarm Developments – Marine Habitats and Species Project. Report from the Marine Biological Association to The Department of Trade and Industry New & Renewable Energy Programme. (AEA Technology, Environment Contract: W/35/00632/00/00.)

Her Majesty's (HM) Government (2011).UK Marine Policy Statement. Available Online: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69322/pb3654-marine-policy-statement-110316.pdf [Accessed: March 2015]

IEEM. (2010). Guidelines for Ecological Impact Assessment in Britain and Ireland - Marine and Coastal Consultation document. Available Online: http://www.cieem.net/data/files/Resource_Library/Technical_Guidance_Series/EcIA_Guidelines/Final_EcIA_Marine_01_Dec_2010.pdf [Accessed: March 2015]

IEMA. (2004). Guidelines for Environmental Impact Assessment.

Inch Cape Offshore Limited (ICOL) (2013). Inch Cape Offshore Limited Offshore Environmental Statement. [ONLINE] Available Online: http://www.inchcapewind.com/publications/environmental-statement/introduction [Accessed: April 2015]

Kerckhof, F., Norro, A., Jaques, T. and Degraer, S. (2009). Early colonisation of a concrete offshore windmill foundation by marine biofouling on the Thornton Bank (southern North Sea). Within *S. Degraer, R.S. Brabant (Eds.), Offshore Windfarms in the Belgian part of the North Sea: State of the Art after two years of Environmental Monitoring, Brussels (2009) p. 287+annexes.*

Krone, R., Gutow, L. Joschko, T.J. and Schroder, A. (2013). Epifauna dynamics at an offshore foundation – Implications of future wind power farming in the North Sea. *Marine Environmental Research.* **85:** pp. 1-12.

Langhamet, O. (2010). Effects of wave energy converters on the surrounding soft-bottom macrofauna (west coast of Sweden. *Marine Environmental Research.* 69: pp. 374-381.

Nelson, P.A. 2003. “Marine fish assemblages associated with fish aggregating devices (FADs): effects of fish removal, FAD size, fouling communities, and prior recruits.” *Fishery Bulletin*. **101**: 835- 850.

Newell, R.C. Seiderer, L.J., Simpson, N.M. and Robinson, J.E. (2004). *Impacts of Marine Aggregate Dredging on Benthic Macrofauna off the South Coast of the United Kingdom*. Journal of Coastal Research, **20**: pp. 115-125.

OSPAR (2008). OSPAR Guidance on Environmental Considerations for Offshore Windfarm Development. Available Online: www.ospar.org [Accessed: March 2015]

OSPAR. (2009). Assessment of the environmental impacts of cables. Available Online: http://qsr2010.ospar.org/media/assessments/p00437_Cables.pdf [Accessed: April 2015].

Paramor, O.A.L., Allen, K.A., Aanesen, M., Armstrong, C., Hegland, T., Le Quesne,W., Piet, G.J., Raakær, J., Rogers, S., van Hal, R., van Hoof, L.J.W., van Overzee, H.M.J., and Frid,C.L.J. (2009) MEFEPO North Sea Atlas. University of Liverpool. ISBN 0 906370 60 4

Reubens, J.T., Degraer, S. and Vincx, M. (2011). Aggregation and feeding behaviour of pouting (Trisopterus luscus) at wind turbines in the Belgian part of the North Sea. Fisheries Research. 108 (1): pp. 223-227.

Royal Haskoning. (2011). *SeaGen Environmental Monitoring Programme*. Final Report. MCT. Available Online: http://seageneration.co.uk/files/SeaGen-Environmental-Monitoring-Programme-Final-Report.pdf [Accessed: July 2015]

Saunders , G., Bedford, G.S., Trendall, J.R., and Sotheran, I. (2011). Guidance on survey and monitoring in relation to marine renewables deployments in Scotland. Volume 5. Benthic Habitats. Unpublished draft report to Scottish Natural Heritage and Marine Scotland. http://www.s nh.gov.uk/docs /B925810.pdf

Scottish Natural Heritage. (2013a). A handbook on environmental impact assessment. Available Online: http://www.snh.gov.uk/docs/A1198363.pdf [Accessed: April 2015]

Scottish Natural Heritage. (2013b). Priority Marine Features (PMFs) in Scotlands' Seas. Available Online: http://www.snh.gov.uk/protecting-scotlands-nature./priority-marine-features/ [Accessed: April 2015]

Scottish Parliament. (2010). Marine (Scotland) Act. Available Online: http://www.legislation.gov.uk/asp/2010/5/pdfs/asp_20100005_en.pdf [Accessed: March 2015]

Strategic Environmental Assessment (SEA) 5. (2004). Strategic Environmental Assessment of parts of the northern and central North Sea to the east of the Scottish mainland, Orkney and Shetland. Available Online: https://www.gov.uk/government/publications/strategic-environmental-assessment-5-supporting-documents [Accessed: April 2015]

The Council of the European Communities (1992). Council Directive 92/43/EEC of 21 May 1992 on the Conservation of natural habitats and of wild fauna and flora (Habitats Directive) as amended. Available Online: Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1992L0043:20070101:EN:HTML [Accessed: April 2015]

U.S. Department of Energy. (2011). Draft Environmental Assessment for University of Maine's Deepwater Offshore Floating Wind Turbine Testing and Demonstration Project. *Office of Energy and Renewable Energy Golden Field Office.* Available Online: http://energy.gov/nepa/downloads/ea-1792-draft-environmental-assessment [Accessed: April 2015]

Ware, S.J. and Kenny, A.J. (2011). Guidelines for the Conduct of Benthic Studies at Marine Aggregate Extraction Sites (2nd Edition). Marine Aggregate Levy Sustainability Fund, 80 pp

5. Fish & Shellfish

5.1. Introduction

1. This chapter describes the baseline and assesses the impacts of the Kincardine Offshore Windfarm on fish and shellfish ecology. In order to quantify the spatial and temporal variation, fish populations are described both at the local level and at the wider regional level (North Sea) in order to provide context to the baseline.

2. The following areas are referred to in this impact assessment:

- Development Area (WTG Deployment Area); and
- Offshore Export Cable Corridor.

3. These areas combined are classed as the Project.

4. This chapter makes reference, where relevant, to the following chapters to gain a better understanding of the baseline and therefore the potential impacts associated with the fish and shellfish ecology:

- Chapter 4: Benthic Ecology
- Chapter 6: Marine Mammals
- Chapter 14: Commercial Fisheries

5. Predicted impacts on Special Areas of Conservation (SACs) designated for migratory fish have been assessed within the Habitat Regulations Assessment, Section 8.2.2.

6. The Project falls under The Scottish Government's 'Survey, Deploy, and Monitor' licensing policy. This policy is applied following detailed discussions with Marine Scotland. Due to the 'low' risk associated with the small scale of development and because the WTGs are classed as 'limited device risk' KOWL were only required to undertake strategic, limited surveys to be undertaken to date. Therefore, currently no site specific surveys relating to fish and shellfish ecology have been undertaken to date.

5.1.1. Legislation and Guidance

7. The legislation and guidance which relate to the assessment of the potential impacts on fish and shellfish ecology in and around the Project are detailed below:

- The Habitat Regulations 1994 (as amended in Scotland) and the Offshore Marine Conservation (Natural Habitats) Regulations 2007 which implement the species protection requirements of the Habitats Directive (92/43/EEC) in Scotland, on land, in inshore and offshore waters;
- Wildlife and Countryside Act 1981;
- The Nature Conservation (Scotland) Act 2004;
- Marine (Scotland) Act 2010;
- UK Biodiversity Action (UKBAP);
- Centre for Environment, Fisheries and Aquaculture Science (Cefas) (2011a), Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects. Cefas contract report: ME5403; and
- Marine Management Organisation (MMO), Scottish Natural Heritage (SNH) the Joint Nature Conservation Committee (JNCC), Natural England and Countryside Council for Wales (CCW). Guidance on the assessment of effects on the environment and cultural heritage from marine renewable development.

8. Within the Habitats Directive, fish species which are listed in Annex II of the EU Habitats Directive and are native to the UK should be conserved through the designation of Special Areas of Conservation (SACs). Of these species Atlantic salmon and lamprey are considered to be native to the UK. In addition, Atlantic salmon are included in Schedule 4 of the Habitats Regulations as animals which may not be captured or killed in certain ways.

9. Basking sharks are protected under Schedule 5 of the Wildlife and Countryside Act (1981 as amended) which prohibits the killing, injuring or taking by any method of those wild animals listed in Schedule 5. In addition the species is included as a priority species in the Scottish Marine Wildlife Watching Code (SMWWC) introduced in 2006.

10. A single Priority list of marine habitats and species in Scotland's seas has been developed jointly by Scottish Natural Heritage (SNH) and the Joint Nature Conservation Committee (JNCC). Habitats and species listed are known as Priority Marine Features (PMF). The list has been developed in order to assist in the delivery of Marine Scotland's vision for marine nature conservation which is outlined in the Marine Nature Conservation Strategy. There may be some fish species on the list which occur in the Project Area.

11. The UK Biodiversity Action Plan (UKBAP) identifies a list of species of conservation concern in response to the Convention on Biological Diversity (CBD). A number of marine fish species are listed in the UKBAP which may be present in the Project Area.

12. The International Union for Conservation of Nature (IUCN) Red list of threatened species include fish species which have the potential to be present in the Project area and identifies their conservation status.

5.1.2. Stakeholder Consultation

13. This section provides a summary of scoping responses of statutory and non-statutory consultees in relation to the assessment of effects of the Project on fish and shellfish. Scoping responses are summarised in Table 5-1.

Table 5-1 Stakeholder Scoping Report Responses

Consultee	Consultee Response	Project Response
Marine Scotland Science (MSS)	Generally, throughout the document, the authors need to consider benthos, fish and shellfish as separate topics not as one subject.	Benthic Ecology is considered separately to fish and shellfish within Chapters 4 and 5 respectively.
	Large numbers of basking shark have been recorded from single sites (off Islay for example) not just single animals. Admittedly on the west coast	Noted, basking sharks are discussed in Section 5.2.5.
	This section heading is a little misleading as the section contains other material on fish, including material which will also be relevant to diadromous fish. The developer should include in the ES any available information on likely use by diadromous fish of areas which may be affected by the work - which species use the areas? For feeding or migration? Swimming depths? Tendency to swim on or offshore? Times of year? and in the case of salmon and sea trout, comments on the likely origin / destination of fish using the area	Noted. Information which was available at the time of writing is included in Section 5.2.
	EMF during operation. In contrast with 10.6.1.2 this section describes salmon sea trout and eels as being key conservation species. This is true, but salmon and sea trout are also of recreational and commercial fishery importance	Salmon and Sea Trout Fisheries are discussed in Chapter 14.

Consultee	Consultee Response	Project Response
	Some consideration of noise will also be needed	Noted, impacts associated from noise are considered in Sections 5.4.1.3, 5.4.2.4 and 5.4.4.2.
	Although, because the intention (as in 3.7. Anchors and moorings) is to develop the project without the use of piled anchors, it is not intended to have a separate noise study, there should still be some consideration of possible effects of noise, for example because of possible effects of wave noise stemming from the structures and operational noise on diadromous fish migration. In addition, if piled anchors do have to be used, there will have be more detailed consideration of the potential effects of noise generation from this.	See comment above.
	The reviews of Gill and Bartlett (2010) and Gill *et al.,* (2012) mentioned in my comments on 10.6.2 may also be useful in the context of potential effects of noise on diadromous fish.	Noted and assessed see Sections 5.4.1.3, 5.4.2.4 and 5.4.4.2.
	A detailed literature review (primary and grey literature) will be expected with all overlapping layers (spawning grounds overlap: cod, herring, plaice, lemon sole, sandeel, and whiting; nursery grounds: saithe, sandeel, lemon sole, sprat, and whiting) to be undertaken as part of the EIA.	Spawning and nursery grounds are detailed in relevant species sections within the baseline Section 5.2 and Figures 5-3 to 5-7.
	The site overlaps with, but occupies very small portions of, potential spawning and nursery habitats for numerous commercial fish species. There are also likely to be numerous marine fish PMFs relevant to the proposed development location and with some sensitivity to selected pressures (e.g. herring, mackerel, cod, sandeels, whiting, saithe). In all cases, however, the scale and nature of any impacts are sufficiently small and/or temporary that we can reasonably consider there to be no significant impacts upon the national, regional or population-level status of these species. Neither is a proposal of this size likely to add markedly to cumulative impacts on marine fish or shellfish.	Noted and discussed further in the impact assessments Section 5.4.
	Section 6 of HRA screening- Test of Likely Significant Effect. As there is no pile driving involved the residual factors to consider are EMF during operation and operational noise. The document only considered EMF and despite burial of the cable to a target depth of 1.5 metres, which would provide a very high level of protection, concluded LSE for the three salmon SACs. The logic for this is unclear although we are aware that SNH also made a similar suggestion. In our view, there should also be consideration of operational noise and there should be more careful consideration over whether No LSE would be the correct call.	Atkins took this into consideration and included EMF impacts as part of the HRA appropriate assessment (see Separate Document for HRA)
	Section 7 of HRA screening- The document defers detailed consideration until later when Atkins will prepare a note to inform an appropriate assessment. It is possible that this stage may not be needed in respect of salmon SACs.	Noted (see Separate Document for HRA)

Consultee	Consultee Response	Project Response
	There are currently no aquaculture sites registered with Marine Scotland Science located in the vicinity of the Kincardine Floating Offshore Wind demonstrator Project proposed by Atkins – Kincardine Offshore Windfarms Ltd. The nearest marine aquaculture sites are situated over 100km south of the proposed development (See Annexe 1). These are both active land based tank sites using seawater which is pumped ashore. The shellfish site at North Berwick holds European lobsters and is operated by The Firth of Forth Lobster Hatchery. The finfish site near St Abbs Head is operated by St Abbs Marine Station and holds a variety of marine finfish species.	Noted and stated within Chapter 14.
SNH	If gravity-anchors are to be used, there should be further assessment of benthic/demersal fish impacts with the benefit of knowledge on the scale of the anchors and any necessary seabed preparation.	Noted. Preferred anchors are drag embedment anchors.
	Where sensitivities and their ecological importance are uncertain, the potential for monitoring should be considered: Loss of or damage to sandeel habitat and herring spawning habitat, particularly during their respective spawning seasons. Existing benthic survey data (biological and physical) should be able to determine the likely suitability of the seabed for these functions, so no additional survey is expected to be needed (except for Export Cable route). We note and support the statement on page 73: “It is believed that the windfarm installation periods can be designed to take into account important fish species in the area, and in particular herring spawning periods to minimise impacts”.	Details of the benthic survey are summarised in Section 5.2.1 and detailed further in Chapter 4. A Project Environmental Management Plan will be prepared which will detail post construction monitoring activities.
	Electro-magnetic fields – impacts from EMF are poorly understood. Consideration should not be limited to diadromous fish. We note that the commercial fisheries section of the scoping report identifies EMF as of „medium‟ potential significance and therefore will be scoped into the EIA. The assessment can therefore be readily extended to other fish and shellfish.	Electromagnetic fields (EMF) are discussed within Sections 5.4.2.3 and Section 5.4.5.2.
	Fish aggregation under/around sub-structure and other infrastructure – fish aggregation may be perceived as positive if it enhances feeding or reproductive opportunities or if it provides a habitat for species that are otherwise in a degraded state due to being habitat-limited. However, it may also be perceived as negative if fish aggregation results in increased risk of collision or entanglement of subsequently attracted predators (seabirds & mammals, respectively).	Fish aggregation is discussed in Section 5.4.2.5.
	For spawning and nursery ground information, refer to Ellis *et al., (*2010)16 and Coull *et al., (*1998)17. While this reference provides maps of spawning and nursery grounds for most of the key marine fish species, these are only broad indications of likely potential spawning areas, much of which is based on relatively old data and incorporates temporal and spatial variability. Also note that MSS are in the process of updating this information, which may be available in time for use in	Noted and discussed in Section 5.2.

Consultee	Consultee Response	Project Response
	this application. Spawning and nursery grounds are not spatially or temporally fixed, potentially moving according to the conditions of the substrate, seabed habitats, climate and hydrodynamic regimes	
	For basking sharks it will also be necessary to address the relevant legal requirements of the Wildlife and Countryside Act (1981), including amendments through the Wildlife and Natural Environment (WANE) (Scotland) Act.	Noted, legislation relating to basking sharks is considered in Section 5.1.1.
	With regard to potential impacts from noise on diadromous fish species, we welcome that piling will not be used. Evaluation of potential noise impacts on fish should include consideration of the migratory behaviour of diadromous fish species (we recognise that there are limited data available on the marine behaviour of these species and their vulnerability to potential impacts from noise, EMF and sedimentation)	Noted and discussed in Sections 5.4.1.3 and 5.4.4.2
ASFB	In the case of the proposed Kincardine Development we believe that the following SACs should be scoped in: River Tweed, River Teith, River Tay, River South Esk, River Dee, River Spey.	Assessments of impacts to SACs is discussed within the Habitat Regulations Appraisal (see separate document).
	Subsea noise during construction We would seek assurance that the deployment of possible mooring/anchoring options will not adversely affect emigrating smolts or returning adults	Noted and discussed in Section 5.4.1.3 and 5.4.4.2
	Electromagnetic fields (EMFs) arising from cabling We would seek assurance that the cabling arising from the proposed floating offshore wind substructures, which we assume will not be shielded and will sit within the water column, will not adversely affect emigrating smolts or returning adults.	Electromagnetic fields (EMF) are discussed within Sections 5.4.2.3 and 5.4.5.2.
	Disturbance or degradation of the benthic environment (including secondary effects on prey species) It is important to ensure that such effects are quantified and assessed in the Environmental Statement.	Discussed in Chapter 4.
	Aggregation effects Whilst the aggregation of prey items around physical structures might be seen as a positive effect, possible negative effects might include the associated aggregation of predators.	Fish aggregation is discussed in Section 5.4.2.5.
	EMF We believe that burial depth of cables should be based on research, but in the absence of definitive data we believe that **all** cables should be buried to a **minimum** depth of 1.5m, for **all** offshore renewable developments. Where cable burial is not possible due to hard substrates etc. we believe that all cables should be shielded to an equivalent depth by placing a suitable substrate on top of the cable or by some other means.	EMF is discussed in Sections 5.4.2.3 and 5.4.5.2. All cables will be buried, where possible, in line with recommendations from DECC (2011).
SFF	The SFF would expect the EIA to include detailed baselines of nursery areas, spawning grounds and commercial species.	Nursery and spawning areas are

Consultee	Consultee Response	Project Response
		discussed in Section 5.2.

5.1.3. Data Sources, Gaps and Uncertainties

14. A detailed review was undertaken of the literature currently available, in order to give an overview of the general ecology of fish and shellfish species known to occur in the wider North Sea region. Key data sources are listed below:

- Centre for Environmental, Fisheries and Aquaculture Science (Cefas);
- The Joint Nature Conservation Committee (JNCC);
- Collaborative Offshore Wind Research Into the Environment (COWRIE);
- Marine Scotland Science;
- Environment Agency (EA);
- Scottish Environmental Protection Agency (SEPA);
- Scottish Natural Heritage (SNH);
- European Seabirds At Sea (ESAS) surveys (for presence of seabirds, marine mammals and basking sharks);
- ICES – International Herring Larvae Survey (IHLS); and
- Journals, white papers and research papers (particularly Ellis *et al.,* 2012 and Coull *et al.,* 1998).

15. Information on spawning and nursery grounds is detailed in Section 5.6, which is based on the information provided in Ellis *et al.,* (2012), and Coull *et al.,* (1998). The limitations of these sources must be recognised. The publications provide only an indication of the general locations of spawning and nursery grounds. They do not define precise boundaries, particularly in the context of the relatively small footprint of the Project. Similarly the spawning seasons in the publications represent the maximum duration of spawning on a species/stock basis. Actual spawning seasons will fall within this period but may be shorter. In addition spawning and nursery grounds for most fish species are dynamic features of life history and are rarely fixed in one location from year to year. Despite these limitations, it is considered that the data available provide the best available and accepted knowledge base against which impacts can be assessed.

16. It is recognised that there are gaps in the understanding of the distribution of migratory species including several species of conservation importance (e.g. salmonids). Exact migration routes to and from feeding and spawning grounds are not known in detail. The lack of data however, has not compromised the impact assessment as it is an appropriate level of detail and the best available knowledge at present.

5.1.4. Site Specific Surveys

17. No surveys have been undertaken specifically for fish and shellfish ecology, however, this chapter is supported by Marine Scotland Science (MSS) drop-down video (DDV) surveys undertaken to assess the benthic ecology and habitat characterisation in the area (see Chapter 4). The results of the benthic ecology survey combined with information from the commercial fisheries provides an indication of species which are likely to be present in the area.

18. Data gathered during the benthic ecology baseline surveys using drop down video pertinent to fish and shellfish have been included in the assessment (full methodology and results are detailed in Chapter 4. Where possible fish were identified to species level, however for the most part it was only possible to identify fish to family level due to visual quality of the footage.

5.1.5. Study Area

19. The study area corresponds to the International Council for the Exploration of the Sea (ICES) rectangles 43E7, 43E8 and 42E8 identified within Chapter 14. In addition the study area encompasses the salmon fishery districts in closest proximity to the Project (areas 14, 15, 16 and 17 detailed in Figure 5-2).

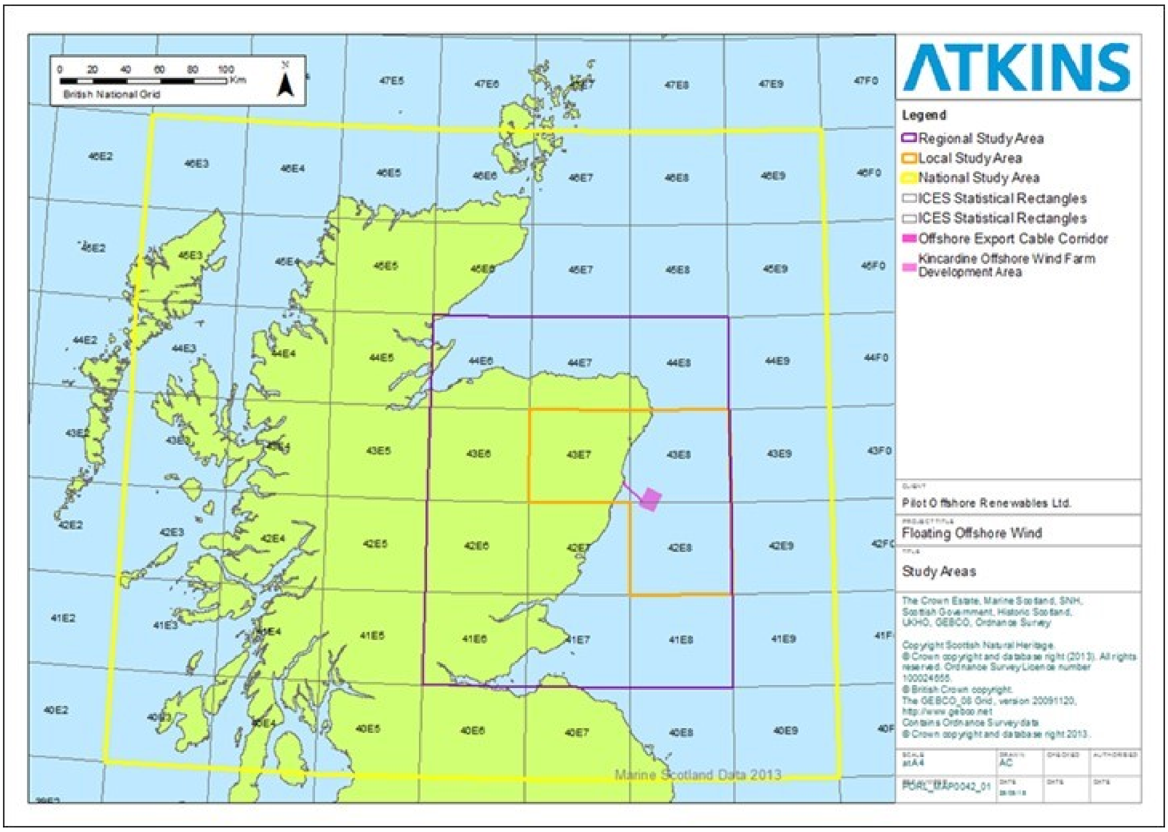

Figure 5-1 Study Areas

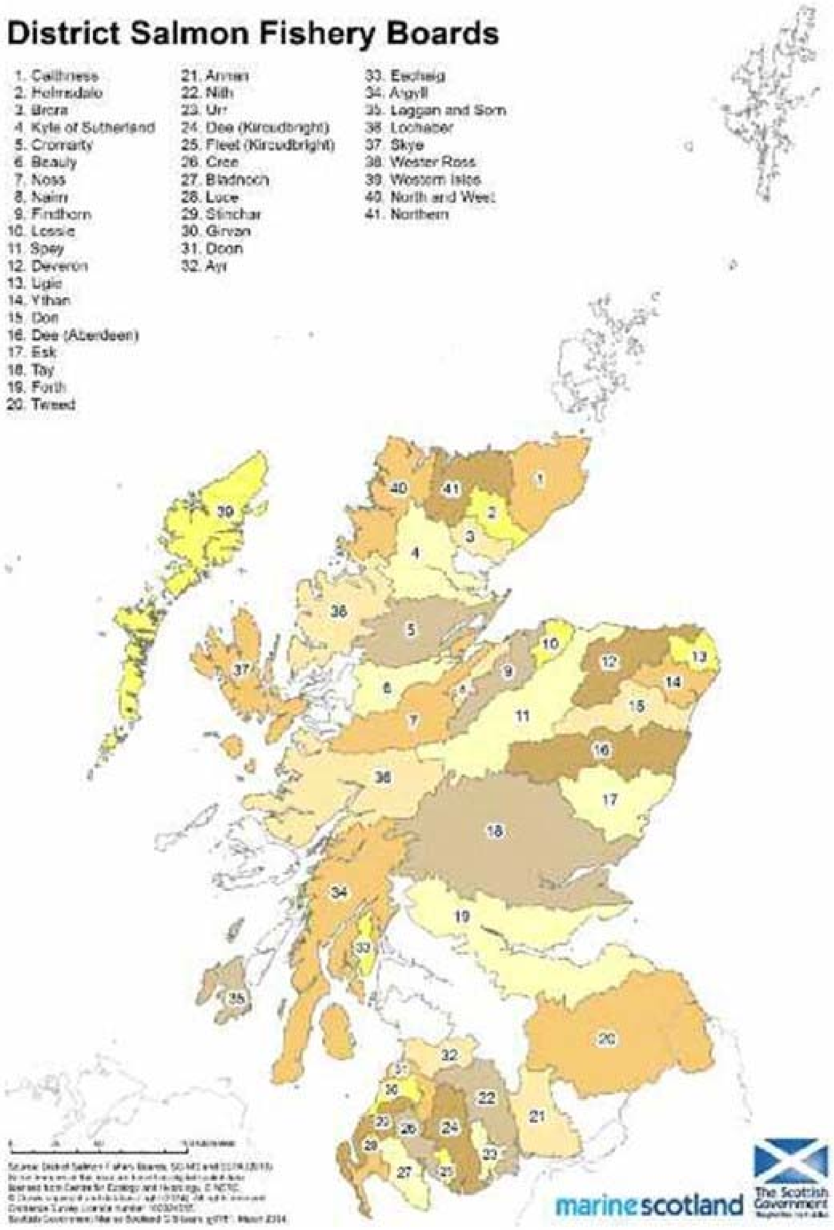

Figure 5-2 District Salmon Fishery Boards (Source: Marine Scotland)

5.2. Baseline Environment

20. This baseline has been informed by a detailed desk-based review of existing data sources. The baseline describes aspects of life history, biological sensitivities, spawning and nursery areas and identifies those species of conservation concern. Many species are highly mobile and widely distributed over both the Development Area and the Offshore Export Cable Corridor.

5.2.1. Benthic Environment

21. A full description of the benthic environment is described in Chapter 4. In summary, the sediment within the Development Area comprises Offshore (Deep) Circalittoral Sediment (SS.SSa.OSa). Within the Offshore Export Cable Corridor the substrate types identified were Circalittoral Fine Sand (SS.SSa.CFiSa), Offshore (Deep) Circalittoral Sediment (SS.SSa.OSa) and in two locations Circalittoral Coarse Sediment' (SS.SCS.CCS).

22. Due to visual quality of the DDV footage it was not possible to identify fish to species level. A number of fish were observed, predominantly flat fish (Pleuronectidae).

5.2.2. Commercial Fisheries Data

23. Commercial fisheries data provides an additional insight into the species found in the vicinity of the Development Area and the Offshore Export Cable Corridor. Analysis of MSS and MMO landings data highlights the dominance of king scallop (*Pecten maximus*) in ICES rectangles 43E8 and 42E8. In addition catches in ICES rectangle 43E7 illustrate the dominance of crab (edible and velvet). A full break down of landings is described in Chapter 14 and Appendix E.

24. Commercial species which contributed to catch in the area are:

- Norway lobster – *Nephrops norvegicus*
- Lobster
- Squat Lobster
- Edible Crab
- Velvet Swimming Crab
- Green Crab
- Pink Shrimp
- Whelks
- King Scallop
- Queen Scallop
- Squid
- Razor clam
- Cod
- Whiting
- Haddock
- Saithe
- Gurnards
- Pollack
- Ling
- Red Mullet
- Turbot
- Halibut
- Brill
- Plaice
- Lemon sole
- Hake
- Dab
- Sole
- Megrim
- Catfish
- Skates and Rays
- Monks or Anglers
- Cuckoo Ray
- Common Skate
- Mackerel
- Horse Mackerel
- Herring

5.2.3. Pelagic Fish Species

25. Pelagic fish species can be described as fish which inhabit the water column, including near surface waters. Distribution of pelagic species can vary significantly annually and can be affected by changes in hydrographic conditions.

26. According to Coull *et al.,* (1998) and Ellis *et al.,* (2012), the following species are likely to be present in the Development Area and the Offshore Export Cable Corridor:

- Mackerel (*Scomber scombrus*)
- Herring (*Clupea harengus*)
- Sprat (*Sprattus sprattus*)

27. As indicated by catch value (Chapter 14), herring and mackerel are the most important species landed by the Scottish pelagic fleet (Cefas, 2001). In addition, by weight mackerel is one of the most abundant pelagic species landed (Chapter 14). Within the Development Area and Offshore Export Cable Corridor landings (averaged 2009-2015) are relatively low.

5.2.3.1. Pelagic Spawning and Nursery Areas

28. Data from Coull *et al.,* (1998) and Ellis *et al.,* (2012) indicate that herring spawn off the northeast coast of Scotland, and spawning is likely to occur within the Development Area and the Offshore

Export Cable Corridor. Data from Ellis *et al.,* (2012) also indicates that high intensity nursery areas for herring are located within the Development Area and the Offshore Export Cable Corridor (Figure 5-3).

29. Data from Coull *et al.,* (1998) and Ellis *et al.,* (2012) show that mackerel do not spawn in the vicinity of the Development Area and the Offshore Export Cable Corridor. However there are low intensity nursery grounds which have been identified (Figure 5-3).

30. Data from Coull *et al.,* (1998) and Ellis *et al.,* (2012) show that sprat have spawning areas and nursery areas close to the Development Area and the Offshore Export Cable Corridor.

31. Figure 5-3 details the spawning and nursery areas identified for the key pelagic species within the Development Area and the Offshore Export Cable Corridor, along with their seasonality and conservation status.

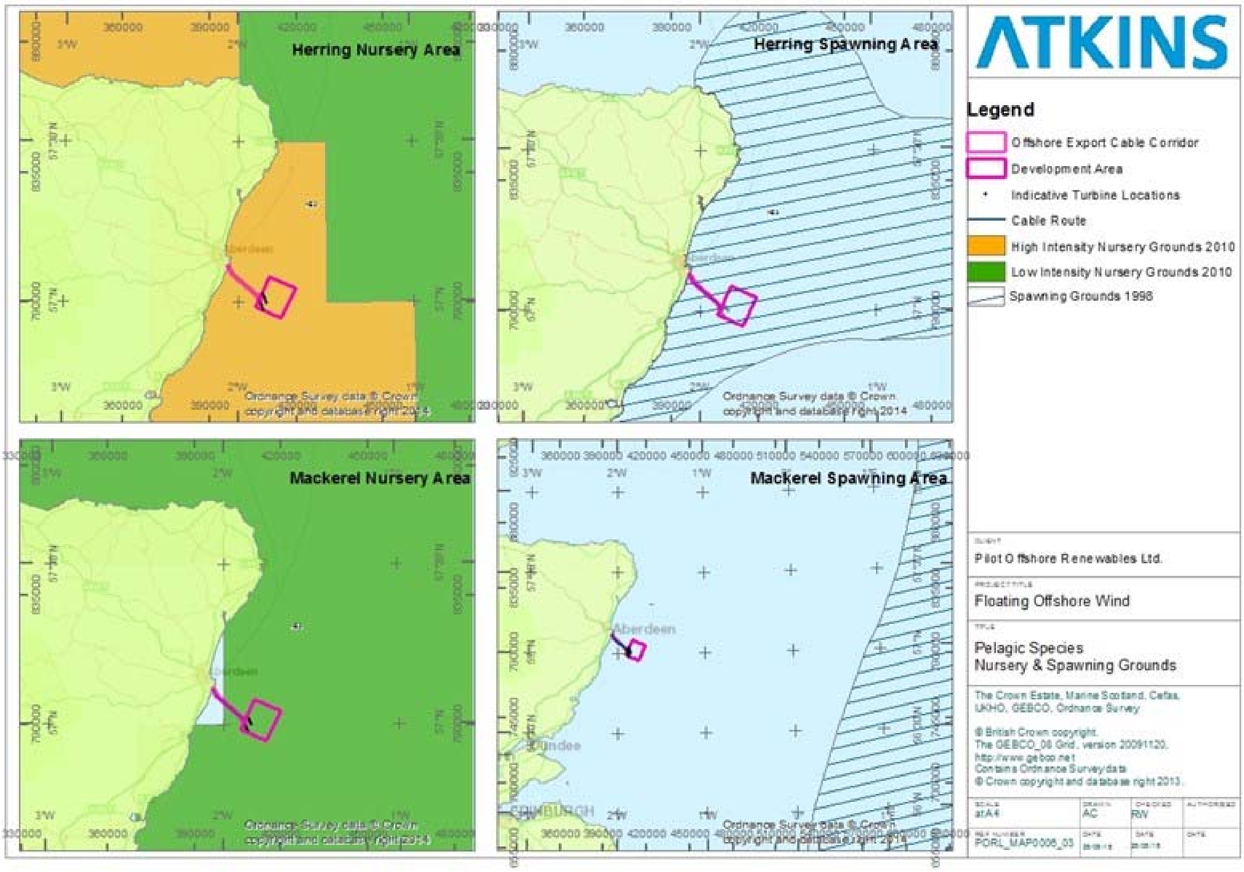

Figure 5-3 Pelagic Species Spawning and Nursery Areas

5.2.3.1.1. Herring

32. Herring are classed as sensitive species as they spawn in well-defined areas. Based on the spawning areas and timing of the spawning period, herring can be divided into sub-populations. Herring which spawn of the east coast of Scotland are known as the Orkney/Shetland and Buchan components. The Buchan component (situated off Peterhead) is the closest sub-population in context to this study and spawn in September and October.

33. Herring eggs are demersal with the larval and post-larval stages being pelagic which drift with the currents. Herring are known to deposit their eggs on a variety of substrates ranging from boulders, rock, small stones, coarse sand, shell fragments, macrophytes and manmade pots which the eggs stick to. However, it is widely considered that gravel is the preferred spawning substrate (Drapeau, 1973; Rogers & Stock, 2001). In addition herring eggs are also known to be an important food source for some predators (Rankine & Morrison, 1989). Herring may be disturbed by and avoid raised suspended sediment levels (Birkuland and Wijsman, 2005). Based on the nature of the active, sandy seabed present in the Development Area and Offshore Export Cable Corridor (as discussed in Chapters 3 and 4), it is unlikely that the area will support herring spawning directly. However it is likely that surrounding areas support herring spawning.

34. Unlike many fish, herring have a specialised adaptation which connects the swim bladder and oesophagus to the inner ear. This adaptation make herring one of the most sensitive fish species to noise (ICES, 2006).

Table 5-2 Pelagic Species with defined spawning and nursery grounds within the Development Area and Offshore Export Cable Corridor (based on information from Coull *et al.*, 1998 and Ellis *et al.*, 2012, taken from Statoil, 2014)

Species	Spawning Grounds		Spawning Season (Month)												Nursery Grounds		Conservation Importance
	Development Area	Offshore Export Cable Corridor	J	F	M	A	M	J	J	A	S	O	N	D	Development Area	Offshore Export Cable Corridor	
Mackerel (*Scomber scombrus)*	n/a	n/a					*	*	*								• Priority Marine Feature • UKBAP • IUCN Red List (Least Concern)
Herring (*Clupea harengus)*																	• Priority Marine Feature • UKBAP • IUCN Red List (Least Concern)
Sprat (*Sprattus sprattus*)	n/a	n/a															• None

Key			
	Low Intensity	*	Peak Spawning Period
	High Intensity		Spawning Period
	Undefined Intensity	n/a	Insufficient information available

NB. Intensity rates (high and low) are defined by catch rates from various surveys across the UK and modelled by Ellis *et al.,* (2012)

5.2.4. Demersal Fish Species

35. Demersal fish species can be described as fish which live on or near the seabed and feed on bottom-living organisms and other fish. Distribution of species is related to abiotic factors such as sediment type (as a refuge), hydrography, competition for habitat and biotic processes (e.g. predator-prey interaction). Demersal species which can be found off the north east coast of Scotland include gadoids (such as cod and haddock), sandeel, flatfish and elasmobranchs (sharks and rays - discussed separately in Section 5.2.5).

36. According to Coull *et al.,* (1998) and Ellis *et al.,* (2012), the following demersal species are likely to be present in the Development Area and the Offshore Export Cable Corridor:

- Whiting (*Merlangius merlangus*)
- Cod (*Gadus morhua*)
- Haddock (*Melanogrammus aeglefinus*)
- Sandeel (*Amodytes marinus*)
- Saithe (*Pollacius virens*)
- Ling (*Molva molva*)
- Plaice (*Pleuronectes platessa*)
- Norway pout (*Trisopterus esmarkii*)
- European hake (*Merluccius merluccius*)
- Lemon sole (*Microstomus kitt*)
- Anglerfish (*Lophius piscatorius*)

5.2.4.1. Demersal Spawning and Nursery Areas

37. Data from Coull *et al.,* (1998) and Ellis *et al.,* (2012) indicate that several demersal fish species spawn in the vicinity of both the Development Area and the Offshore Export Cable Corridor (see Table 5-3). Figure 5-5 and 5-6 show spawning and nursery grounds for identified species.

38. Many demersal species such as cod, whiting and plaice have buoyant eggs which are released into the water column where they remain for several weeks until the pelagic larvae emerge (van Damme *et al.,* 2011). Figure 5-6 details the key demersal species in the area, their conservation status and spawning seasons.

Figure 5-4 Demersal Species Nursery Areas (Coull *et al.,* (1998) and Ellis *et al.,* (2012))

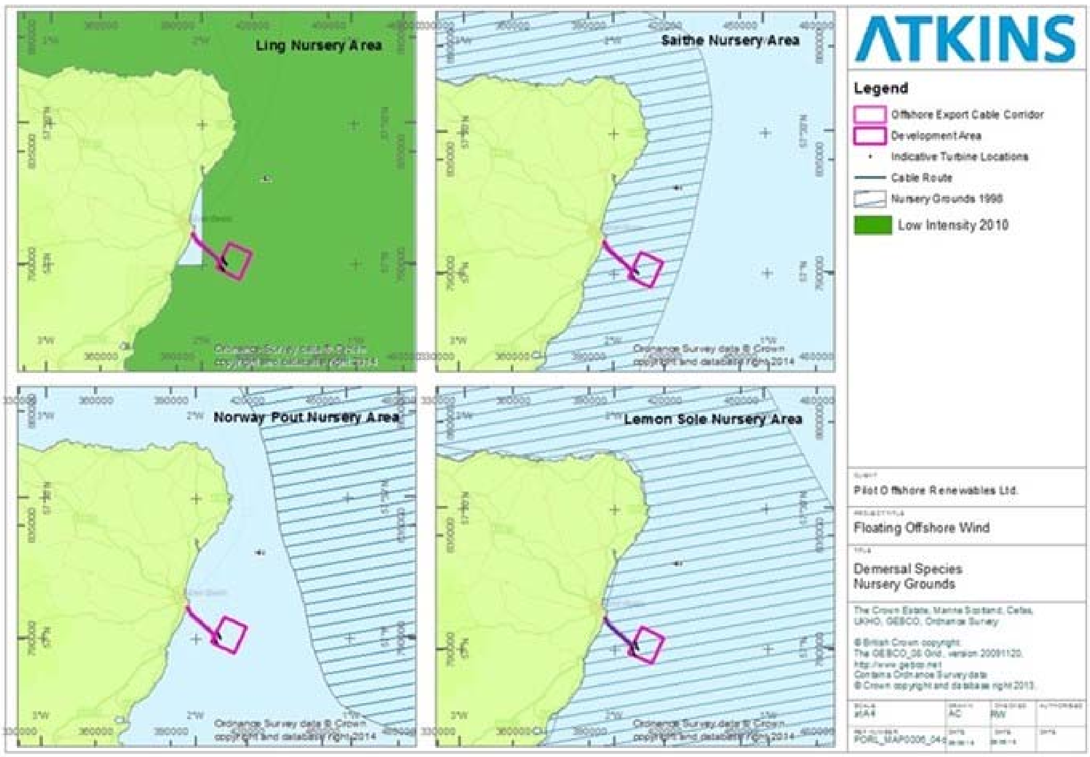

Figure 5-5 Demersal Species Nursery Grounds Continued (Coull *et al.,* (1998) and Ellis *et al.,* (2012))

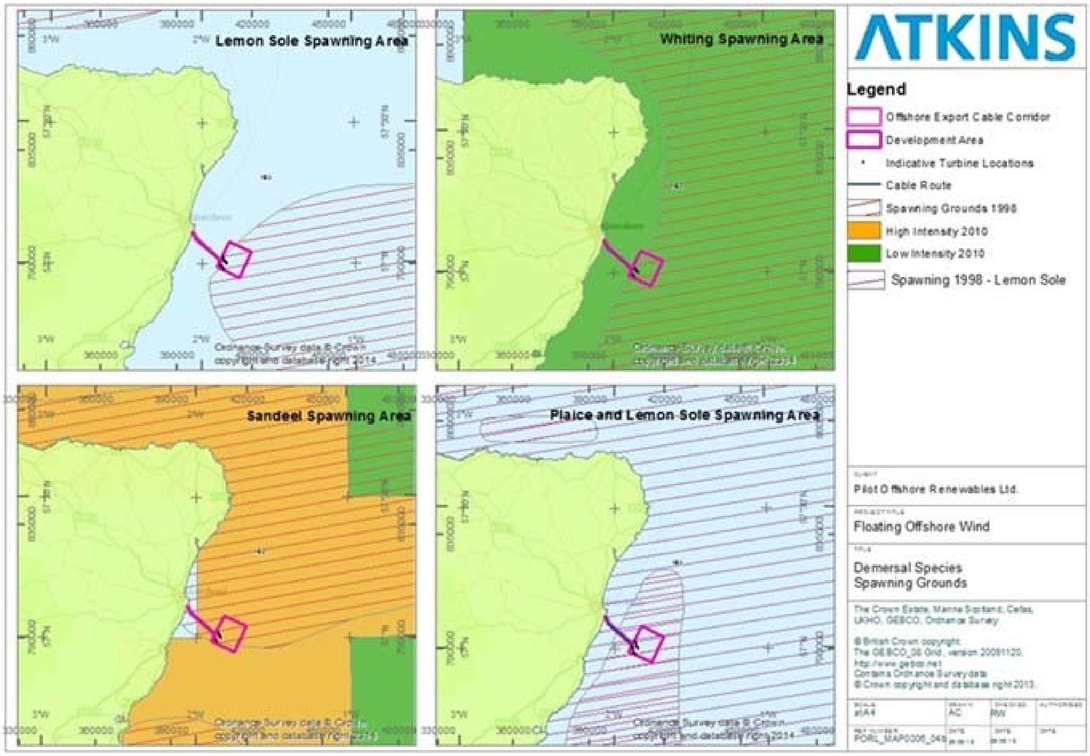

Figure 5-6 Demersal Species Spawning Areas

5.2.4.1.1. Sandeel

39. Sandeel are major predators of zooplankton and therefore play an important role in the North Sea food web. In addition sandeel are the principle prey of main top predators including other demersal fish (e.g. cod), marine mammals and birds.

40. Sandeel occur in many locations on the east coast of Scotland. There are five species of sandeel in the North Sea, however *Ammodytes marinus* is the most common in commercial landings in Scotland. Sandeels are particularly sensitive demersal species as they spawn in specific habitats. Studies have found that sandeel favour seabed's containing a high proportion of medium and coarse sands (particle sizes ≥ 0.25mm to < 2mm) and a low silt content (Holland *et al.,* 2005). Sandeel are also known to prefer depths of 30-70m although they do occur between depths of 15-120m (Holland *et al.,* 2005).

41. The specific habitat preferences of sandeel means that the distribution of post-settled sandeel is patchy. Post settled sandeel are rarely found at depths greater than 15m. Studies have also shown that sandeel are most active in late spring/early summer moving freely between the seabed and the water column. In the autumn and winter months, sandeel are dormant in the sediment except for midwinter spawning emergence (Jensen *et al.,* 2011).

42. Based on the nature of the sediments present in the Development Area and Offshore Export Cable Corridor (as discussed in Chapters 3 and 4), it is likely that the area will support sandeels.

Table 5-3 Demersal Species with defined spawning and nursery grounds within the Development Area and Offshore Export Cable Corridor (based on information from Coull *et al.*, 1998 and Ellis *et al.*, 2012 taken from Statoil, 2014)

Species	Spawning Grounds		Spawning Season (Month)												Nursery Grounds		Conservation Importance
	Development Area	Offshore Export Cable Corridor	J	F	M	A	M	J	J	A	S	O	N	D	Development Area	Offshore Export Cable Corridor	
Sandeel *(Ammodytes marinus)*																	• Priority Marine Feature • UKBAP
Cod (*Gadus morhua*)				*	*												• Priority Marine Feature • UKBAP • OSPAR (Stock depleted and in danger of collapse) • IUCN Red List (Vulnerable although IUCN recognises that this needs to be updated)
Haddock (*Melanogrammus aeglefinus*)	n/a	n/a															• IUCN Red List (Vulnerable although IUCN recognises that this needs to be updated)
Whiting (*Merlangius merlangus*)																	• Priority Marine Feature • UKBAP
Plaice (*Pleuronectes platessa*)			*	*											n/a	n/a	• UKBAP • IUCN Red List (Least Concern)
Lemon sole (*Microstomus kitt*)	n/a	n/a															• None
Anglerfish (Lophiiformes)	n/a	n/a															• Priority Marine Feature • UKBAP
Ling (*Molva molva*)	n/a	n/a															• Priority Marine Feature • UKBAP
European hake (*Merluccius merluccius*)	n/a	n/a		*	*												• UKBAP
Saithe (*Pollacius virens*)	n/a	n/a	*	*											n/a		• Priority Marine Feature

Key			
	Low Intensity	*	Peak Spawning Period
	High Intensity		Spawning Period
	Undefined Intensity	n/a	Insufficient Information Available

NB. Intensity rates (high and low) are defined by catch rates from various surveys across the UK and modelled by Ellis *et al.*, (2012)

5.2.5. Elasmobranch Species

43. The term elasmobranch refers to sharks, rays and skates, also known as cartilaginous fishes (where the skeleton is made from cartilage, not bone). These species are particularly sensitive as they have slow growth rates and low reproductive output (10-100 per year) compared to other species groups (Ellis *et al.,* 2008; McCully Phillips *et al.,* 2015). Due to these biological traits these species have slow rates of stock increase and a low resilience to fishing mortality. Many elasmobranch species are at low stock levels having been highly susceptible to the effects of over fishing. As such, spatial management measures have been introduced to protect remaining stocks (Nicholson *et al.,* 2000; ICES, 2008).

44. Within the North Sea there are approximately ten skate and ray species which occur commonly in addition to several demersal shark species such as tope (*Galeorhinus galeus*) (ICES, 2008). Elasmobranch species which may be present in the area include:

- Basking shark (*Cetorhinus maximus*)
- Spurdog (*Squalus acanthias*)
- Porbeagle (*Lamna nasus*)
- Tope (*Galeorhinus galeus*)
- Lesser spotted dogfish (*Scyliorhnius caniculai)*
- Kitefin (*Dalatias licha*)
- Nurse hound (*Scyliorhinus stellarisi)*

45. Protected elasmobranch species include the basking shark (*Cetorhinus maximus*), which is the second largest fish in the world. The basking shark is typified by slow growth, large size and late sexual maturity. Legislation relating specifically to the basking shark is detailed in Section 5.1.1.

46. Elasmobranch species may be sensitive to effects including noise and electromagnetic fields generated by subsea cables. Studies have shown that some elasmobranch species (lesser spotted dogfish and thornback ray) respond to the presence of electromagnetic fields generated from subsea cables (Gill *et al.,* 2009). When a reaction occurred this was species specific and in some cases individual specific. This will be discussed as part of the impact assessment in Sections 5.4.2.3 and 5.4.5.2.

5.2.5.1. Elasmobranch Spawning and Nursery Areas

47. Ellis *et al.,* (2012) indicate that there are no elasmobranch spawning areas in the vicinity of either the Development Area or Offshore Export Cable Corridor. However, low intensity nursery areas have been identified (Figure 5-7) within the Development Area and the Offshore Export Cable Corridor for:

- Spurdog (*Squalus acanthias*)
- Tope (*Galeorhinus galeus*)
- Common Skate Complex (*Dipturus batis*)
- Spotted Ray (*Raja montagui*)

48. During the desk review no further data were found for these species spawning or having nursery areas within the Development Area and the Offshore Export Cable Corridor. However, habitat preferences for the common skate and spotted ray indicate that they may be present in the area.

49. Common skate prefer sandy and muddy seafloor at depths of 10-600m with juveniles preferring shallower waters (Neal *et al.,* 2008). Spotted ray have a habitat preference for sand and coarse sand-gravel substrates and commonly occur at depths of 28-100m (Ellis *et al.,* 2007). These habitats are similar to those found within the Development Area and the Offshore Export Cable Corridor (Chapter 4).

50. Basking sharks are found in British waters from April around the South West coast of England. The most frequent sighting of basking shark in Scotland occur off the west coast of Scotland in August. Sightings of basking shark were infrequent on the north east coast of Scotland during a study by Nicholson *et al.,* (2000). During the 2013 HiDef Surveys there was only one definite sighting of a basking shark. Basking sharks have a long gestation period of 1-3 years after which females give birth to up to six live pups. Each pup can measure up to 1.5m in length. Mating is thought to occur in early summer and birth in late summer (Fowler, 2005).

51. Table 5-4 details spawning seasons, levels of nursery ground intensity and conservation importance of species identified with nursery areas in the vicinity of the Project.

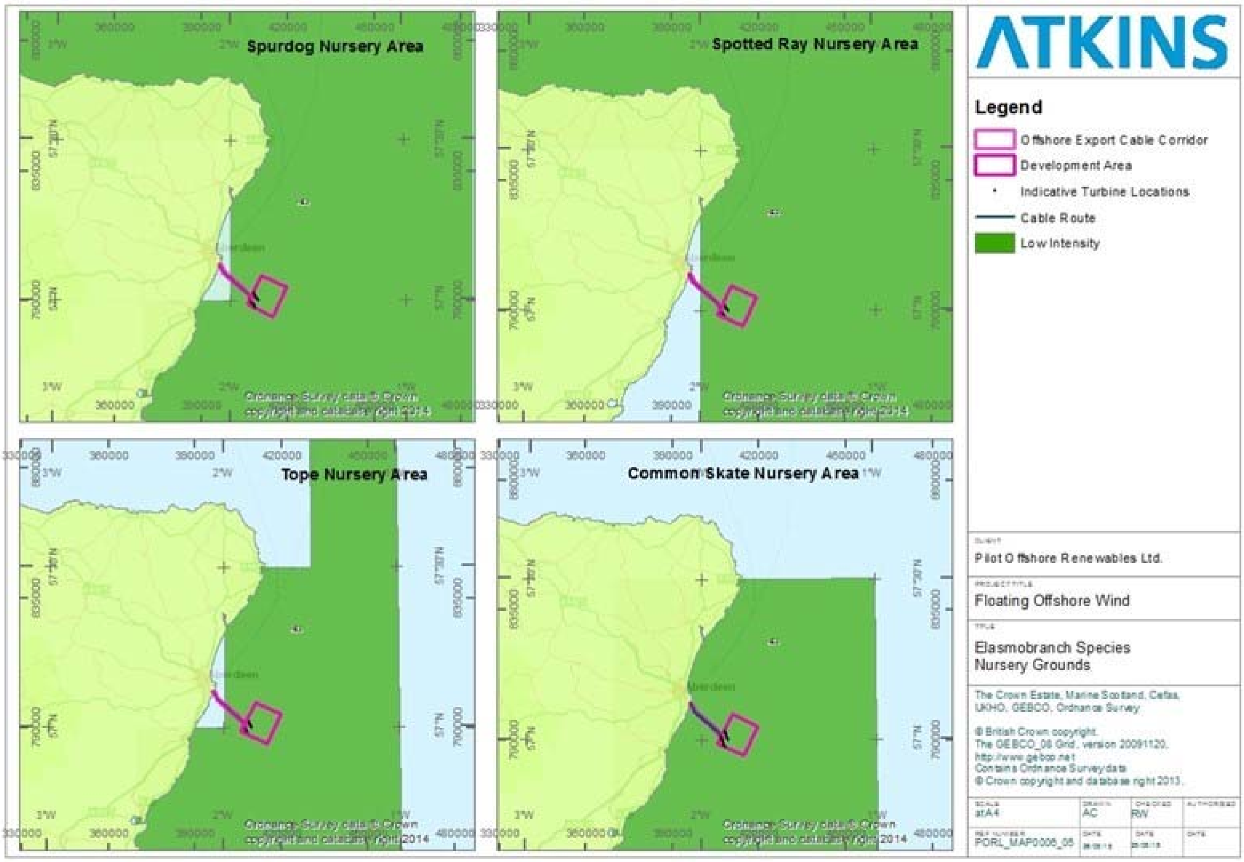

Figure 5-7 Elasmobranch Nursery Areas (Coull *et al.*, 1998 and Ellis *et al.*, 2012)

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Table 5-4 Species with defined spawning and/or nursery grounds (based on Coull *et al.*, 1998 and Ellis *et al.*, 2012, taken from Statoil, 2014)

Species	Spawning Grounds		Spawning Season (Month)												Nursery Grounds		Conservation Importance
	Development Area	Offshore Export Cable Corridor	J	F	M	A	M	J	J	A	S	O	N	D	Development Area	Offshore Export Cable Corridor	
Spurdog (*Squalus acanthias*)	n/a	n/a															• Scottish Nature Conservation MPA search feature (marine life stages) • OSPAR species (stock depleted and in danger of collapse). • IUCN Red List (vulnerable) • UKBAP • Priority Marine Feature
Tope (*Galeorhinus galeus*)	n/a	n/a															• UKBAP • ICUN Red List (vulnerable)
Common Skate (*Dipturus batis*)	n/a	n/a															• Scottish Nature Conservation MPA search feature (marine life stages) • OSPAR species (stock depleted and in danger of collapse). • UKBAP • Priority Marine Feature
Spotted Ray (*Raja montagui*)	n/a	n/a															• OSPAR • IUCN Red List (Least Concern)
Basking shark (*Cetorhinus maximus*)	n/a	n/a															• IUCN Red List (Vulnerable) • UKBAP • European Protected Species (EPS) • Annex II Species • CITES Appendix II

Key			
	Low Intensity	*	Peak Spawning Period
	High Intensity	**	Grounds within 30 km of the Development Area or Offshore Export Cable Corridor
	Undefined Intensity	n/a	Insufficient Information Available
	Spawning Period		

NB. Intensity rates (high and low) are defined by catch rates from various surveys across the UK and modelled by Ellis *et al.*, (2012)

5.2.6. Diadromous Species

52. Diadromous species are defined as those fish species which spend portions of their life cycles both in freshwater and at sea. The identified diadromous species which may pass through the Development Area and/or Offshore Export Cable Corridor occasionally are:

- Atlantic salmon (*Salmo salar*);
- Sea trout (*Salmon trutta*);
- European eel (*Anguilla anguilla*);
- River Lamprey (*Lampetra fluviatilis*);
- Sea Lamprey (*Petromyzon marinus*); and in rare cases
- Sparling (*Osmerus eperlanus*)

53. Atlantic salmon, sea trout and lampreys spend the majority of their lives at sea, returning to freshwater to reproduce. European eel differ, migrating out to sea in order to spawn with larvae making the return journey.

54. Studies have shown that most adult salmon and smolts leave the rivers and travel north either passing through or making use of areas around west Greenland and the Faroe Islands. Smolts are young salmon which migrate to the sea for the first time. Smolts are believed to move offshore in schools to forage. Table 5-5 illustrates the main migratory periods for salmon. However it should be noted that migration times can vary slightly between rivers and between different components of the salmon population within a river. In Scotland smolting normally takes place between April and June, however a small number may reach the size required for spawning in the autumn and drop downstream at this time of year (Maitland and Campbell, 1992). In addition, in relation to adult salmon, stocks comprise a number of distinct temporal components (spring, summer and autumn multi-sea-winter fish and grilse) which means that salmon have the potential to enter Scotland's rivers at any time of the year (Webb *et al*., 2007)

55. Migrating eels are thought to leave European rivers in autumn and the early stages of winter, however very little is known about their behaviour at this time (Orpwood et al., 2015). Studies have reported that eels have been found swimming at depths of 1-17m (averaging around 10m depth) with individuals spending very little time on the sea bed. It is thought that eels spend very little time low down in the water column due to water temperature below the thermocline being too low.

56. Little is known about the distribution of sea lamprey during the marine phase of their lifecycle, reports are varied suggesting a wide range and use of habitats (Maitland, 2003).

57. Sparling (also known as Smelt) are shoaling diadromous migratory fish, distantly related to salmon. Adults enter rivers in early spring to spawn during March and April over a period of over a few days. During this time sparling travel up river to spawn in fresh water before returning to the sea (JNCC, 2014). After spawning, adults return to sea whilst the juveniles remain in the estuary for the remainder of the summer. Many adults die after spawning although some do return to sea, recover and spawn again in later years. Populations of sparling have declined in the UK and are no longer present in many rivers. Most recorded populations of sparling in Scotland are now extinct with the exception of the rivers Cree, Tay and Forth) (Maitland and Lyle, 1996). Sparling have been scoped out of the assessment due to the location of the nearest estuary, the river Tay, being over 130km away.

58. Information on the marine distribution of these species within the Development Area and the Offshore Export Cable Corridor are limited due to gaps in the knowledge of the migratory phases of these species (Malcom *et al.,* 2010). However from available data it may be assumed that species are more likely to be present in the Offshore Export Cable Area rather than the Development Area (Ellis *et al.,* 2012b).

59. Details on salmon and sea trout fisheries are found in Chapter 14.

60. The migratory nature of diadromous species means they may be sensitive to effects such as EMF generated from subsea cables. Salmonids and eels are likely to use EMF for navigational purposes during their long migrations. There is limited knowledge on the effects of EMF on diadromous species and therefore a level of uncertainty in their potential interaction with EMF.

5.2.6.1. Diadromous Species Spawning and Nursery Grounds

61. No spawning or nursery grounds have been identified directly within the Development Area or Offshore Export Cable Corridor. However, they may pass through the area as part of their migration route or as part of their foraging activity. Salmon are present within the River Dee and Don situated to the north of the cable landfall area. The River Dee is also the closest Special Area of Conservation (SAC) to the Project that includes diadromous fish species in its designation.

62. Adult Atlantic salmon returning to rivers on the east coast of Scotland are believed to enter the rivers from the south, migrating up the coast from Northumberland between October and January (Malcom *et al.,* 2010).

Table 5-5 Sensitive periods and conservation status of key diadromous species likely to be present in the area (source: SNH, 2013)

Species	Time of migration to and from natal rivers												Conservation Importance
	J	F	M	A	M	J	J	A	S	O	N	D	
Atlantic salmon (*Salmo salar*)													• Habitats Directive • SAC qualifying feature for the River Dee and the South Esk SACs • Priority Marine Feature • UKBAP • OSPAR species • IUCN Red List Species (lower risk/ least concern) IUCN recognise that this status needs to be updated)
Sea trout (*Salmo trutta*)													• Priority Marine Feature • UKBAP • IUCN Red List (Least concern)
European eel (*Anguilla Anguilla*)													• Priority Marine Feature • UKBAP • OSPAR Species • IUCN Red List (Critically endangered)
River lamprey (*Lampetra fluviatillis*)													• Habitats Directive • Priority Marine Feature • UKBAP • IUCN Red List (Least concern)
Sea lamprey (*Petromyzon marinus*)													• Habitats Directive • Priority Marine Feature • UKBAP • OSPAR Species • IUCN Red List (Least concern)

Key	
	Migration times

5.2.7. Shellfish Species

63. The northeast coast of Scotland is an important area for populations of European lobster, edible crab, *Nephrops* (also known as Norway lobster), squid and scallops. These species are an important element of the commercial fishing industry along the northeast coast and within the Development Area and Offshore Export Cable Corridor (Chapter 14). In addition, these species play in important ecological role as principle prey for larger fish species, marine birds and marine mammals.

64. Squid have been included within this Section as primary information on present species has been sourced from Marine Scotland commercial fisheries landings data. Within the landings data, squid are categorised as shellfish.

65. According to commercial landings data the following shellfish species are present within the Development Area and the Offshore Export Cable Corridor:

- Edible crab (*Cancer pagurus*)
- Velvet swimming crab (*Necora puber*)
- European lobster (*Homarus gammarus*)
- Squid (*Loligo forbesi*)
- Scallop (*Pecten maximus*)
- Norway lobster (*Nephrops norvegicus*)

5.2.7.1. Freshwater Pearl Mussel (FWPM)

66. The freshwater pearl mussel (*Margaritifera margaritifera*) colonise and inhabit clean fast flowing rivers and streams, and spread by way of temporary parasitisation of Atlantic salmon and sea trout. A healthy population of salmonids is essential to the lifecycle of the freshwater pearl mussels. As such their association with salmon and sea trout requires their consideration in the assessment with these species.

67. The complex lifecycle and vulnerability of the freshwater pearl mussel to river pollution has led to significant population declines resulting in full conservation status and protection of the species. The SACs in the River Dee and the South Esk are designated for the freshwater pearl mussel (*Magaritifera margaritifera*) in conjunction with Atlantic salmon (see Section 8.2.2 of the HRA document).

68. Assessment of impacts on FWPM will only be undertaken if a significant impact on salmon and sea trout is identified. This is due to their associated life cycle requirements.

5.2.7.2. Shellfish Spawning and Nursery Areas

Squid

69. Squid occur seasonally on the northeast coast of Scotland. Squid reach sexual maturity at one year and reproduce only once within their limited lifespan. Breeding occurs yearly from autumn to spring. Currently there are no data on spawning or nursery grounds of squid in the vicinity of the Development Area or the Offshore Export Cable Corridor. Little is known about the preferred habitat for squid, however individuals feed on small crustaceans and juvenile fish.

European Lobster

70. Female European lobsters reach sexual maturity at a size of 75-85mm (5-7 years old). Male lobsters mature at a slightly smaller size / age (Beard and McGregor, 2004). Mating occurs in the summer with egg bearing females appearing from September to December. Eggs can be carried for up to 12 months depending on water temperature before hatching in spring and early summer months. Lobster nursery grounds are generally found on rocky ground in coastal waters. Currently there are no data on spawning or nursery grounds of lobster in the vicinity of the Development Area or the Offshore Export Cable Corridor. However, as the habitat is mainly mobile sand, it is therefore not likely to be a very important nursery ground.

<u>**Crabs (Edible)**</u>

71. Female crabs move inshore in late spring to moult, then mate shortly after. Females then move offshore in late summer/early autumn. They move against the prevailing current to ensure that the larvae can drift back to the coastal nursery area. Larvae are released in late spring/early summer where they remain in a pelagic form for two months before settling as juveniles in the intertidal zone in late summer/early autumn. Currently there are no data on spawning or nursery grounds of crabs in the vicinity of the Development Area or the Offshore Export Cable Corridor.

72. Edible crabs are most commonly found in rocky reefs, mixed coarse ground and soft sediments such as that found in the Development Area and Offshore Export Cable Corridor.

<u>**Crabs (Velvet Swimming)**</u>

73. Small individuals are observed on inshore bedrock areas and rocky habitats and most numerous on sheltered shorelines. This habitat is not found within the Development Area or Offshore Export Cable Corridor, and so velvet swimming crab are not expected to be found in the Project area.

<u>***Nephrops norvegicus***</u>

74. Data from Coull *et al.* (1998) indicate that there are *Nephrops* spawning grounds in the vicinity of the Development Area and the Offshore Export Cable Corridor. *Nephrops* are mud-burrowing fauna and are limited in their distribution by the extent of suitable sediments ranging from sandy mud (70% sand, 30% silt and clay) to soft mud (100% silt and clay).

75. A single *Nephrop* was observed (DDV site TV17 see Figure 5-8) in the vicinity of Offshore Export Cable Corridor indicating their presence in the area. The habitats observed (Chapter 3 and 4) do not correlate with the preferred habitat of Nephrops. In addition, this observation was made further north than the Offshore Export Cable Corridor, indicating that Nephrops inhabit areas north of the Project area.

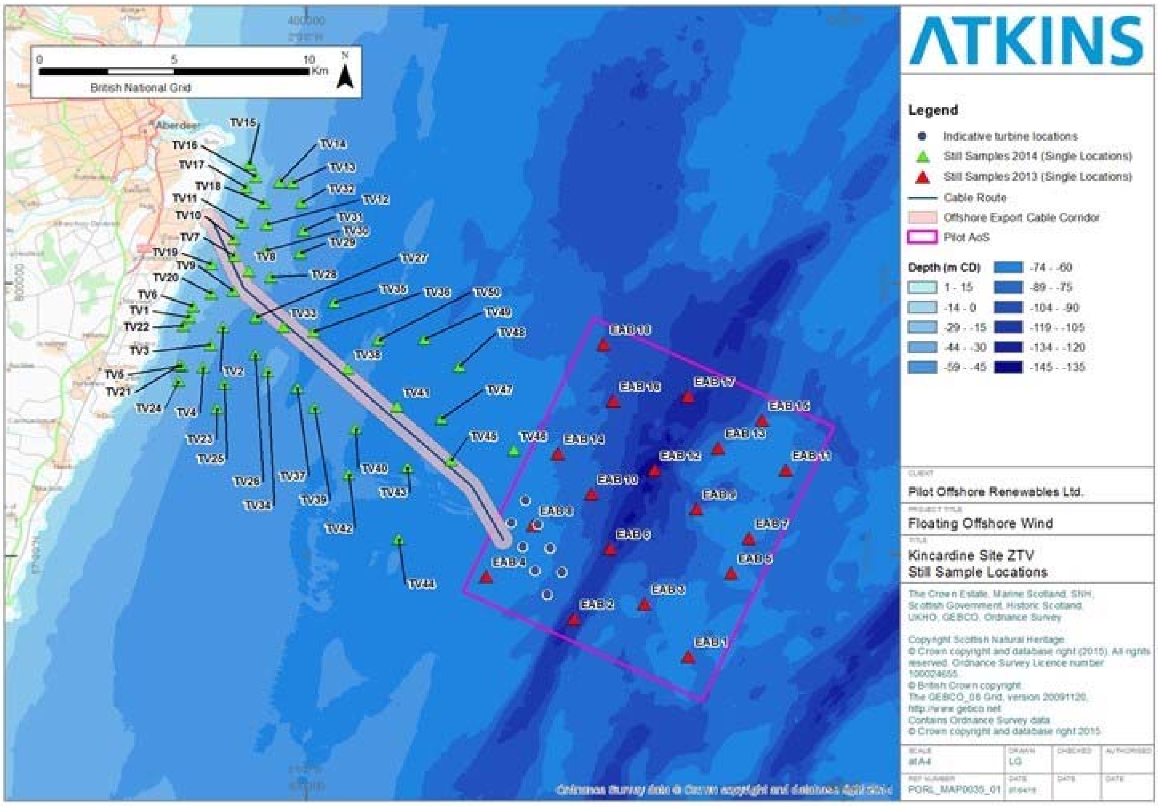

Figure 5-8 Locations of drop-down video (DDV) survey

Scallops

76. Scallops are sedentary for most of their lifecycle which indicate that their spawning areas correspond with the distribution of adults. In Scottish waters spawning occurs in the spring and autumn (Scottish Government, 2008). It is speculated in Pawson (1995) that a minimum density of spawning adults may be necessary to ensure good recruitment. Consequently, productive spawning areas may be restricted by the overall population distribution of the species. It is therefore possible that spawning grounds for scallops may be present in the area however this is based on the presence of sedentary adults only.

Table 5-6 Shellfish species with defined spawning and nursery grounds within the Project Area (based on information off Marine Scotland Website)

Species	Present in Area		Spawning Season												Migration
	Development Area	Offshore Export Cable Corridor	J	F	M	A	M	J	J	A	S	O	N	D	
Squid	Yes	Yes													Inshore migrations; juveniles move from shallow inshore spawning grounds to feeding grounds in deeper water until sexual maturity when they migrate inshore to spawn.
European lobster	Yes	Yes													Only a few miles along the shore.
Edible Crab	Yes	Yes													Female edible crabs may travel 2-3km per day and may undertake migrations of up to 200nm to lay their eggs.
Nephrops	No	No													Do not Migrate
Scallop	Yes	Yes													Do not Migrate

Key	
	Spawning Season

5.3. Assessment Methodology

77. Detail of the EIA process and full methodology are described in Chapter 1. Specific criteria relating to fish and shellfish ecology have been developed for the sensitivity of receptors and magnitude of effect (Table 1-4 and Table 1-5).

78. The potential impacts from construction, operation, maintenance and decommissioning on the Project are identified and their significance assessed with regard to the sensitivity of receptors and the magnitude of effect.

5.3.1. Design Envelope

79. The potential development parameters and scenarios of the Project are defined as a Rochdale Envelope.

80. The assessment of potential impacts on fish and shellfish ecology within this chapter is based on the Rochdale Envelope, with the development methodology and parameters being based on the worst case scenario.

81. For the assessment, these scenarios include:

- Consideration of the maximum number of WTGs with the largest footprint, therefore the maximum loss of area (in this case this is 8 x 6MW WTGs);
- Worst case positioning of WTGs; and
- For the Offshore Export Cable Corridor, it is assumed that two export cables will be required and installed at the shore end via Horizontal Directional Drilling (HDD). These will be laid within a 500m corridor outlined in Chapter 2.

82. Full details of each Project parameter and expected construction and installation times are noted in Table 1.3 in Chapter 1. Key parameters for the worst case scenario for each potential impact are detailed in Table 5-7 and Table 5-8.

Table 5-7 Worst Case Scenario for Development Area

Potential Impact	Design Envelope Scenario Assessed
Construction	
Direct temporary habitat disturbance	Seabed area disturbed resulting from: • Seabed preparation for drag embedment anchors for mooring lines – worst case assumed to be 10 x 10m area per anchor, including pre-tensioning movement. This would give a maximum area (four anchors per WTG = 32 anchors) 3,200m^2 • Maximum 12 inter-array cables Inter-array cable length 2.5km each Inter-array cable diameter 180mm Inter-array cables will not be buried. • 4 drag embedment anchors per substructure • Trench for start of the Export cable • Remedial cable protection will be installed where required along the Export Cable, e.g. localised burial.
Habitat loss	• Installation of four drag embedment anchors per WTG, totalling 32 anchors. • Trench for start of the Export cable. • Remedial cable protection will be installed where required along the Export Cable, e.g. localised burial.
Disturbance or physical injury associated construction and installation noise	• Construction noise from seabed preparations and installations of anchors (see Chapter 8 for more detail)
Operation and Maintenance	

Potential Impact	Design Envelope Scenario Assessed
Construction	
Creation of new habitat from project infrastructure	• Introduction of new substrate which is available for colonisation from the anchor stick-up, chains, floating platforms
Effect on fish and shellfish resources due to reduced fishing pressure in the area	• Qualitative assessment based on worst case recognised as the minimum potential loss of fishing grounds
Effects of EMF and thermal emissions associated with subsea cables	• Longest length and no burial is recognised as the worst case in terms of EMF exposure
Disturbance or physical injury associated with operational noise	• Operational noise from works in the Development Area resulting from WTG operation and maintenance

Table 5-8 Worst Case Scenario – Offshore Export Cable Corridor

Potential Impact	Design Envelope Scenario Assessed
Construction	
Direct temporary habitat disturbance	• The worst case scenario for temporary disturbance of seabed disturbed across the Offshore Export Cable Corridor resulting from Export Cable installation is 0.09 km^2 (15 km cable with two 3 m wide cable trenches). • Remedial cable protection will be installed where required along the Export Cable, e.g. localised burial.
Habitat loss	• Total area of original habitat loss for the Offshore Export Cable Corridor based on 10% of the cables needing to be protected using other means than burial is 0.09 km^2. Maximum 2 cables Cable length 15km each Cable overall diameter 180mm. Cable to be buried to target depth of 1.5m. • If the target burial depth is not reached, remedial cable protection, e.g. concrete mattressing or rock dumping, may be required or if subsequent scour is noted during the regular cable surveys.
Disturbance or physical injury associated construction and installation noise	• Construction noise from seabed preparations for installation of Offshore Export Cable (see Chapter 8 for more detail).
Operation and Maintenance	
Creation of new habitat from project infrastructure	• Introduction of new substrate which is available for colonisation (limited to mattressing or rock dump).
Effect on fish and shellfish resources due to reduced fishing pressure in the area	• Qualitative assessment based on worst case recognised as the minimum potential loss of fishing grounds
Effects of EMF and thermal emissions associated with subsea cables	• The Export Cables will be buried to a depth of at least 1.5m (ground conditions dependent) to protect against trawling/anchoring issues as advised by DECC (2011).

5.3.2. Embedded Mitigation

83. Embedded mitigation measures to minimise environmental effects on fish and shellfish are detailed as follows:

- Cables will be buried to a target depth of 1.5m in accordance with DECC Guidelines (2011) which will reduce the potential for impacts relating to EMF;
- Cables will be specified to reduce EMF emissions as per industry standards and best practice such as the relevant IEC (International Electrotechnical Commission) specifications; and
- Sensitive migration or spawning times will be avoided were possible during construction.

5.3.3. Assessment Criteria

84. The range of impacts considered in the impact assessment is based on the impacts identified during EIA Scoping (Scoping Report) and any further potential impacts which have been highlighted as the EIA has progressed. The impacts identified are:

- Loss of habitat;
- Temporary disturbance to habitat;
- Barrier effects;
- Noise;
- Electromagnetic Fields (EMF) and thermal emissions from subsea cables;
- Loss of spawning and nursery grounds;
- Reduction of fishing pressure; and
- Fish aggregation (FAD) potential.

85. The following impacts were scoped out of the assessment:

- Fish smothering from increased SSC; and
- Pollution due to leaks and spills from vessels or other plant equipment.

86. In order to assess the significance of the impacts (see Chapter 1) on the identified receptors the sensitivity of the receptors and magnitude of effect must be taken into account.

87. For the impact assessment for fish and shellfish, the sensitivity of the identified receptors is defined as either high, moderate, low or negligible based on the following definitions (Table 5-9).

Table 5-9 Definitions of receptor sensitivity

Receptor Sensitivity	Receptor Characteristics
High	Receptor with no capacity to accommodate a particular effect with no recoverability or adaptability. Or the receptor provides a key ecological function.
Moderate	Receptor with low capacity to accommodate a particular effect with low recoverability or adaptability
Low	Receptor with medium capacity to accommodate a particular effect with medium recoverability or adaptability.
Negligible	Receptor is generally tolerant and can accommodate a particular effect without the need to recover or adapt.

88. The magnitude of an effect is quantified where possible, and based on the following four characteristics and is defined as either major, moderate, minor or negligible as defined in Table 5-10:

- Spatial Extent (the geographical range of the effect);
- Duration (how long the effect lasts);
- Frequency (how often the effect occurs); and
- Severity (the degree of change).

Table 5-10 Definitions of the magnitude of effect

Magnitude of Effect	Definition
Major	The effect is on a large scale or spatial extent or occurs for a prolonged period of time or at a high frequency, resulting in extensive temporary changes or permanent changes to baseline spawning/nursery/feeding grounds and/or migratory routes in the Project Area.
Moderate	The effect is over a large scale or spatial extent or occurs long term or at a medium frequency resulting in extensive temporary change or some permanent change to baseline spawning/nursery/feeding grounds and/or migratory routes in the Project Area.
Minor	Effect is localised or occurs for a short duration and no long term noticeable effects above the level of natural variation experienced in the Project Area.
Negligible	Undetectable changes to baseline spawning/nursery/feeding grounds and/or migratory routes in the Project Area.

5.4. Impact Assessment

5.4.1. Development Area - Construction

89. Effects arising from construction and installation of the Project have the potential to impact directly on fish and shellfish species and their related habitats.

90. Chapter 3 states that there is not a significant impact in the increase of SSC. In addition, the increases of suspended sediment will be very small scale and localised. This combined with the mobile nature of species has given grounds for this to be scoped out of this impact assessment

91. The environmental effects from construction are temporary, lasting only through installation activities and a small period after their completion.

5.4.1.1. Direct temporary habitat disturbance

92. Installation of anchors, mooring systems and inter-array cables in the Development Area will result in direct, temporary habitat disturbance. The area calculated to have temporary habitat disturbance is calculated to be 0.129km^2 as discussed in Chapter 4. Temporary disturbance will affect many of the receptors identified in Section 5.2.

93. Habitat disturbance may interrupt spawning or feeding behaviours and deter species from traditional nursery grounds and migration routes, temporarily disturbing the local populations of fish and shellfish. Table 1.3 in Chapter 1 states the expected construction and installation times for installation of mooring lines and inter array cables. Installation times are fourteen days for both elements and are therefore of a short duration.

94. Table 5-11 details the potential significance of this impact for all receptors including pelagic, demersal, elasmobranch, diadromous and shellfish species in relation to the magnitude of effect and specific sensitivity of the receptor.

Table 5-11 Assessment of impacts resulting from temporary habitat disturbance

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Direct temporary habitat disturbance	Pelagic Species	Low and Moderate for herring due to spawning sensitivity of habitat. Pelagic species are likely to temporarily avoid the area during the short construction period. As discussed in Section 5.2.3.1, although the habitat is not ideal, spawning areas for herring are likely to occur within the Development Area, even if this is a 'spill over effect' from more suitable habitats in the surrounding area. Herring are classed as a sensitive species. Additionally, spawning and nursery areas also occur within a much wider geographical context than just the Project area.	Negligible - based on the temporal and spatial limitation of the Development Area. Habitat disturbance is calculated to be 0.129km^2 as discussed in Chapter 4.	Negligible/Minor Minor (Herring only)
	Demersal Species	Low Spawning and nursery areas identified for demersal species are discussed along with conservation importance in Section 5.2.4.1. Sandeel are sensitive due to specific spawning habitats, however there are similar habitats existing in the wider region as discussed in Chapter 4. Similar to pelagic species, demersal species will use avoidance behaviours during the limited construction period.		Negligible/Minor
	Elasmobranchs	Low and Moderate (basking shark only) No spawning areas for elasmobranchs have been identified in the vicinity of the Development Area. Nursery areas for identified species discussed in Section 5.2.5.1 may be present in the vicinity of the area. These species are of high conservation concern, however the nursery areas occur within a much wider geographical context. Elasmobranchs are likely to temporarily avoid the area during the limited construction period. There are similar habitats existing in the wider region.		Negligible/Minor Minor (basking shark only)
	Diadromous Species	Moderate. No spawning or nursery areas were identified in the vicinity of the Development Area. Diadromous species may		Minor

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
		potentially use the Development Area for foraging however none will be reliant on the Development Area for a feeding ground as this is a small proportion of the overall available resources on their migratory route. These species are highly mobile indicating that temporary avoidance behaviours may occur during construction and installation in the Development Area if construction coincides with migration periods. The limited information on salmon and sea trout suggests that migration occurs predominantly inshore (Malcolm *et al.*, 2010). Information suggests that most of the adult migration time is spend swimming in shallow waters (0-40m) (Malcolm *et al.*, 2010). Although construction activities are likely to occur during the salmon migration period (March-June), as the Development Area is located in water depths of >50m migration routes are unlikely to coincide with the Development Area.		
	Shellfish	Low Shellfish are less mobile and have greater site fidelity than most mobile fish species and are therefore likely to be affected more by temporary habitat disturbance than mobile fish species. In the shellfish species in the Development Area are commonly found around the UK and abundance is determined to be high		Negligible/Minor

5.4.1.2. Permanent Habitat Loss

95. The loss of seabed to inter-array cables and anchors has the potential to impact fish and shellfish in a number of ways:

- Changes through predator-prey dynamics resulting from changes in species composition of benthic fauna; and
- Changes through removal of key habitats (spawning and nursery habitats).

96. Changes in prey dynamics have the potential to impact feeding behaviour of adult stocks and therefore their distribution. Many fish species are generalist feeders and it is unlikely that species such as cod and haddock, which feed on a range of pelagic prey (fish, larvae and plankton) will be impacted by changes to seabed communities. The assessment on benthic ecology concluded there will be no significant impact (Chapter 4).

97. The permanent habitat loss due to the presence of inter-array cables, anchors and mooring lines is estimated to be 0.129km^2.

98. Adult fish stocks are not likely to be vulnerable to habitat loss in terms of adaptability, tolerance, their mobile nature and generalist feeding behaviour. However, adult stocks can be affected significantly during spawning, nursery and migratory phases.

99. Table 5-12 details the impact assessment for habitat loss during construction in the Development Area on identified fish and shellfish receptors.

Table 5-12 Assessment of Impacts from Habitat Loss

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Habitat Loss	Pelagic	Low and Moderate (Herring only) Most pelagic fish species have a wide geographical range and a broad diet and are therefore not constrained by dependence on a particular prey item. As such any changes to species composition or prey availability is not predicted to cause any significant effects to adult fish populations in the Development Area. The Development Area encompasses spawning areas for herring and nursery areas for herring, mackerel and sprat (Section 5.2.3.1). However, these grounds are also widely distributed outside the Development Area. In addition the habitats occurring within the Development Area are widely distributed through the wider geographical region (Chapter 4).	Negligible - based on the temporal and spatial limitation of the Development Area. Habitat disturbance is calculated to be 0.129 km^2 as discussed in Chapter 4.	Negligible/Minor Minor (Herring only)
	Demersal	Low Direct loss of habitat is only relevant to a small number of demersal fish species (flatfish), however, due to high mobility and wide geographic ranges these species will be able to use similar, adjacent habitats. Section 5.2.4.1 details the identified spawning and nursery grounds for demersal species. However, these grounds are also widely distributed outside the Development Area.		Negligible/Minor
	Elasmobranchs	Section 5.2.5.1 details the identified nursery grounds for elasmobranchs. No spawning grounds were identified within the Development Area. However, these grounds are also widely distributed outside the Development Area. In addition the habitats occurring within the Development Area are widely distributed through the wider geographical region (Chapter 4).		Negligible/Minor Minor (basking shark only)
	Diadromous	Moderate		Minor

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
		Long term loss of habitat from construction will have a limited impact in diadromous species since they are not thought to rely on specific habitats within the Development Area for any particular ecological function such as spawning and feeding. The seabed habitats in the Development Area are no more important in terms of prey resource than surrounding areas. No spawning or nursery grounds have been identified within the Development Area. However the Development Area may be used as part of their migration route. Diadromous species may potentially use the Development Area for foraging, however none will be reliant on the Development Area for a feeding ground as this is a small proportion of the overall available resources on their migratory route. The habitats occurring within the Development Area are widely distributed through the wider geographical region (Chapter 4).		
	Shellfish	Low Shellfish are less mobile and have greater site fidelity than mobile fish species and are therefore likely to be affected more by habitat loss than mobile fish species. Shellfish will be displaced from areas with permanent infrastructure such as anchors and inter-array cables. Chapter 4 determines the loss of habitat on benthic ecology as minor as the habitats occurring within the Development Area are widely distributed through the wider geographical region. These species will therefore be able to use similar, adjacent habitats and will not be affected at a population level.		Negligible/Minor

5.4.1.3. Disturbance or Physical Injury Resulting from Noise Generated During Construction

100. The following impact assessment considers the potential for subsea noise generated by construction activities to impact fish and shellfish receptors. Details from Chapter 8 have informed this assessment.

101. A variety of sources of noise from construction activities including cable laying, rock placement (as worst case) trenching and vessels may elevate noise levels within the Development Area and cause adverse effects on fish (Chapter 8).

102. Installation of floating offshore structures removes nearly all site construction noise as the units are constructed in port, towed to the site and moored in position, with no piling activities required. Construction related noise is therefore either not generated or significantly reduced as a result of the following:

- There is no piling noise generated;
- The WTG installation vessels spend a limited time on site during construction; and
- KOWL is a small scale development with a short on-site construction phase.

103. Effects of noise on fish are becoming more widely understood and have been assessed specifically for more traditional offshore windfarms using piling methods. Effects are likely to be species specific and may be seen in all life stages from eggs and larvae to mature adults. There is a large variation in anatomical, behavioural and physiological variation among fish which affects the way various species detect and process sound. Despite this, two general categories can be identified as receptors for the noise assessment:

- Hearing generalists which either do not have a swim bladder or one that is poorly developed or is not connected to the inner ear (e.g. sandeels). Elasmobranchs and shellfish are also considered hearing generalists for this assessment); and
- Hearing specialists which have a swim bladder connected to the inner ear (e.g. herring and sprat). Cod are also hearing specialists for this assessment as the anterior part of the swim bladder is in close proximity to the inner ear.

104. The thresholds for mortality, physical injury and traumatic hearing loss for fish species in general from noise generating activities are detailed in Table 5-13 this is used as the worst case thresholds for hearing specialists and therefore it is expected that hearing generalists are more tolerant to sound levels.

Table 5-13 Noise thresholds of fish species in general and taken as (from Nedwell and Brooker, 2008)

Effect	Level
Lethal Effect	Peak to peak levels exceed 240 dB re.1μPa, or an impulse of 100Pa.s.
Physical Injury (e.g. damage to swim bladders or other organs)	Peak to peak levels exceed 220 dB re.1μPa, or an impulse of 35Pa.s.
Traumatic hearing loss	Predicted to occur with sound levels of 130dBht.

105. Below these levels, behavioural and physiological responses may be displayed by fish species, which may affect important feeding, spawning and migration activities.

106. Noise levels as detailed in Chapter 8 are not classed as significant in causing lethal effect, physical injury or traumatic hearing loss for cable laying, rock placement, trenching or vessel noise (medium sized vessels).

107. The magnitude of effect is considered to be negligible due to the small areas of effect around installation activities temporally and spatially due to the restricted nature of cable and anchor activities.

108. Table 5-14 details the impact assessment for noise during construction in the Development Area on identified fish and shellfish receptors.

Table 5-14 Assessment of impacts for noise generated from construction

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Disturbance or physical injury associated construction and installation noise	Pelagic	Low and Moderate (herring only) The majority of pelagic species can be classed as hearing generalists with the exception of herring and sprat which are classed as hearing specialists. Pelagic species which are disturbed will avoid the feeding grounds adjacent to the area of works due the widespread availability of similar feeding grounds. In addition spawning and nursery grounds cover a wide geographical extent. Avoidance and behavioural responses of herring and sprat to subsea noise may result in decreased feeding activity, potential avoidance of spawning grounds and nursery areas.	Negligible based on the localised nature of the potential impact combined with the very temporal and spatial limitation of the Development Area.	Negligible/Minor Minor (Herring only)
	Demersal	Low The majority of demersal species can be classed as hearing generalists with the exception of cod. Avoidance and behavioural responses of cod to subsea noise may result in decreased feeding activity, potential avoidance of spawning grounds and nursery areas. Demersal species which are disturbed will avoid the feeding grounds adjacent to the area of works due the widespread availability of similar feeding grounds. In addition spawning and nursery grounds cover a wide geographical extent.		Negligible/Minor
	Elasmobranchs	Low for all species for this impact Elasmobranchs do not have a swim bladder or other air-filled cavity. They are incapable of detecting sound pressures and therefore particle motion is the only sound stimulus which can be detected (Casper *et al.*, 2012). As such it is determined that impacts to elasmobranchs will be less than those for other species of fish.		Negligible/Minor

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
	Diadromous Species	Moderate The swim bladder of salmon does not play a role in the hearing of the species. Studies by Hawkins and Johnstone (1978) found salmon show low sensitivity to noise. Their ability to respond to noise is regarded as poor with a narrow frequency span and a limited ability to discriminate between different noises. It is therefore unlikely that noise levels generated during construction of the Development Area will affect feeding and migration behaviours of Atlantic salmon. Brown trout very limited information. Sea trout are known to exhibit a high degree of variability and plasticity in their behaviour (Middlemas et al., 2009) Lamprey lack specialist hearing structures and are considered to be hearing generalists (Scottish Government, 2011).		Minor
	Shellfish	Low Studies using lobsters have shown no effect on mortality, appendage loss or ability to regain normal posture after exposure to high noise levels of over 220dB, although some minimal avoidance behaviour was detected (Payne *et al.,* 2007). Reactions to noise and vibrations are not likely to interfere with the ecological function of shellfish, with species likely to return to the area after the impact activity has stopped. Shellfish species such as crabs, lobster and Nephrops are known to produce acoustic signals, however very little is known about their sensitivity to noise or vibrations. André *et al.,* (2011) stated that acoustic trauma is seen in selected cephalopod species, such as the European squid, following exposure to low frequency sound. However, Fewtrell and McCauley (2012) suggest that such alterations are only temporary from experimental studies.		Negligible/Minor

5.4.2. Development Area - Operation and Maintenance

5.4.2.1. Creation of New Habitat from Project Infrastructure

109. The installation of the WTGs, floating substructure and associated anchors may introduce an artificial reef effect. The anchors, mooring lines, possible rock armour protection for cables and submerged portions of the structures could provide habitat for colonising benthic organisms (U.S. Department of Energy, 2011; Bonar *et al.,* 2015).

110. Andersson, (2011) found that the introduction of hard substrate resulting from infrastructure, on soft sandy habitats have the potential to increase the biodiversity on a local scale, with a greater number of fish species recorded after construction due to colonisation. However, the WTG units and associated infrastructure will be installed with antifouling coatings which will inhibit marine colonisation. Maintenance of the structures may also include clearing of biofouling organisms. In addition, inspections of infrastructure may require any colonising organisms to be removed in order for a clear view of the infrastructure to be obtained.

111. The floating substructures may act as Fish Aggregation Devices (FADs) (U.S. Department of Energy, 2011, Bonar *et al.,* 2015). However, this will only impact the area directly around and beneath the structures. The effect of Project infrastructure acting as a fish aggregation device (FAD) is discussed separately in Section 5.4.2.5.

112. The effect of the introduction of a new substrate from the anchor to benthic ecology is discussed fully in Chapter 4 and has been assessed to be negligible/minor. The impact of creation of new habitat from Project infrastructure is considered to be negligible/minor for all receptors as shown in Table 5-15.

Table 5-15 Assessment impacts from creation of habitat from Project infrastructure

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Creation of new habitat from Project infrastructure	Pelagic and Demersal Species	Low Colonisation of the Project infrastructure and introduction of new species (e.g. pelagic species) through increased prey diversity and availability from Project infrastructure is likely at even small scales (Andersson, 2011). However, the habitat is not likely to change over a large extent (area of disturbance 0.129km^2). This area is determined to be negligible within the Development Area and within the wider geographical context. The antifouling coatings and possible removal of biofouling organisms during maintenance will inhibit large quantities of biofouling shellfish. Introduction of subsea infrastructure will provide additional refuge and shelter for species from predation and water movements and additional food sources (Langhammer, 2012). Chapter 4 determined the significance of effect to benthic ecology as negligible/minor and as such it is not thought there will be an associated effect on pelagic or demersal fish species.	Negligible due to size and scale of the project.	Negligible/Minor Negligible/Minor

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
	Elasmobranchs	Low Colonisation of the Project infrastructure and introduction of new species (e.g. elasmobranch species) through increased prey diversity and availability from Project infrastructure is likely at even small scales (Andersson, 2011). However, the habitat is not likely to change over a large extent (area of disturbance 0.129km^2). This area is determined to be negligible within the Development Area and within the wider geographical context. The antifouling coatings and possible removal of biofouling organisms during maintenance will inhibit large quantities of biofouling shellfish. Chapter 4 determined the significance of effect to benthic ecology as negligible/minor and as such it is not thought there will be an associated effect on elasmobranch species.		Negligible/Minor
	Diadromous Species	Low Colonisation of the Project infrastructure and introduction of new species through increased prey diversity and availability from Project infrastructure is likely at even small scales (Andersson, 2011). However, the habitat is not likely to change over a large extent (area of disturbance 0.129km^2). This area is determined to be negligible within the Development Area and within the wider geographical context. In addition, due to the migratory behaviour of diadromous species such as salmon and eel, it is unlikely these species will occur within the Development Area.		Negligible/Minor
	Shellfish Species	Low Colonisation of the Project infrastructure and introduction of new species through increased prey diversity and availability from Project infrastructure is likely at even small scales (Andersson, 2011). However, the habitat is not likely to change over a large extent (area of disturbance 0.129km^2). This area is determined to be negligible within the Development Area and within the wider geographical context		Negligible/Minor

5.4.2.2. Effect on Fish and Shellfish Resources due to Reduced Fishing Pressure

113. Fishing methods such as demersal trawling and scallop dredging effects benthic habitats and associated organisms due to the gear types used. The chains or trawl doors of the trawls and the teeth of the scallop dredge are designed to penetrate the upper few centimetres of the sediment. Several studies on the impacts of trawling and scallop dredging state that these methods are the most disruptive and widespread anthropogenic disturbance on benthic habitats and may substantially alter benthic communities (FAO, 2004).

114. During the operational phase, the potential reduction in fishing activity within the Development Area due to the presence of infrastructure and associated exclusion zones (for safety reasons surrounding the mooring lines) may create a beneficial impact on existing fish and shellfish resources. During operation it is likely that a 500m safety zone will be established around the individual WTGs. The Development Area and exclusion zones (see Chapter 9 for navigational safety reasons) have the potential to act as a No Take Zone (NTZ) (where no fishing can take place) as fishing activities such as scallop dredging, demersal trawling and creeling will not be able to fish in the immediate proximity of the WTGs. Fishing activities and landings trends are discussed in Chapter 14.

115. Table 5-16 details the impact assessment for reduced fishing pressure during operation of the Development Area on identified fish and shellfish receptors.

Table 5-16 Possible positive effect on fish and shellfish due to reduced fishing pressure

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Effect on fish and shellfish due to reduced fishing pressure in the area	Pelagic Species	Low During the operation phase of the windfarm it is likely that no fishing will be possible in the area due to the exclusions zone. The areas of fishing exclusion are relatively small in relation to the adjacent areas which provide similar habitats for fishing (Chapter 4 and Chapter 14) In addition, whilst being important locally to fishermen the area is not extensively fished. Due to uncertainties on how much, if any, fishing pressure would be reduced by the beneficial potential will be negligible/minor (positive) at best for all species, the worst case scenario would be no impact.	Negligible Positive	Negligible/Minor positive
	Demersal Species			
	Elasmobranchs			
	Diadromous Species			
	Shellfish Species			

5.4.2.3. Effects of EMF and Thermal Emissions Associated with Subsea Cables

116. Electromagnetic field (EMF) emissions are generated from the transmission of electricity through cables such as inter-array cables that will be within the Development Area. Cables produce electromagnetic fields which have an electric component and a magnetic component. The direct electric field is blocked through the use of conductive sheathing and it is therefore the magnetic field and resultant induced electric field which is detected in the marine environment.

117. The effects of EMF are largely unknown. Studies to date indicate that EMF emitted by industry standard AC offshore cables are detected by a range of electro-magnetic sensitive fish species such as elasmobranchs (Gill *et al.,* 2005). It has been determined that in close proximity to cables the magnetic component of EMF will be similar to that of the Earth and thus will affect magneto-sensitive species such as pelagic and demersal fish, marine mammals (Chapter 6) and elasmobranchs (Fisher & Slater, 2010).

118. The inter-array cables to be used are 33kV, with significantly less fields surrounding the cables compared to the 132kV cables used in most offshore windfarms. The magnetic field may be up to 6μT at the cable. However, at 2m from the cable this would decrease to approximately 2μT which

is well below that of the Earth's natural magnetic field (between 30μT and 70μT) and may not be detectable by most fish species.

119. The main concerns regarding EMF are that it will interfere with the navigation/orientation of sensitive migratory species (diadromous species) and on a local scale EMF may interfere in foraging behaviour for elasmobranch species. In addition, there are concerns that EMF will change social or reproductive behaviours.

120. It is possible that heat released by subsea cables may increase the temperature in the surrounding sediments and water. This is discussed in more detail in Chapter 4, Section 4.4.2.3. The potential rise in temperature resulting from subsea cables is near impossible to detect against natural fluctuations in surrounding sediments (BERR, 2008).

121. Elasmobranchs and diadromous species are considered the most sensitive to the impact of EMF and are therefore taken forwards as the only receptors for this particular impact.

122. Table 5-17 details the impact assessment for EMF and thermal emissions during operation of the Development Area on identified fish and shellfish receptors.

Table 5-17 Assessment of EMF and thermal emissions associated with subsea cables

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Effects of EMF and thermal emissions associated with subsea cables	Elasmobranchs	Moderate Elasmobranchs are ten thousand times more electro-sensitive than most pelagic and demersal fish species and can detect the magnetic fields that are much weaker than the earth's magnetic field (OSPAR, 2012). Elasmobranchs use electroreceptors to detect the electric fields produced naturally by their prey, the presence of high voltage cables may cause individuals to become confused and spend additional time foraging which will reduce daily food intake and overall fitness. Basking sharks filter-feed on zooplankton (larvae) and it its thought that they identify rich foraging patches through electroreception (Sims and Quayle, 1998). Studies by CMACS (2003 and 2005) show no apparent effect of existing cables on elasmobranch migration and abundance (Faber Maunsell & AECOM., 2007). A COWRIE funded project investigated effects on induced electric fields produce by a cable similar to that used in offshore windfarms. The study found that responses were unpredictable and varied between species and between individuals of the same species (Gill et al., 2009).	Negligible based on the localised nature of the potential impact combined with the very small footprint of inter-array cables and embedded mitigation measures.	Minor
	Diadromous	Moderate The main concern regarding EMF is that it will interfere with the navigation of diadromous fish by affecting the course of their migration causing knock-on effects if they do not reach their feeding, spawning and nursery grounds. Limited information on salmon and sea trout migration suggests predominantly inshore and local use of the marine environment Malcolm *et al.,* 2010). Information available suggests that most of the adult migration time is spend swimming in shallow waters (0-40m) (Malcolm *et al.,* 2010). As the Development Area is located in water depths of >50m migration routes are unlikely to coincide with the Development Area.		Minor

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
		Little is known about the migratory behaviour of European eels (Orpwood *et al.,* 2015). There have however been some studies of field observations of the migratory behaviour of eels over sub-sea cables. Westerberg (2000) observed very small variations in swimming direction in European eel (*Anguilla anguilla*) when crossing HVDC power cables. However there was no overall alteration to migratory behaviour within individuals crossing the cable route area with the same probability in presence and in absence of the cable. Westerberg (2000) concluded that a cable does not result in a permanent obstacle to migration and overall effects on a population are likely to be negligible. In addition studies by Westerberg et al., (2007) concluded that the presence of cables would not pose a threat to migration of eels. Any effect from high intensity magnetic fields will be highly localised and potentially resolved by burial of the cable. Investigations by Orpwood *et al,* 2015 indicate that high voltage AC cables may be detected by eels but do not constitute a barrier to migration. There is very little information present for EMF impacts on sea lamprey.		

5.4.2.4. Disturbance or Physical Injury Associated with Operational Noise

123. Sources of operational noise will include WTG vibration and maintenance vessel noise (see Chapter 8 for noise assessment). Operation and maintenance may involve an increase in vessel traffic compared to baseline conditions (see Chapter 8 and 9). It is likely that during any maintenance activities, background noise and vibrations from vessel engines will increase in the surrounding environment both within the Development Area and from commuting vessels to and from the Development Area. However, due to the proximity to Aberdeen harbour (19km), there will be a relatively high level of vessel movements already occurring in the area (see Chapter 9 for vessel movements). Operational noise from offshore windfarms has been reported to be in the region of 2dB noisier than the surrounding sea environment (Nedwell, *et al.,* 2007). This increase is not thought to have lethal effects or cause damage to fish species.

124. The impacts of increased noise on fish and shellfish is discussed in detail in Section 5.4.1.3. The same conclusions drawn for disturbance from construction noise apply to operational noise levels (see Table 5-13). The highest significance determined is minor with respect to diadromous species due to their sensitivity. The receptor significance of pelagic and demersal fish, elasmobranchs and shellfish is determined as negligible/minor.

5.4.2.5. Creation of Fish Aggregation Device (FAD) due to Presence of Project Infrastructure

125. During the operational phase of the Project, the presence of floating subsea infrastructure has the potential to act as a fish aggregation device (FAD). Generally FADs are floating substructures in the marine environment which attract species of fish. (U.S. Department of Energy, 2011 and Bonar *et al.,* 2015).

126. As a result of colonisation by flora and fauna on the structures this may lead to an increase in food availability for some species. Studies have shown that fish assemblages associated with FADs supporting a well-developed biofouling community were larger and more species-rich than those around FADs devoid of a biofouling community (Nelson, 2003). Studies have shown that it requires approximately five years for stable community changes to become noticeable around FADs (Jensen, 2002; Hille Ris Lambers and Ter Hifstede, 2009; Lindeboom *et al.,* 2011). There will be some biofouling of the structure, but these will be limited through the use of anti-fouling coatings and inspection surveys. Therefore colonisation is determined to be minimal.

127. Species do not use the impacted areas at the exclusion of other habitats, suggesting that other habitats outside the Project Area will still be required to provide a number of key functions such as refuge areas. In addition while the introduction of FADs may be beneficial to fish species, it is not known whether they increase populations locally or simply act as an aggregation device for existing fish resulting in a spatial shift in fish resources. Any increases in fish populations are expected to be imperceptible in the context of the wider populations. The potential refuge the turbine substructure may provide is likely to only enhance the population by a small degree.

128. Studies on fixed structures in relation to the operational phase fish surveys reported in the strategic review of offshore windfarms (Cefas, 2009) noted that there were no major changes in fish species composition from any of the sites studied. This indicates that no major FAD effects were created by the presence of fixed offshore windfarm infrastructure and is relatable to the anchors and cables of the floating substructures.

129. Due to the distance between the WTGs and scale of the Project it is not expected that a significant FAD effect will take place.

130. For the purposes of this assessment, effects on species from FADs are only predicted for pelagic, demersal and elasmobranch species. No secondary impacts are thought to occur from FAD impacts on shellfish or other species such as birds (Chapter 7) and marine mammals (Chapter 6), however these are discussed in their respective chapters.

131. Table 5-18 details the impact assessment for creation of FADs during operation of the Development Area on identified fish and shellfish receptors.

Table 5-18 Assessment of Fish Aggregation Device resulting from Project infrastructure

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Fish Aggregation Device due to presence of Project infrastructure	Pelagic and Demersal Species	Low and Moderate (herring only) Pelagic and demersal fish species are attracted to structures acting as FADs (Wilhelmsson *et al.*, 2006). Species use the new infrastructure as refuge or shelter from currents or for foraging on fauna which may have colonised the structures. Studies from around oil platforms in the North Sea have shown large aggregations of mackerel, cod and saithe in close proximity to the structures (Fujii, 2015). In addition studies showed well defined gradients in which enhanced fish density declines sharply beyond 100-300 m from the structures (Lokkeborg *et al.*, 2002). However in order to enhance a local population it is not sufficient for fish to just be attracted to a structure as it may represent a simple redistribution of fish to a more confined area (Bohnsack, 1989). It is thought that FADs act as devices which concentrate fish stocks rather than increase recruitment levels of juveniles to adult populations (Inger *et al.*, 2009). Given the small size and scale of the Project and distance between WTGs a significant FAD effect is not expected.	Negligible based on the localised nature of the potential impact combined with the very small footprint of infrastructure.	Negligible/Minor

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
	Elasmobranchs	Low FADs may attract larger numbers of elasmobranchs to the area in association with larger prey numbers at the surface, within the water column. However, as with pelagic and demersal species due to small size and scale of the Project and distance between WTGs a significant FAD effect with relation to elasmobranchs is not expected. In addition only a small effect is predicted for prey species and therefore there will only be a small knock-on effect for predators		Negligible/Minor
	Diadromous Species	Low The creation an FAD is not predicted to affect diadromous species during migration other than as a possible refuge. FAD effects are predicted to be low, due to the small size of the Project and distance between WTGs.		Negligible/Minor

5.4.3. Development Area - Decommissioning

132. Potential effects from decommissioning are considered to be less than the worst case effects assessed in the construction phase (Section 5.4.1). The decommissioning approach is described in Chapter 2. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 and subject to approval by the Department of Energy and Climate Change (DECC) prior to implementation.

133. No seabed preparation for cables will be required for the removal of the inter-array cables, mooring lines and anchors causing a minimal amount of material to be suspended in the water column. There will be no other works or structures used, such that the scale of works will be no greater than that of the construction phase. It is therefore considered that the identified impacts will be no greater than those predicted for the construction phase.

5.4.4. Offshore Export Cable Corridor - Construction

5.4.4.1. Direct Temporary Habitat Disturbance

134. Installation of the Offshore Export Cable from the Development Area to landfall will result in direct, temporary habitat disturbance from installation of the Export Cables and anchoring of the Export Cable installation vessels. In total, the area affected will cover an area of seabed of 0.045km^2 over the total length of the two Export Cables.

135. Preferred cable protection is burial to a depth of 1.5m in accordance with DECC guidelines (2011). As such disturbance is determined to be temporary as the dredged sediment is put back in place to bury the cable. There will be no long term habitat loss associated with the Offshore Export Cables. Table 1.3 in Chapter 1 outlines the anticipated construction and installation durations for elements of the Project. The largest impact to migratory species will be during the installation of the Export Cables however it is anticipated this will be completed within five days and therefore will not cause significant disruption.

136. The majority of benthic species which will be directly affected as a result of installation are thought to recover relatively quickly (see Chapter 4 for detailed discussion).

137. Table 5-19 details the impact assessment for habitat disturbance during construction of the Offshore Export Cables on identified fish and shellfish receptors.

Table 5-19 Assessment of habitat disturbance from construction of the Offshore Export Cable Corridor

Impact	Identified Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Direct temporary habitat disturbance from Offshore Export Cable Corridor	Pelagic Species	Low and Moderate (herring only) Temporary habitat disturbance from installation of the Offshore Export Cable is predicted to have a limited effect on pelagic species. This is due to their high level of mobility, broad diet and the very small area affected which will allow the species to use similar adjacent areas. There are similar habitats existing in the wider region as discussed in Chapter 4. As discussed in Section 5.2.1 spawning areas for herring are likely to occur within the Offshore Export Cable Corridor. Herring are classed as sensitive species due to their specific habitat preferences for spawning. However, spawning and nursery areas occur within a much wider geographical context.	Negligible - based on the temporal and spatial limitation of the Offshore Export Cable Corridor and embedded mitigation measures. Habitat disturbance is calculated to be $0.045km^2$ as discussed in Chapter 4.	Negligible/Minor Minor (Herring only)
	Demersal Species	Low Spawning and nursery areas identified for demersal species are discussed along with conservation importance in Section 5.2.4.1. Sandeel are sensitive due to specific spawning habitats, however there are similar habitats existing in the wider region as discussed in Chapter 4. Most other species spawn within the water column and as such critical spawning habitats will not be affected. Similar to pelagic species, demersal species will use avoidance behaviours during the limited construction period.		Negligible/Minor
	Elasmobranchs	Low No spawning areas for elasmobranchs have been identified in the vicinity of the Offshore Export Cable Corridor. Nursery areas for identified species discussed in Section 5.2.5.1 may be present in the vicinity of the area. These species are of high conservation concern, however, the spawning areas occur within a much wider geographical context. Elasmobranchs are likely to temporarily avoid the area during the limited construction period. There are similar habitats existing in the wider region as discussed in Chapter 4.		Negligible/Minor

Impact	Identified Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
	Diadromous Species	Low No spawning or nursery areas were identified in the vicinity of the Offshore Export Cable Corridor. Diadromous species may potentially use the Offshore Export Cable Corridor for foraging however none will be reliant on Offshore Export Cable Corridor for a feeding ground as this is a small proportion of the overall available resources on their migratory route. These species are highly mobile indicating that temporary avoidance behaviours may occur during construction and installation in the Offshore Export Cable Corridor if construction coincides with migration periods. Disturbance arising from construction activities is not likely to act as a barrier to migrating species due to the small area that may be disturbed at a given time. Although construction activities are likely to occur during the salmon migration period (March-June), the total time of construction is only estimated to be 1 week and effects will be temporary. In addition, Chapter 3 determines that there will not be a significant sediment plume as a result of construction and any increases in SSC will be temporary. Information available suggests that most of the adult migration time is spend swimming in shallow waters (0-40m) (Malcolm *et al.,* 2010), therefore the area affected will likely only be areas closest to shore.		Negligible/Minor
	Shellfish	Low Shellfish are less mobile and have greater site fidelity than mobile fish species and are therefore likely to be affected more by temporary habitat disturbance than mobile fish species. However, many species of shellfish are relatively tolerant to disturbance and individuals are expected to be able to recover quickly with minimal effect on populations (Sabatini and Hill, 2008). In addition the area of disturbance is 0.045km^2 which is relatively small to the similar habitats found in the area. In addition the shellfish species in the Offshore Export Cable Corridor are widely found in the UK and abundance is determined to be high.		Negligible/Minor

5.4.4.2. Disturbance or Physical Injury Associated with Construction Noise

138. Cable laying activities are known to produce noise at a source level of 178dB re 1μPa at one meter from source (Nedwell *et al.*, 2003). Cable laying will take less than a week to complete and therefore noise generated will be of a temporary nature.

139. Table 5-20 details the impact assessment for noise during construction of the Offshore Export Cables on identified fish and shellfish receptors.

Table 5-20 Disturbance or physical injury associated with construction and installation noise for Offshore Export Cables

Impact	Identified Receptor	Sensitivity	Magnitude of Effect	Significance
Disturbance or Physical Injury Associated with Construction and installation noise of the Offshore Export Cable	Pelagic, Demersal and Elasmobranch Species	Low and Moderate (herring & Basking Shark) Modelling for a number of mobile fish species, using measured noise levels during cable burial shows that while levels will be higher than background sea state noise, and will be detectable, the level is below that of 90dBht. Therefore, strong avoidance reactions are not expected for these species (BERR, 2008). Model outputs for cable laying for dab, cod and herring revealed that the audible distances are not estimated to exceed 90Bht beyond 1m. Given the small area which would be affected by noise during construction and installation of the Offshore Export Cable and the large geographical spread of spawning and nursery grounds identified in Section 5.2.3 and 5.2.4 the effect of noise on these species is considered to be very limited.	Negligible - based on the temporal and spatial limitation of the Offshore Export Cable Corridor. Habitat disturbance is calculated to be 0.045 km^2 (per Export Cable) as discussed in Chapter 4.	Negligible/Minor Minor Minor
	Diadromous Species	Moderate Noise from the construction and installation of the Offshore Export Cable has the potential to be detected by diadromous species such as salmon migrating to, and from, freshwater habitats to spawn, noise modelling conducted for general cable construction indicates no avoidance or significant behavioural reactions of salmon (Nedwell *et al.*, 2003).		Minor
	Shellfish	Low Reactions to noise and vibrations are not likely to interfere with the ecological function of shellfish, with species likely to return to the area after the impacts activity has stopped. Shellfish species such as crabs, lobster and Nephrops are known to produce acoustic signals, however, very little is known about their sensitivity to sound or vibrations.		Negligible/Minor

5.4.5. Offshore Export Cable Corridor – Operation and Maintenance

5.4.5.1. Direct Temporary Habitat Disturbance from Operation and Maintenance

140. During the operational phase of the Project, temporary habitat disturbance from any necessary Export Cable reburial will occur. Currently the annual disturbance estimate for reburial is unknown and the potential for remedial cable reburial will be assessed post installation as part of the survey, deploy, monitor scheme. The total area of temporary habitat disturbance caused by the installation of the Offshore Export Cable is 0.045km^2 per cable and it is very unlikely that the whole cable will need to be reburied. The area of temporary disturbance is therefore likely to be less than 0.045km^2.

141. Effects to identified receptors will be the same as identified and discussed in Section 5.4.4.1 and the impact significance predictions will be the same (or potentially less if the whole cable does not need to be reburied) as discussed in Table 5-19.

5.4.5.2. Effects of EMF and thermal emissions associated with Export Cables

142. An overview of behavioural responses to EMF and thermal emissions in respect to inter-array cabling is detailed in Section 5.4.2.3.

143. EMF generated from the Export Cables will be the same as emitted from the inter-array cables as 33kV cables will be used and as such the effects to identified receptors will be similar (see Section 5.9.2.3). The geographical spread of the effect however, is greater as EMF will be emitted along the whole length (15km) of the Offshore Export Cable Corridor running from the Development Area to landfall, passing through different depths of water and potentially creating a barrier to coastal movements for certain receptors.

144. The Export Cables will be buried to a target depth of 1.5m in accordance to DECC (2011) Guidelines. Burial will increase the distance between electro-magnetic fields and contact with fish and shellfish receptors. In general there is a lack of knowledge on the effect of EMF on many fish species particularly diadromous species which leads to a level of uncertainty regarding the potential impact of EMF on diadromous species. Information provided in Table 5-21 is based on information available at the time of writing.

145. Table 5-21 details the impact assessment for EMF and thermal emissions during operation of the Offshore Export Cables on identified fish and shellfish receptors.

Table 5-21 Effects of EMF and thermal emissions associated with the Offshore Export Cables

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Effects of EMF and thermal emissions associated with subsea cables	Elasmobranchs	Moderate Elasmobranchs can detect the magnetic fields that are much weaker than the earth's magnetic field and are ten thousand times more electro-sensitive to most pelagic and demersal fish species (OSPAR, 2012). Elasmobranchs use electroreceptors to detect the electric fields produced naturally by their prey, the presence of high voltage cables may cause individuals to become confused and spend additional time foraging which will reduce daily food intake and overall fitness. Studies at Robin Rigg windfarm identified no significant difference in the distribution of electro sensitive elasmobranchs along the cable corridor after two years of monitoring (Malcom *et al.,* 2013). Basking sharks filter-feed on zooplankton (larvae) and it its thought that they identify rich foraging patches through electroreception (Sims and Quayle, 1998).	Negligible based on the localised nature of the potential impact combined with the very small footprint of Offshore Export Cables.	Minor
	Diadromous	Moderate The main concern regarding EMF is that it will interfere with the navigation of diadromous fish by affecting the course of their migration causing knock-on effects if they do not reach their feeding, spawning and nursery grounds. This is increased during the area of the Offshore Export Cable as EMF is emitted along the complete length (15km). There is therefore the potential to cause a barrier effect to migrating diadromous species. Salmon are reported to predominantly swim in the top 10 m of the water column (Malcom *et al.,* 2010). In addition it is considered that EMF impacts to salmon from subsea cables will not be present in water depths greater than 20m due to attenuation of EMF in seawater (Gill and Bartlett, 2010). Cable burial or other cable protection measures reduce magnetic fields by increasing the distance between the cable and the organism (Armstrong *et al.,* 2015). Studies by Armstrong *et al*., (2015) indicate that there is no evidence that magnetic fields used in experiments changed the passage times of adults or post smolts. Further, there was no evidence that magnetic fields significantly slowed or obstructed movements of salmon. Little is known about the migratory behaviour of European eels (Orpwood *et al.,* 2015). There have however been some studies of field observations of the migratory behaviour of eels over sub-sea cables. Westerberg (2000) observed very small variations in swimming		Minor

		direction in European eel (*Anguilla anguilla*) when crossing HVDC power cables. However there was no overall alteration to migratory behaviour within individuals crossing the cable route area with the same probability in presence and in absence of the cable. Westerberg (2000) concluded that a cable does not result in a permanent obstacle to migration and overall effects on a population are likely to be negligible. In addition studies by Westerberg et al., (2007) conclude that the presence of cables would not pose a threat to migration of eels. Any effect from high intensity magnetic fields will be highly localised and potentially resolved by burial of the cable. Investigations by Orpwood *et al,* 2015 indicate that high voltage AC cables may be detected by eels but do not constitute a barrier to migration.		

5.4.6. Offshore Export Cables - Decommissioning

146. Potential effects from decommissioning are considered to be lower than the worst case effects assessed in the construction phase (Section 5.4.4) due to the Export Cables being left in-situ. The decommissioning approach is described in Chapter 2. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 and subject to approval by the Department of Energy and Climate Change (DECC) prior to implementation.

5.5. Mitigation

147. The assessment of fish and shellfish has assessed the worst case scenario impacts of the Project in isolation and cumulatively. This has concluded that changes to fish and shellfish will be of no more than a minor/moderate impact to identified receptors.

148. From the results of this impact assessment, it has been concluded that the Embedded Mitigation detailed in Section 5.3.2 is appropriate to reduce any potential impacts relating directly to fish and shellfish ecology to an acceptable level. As such, no additional mitigation measures are proposed for the Project.

5.6. Monitoring

149. Monitoring of the cable route, inter-array cables and mooring systems will be undertaken on a regular basis during the operational phase of the Project to ensure they are operating as per the design specifications. Initial surveying will take place twice annually, tailing off during the life cycle of the development if no adverse impacts are identified. These surveys will use ROVs/vessel mounted sensors (i.e. multibeam sonar) to assess the condition of the assets. A full Export Cable route survey will also be undertaken as per the design specifications. This will allow monitoring of the fish and shellfish to be assessed in line with the survey, deploy and monitor scheme that the development will operate within.

5.7. Cumulative Impacts

5.7.1. The Project

150. The impacts identified and assessed as having a potential cumulative effect over the construction, operation, maintenance and decommissioning phases are the same as identified in the Development and Offshore Export Cable Corridor in isolation.

5.7.1.1. Direct, Temporary Habitat Disturbance caused by Construction

151. The combination of construction activities for the Development Area and the Export Cable Corridor will result in a total area of temporary habitat disturbance during construction of 0.174km^2 based on the worst case scenario. As described in the individual assessments (Sections 5.4.1.1 and 5.4.4.1), the disturbance is considered to be localised for the identified receptors in relation to the wider geographical context of available habitat. The proportion of the wider geographical area which is affected by this impact will be no larger than for the Development Area and the Offshore Export Cable Corridor in isolation. As such the discussions and significance of impacts within Tables 5-11 and 5-19 are relevant for the cumulative assessment. The significance of receptors is detailed in Table 5-22.

Table 5-22 Cumulative Assessment of Development Area and Offshore Export Cable Corridor for Direct, Temporary Habitat Disturbance

Impact	Identified Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Direct temporary habitat disturbance	Pelagic Species	Low and Moderate (Herring only) Pelagic species are likely to temporarily avoid the area during the short construction period. As discussed in Section 5.2.3.1, although the habitat is not ideal, spawning areas for herring are likely to occur within the Development Area and Offshore Export Cable Corridor, even if this is a 'spill over effect' from more suitable habitats in the surrounding area. Herring are classed as a sensitive species. Additionally, spawning and nursery areas also occur within a much wider geographical context than just the Project area.	Negligible - based on the temporal and spatial limitation of the Development Area. Habitat disturbance is calculated to be $0.129km^2$ as discussed in Chapter 4.	Negligible/Minor for most species. Minor (herring only)
	Demersal Species	Low Spawning and nursery areas identified for demersal species are discussed along with conservation importance in Section 5.2.4.1. Sandeel are sensitive due to specific spawning habitats, however there are similar habitats existing in the wider region as discussed in Chapter 4. Most other species spawn within the water column and as such critical spawning habitats will not be affected. Similar to pelagic species, demersal species will use avoidance behaviours during the limited construction period.		Negligible/Minor

	Elasmobranchs	Low No spawning areas for elasmobranchs have been identified in the vicinity of the Development Area. Nursery areas for identified species discussed in Section 5.2.5.1 may be present in the vicinity of the area. These species are of high conservation concern, however the nursery areas occur within a much wider geographical context. Elasmobranchs are likely to temporarily avoid the area during the limited construction period. There are similar habitats existing in the wider region		Negligible/Minor
	Diadromous Species	Moderate No spawning or nursery areas were identified in the vicinity of the Development Area or Offshore Export Cable Corridor. Diadromous species may potentially use the Development Area and Offshore Export Cable Corridor for foraging however none will be reliant on these areas for feeding grounds as this is a small proportion of the overall available resources on their migratory route. These species are highly mobile indicating that temporary avoidance behaviours may occur during construction and installation in the Development Area and the Offshore Export Cable Corridor if construction coincides with migration periods. Disturbance arising from construction activities is not likely to act as a barrier to migrating species due to		Minor

		the small area that may be disturbed at a given time. Although construction activities are likely to occur during the salmon migration period (March-June), the total time of construction is temporary and of short duration. In addition, Chapter 3 determines that there will not be a significant sediment plume as a result of construction and any increases in SSC will be temporary. Information available suggests that most of the adult migration time is spend swimming in shallow waters (0-40m) (Malcolm *et al.*, 2010), therefore the area affected will likely only be areas closest to shore.		
	Shellfish	Low Shellfish are less mobile and have greater site fidelity than mobile fish species and are therefore likely to be affected more by temporary habitat disturbance than mobile fish species. However, many species of shellfish are relatively tolerant to disturbance and individuals are expected to be able to recover quickly with minimal effect on populations (Sabatini and Hill, 2008). In addition the area of disturbance is 0.045km^2 which is relatively small to the similar habitats found in the area. In addition the shellfish species in the Development Area and Offshore Export Cable Corridor are widely found in the UK and abundance is determined to be high.		Negligible/Minor

5.7.1.2. Disturbance or Physical Injury Associated With Construction Noise

152. As construction of the windfarm is likely to be a phased approach, there is limited scope for cumulative impacts to occur. The inter-array cables are due to be installed first, followed by the anchors, and then Export Cables, before the floating structures and WTGs are towed to site. Therefore, the significance values stated in the individual assessments in Sections 5.4.1.3 and 5.4.4.2 can be considered as the worst case.

5.7.1.3. Effects of EMF and Thermal Emissions during Operation

153. The effects of EMF and thermal emissions are discussed in more detail in Sections 5.4.2.3 and 5.4.5.2. As discussed, the effects are very localised within the Development Area and the Offshore Export Cable Corridor and do not present a cumulative effect beyond that of the sites assessed individually.

5.7.1.4. Disturbance of Physical Injury Associated With Operation Noise

154. As detectable operational noise is predicated to come from the Development Area only during operation, no cumulative impact of the Project exists.

5.7.1.5. Reduced Fishing Activity Associated With Operation

155. As reduction in fishing pressure during the operational phase is predicted to occur within the Development Area only, no cumulative impact of the Project exists.

5.7.1.6. Creation of New Habitat Due to Presence of Project infrastructure.

156. As creation of new habitat due to Project infrastructure (e.g. anchors) are predicted to occur within the Development Area only, no cumulative impact of the Project exists.

5.7.1.7. Effects of Decommissioning

157. Potential effects from decommissioning are considered to be equivalent to or lower than the worst case effects assessed in the construction phase (Sections 5.4.1 and 5.4.4) due to Export Cables being left in-situ. The decommissioning approach is described in Chapter 2. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 and subject to approval by the Department of Energy and Climate Change (DECC) prior to implementation.

5.7.2. Other Projects

158. All elements of the Project with other relevant projects must be considered together in order to allow a full cumulative impact assessment to be undertaken.

159. No cumulative impacts with onshore windfarms with respect to fish and shellfish have been identified and therefore have been scoped out of the cumulative assessment. Table 5-25 below provides details of the offshore wind projects identified.

Table 5-23: Projects Considered for Cumulative Impacts

Project name	Distance from Pilot Park	Project developer	High level description	Project status
Aberdeen Harbour Expansion	15km	Aberdeen Harbour	Expansion and diversification of the capabilities of the existing Aberdeen harbour at Nigg Bay.	Environmental Statement submitted November 2015
European Offshore Wind Deployment Centre (EOWFL)	17km	Aberdeen Offshore Windfarm Ltd	Offshore wind turbine deployment centre for 11 turbines with up to 100 MW capacity.	Consented
Eastern HVDC link from north Aberdeen to Newcastle upon Tyne	30km	National Grid Electricity Transmission and Scottish Hydro Electricity Transmission Ltd	This cable route will go from Sandford Bay Beach, approximately 30km north of Aberdeen to Hawthorn Pit, just south of Newcastle Upon Tyne.	In Planning
Seagreen Alpha Offshore Windfarm and Seagreen Bravo Offshore Windfarm	34km	Seagreen Wind Energy Limited	Offshore windfarm and export cabling to be developed in three Phases with a total target capacity of 3.5 GW. Phase 1: Alpha and Bravo. 1,050 MW, Export Cable to Carnoustie in Angus. Phase 2: Charlie, Delta and Echo. Phase 3: Foxtrot and Golf.	Phase 1 – consented Phase 2 & 3 – EIA Scoping Opinion issued
Hywind Scotland Pilot Park	45km	Statoil	Pilot project for five 6MW floating wind turbines	Consented
Inch Cape Offshore Windfarm	47km	Inch Cape Offshore Windfarm Ltd	Offshore windfarm up to 213 turbines, covering an area of up to 150km2 with capacity of approximately 1,000 MW.	Consented
Neart na Gaoithe Offshore Windfarm	74km	Mainstream Renewable Power	Offshore windfarm, 75 - 125 turbines, 450 MW with 33km Export Cable to shore.	Consented Offshore construction due to begin in 2015 subject to consent
Moray Offshore Renewables Windfarm (eastern Development Area)	125km	Moray Offshore Renewables Ltd (MORL)	A 1,500 MW windfarm over an area of 125km^2 in the outer Moray Firth. Includes an Export Cable approximately 105 km in length offshore to Fraserburgh and 30km onshore to substation.	1.116 MW consented. Construction planned to begin Q3 2015 to full generation in Q3 2020
Beatrice Offshore Windfarm Ltd (BOWL)	150km	SSE	An offshore windfarm with a maximum of 227 offshore turbines, generating up to 1,000 MW in the outer Moray Firth. Includes an electrical transmission cable along a 65km corridor to the shore at Portgordon and 20km of onshore cable to a new substation at Blackhill hock.	Consented

5.7.2.1. Impacts during Construction and Installation

160. There is the potential for the Project to result in cumulative impacts from the loss of spawning and nursery grounds and simultaneous noise during the installation and construction of the Project. However, impacts will be restricted to very short timescales and only occur over a small geographical area in relation to the wider geographical context of available habitats and will not be significant.

161. In addition, based on information currently available, it is not likely that the construction schedule of the Project will overlap temporally or geographically with other identified windfarms. As such it is not likely that there will be any concurrent construction activities.

5.7.2.2. Impacts during Operation and Maintenance

162. Similarly during the operation and maintenance phases of the Project although there is the potential for cumulative impacts from noise generated during vessel activities and turbine operation and changes in abundance in species due to the presence of Project infrastructure, impacts are predicted to occur over very small geographical area and are not significant. Therefore there is little likelihood of cumulative impacts from the Project and other projects identified in Table 5-23.

5.8. Summary and Residual Impacts

163. The following tables summarise the significance for all effects considered for the Development Area, Offshore Export Cable Corridor and the Project Combined. As the Embedded Mitigation presented in Section 5.3.2 has been deemed sufficient in both the Development Area and Offshore Export Cable Corridor, the impacts presented below (Table 5-24, Table 5-25 and Table 5-26) are residual impacts.

Table 5-24 Summary of Effects - Development Area

Impact	Receptor	Impact Significance	Mitigation	Residual Significance
Construction (and Decommissioning)				
Direct Temporary habitat Disturbance	Pelagic Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (Herring only)	Embedded Mitigation with no Additional Mitigation	Minor (Herring only)
	Demersal Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Elasmobranchs	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (Basking shark only)	Embedded Mitigation with no Additional Mitigation	Minor (Basking shark only)
	Diadromous Species	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Shellfish Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
Habitat Loss	Pelagic Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (Herring only)	Embedded Mitigation with no Additional Mitigation	Minor (Herring only)
	Demersal Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Elasmobranchs	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (basking shark only)	Embedded Mitigation with no Additional Mitigation	Minor (basking shark only)
	Diadromous Species	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Shellfish Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor

Impact	Receptor	Impact Significance	Mitigation	Residual Significance
Disturbance or physical injury from noise	Pelagic Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Demersal Species	Negligible/minor Minor (Herring only)	Embedded Mitigation with no Additional Mitigation	Negligible/minor Minor (Herring only)
	Elasmobranchs	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (basking shark only)	Embedded Mitigation with no Additional Mitigation	Minor (basking shark only)
	Diadromous Species	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Shellfish Species	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Operation				
Creation of new habitat from Project infrastructure	Pelagic Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (herring only)	Embedded Mitigation with no Additional Mitigation	Minor (herring only)
	Demersal Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Elasmobranchs	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (basking shark only)	Embedded Mitigation with no Additional Mitigation	Minor (basking shark only)
	Diadromous Species	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Shellfish Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
Effects of fish and shellfish from reduced fishing pressure	Pelagic Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor

Impact	Receptor	Impact Significance	Mitigation	Residual Significance
	Demersal Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Elasmobranchs	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Diadromous Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Shellfish Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
Effects of EMF and thermal emissions	Elasmobranchs	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Diadromous Species	Minor	Embedded Mitigation with no Additional Mitigation	Minor
Disturbance or physical injury from operational noise	Pelagic Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (herring only)	Embedded Mitigation with no Additional Mitigation	Minor (herring only)
	Demersal Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Elasmobranchs	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Diadromous Species	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Shellfish Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
Creation of fish aggregation devices	Pelagic Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Demersal Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor

Impact	Receptor	Impact Significance	Mitigation	Residual Significance
	Elasmobranchs	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Diadromous Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Shellfish Species	No impact	Embedded Mitigation with no Additional Mitigation	No impact

Table 5-25 Summary of Effects - Offshore Export Cable Corridor

Impact	Receptor	Impact Significance	Mitigation	Residual significance
Construction (and Decommissioning)				
Direct Temporary habitat Disturbance	Pelagic Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (Herring only)	Embedded Mitigation with no Additional Mitigation	Minor (Herring only)
	Demersal Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Elasmobranchs	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (Basking shark only)	Embedded Mitigation with no Additional Mitigation	Minor (Basking shark only)
	Diadromous Species	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Shellfish Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
Disturbance or physical injury from noise	Pelagic Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Demersal Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (Herring only)	Embedded Mitigation with no Additional Mitigation	Minor (Herring only)
	Elasmobranchs	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (basking shark only)	Embedded Mitigation with no Additional Mitigation	Minor (basking shark only)
	Diadromous Species	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Shellfish Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor

Operation				
Direct Temporary habitat Disturbance	Pelagic Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (Herring only)	Embedded Mitigation with no Additional Mitigation	Minor (Herring only)
	Demersal Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Elasmobranchs	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (Basking shark only)	Embedded Mitigation with no Additional Mitigation	Minor (Basking shark only)
	Diadromous Species	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Shellfish Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
Effects of EMF and thermal emissions	Elasmobranchs	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Diadromous Species	Minor	Embedded Mitigation with no Additional Mitigation	Minor

Table 5-26 Summary of Effects – The Project

Impact	Receptor	Impact Significance	Mitigation	Residual Significance
Construction (and Decommissioning)				
Direct Temporary habitat Disturbance	Pelagic Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (Herring only)	Embedded Mitigation with no Additional Mitigation	Minor (Herring only)
	Demersal Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Elasmobranchs	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (Basking shark only)	Embedded Mitigation with no Additional Mitigation	Minor (Basking shark only)
	Diadromous Species	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Shellfish Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
Habitat Loss	Pelagic Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (Herring only)	Embedded Mitigation with no Additional Mitigation	Minor (Herring only)
	Demersal Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Elasmobranchs	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (basking shark only)	Embedded Mitigation with no Additional Mitigation	Minor (basking shark only)
	Diadromous Species	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Shellfish Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor

Impact	Receptor	Impact Significance	Mitigation	Residual Significance
Disturbance or physical injury from noise	Pelagic Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Demersal Species	Negligible/minor Minor (Herring only)	Embedded Mitigation with no Additional Mitigation	Negligible/minor Minor (Herring only)
	Elasmobranchs	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (basking shark only)	Embedded Mitigation with no Additional Mitigation	Minor (basking shark only)
	Diadromous Species	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Shellfish Species	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Operation				
Creation of new habitat from Project infrastructure	Pelagic Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (herring only)	Embedded Mitigation with no Additional Mitigation	Minor (herring only)
	Demersal Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Elasmobranchs	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (basking shark only)	Embedded Mitigation with no Additional Mitigation	Minor (basking shark only)
	Diadromous Species	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Shellfish Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
Effects of fish and shellfish from reduced fishing pressure	Pelagic Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor

Impact	Receptor	Impact Significance	Mitigation	Residual Significance
	Demersal Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Elasmobranchs	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Diadromous Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Shellfish Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
Effects of EMF and thermal emissions	Elasmobranchs	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Diadromous Species	Minor	Embedded Mitigation with no Additional Mitigation	Minor
Disturbance or physical injury from operational noise	Pelagic Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor (herring only)	Embedded Mitigation with no Additional Mitigation	Minor (herring only)
	Demersal Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Elasmobranchs	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Diadromous Species	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Shellfish Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
Creation of fish aggregation devices	Pelagic Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
		Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Demersal Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor

Impact	Receptor	Impact Significance	Mitigation	Residual Significance
	Elasmobranchs	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Diadromous Species	Negligible/minor	Embedded Mitigation with no Additional Mitigation	Negligible/minor
	Shellfish Species	No impact	Embedded Mitigation with no Additional Mitigation	No impact

5.9. References

André, M., Solé, M., Lenoir, M., Durfort, M., Quero, C., Mas, A., Lombarte, A., van der Schaar, M., Lopéz-Bejar, M., Morell, M., Zaugg, S. and Houégnigan, L. (2011). Low-frequency sounds induce acoustic trauma in cephalopods. Available Online: http://www.esa.org/pdfs/Andre.pdf [Accessed: August: 2015]

Andersson, M. H., 2011. *Offshore windfarms - ecological effects of noise and habitat alteration on fish.* PhD Thesis, Department of Zoology, Stockholm University. Available Online: http://su.diva-portal.org/smash/record.jsf?pid=diva2:391860 [Accessed: August 2015].

Armstrong, J.D., Hunter, D.C., Fryer, R.J., Rycroft, P. and Orpwood, J.E. Behavioural Responses of Atlantic Salmon to Mains Frequency Magnetic Fields Scottish Marine and Freshwater Science Volume 6 Number 9

Beard, T. W. and McGregor, D. (2004). *Storage and care of live lobsters.* Laboratory Leaflet Number 66 (Revised) Cefas, Lowestoft, 2004. Available Online: http://www.cefas.co.uk/publications/lableaflets/lableaflet66rev.pdf [Accessed: August 2015].

BERR (2008). Review of Cabling Techniques and Environmental Effects applicable to the Offshore Windfarm Industry. Technical Report form Royal Haskoning and BOMEL to the Department of Enterprise and Regulatory Reforms (BERR) in association with DEFRA. Available online from: http://webarchive.nationalarchives.gov.uk/+/http://www.berr.gov.uk/files/file43527.pdf [Accessed: August 2015].

Birklund, J. and Wijsman, J. W. M., 2005. Aggregate extraction: A review on the effects on ecological functions. Report Z3297/10 SAWDPIT Fifth Framework Project no EVK3-CT-2001-00056.

Bohnsack, J.A. (1989). Are High Densities of Fishes at Artificial Reefs the Result of Habitat Limitation or behavioural Preference? Bulletin of Marine Science. 44 (2): pp. 631-645.

Bonar, P.A.J., Bryden, I.G. and Borthwick, A.G.L. (2015). Social and Ecological impacts of marine energy development. *Renewable and Sustainable Energy Reviews.* **47**:pp. 486-495.

Casper, B.M., Halvorsen, M.B. and Popper, A.N. (2012). Are sharks even bothered by a noisy environment? Advances in Experimental Medicine and Biology. 730: pp. 93-97.

Cefas. (2001). North Sea Fish and Fisheries. Technical report produced for Strategic Environmental Assessment – SEA2. Available Online: http://www.cefas.defra.gov.uk/media/20461/tr_003.pdf [Accessed: August 2015]

Cefas (2009). Strategic Review of Offshore Windfarm Monitoring Data Associated with FEPA Licence Conditions, Underwater Noise ME1117.

Conner, D.A., Allen, J.H., Golding, N., Howell, K.L., Lieberknecht, L.M., Northern, K.O. and Reker, J.B. (2004). The Marine Habitat Classification for Britain and Ireland Version 04.05 JNCC, Peterborough. ISBN 1 861 07561 8 (internet version). Available Online: www.jncc.gov.uk/MarineHabitatClassification. [Accessed: February 2015]

DECC. (2011). National Policy Statement for renewable Energy Infrastructure (EN-3). Available Online: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/37048/1940-nps-renewable-energy-en3.pdf [Accessed: June 2015]

van Damme, C., Hoek, R., Beare, D., Bolle, L., Bakker, C., van Barneveld, E., Lohman, M., Os-Koomen, E., Nijssen, P., Pennock, I. and Tribuhl, S. (2011). Shortlist Master Plan Wind Monitoring fish eggs and larvae in the Southern North Sea: Final report Part A. IMARES Wogeningenur.

Drapeau, E. (1973). Sedimentology of herring spawning grounds on Georges Bank. ICNAF Res. Bull 10: 151-162

Ellis, J.R, Clarke, M.W., E, Cortes. Heessen, H.J.L, Apostolaki, P., Carlson, J.K. and Kulka, D.W. (2008). Management of elasmobranch fisheries in the North Atlantic. A.I.L. Payne, A.J. Cotter, E.C.E. Potter (Eds.), Advances in Fisheries Science. 50 Years on from Beverton and Holt, Blackwell Publishing, Oxford (2008), pp. 184–228.

Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. (2012). Spawning and nursery grounds of selected fish species in UK waters. Sci. Ser. Tech. Rep., Cefas Lowestoft, 147: 56 pp.

Ellis, J., Ungaro,N., Serena,F., Dulvy,N., Tinti,F., Bertozzi, M., Pasolini, P., Mancusi,C. & Noarbartolo di Sciara, G. (2007). *Raja montagui*. The IUCN Red List of Threatened Species. Version 2015.2. Available Online www.iucnredlist.org. [Accessed: August 2015].

Faber Maunsell & AECOM. (2007). Scottish Marine Renewables SEA. Environmental Report Section C SEA Assessment: Chapter C18 EMF. Available Online: http://www.gov.scot/Resource/Doc/921/0058879.pdf [Accessed: February 2016]

FAO. (2004). Impact of trawling and scallop dredging on benthic habitats and communities. Available Online: http://www.fao.org/docrep/008/y7135e/y7135e00.HTM [Accessed: August 2015]

Fewtrell, J.L., McCauley, R.D. (2012). Impact of air gun noise on the behaviour of marine fish and squid. *Marine Pollution Bulletin,* 64 (5), 984–993.

Fisher, C. and Slater, M. (2010). Electromagnetic Field Study. Available Online: http://oregonwave.org/oceanic/wp-content/uploads/2015/04/OWET-EMF-on-Marine-Species_FINAL_Full_web.pdf [Accessed: August 2015]

Fowler S.L., 2005. Status of the basking shark: *Cetorhinus maximus* (Gunnerus). In Fowler S.L., Camhi M., Burgess G., Fordham G., Musik J., Sharks, rays and chimaeras. The status of the Chondrichthyan fishes. IUCN species survival commission shark specialist group. IUCN, Gland, Switzerland and Cambridge UK, 461 pp.

Gill, A.B., Gloyne-Phillips, I., Neal, K.J. and Kimber, J.A. (2005). Cowrie Phase 1.5 Electromagnetic Fields Review. The Potential Effects of Electromagnetic Fields Generated by Sub-sea Power Cables associated with Offshore Windfarm developments on Electrically and Magnetically Sensitive Marine Organisms – A Review. Final Report.

Gill, A., Huang, Y., Gloyne-Philips, I., Metcalfe, J., Quayle, V., Spencer, J. and Wearmouth, V. (2009). COWRIE 2.0 Electromagnetic Fields (EMF) Phase 2: *EMF-sensitive fish response to EM emissions from sub-sea electricity cables of the type used by the offshore renewable energy industry*. Commissioned by COWRIE Ltd (project reference COWRIE-EMF-1-06).

Hille Ris Lambers, R., and Ter Hofstede, R. (2009). Refugium Effects of the MEP-NSW Windpark on Fish: Progress Report 2007 IMARES, Wageningen UR Report number: OWEZ R 264 T1 20091110 (demersal) p 23.

Holland G., Greenstreet, S., Gibb, I., Fraser, H. and Robertson, M., (2005). Identifying sandeel Ammodytes marinus sediment habitat preferences in the marine environment. Marine Ecology Progress Series, 303, 269-282.

ICES. (2006). *ICES CIEM ICES Fish Map – Herring*. Available Online: http://ecosystemdata.ices.dk/Map/index.aspx?Action=AddLayer&DataSet=657&LatN=&LatS=&LonE=&LonW=&Sdate=&Edate= [Accessed: August 2015].

Inger, R., Attrill, M.J. Bearhop, S., Broderick, A.C., Grecian, J., Hodgeson, D.J., Mills, C., Sheehan, E., Votier, S.C.m Witt, M.J. and Godlet, B.J. (2009). Marine renewable energy: potential benefits to biodiversity? An urgent call for research. Journal of Applied Ecology. 46 96): pp. 1145-1153.

Jensen, A. (2002). Artificial reefs of Europe: perspective and future. ICES Journal of Marine Science, 59: 3 - 13.

JNCC. (2014). Smelt (*Osmerus eperlanus*). Available Online: http://jncc.defra.gov.uk/page-5667 [Accessed: 10/02/2016]

Langhamer, O. (2012). Artificial Reef Effect in relation to Offshore Renewable Energy Conversion: State of the Art. *The Scientific World Journal. Article ID 386713.*

Lindeboom, H. J., Kouwenhoven, H. J, Bergman, M. J. N., Bouma, S., Brasseur, S., Daan, R., Fijn, R. C., de Haan, D., Dirksen, S., van Hal R, Hille Ris Lambers, R, ter Hofstede, R., Krijgsveld K L, Leopold, M., and Scheidat, M. (2011). Short-term ecological effects of an offshore windfarm in the Dutch coastal zone; a compilation. Focus on the Environmental Impact of Wind Energy Environmental Research Letters Volume 6 Number 36 035101 doi:10.1088/1748-9326/6/3/035101

Løkkeborg, S., Humborstasd, O., Jørgensen, T. and Soldal, A.V. (2002). Spatio-temporal variations in gillnet catch rates in the vicinity of North sea oil platforms. *ICES Journal of Marine Science.* 59: pp. 294–299.

Maitland, P. and Lyle, A. (1996). The smelt *Osmerus eperlanus* in Scotland. Available Online: http://aquaticcommons.org/4571/1/PMaitland.pdf [Accessed: 26/01/2016].

Maitland, P.S. and Campbell, R.N. Freshwater fishes of the British Isles. Colllins. No. 75.

Malcolm, I. A., Godfrey, J. and Youngson, A. F., (2010). Review of migratory routes and behaviour of Atlantic salmon, sea trout and European eel in Scotland's coastal environment: implications for the development of marine renewables. *Scottish Marine and Freshwater Science,* **1**, 14. Available online: http://www.scotland.gov.uk/Resource/Doc/295194/0111162.pdf [Accessed: August 2015].

Malcolm, I. A., Armstrong, J.D., Godfrey, J.D., Maclean J.C. and Middlemas S.J. (2013). The Scope of Research Requirements for Atlantic salmon, Sea Trout and European eel in the Context of Offshore Renewables. *Marine Scotland Science Report 05/13.* Available Online: http://www.gov.scot/Topics/marine/science/Publications/publicationslatest/Science/MSSR/2013/0513 [Accessed: January 2016]

McCully Phillips, S.R., Scott, F. and Ellis, J.R. (2015). Having confidence in productivity susceptibility analyses: A method for underpinning scientific advice on skate stocks? Fisheries Research. In Press, Corrected Proof.

Middlemas, S. J., Stewart, D. C., Mackay, S., & Armstrong, J. D. Habitat. 2009. Use and dispersal of post-smolt sea trout *Salmo trutta* in a Scottish sea loch system. *Journal of Fish Biology,* **74**(3), 639-651.

Nicholson, D., Harris, E. & Pollard, S. (2000). The location and usage of sites in Scotland by the basking shark *Cetorhinus maximus.* Scottish Natural Heritage Commissioned Report F99AA402

Neal, K., Pizzolla, P., Wilding, C. (2008). *Dipturus batis*. Common Skate. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. Available Online: http://www.marlin.ac.uk/speciesfullreview.php?speciesID=3183 [Accessed: August 2015]

Nedwell, J. R., Howell, D. and Langworthy, J. (2003). Assessment of sub-sea acoustic noise and vibration from offshore wind turbines and its impact on marine wildlife; initial measurements of underwater noise during construction of offshore windfarms, and comparison with background noise. Cowrie Report No. 544 R 0424.

Nedwell, J. R. and Brooker, A. G. (2008). Measurement and assessment of background underwater noise and its comparison with noise from pin pile drilling operations during installation of the SeaGen tidal turbine device, Strangford Lough. Subacoustech Report No. 724R0120 to COWRIE Ltd. ISBN: 978-0-9557501-9-9.

Nedwell, J. R., Parvin, S. J., Edwards, B., Workman. R., Brooker, A. G. and Kynoch, J. E. (2007). Measurement and interpretation of underwater noise during construction and operation of offshore windfarms in UK waters. Subacoustech Report No. 544R0738 to COWRIE Ltd. ISBN: 978-0-9554279-5-4.

Orpwood, J.E., Fryer, R.J., Rycroft, P. and Armstrong, J.D. (2015). Effects of AC Magnetic Fields (MFs) on Swimming Activity in European Eels *Anguilla anguilla*). Scottish Marine and Freshwater Science. Volume 6, Number 8.

OSPAR Commission, (2012). Guidelines on Best Environmental Practice (BEP) in Cable Laying and Operation. OSPAR 12/22/1, Annex 14

Payne, J.F., Andrews, C.A., Fancey, L.L., Cook, A.L., and Christian, J.R. (2007). Pilot study on the effect of seismic air gun noise on lobster (*Homarus americanus*). Can. Tech. Rep. Fish. Aquat. Sci. 2712: v + 46.

Peck, M.A., Baumann, H., Clemmesen, C., Herrmann, J.P., Moyano, M. and Temming, A. (2015). Calibrating and comparing somatic-, nucleic acid-, and otolith-based indicators of growth and condition in young juvenile European sprat (*Sprattus sprattus*). Journal of Experimental Marine Biology and Ecology.471: pp. 217-225.

Rogers, S. & Stocks, S. (2001). North Sea Fish and Fisheries. Technical report for Strategic Environmental Assessment (SEA) pp. 72.

Sabatini, M. and Hill, J. (2008). *Nephrops norvegicus*. Norway lobster. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. Available Online: http://www.marlin.ac.uk/speciessensitivity.php?speciesID=3892 [Accessed: August 2015]

Scottish Government. (2008). Scottish Scallop Stocks – Biology and Assessment. Available Online: http://www.gov.scot/uploads/documents/fm20scallopbiology08.pdf [Accessed: August 2015].

Scottish Government. (2011). Habitats Regulations Appraisal of Draft Plan for Offshore Wind Energy in Scottish Territorial Waters: Appropriate Assessment Information Review. *Potential for Adverse Effects on Anadromous Fish and Freshwater Pearl Mussel Features.* Available Online: http://www.gov.scot/Publications/2011/03/04165857/19 [Accessed: January 2016].

U.S. Department of Energy. (2011). Draft Environmental Assessment for University of Maine's Deepwater Offshore Floating Wind Turbine Testing and Demonstration Project. *Office of Energy and Renewable Energy Golden Field Office.* Available Online: http://energy.gov/nepa/downloads/ea-1792-draft-environmental-assessment [Accessed: August2015]

Webb, J., Verspoor, E., Aubin-Horth, N., Romakkaniemi, A. and Amiro, P. (2007). The Atlantic Salmon. *In* The Atlantic salmon: Genetics, Conservation and Management. Pp. 17-56.

Westerberg, H. (2000) Effect of HVDC cables on eel orientation. In Merck, T & von Nordheim, H (eds). Technishe Eingriffe in marine Lebensraume. Published by Bundesamt fur Naturschutz.

Westerberg, H & Begout-Anras, M.L. (2000) Orientation of silver eel (Anguilla anguilla) in a disturbed geomagnetic field. Advances in Fish Telemetry. Proceedings of the Third Conference on Fish Telemetry in Europe, Norwich, England, June 1999. Eds. Moore, A. & Russel, I. Cefas Lowestoft.

Westerberg, H. (1994). Fiskeriundersökningar vid havsbaserat vindfraftverk 1990-1993. Rapport, Fiskeriverket, Utredningskontoret, Jönköping, pp. 1-44. (In Swedish). Cited in: Gill, A.B. & Bartlett, M. (2010). Literature review on the potential effects of electromagnetic fields and subsea noise from marine renewable energy developments on Atlantic salmon, sea trout and European eel. *Scottish Natural Heritage Commissioned Report No.401.*

Wilhelmssin, D., Malm, T. and Ohman, M.C. (2006). The influence of offshore wind power on demersal fish. ICES Journal of Marine Sciences. 63: pp.775-784.

6. Marine Mammals

6.1. Introduction

1. This chapter assesses the potential impacts on marine mammals which may result from the Kincardine Floating Offshore Windfarm.

2. As described in Chapter 1, the Kincardine Floating Offshore Windfarm is made up of three components (Development Area, Offshore Export Cable Corridor and Onshore Area). This chapter only makes reference to the Development Area and the Offshore Export Cable Corridor as defined below.

- The Development Area – the windfarm area including the Wind Turbine Generators (WTG), floating substructures and inter-array cables.
- The Offshore Export Cable Corridor – the area within which the proposed export cables will be laid, from the perimeter of the Development Area to the Onshore Area at Mean High Water Spring (MHWS).
- These areas combined are referred to as the Project.

3. The potential impacts arising from both the Development Area and the associated Offshore Export Cable Corridor are described, including an indication of any cumulative impacts. For the purposes of this assessment, the Development Area comprises the Wind Turbine Generators (WTG) and inter array cabling.

4. The following appendices and chapters should be read in conjunction with this chapter:

- Chapter The Physical Environment
- Chapter 4: Benthic Ecology
- Chapter 5: Fish and Shellfish
- Chapter 8: Noise
- Chapter 9: Maritime Navigation
- Appendix B: Aerial Surveys Report
- Appendix C: Shipping and Navigation PHA

6.1.1. Legislation and Policy

5. Marine Mammals in United Kingdom (UK) territorial waters are afforded protection by the following International, European and National legislation:

- **The Council Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Flora and Fauna 1992 (Habitats Directive)**:

  The Habitats Directive has been transposed into Scottish Law through two different regulations:

  - The **Conservation (Natural Habitats, &c.) Regulations 1994** (Habitats Regulations) covering territorial waters from 0 to 12nm; and
  - The **Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2010** (Offshore Marine Regulations) covering 12 to 200nm.

  Under the Habitats Directive, Bottlenose Dolphin, Harbour Porpoise, Grey Seals and Harbour Seals are identified in Annex V as protected species for which Special Areas of Conservation (SACs) must be designated. Certain measures are also required in relation to the managed exploitation of Annex V species, which includes restrictions on methods of taking or killing cetaceans (porpoise, dolphins and whales) and pinnipeds (seals).

The Habitats Directive offers strict protection from all forms of deliberate capture or killing, deliberate disturbance (particularly during the periods of breeding, rearing, hibernation and migration) and deterioration or destruction of breeding sites or resting places. Certain species are listed in Annex IV of the Habitats Directive as species of European Community interest and in need of strict protection. Those species listed in Annex IV of the Habitats Directive whose natural range includes any area of the UK are called European Protected Species (EPS). The Habitats Regulations and Offshore Marine Regulations provide the protection afforded to EPS. All cetaceans and otters are designated as EPS; however the legislation does not currently extend to pinnipeds.

Under Regulation 53 of the Habitats Regulations an EPS licence can be issued for developments to allow them to work within the law. These are issued for specific purposes stated in the Regulations, if certain tests are met.

- **The Marine (Scotland) Act 2010:**
  The Marine (Scotland) Act 2010 replaced the Conservation of Seals Act 1970 in Scottish Waters and introduced improved protection for seals. The Act introduced significant changes to seal legislation, with enhanced seal protection measures balanced by appropriate management under a new comprehensive licensing system. Under Part 6 of the Marine (Scotland) Act 2010, it is an offence to kill, injure or take a seal at any time of year, except to alleviate suffering or where a licence has been issued to do so by Marine Scotland. It is also an offence to harass seals at haul out sites.

- **The Wildlife and Countryside Act 1981 (as amended) (from 0 to 12nm):**
  The Act provides protection to all cetaceans found within UK territorial waters (listed in Schedule 5 and 6 of the Act). Under Section 9 of the Act, it is an offence to intentionally kill, injure or take cetaceans; and to cause damage or destruction to certain areas used by cetaceans for shelter and protection, or to intentionally disturb animals occupying such areas.

- **The Nature Conservation (Scotland) Act 2004:**
  The Act contains measures to improve the existing species protection offered by the Wildlife and Countryside Act 1981, including the extension of existing protection for cetaceans from intentional disturbance to encompass protection from reckless disturbance.

- **The UK Biodiversity Action Plan 1994 (UK BAP):**
  The UK BAP has produced a list of species of importance across the UK as a response to commitments under the Convention of Biological Diversity (CBD). The UK BAP describes the biological resources of the UK and provides detailed conservation plans for these resources. The post 2010 Biodiversity Framework replaces the previous UK BAP and includes 21 species of marine mammal, including Harbour Porpoise, Bottlenose Dolphin and Harbour Seal.

- **The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention):**
  Since 1972, the OPSAR Convention has worked to identify threats to the marine environment through organised programs and measures to ensure national action. The OSPAR Commission assess which species and habitats require protection due to being threatened and/or experiencing a decline in population. This list includes Harbour Porpoise, Bottlenose Dolphin, White-beaked Dolphin, Minke Whale and Common Dolphin. Within the Convention, there are also a series of annexes dealing with pollution from anthropogenic sources, including underwater noise pollution.

- **The Agreement on the Conservation of Small Cetaceans of the Baltic, North-East Atlantic, Irish and North Seas 1994 (ASCOBANS):**
  The Agreement was set up under the auspices of the Convention on Migratory Species of Wild Animals (CMS) in 1994 to co-ordinate and implement conservation measures for all small cetaceans in the North and Baltic Seas. The Agreement requires Member States to make efforts towards reducing pollution, bycatch in fishing nets, ship strikes and disturbance by recreational and seismic activities.

6. Section 123 of the **Marine and Coastal Access Act 2009** and Section 79 of the **Marine (Scotland) Act 2010** provide for the development of a marine spatial planning system. These Acts enable the creation of Marine Protection Areas (MPAs) to protect species and features of national and regional importance, including species not previously covered by European legislation. The Scottish Government has developed a network of MPAs that contribute to the conservation or improvement of the marine environment in the UK by conserving a scientific selection of both marine diversity (species and habitats) and geo-diversity. The eventual aim is for all MPAs, including Special Areas of Conservation (SACs), to become part of this MPA network.

7. As of July 2014, 30 MPAs have been designated in Scotland. Of the 30 MPAs, 17 fall under the Marine (Scotland) 2010 Act in Scottish territorial waters and 13 fall under the Marine and Coastal Access Act 2009 in offshore waters, one of which is the Firth of Forth Banks Complex. The Firth of Forth Banks Complex is located in offshore waters to the east of Scotland and covers a highly productive and biologically rich area. The MPA comprises three areas with ocean quahog aggregations, sand and gravel habitats and underwater mounds. Although no marine mammals are listed as protected features of this MPA, their prey may indirectly benefit; therefore the MPA will be considered within the cumulative impact assessment for the Project.

8. In 2013, the Scottish Government issued a Draft National Marine Plan. The Draft National Marine Plan sets out strategic policies with an aim of managing the competing demands on the marine environment for the sustainable use of Scotland's marine resources. An objective of the Draft National Marine Plan is to turn Scotland's renewable energy resources into a fully developed industry while minimising the environmental impacts from the construction and operation of such developments.

9. In addition, a priority list of marine habitats and species in Scotland's seas, known as Priority Marine Features, also applies to marine mammals. The list contains 81 habitats and species considered to be of conservation importance in Scotland's seas and is used to help focus conservation actions and marine planning. Several species of cetacean and seals are included in the list of Priority Marine Features.

6.1.2. Stakeholder Consultation

10. Key stakeholders were consulted during the scoping phase, and subsequently as part of the Habitats Regulations Appraisal (HRA).

11. A summary of the Consultee responses to the Environmental Scoping Assessment in relation to marine mammals can be viewed in Table 6-1 below.

12. The information received through consultation, together with the formal Scoping Opinion and recognised industry best practice, has informed the methodology and scope for the assessment of the impacts on marine mammals as summarised in this chapter.

Table 6-1 Summary of Consultation Responses and Project Responses

Kincardine Offshore Windfarm Environmental Scoping Assessment		
Consultee	**Consultee Response**	**Project Response**
Marine Scotland Science (MSS)	Although, because the intention is to develop the project without the use of piled anchors, it is not intended to have a separate noise study, there should still be some consideration of possible effects of noise, for example, because of possible effects of wave noise stemming from the structures and operational noise. In addition, if piled anchors do have to be used, there will have to be more detailed consideration of the potential effects of noise generation from this.	Although the Project will be developed without the use of piled anchors, the possible effects of noise have been considered, e.g. wave noise stemming from the structures, construction and operational noise in Chapter 8 and utilised in this chapter as necessary.

Kincardine Offshore Windfarm Environmental Scoping Assessment		
Consultee	**Consultee Response**	**Project Response**
MSS	We would like to point out that should it be necessary to use techniques such as impact pile driving to install the moorings for the turbines, we would expect to see a full noise propagation assessment, including ranges at which marine mammal species may receive noise levels sufficient to injure, cause PTS or disturb.	The Project will be developed using drag embedment anchors rather than piled anchors; therefore no pile driving will be undertaken. As a result, a full noise propagation assessment is deemed unnecessary, but an underwater noise assessment is provided in Chapter 8 and cross referenced in this chapter as necessary. If for some reason it were necessary to use an alternate method of anchoring we recognise that additional study would be required regarding underwater noise.
MSS	SNH have commissioned a report into the potential for entanglement of marine mammals in mooring lines. Although this is not yet available, MSS advise that taut, rigid moorings are likely to present less of a risk to marine mammals. The applicant should also consider the frequency with which they may check their mooring lines for debris, as this may contribute to the risk of entanglement.	The SNH report, which is now available, has been used to inform the ES. Load cells will be installed on the mooring lines and cables, which will indicate if debris has become attached, and a regular monitoring programme will be put in place for debris.
MSS	MSS consider that the project site is sufficiently distant from any seal SAC that it is unlikely there would be any effect to them. MSS also consider that the development is unlikely to impact upon the Moray Firth SAC, as long as no noisy construction activities are undertaken.	Agreed.
MSS	Given the small number of seals sighted during the aerial surveys, MSS advise the applicant to use and make reference to the seal usage maps available on our website. Their assessment should refer to the PBR (Potential Biological Removal) for harbour seals on the east coast of Scotland and take account of this, should it be likely that injury to seals may occur.	The MSS seal usage maps and 2015 PBR values have been used to inform the ES.
MSS	The applicant should be aware that legislation regarding disturbance (through any means) to cetaceans, is different within 12NM of the Scottish	The relevant inshore and offshore legislation has been noted in Section 6.1.1.

Kincardine Offshore Windfarm Environmental Scoping Assessment		
Consultee	**Consultee Response**	**Project Response**
	coast than that from the 12NM to 200NM.	
MSS	Sub bottom profilers are likely to be considered to pose a risk to disturbance, so MSS would advise discussion with MS-LOT regarding the requirement for an EPS licence.	Marine Scotland Licensing Operations Team (MS-LOT) would be consulted regarding the requirement for a European Protected Species (EPS) licence. However, it is recognised that compliance with the JNCC seismic guidelines will reduce the risk of injury to EPS to negligible levels (JNCC, 2010).
MSS	The applicant should be aware of the issues surrounding spiral lacerations to seals which appear to be caused as a result of interaction with boat propellers. The applicant should carefully consider whether they can offer any mitigation with respect to this issue.	This issue has been assessed within the ES and appropriate mitigation measures proposed. The recent evidence of predatory behaviour does not completely eliminate ship propellers, but it is now less likely that they are a key factor (The Scottish Government, 2015).
MSS	The applicant may wish to contact MSS in relation to data held on dolphin and porpoise use of sites along the east coast of Scotland. The sites with monitoring data are noted in this topic sheet (http://www.scotland.gov.uk/Resource/0042/00426891.pdf).	East Coast Cetacean Data has been received. Usability of data is limited as currently unable to separate data to species level, this will be possible for future studies.
Scottish Natural Heritage (SNH)	We welcome the project developers approach to focus upon data collection at critical times in consultation with key experts to optimise data gathering and analyses. We also note and welcome that the developers are committed to an extended monitoring programme beyond consent application in order to maximise learning from this demonstration project.	Noted.
SNH	Although this development will not involve pile driven foundations, other potential impacts could arise from this development both individually and cumulatively. As such, all potential impacts require detailed consideration within the assessment.	Both individual and cumulative potential impacts have been considered in detail within the assessment.
SNH	We consider that one year of survey is not sufficient to adequately characterise marine mammal abundance and use of the Development Area. However, to achieve characterisation would require a much greater survey effort.	Noted and agreed.

Kincardine Offshore Windfarm Environmental Scoping Assessment		
Consultee	**Consultee Response**	**Project Response**
	Given the scale of the development and the fact that it is a demonstration project, we advise that effort should be directed at post consent monitoring. We note and welcome the intention to develop a post-deployment monitoring plan that will include surveys of birds, marine mammals, fish and benthic communities at the project site.	
SNH	More thought should be given to potential entanglement of larger marine mammals.	Entanglement of large marine mammals has been considered further within section 6.5.1.6.
SNH	Planned vessel activity should be discussed to assess potential disturbance, particularly if there is potential for the use of ducted propellers.	Planned vessel selection and activity relating to construction, operation and decommissioning activities will be discussed and detailed within the final Project Environmental Management Plan (PEMP). Defined navigational routes will be utilised by vessels to reduce the risk of collision with marine mammals.
SNH	Potential impacts from marine mammals resulting from this development include noise disturbance from the geophysical survey, disturbance from increased vessel activity, noise and disturbance from cable laying activity, entanglement from the array of moorings and inter array cables (including any snagged fishing gear) and specifically for seals, potential for corkscrew mortality from vessels using ducted propellers.	Noted and agreed. These are all assessed in this chapter.
SNH	Table 10-21 lists the baseline sources of information used. This seems reasonably comprehensive and includes sources such as SCANS II. However, more detail is required including detailed and specific references for data sources.	Noted. More detail has been included on specific references.
SNH	SCANS II is identified as a key source for broad scale abundance and density estimates, however it should be remembered that this was also a snapshot survey. A further source of information would be the JNCC Joint Cetacean Protocol.	The JNCC Joint Cetacean Protocol has been used to inform the ES; however, the majority of data is for the Irish Sea. Phase III is currently ongoing.
SNH	Table 10-24 (floating offshore devices): whilst the development as proposed is likely to present a relatively low risk to marine mammals, in comparison to pile driven windfarms it is not clear from the comment / justification section why there	Noted. The potential for entanglement has been assessed in section 6.5.1.6

Kincardine Offshore Windfarm Environmental Scoping Assessment		
Consultee	**Consultee Response**	**Project Response**
	is a positive significance for construction and decommissioning. This should not be scoped out of the ES given the potential for entanglement with the moorings has not been fully explored.	
SNH	Table 10-24 (corkscrew injuries): we highlight that due consideration should be given to the most recent knowledge available relating to corkscrew injuries to seals, consistent with seals being drawn through a ducted propeller such as a Kort nozzle or some types of Azimuth thrusters. Vessels used for the proposed development could use such equipment (all injuries observed to date have been fatal). We agree that this potential impact should be scoped in.	Noted. The recent evidence of predatory behaviour does not completely eliminate ship propellers, but it is now less likely that they are a key factor (The Scottish Government, 2015). The potential for corkscrew injuries is assessed in section 6.5.1.4.
SNH	Table 10-24 (marine mammal entanglement): we broadly agree with this, but this issue should be explored further in the ES. Comparison is made to structures used in the oil and gas installations, but it would be informative to contrast the scale of each type, e.g. will there be a comparable number of moorings in a comparable area? Larger marine mammals (in this case minke whale and basking shark) are at a relatively greater risk of entanglement. Discussion should include the structure of the moorings and the inter-array cabling proposed, including specifics of moorings used, separation distance between moorings, the degree of slack etc., together with the likely occurrence of the larger fauna in the development area, particularly should the development area become a fish aggregation device. As these moorings will aim to keep the turbines in a static location, it is likely that the moorings will be taught and therefore present a lesser risk. But it is suggested that catenary moorings and dynamic inter-array cabling will be used. Also to consider the potential for entanglement via snagged fishing gear. This warrants further discussion in the ES.	Entanglement of marine mammals has been fully considered within section 6.5.1.6.
SNH	Table 10-24 (noise disturbance): agree with this assessment. Noise from the construction and operation of this	There will be further consultation prior to the geophysical surveys, which are planned for the detailed design stage of the Project.

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Consultee	**Consultee Response**	**Project Response**
	development is unlikely to be a significant issue. However, we would need information on the geophysical surveys planned for both the survey area and the cable route, as this could result in acoustic disturbance.	
SNH	Cumulative impacts: prospective work schedule should be presented in comparison with other development timetables to assess any potential overlap.	Cumulative potential impacts have been considered in detail within the assessment, including those from prospective work.
SNH	We recommend: • That reference populations are considered in relation to species Management Units (MUs) • That all activities / developments both on going and proposed within these MUs are considered in relation to this proposed project • Guidance on the protection of marine European Species from injury and disturbance within Scottish inshore waters has now been published on the Marine Scotland website.	Noted. Management Units have been referenced within the ES and considered within the assessment.
SNH	Marine mammal protection legislation: this section includes key detail, but is poorly written; this should be better presented in the ES.	This section has been updated and includes additional details of the key relevant legislation within the ES (see Section 6.1.1).
SNH	Marine mammal legislation: It should be noted that (whilst not a marine mammal) basking shark have full legal protection under the Wildlife & Countryside Act 1981 (as amended by the Nature Conservation (Scotland) Act 2004).	Noted. This has been covered in Chapter 5 section 5.2.
SNH	Whilst we appreciate the positive qualities of a high definition video survey, it remains a method designed for birds.	Noted. The results of the Hi Definition surveys along with other sources have been used to inform this assessment (Table 6-2).
SNH	A density figure is estimated only for harbour porpoise. This un-adjusted density is presented as 0.10 animals/km^2 (in comparison to the SCANS II = 0.18 animals/km^2). This is likely to be an underestimate.	Noted. Updated density estimates have been presented following additional data and have been adjusted for availability bias. This is covered in Section 6.2.1 with further detail in Appendix B.
SNH	There is an issue with the availability of bias correction factors for harbour porpoise in aerial surveys. There are two methods of calculating the	Noted. Updated density estimates have been presented following additional data and have been adjusted for availability bias. This is

Kincardine Offshore Windfarm Environmental Scoping Assessment		
Consultee	**Consultee Response**	**Project Response**
	correction factor according to available literature. One is to use all sightings assuming that they were within a maximum depth available for sighting, and the second method is to only use those animals that were observed surfacing. However, the adjustment calculated from the second method results in much higher corrected densities (up to a factor of 10 – in comparison to a factor of 2). This issue is unlikely to be elucidated until a target study is conducted to compare this methodology with established vessel transect surveys. The issue should be made clear in the ES, together with clear identification of the uncertainty in the density presented.	covered in Section 6.2.1 with further detail in Appendix B.
SNH	We query the marine mammal categories used in this report: example in Table 26 – 'dolphin species' and 'cetacean species' categories are used since dolphins are cetaceans. This should be made clearer in the next report as it does not necessarily instil great confidence in species identification.	This typing error has been corrected within the ES.
SNH	Under the HRA, the potential impacts of this proposal will need to be considered alone and in combination with other plans and projects. At this stage, we would advise that the following projects may require further consideration: • European Offshore Wind Deployment Centre • Moray Firth Offshore Windfarm Applications • Forth and Tay Offshore Windfarm Applications • National Renewable Infrastructure Plan (harbour and port applications) • Cable works in the vicinity of Peterhead, including the proposed HVDC cable to NE England • The Hywind proposed floating wind demonstrator project	The potential for cumulative impacts have been considered both within the HRA and the ES.
SNH	We advise that the applicant will need to consider the following SACs for HRA, due to potential connectivity between the development and the site:	Noted and considered within the HRA.

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Consultee	**Consultee Response**	**Project Response**
	• Moray Firth SAC designated for Bottlenose dolphin (*Tursiops truncatus*). We advise that noise impact assessment from vessels, anchoring and other operations is likely to be an important part of assessing any direct disturbance to bottlenose dolphin, including their potential displacement from feeding grounds and other supporting habitats. While we consider that the construction phase may give rise to the greatest risk of disturbance, we do highlight that impacts during the operational phase also need to be considered, as well as any repowering and decommissioning work. It will also be important for the applicant to consider impacts on prey species. We highlight that cumulative impacts are a key concern and should be addressed.	
Whale and Dolphin Conservation	Overall, we mainly agree with the potential impacts to be 'scoped in' to the EIA in Table 10.24 – Potential impacts on marine mammals. Whilst we do not agree that floating offshore devices can have positive benefits to marine mammals during construction and decommissioning as stated in Table 10-24, we agree that this is 'scoped out' of the EIA.	Noted. Reference to floating offshore devices having a positive effect has been removed and all relevant potential impacts have been assessed.
Whale and Dolphin Conservation	Noise disturbance should be 'scoped in' due to the present uncertainty of the type of mooring to be used for the turbines e.g. anchors requiring pile driving might potentially be used.	Piling will not be used in the Project. Other underwater noise impacts are covered in Chapter 8 and cross-referenced in Chapter 6 as necessary.
Whale and Dolphin Conservation	We agree with how the developers will obtain information and account for other developments in the cumulative impacts in Section 1.17. Developments in the Moray Firth, e.g. BOWL and MORL, should also be included because they are within the known range (and management unit) for the SAC bottlenose dolphin population and construction will potentially overlap.	Noted. These have been covered in the cumulative assessment (section 6.8).
Whale and Dolphin Conservation	Habitats Regulations Appraisal (HRA) Screening: whilst not a requirement for the HRA, the potential impact on cetacean species not covered in Annex II of the Habitats Directive e.g. minke whale, harbour porpoise and white-beaked dolphin, should also be given adequate consideration. These species are listed as Priority Marine Features	Noted. These species are covered in this chapter.

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Consultee	**Consultee Response**	**Project Response**
	and minke whale and white- beaked dolphin are drivers in the Scottish Marine Protected Areas project.	
Kincardine Offshore Windfarm Final Report on Aerial Surveys from April 2013 to April 2014		
Consultee	**Consultee Response**	**Project Response**
SNH	This one year baseline survey report does not fundamentally change our scoping advice in relation to marine mammals for the 8 month interim survey report provided in our response of 9 June 2014. There were no additional species of marine mammal observed and the calculated densities are still relatively small.	Noted.
SNH	In the interim report, authors alluded to potential issues with the correction for availability bias. As a result of this the methodology in this one year report differs slightly from that in the 8 month report. There are two approaches using known diving rates using data from Teilmann *et al*. (2013): "either applying a correction based on an assumption that all animals are visible at the surface and when submerged down to 2m depth; or by applying a correction factor only to the density of animals observed breaking the surface". These approaches are used in both the interim and final reports, however, the analysis method has changed in the one year report when using the surfacing rate approach. In the 8 month interim report all observations within the video transect were used. This generated an upward adjustment of the density by a factor of 7-10. In the one year report, the number of observed surfacings on a reference line within the videoed area has been used. This new method results in an upward adjustment of the density by a factor of 2.8 - 3.9, which is much less than the previous report. We note that the authors consider that the previous method in the 8 month interim report gives too high an estimate and therefore recommend that the reference line method be used for calculations instead. We would be interested of learning of any studies or analyses by the authors to explore the efficacy of this novel reference line surfacing rate	Noted. An updated Hi Definition report is now available (dated August 2015) which has been included as Annex B. This report explains both methods of correction and presents the results of the full 16 months of survey. This updated information has been used to inform this chapter of the ES.

Kincardine Offshore Windfarm Environmental Scoping Assessment		
Consultee	**Consultee Response**	**Project Response**
	density correction approach that would suggest the method is more accurate than that previously used.	
SNH	The density levels quoted are similar or higher than those cited in SCANS-II (2005). In the ES, abundance numbers should be fully referenced so it is clear where the data has been generated from.	Noted, and referenced throughout chapter.
SNH	The population estimate in the one year report is higher than that in the 8 month interim report. In the one year report, estimates are cited for the smaller site rather than the wider buffer area. We recommend a population estimate for the wider buffer area for the one year report in included in the ES.	Noted – Kincardine Survey Area (including buffer) population estimate has been used. An updated Hi Definition report is now available (dated August 2015) which has been included as Annex B. This report presents the results of 16 months of survey.
Habitats Regulations Appraisal – Screening Report		
Consultee	**Consultee Response**	**Project Response**
SNH	This report provides a thorough exploration of HRA issues for marine mammals. We have previously commented on this proposed project, in particular the HiDef wildlife survey reports. There were 16 surveys conducted between May 2013 and September 2014 and it is noteworthy that bottlenose dolphin were not sighted in these surveys. It is unlikely that this development will present significant issues from a HRA and bottlenose dolphin perspective.	Noted.
SNH	The proposed location is 15 km from the coast. Bottlenose dolphin tend to stay close inshore, so it is conceivable that not many use that area of sea. We know that they are observed along the coastline between Aberdeen and Stonehaven, so it cannot be excluded that they may use the development area.	Noted.
SNH	This scoping report commits to considering bottlenose dolphin from the Moray Firth SAC even though the risk to this species from the development is considered to be low. The developers proposed to produce a note to inform an AA. We welcome this approach and support the inclusion of the Moray Firth SAC for consideration.	Noted.

Kincardine Offshore Windfarm Environmental Scoping Assessment		
Consultee	**Consultee Response**	**Project Response**
SNH	The scoping report indicated that catenary moorings will be used. Moorings and inter array cables – potential for entrapment (our report 'Understanding the potential for marine entanglement risk from marine renewable energy developments') suggests a higher risk to larger marine mammals, but nonetheless this aspect needs to be considered, particularly the risk of ghost fishing gear or other debris becoming snagged on the mooring structure. We recommend that a monitoring scheme is developed in conjunction with the operation and maintenance schedule for the development to consider this issue.	Noted. Load cells will be installed on the mooring lines and cables, which will indicate if debris has become attached, and a regular monitoring programme will be put in place for debris.
SNH	The developers state that there is the 'possible elimination of piling' and the 'intention to develop the project without the use of piled anchors'. This will not be known until the engineering aspects of the project are more fully developed. Nonetheless, the noise emitted from the piling of anchor structures is unlikely to be at the same intensity as pile driven monopoles or multiple pin piles due to the differences in sizes involved. Until further information becomes available, our previous comments relating to noise remain relevant: 'Noise from the construction and operation of this development is unlikely to be a significant issue. However, we would need information on the geophysical surveys planned for both the survey area and the cable route, as this could result in acoustic disturbance'.	Noted. Piling will not be used in the development and other sources of construction and operation noise have been assessed in Chapter 8. Details of the geophysical survey requirements are not yet known. Further consultation will be undertaken once the survey specification is known.
SNH	We would advise that the developers should consider the Management Unit population of bottlenose dolphin as the SAC population as connectivity has been established on the east coast. The Coastal East Scotland abundance is recorded as 195 animals (Cheney *et al*., 2013).	Noted and considered within the ES.

6.2. Baseline Environment

13. The Aberdeen area is an important area for marine mammals, with up to 18 species recorded from sighting or stranding records in Aberdeen Bay and the surrounding area in the data sources listed in Table 6-2; including fifteen species of cetaceans (porpoise, dolphins and whales) and three species of pinniped (seals). Of these, Bottlenose Dolphins, Harbour Porpoises, White-beaked Dolphins, Minke Whales, Risso's Dolphins, Harbour Seals and Grey Seals occur regularly in the area, with other species only being recorded occasionally or rarely (Aberdeen Offshore Windfarm Limited (AOWFL), 2012; European Offshore Wind Deployment Centre (EOWDC) surveys).

14. This baseline characterisation has been compiled using existing (published) information, combined with the findings of the HiDef aerial surveys undertaken in 2013 and 2014. A summary of the data utilised for the baseline characterisation is presented in Table 6-2.

Table 6-2 Summary of the data utilised for the baseline characterisation

Type / Description of Data	Source
Marine Mammal Abundance Data	Marine Scotland; Small Cetacean Abundances in the North Sea (SCANS) Survey in July 1994, 1965, 1966 and December 2006 (SCANS II); North Atlantic Sightings Surveys (NASS) in 1989; Norwegian Independent Line Transect Surveys (NILS) in 1995 and 1998; SMRU and SMRU Ltd (The University of St Andrew's); The University of Aberdeen; JNCC & SNH; The Seawatch Foundation; UK Cetacean Stranding Investigation Programme; NORCET Cetacean Survey Data; Moray Firth Cetacean Study 2009 – 2011; High Definition Aerial Surveys 2013 – 2014; East Coast Marine Mammal Acoustic Study (limited use of data due to data limitation of being unable to separate data to species level, this will be possible for future studies)
Electromagnetic Field Data	Marine Scotland; Collaborative Offshore Wind Research into the Environment (COWRIE)

6.2.1. Aerial Surveys

15. A series of monthly aerial surveys were commissioned for this Project to monitor bird and marine mammal species and abundances within the Development Area and Offshore Export Cable Corridor during 2013 and 2014. The survey methods used were agreed with Marine Scotland, and the survey flight plan and transects are shown in Figure 6-1. Further details of the survey methods, analysis and results are presented in Appendix B.

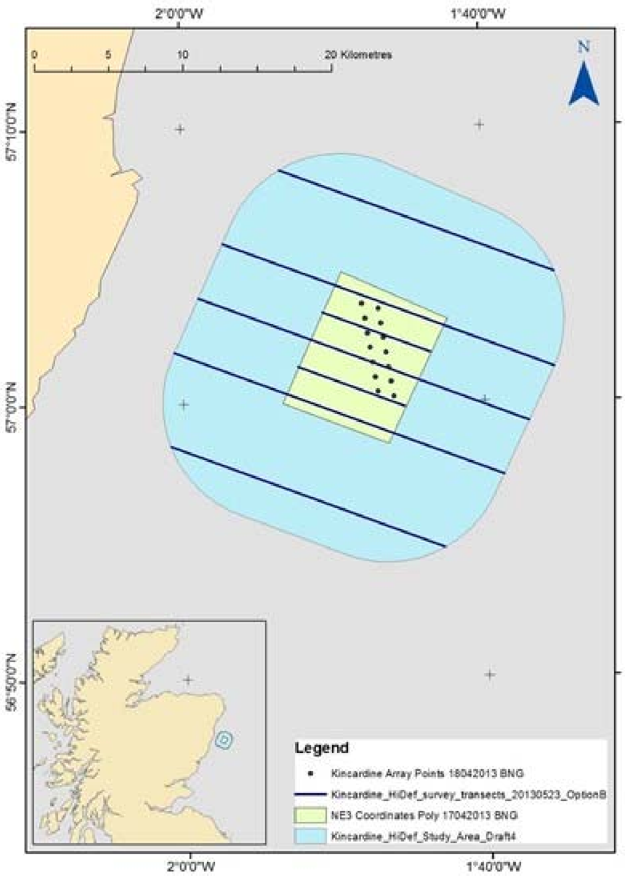

Figure 6-1 HiDef Aerial Survey Flight Plan showing transects

16. Over the whole survey period, a total of 138 sightings were recorded. 111 sighting were identified as mammals to species level, the remaining 25 sightings were assigned to a species group. Table 6-3 summarises the abundances of the identified marine mammal species per survey flight and a total abundance over the whole survey period.

Table 6-3 Summary of aerial survey effort and observations

Survey Date	Species Abundance				
	Harbour Porpoise	Minke Whale	White-Beaked Dolphin	Grey Seal	Harbour Seal
May 2013	0	0	0	0	1
May 2013	13	1	0	0	0
June 2013	7	0	0	0	0
July 2013	15	0	9	0	0
September 2013	2	0	0	0	0
October 2013	6	0	0	2	0
October 2013	2	0	0	0	0
December 2013	5	0	0	0	0
January 2014	6	0	0	0	0
February 2014	8	0	0	1	0
March 2014	1	0	0	0	0
April 2014	0	0	0	1	0

Survey Date	Species Abundance				
	Harbour Porpoise	Minke Whale	White-Beaked Dolphin	Grey Seal	Harbour Seal
May 2014	17	1	0	4	0
July 2014	5	0	0	0	0
August 2014	2	0	0	0	0
September 2014	0	1	0	1	0
Total	**89**	**3**	**9**	**9**	**1**

17. Abundance estimates of species in the Kincardine Survey area from the HiDef surveys are illustrated in Table 6-4. For Harbour Porpoise, abundance estimates have been adjusted (as described in Appendix B) to account for availability bias, and thus provide an assessment of true abundance rather than relative abundance for diving species. The density, total estimated population, along with upper and lower 95% confidence intervals for each species group have been calculated using strip transect analysis and rounded to two decimal places.

18. The abundance of marine mammal species that are known to occur or have been previously recorded in the Aberdeen Bay area is shown in Table 6-5. A summary of the presence, seasonal occurrence and seasonal sensitivities of marine mammals in the Aberdeen area is shown in Table 6-6 and described in section 6.2.2 (marine mammal descriptions)

Table 6-4 Abundance estimates of species in the Kincardine Survey Area during combined monthly surveys between April 2013 and September 2014

Category	Density Estimate (n/km^2)	Population Estimate (Number)	Lower 95% Confidence Limit of Population (number)	Upper 95% Confidence Limit of Population (number)
Grey Seal	0.01	5	2	9
Harbour Seal	0.00	1	0	2
Minke Whale	0.00	2	0	4
White-Beaked	0.01	5	1	11
Harbour Porpoise*	0.29	157	115	203

*Adjusted monthly density and population estimates for Harbour Porpoise in the Kincardine survey area taking account of the potential numbers of animals that might have been unavailable for detection using only surfacing animals.

Table 6-5 Summary of abundance of marine mammals within Aberdeen Bay and Surrounding Area (AOWFL, 2012)

Common Name	Latin Name	Abundance
Bottlenose Dolphin	*Tursiops truncates*	Common / Regular
Harbour Porpoise	*Phocoena phocoena*	Common / Regular
White-beaked Dolphin	*Lagenorhynchus albirostris*	Common / Seasonal
Minke Whale	*Balaenoptera acutorostrata*	Common Seasonal
White-sided Dolphin	*Lagenorhynchus acutus*	Occasional
Killer Whale	*Orcinus orca*	Rare
Common Dolphin	*Delphinus delphis*	Infrequent / Rare
Risso's Dolphin	*Grampus griseus*	Occasional
Striped Dolphin	*Stenella coeruleoalba*	Rare
Long-finned Pilot Whale	*Globicephala melas*	Infrequent / Rare
Sperm Whale	*Physeter microcephalus*	Infrequent / Rare
Humpback Whale	*Megaptera novaeangliae*	Rare
Fin Whale	*Balaenoptera physalus*	Rare
Sowerby's Beaked Whale	*Mesoplodon bidens*	Rare
Northern Bottlenose Whale	*Hyperoodon ampullatus*	Rare
Harbour Seal	*Phoca vitulina*	Common / Regular
Grey Seal	*Halchoerus grypus*	Common / Regular

Table 6-6 Summary of the presence, seasonal occurrence and seasonal sensitivities of marine mammals in the Aberdeen Bay and surrounding area (AOWFL, 2012)

Species	Presence							Seasonal Occurrence					
		J	F	M	A	M	J	J	A	S	O	N	D
Bottlenose Dolphin	Regular				*		*	*	*	*			
Harbour Porpoise	Regular				*	*	*	*	*	*			
White-beaked Dolphin	Regular / Seasonal						*	*	*				
Minke Whale	Regular												
White-sided Dolphin	Occasional												
Killer Whale	Rare												
Common Dolphin	Occasional												
Risso's Dolphin	Occasional / Regular												
Striped Dolphin	Rare												
Long finned pilot Whale	Occasional												
Sperm Whale	Rare												
Humpback Whale	Rare												

Species	Presence										Seasonal Occurrence			
		J	F	M	A	M	J	J	A	S	O	N	D
Fin Whale	Rare												
Northern Bottlenose Whale	Rare												
Sowerby's Beaked Whale	Rare												
Harbour Seal	Regular						*	*	*	*			
Grey Seal	Regular		*	*	*						*	*	
Hooded Seal	Rare												
Key	Present in area (sighting and / or stranding)												
	Peak abundance												
	Potential to be present in the area												
	Seasonal sensitivities (e.g. calving period, moulting period)										*			

6.2.2. Marine Mammal Species

6.2.2.1. Harbour Porpoise (*Phocoena phocoena*)

19. Harbour Porpoise were the most recorded cetacean species during the AOWFL / EOWDC surveys with 390 observations consisting of 655 individuals recorded. They were also the most frequently recorded cetacean species during the HiDef aerial surveys, with 89 observations recorded over the total survey period (Table 6-6).

20. Harbour Porpoise have a wide range and distribution in both coastal and offshore areas. Although peak occurrence is between August and September, Harbour Porpoise are known to occur in the Aberdeen area throughout the year (AOWFL, 2012; EOWDC surveys).

21. The peak calving season for Harbour Porpoise in Scottish waters is between April and June. Calves have been observed off Aberdeenshire between May and September, indicating a possible increased sensitivity to any potential disturbance during this time (AOWFL, 2012; EOWDC surveys).

22. Harbour Porpoise feed on a variety of fish stocks including Whiting, Sandeels, Haddock / Pollock and Trisopterus sp.

6.2.2.2. Bottlenose Dolphin (*Tursiops truncatus*)

23. Bottlenose Dolphins are generally found within coastal waters, although they have been observed in offshore areas off north east Scotland. Bottlenose Dolphins have been observed off Aberdeen throughout the year (AOWFL, 2012; EOWDC surveys). Although there appears to be an increase in occurrence between October and May (Quick *et al.*, 2014)

24. Bottlenose Dolphins were the second most frequently sighted cetacean species during the EOWDC surveys, with a total of 25 observations of 117 individuals being observed. The majority of the sightings occurred in the spring and summer months. A higher number of Bottlenose Dolphins were observed in the vicinity of the entrance to Aberdeen Harbour, which is a known 'hotspot' for dolphin sightings. Bottlenose Dolphins were frequently recorded in close proximity to the harbour entrance, with their presence being linked to salmon migration up the river.

25. Bottlenose Dolphins were not recorded during the HiDef aerial surveys.

26. Bottlenose Dolphins in the Aberdeen area form part of the resident population of the Moray Firth Special Area of Conservation (SAC), which have a range extending from the Moray Firth into the Firth of Forth. There appear to be two subgroups within the population: one group spend most of their time within the inner Moray Firth SAC, the second group has a wider range (AOWFL, 2012; EOWDC surveys).

27. Young Bottlenose Dolphins have been observed in the Aberdeen area during spring and early summer, indicating a possible increased sensitivity to any potential disturbance during this time (AOWFL, 2012; EOWDC surveys).

28. From the available information, it is apparent that the Aberdeen area is important for Bottlenose Dolphin; however, it is unclear how reliant they are on this area in relation to other areas along the North-east coast of Scotland (AOWFL, 2012; EOWDC surveys).

29. The proposed Development Area is approximately 18km from the coast. Bottlenose Dolphins tend to stay close inshore, therefore it's conceivable that not many would use this area. However, they are observed along the coastline between Aberdeen and Stonehaven, so it cannot be excluded that they may use the Development Area (SNH HRA response).

6.2.2.3. White-beaked Dolphin (*Lagenorhynchus albirostris*)

30. White-beaked Dolphins are present in the central and northern North Sea throughout most of the year. Sightings data suggests their presence in the coastal waters off Aberdeenshire is seasonal, with sightings recorded between June and August. Evidence from stranding data also indicates that they may be present in the area between February and October (AOWFL, 2012; EOWDC surveys).

31. The movement of White-beaked Dolphins into coastal waters during summer months is thought to be related to calving, with calves also being observed off Aberdeenshire between June and August (AOWFL, 2012; EOWDC surveys). This indicates a possible increased sensitivity to any potential disturbance during this time.

32. It is possible that the seasonal movement of White-beaked Dolphins is also related to the seasonal abundance of prey species, such as Herring and Mackerel. It should be noted that, along the Aberdeenshire coast, White-beaked Dolphins appear to have a preference for sections of the coast adjacent to deeper waters, with a higher incidence of sightings between Aberdeen and Stonehaven compared to the area between Aberdeen and Collieston.

33. A total of 29 observations, consisting of a total of 117 individual White-beaked Dolphins were recorded during the AOWFL / EOWDC surveys. 28 of the observations, consisting of 114 individuals, were recorded in the surveys occurring between 2010 and 2011, which covered a region of deeper water. All observations of White-beaked Dolphins between 2010 and 2011 were recorded in water depths of 20m or more.

34. The EOWDC survey data supports the occurrence of White-beaked Dolphin as a seasonal summer visitor that possibly moves to coastal waters following prey such as Mackerel for calving purposes. Although White-beaked Dolphins are found throughout the central North Sea and generally in more offshore areas, it is apparent that the coastal waters off Aberdeenshire are important during the summer period (AOWFL, 2012; EOWDC surveys).

35. During the HiDef aerial surveys, nine White-beaked Dolphin observations were recorded (Table 6-6).

6.2.2.4. Minke Whales (*Balaenoptera acutorostrata*)

36. Minke Whales are the most common of the baleen whales in Scottish waters. Although observations do indicate that they may be present throughout the year, Minke Whales occur throughout the central and northern North Sea primarily during the summer months (July – August). They are generally observed in offshore deeper waters, but appear to move into coastal waters along the North-East coast of Scotland from July (AOWFL, 2012; EOWDC surveys).

37. Minke Whales generally feed on small pelagic fish, such as Sandeels, Herring and Sprat, with the seasonal movement of Minke Whales into coastal waters during the summer thought to be related to prey availability.

38. There were a total of 12 observations of Minke Whales during the EOWDC boat surveys. One Minke Whale was recorded during 2007 and 2008, and 11 observations, all being solitary individuals, were recorded during 2010 and 2011. During the HiDef aerial surveys, three Minke Whale observations were recorded (Table 6-6).

39. Minke Whales are thought to have a preference for water depths of 40m or more (AOWFL, 2012; EOWDC surveys). Although Minke Whales occur regularly in the area off Aberdeen, especially during summer, it is unclear how important this area is in relation to other areas.

40. In recognition of the importance and vulnerability of the Minke Whale and its close relatives, there is a grouped species action plan for all baleen whales in the UK Biodiversity Action Plan now taken forward by the Scottish Government under the Scottish Biodiversity Strategy.

6.2.2.5. Risso's Dolphin (*Grampus griseus*)

41. In the northern and central North Sea, Risso's Dolphins are primarily observed around Shetland and Orkney. However, there has been an increase in sightings along the North-East coast in recent years and Risso's Dolphins have been recorded off Aberdeenshire since 2005 at various times of the year.

42. As part of the AOWFL / EOWDC surveys, Risso's Dolphins were observed during vantage point surveys, and in the July 2011 boat survey two observations consisting of 15 individuals were recorded. This increase in sightings may point towards an increase in the use of the Aberdeen area in comparison to historic levels. Possible reasons for the apparent increase in observations in the area are unclear, but could be related to prey availability (AOWFL, 2012; EOWDC surveys).

43. Risso's Dolphins were not recorded during the HiDef aerial surveys.

44. It is not clear if Risso's Dolphins frequent the proposed Development Area; however, further monitoring surveys planned by KOWL will provide fundamental data on the distribution of this species.

6.2.2.6. Grey and Harbour Seals (*Halchoerus grypus* and *Phoca vitulina*)

45. Grey and Harbour Seals are frequently sighted throughout the year off the coast of Aberdeen and in Aberdeen Bay, especially at the entrances to the rivers Dee and Don.

46. The Grey Seal was the most frequently recorded seal species during the AOWFL / EOWDC surveys, with a total of 21 individuals recorded during the boat based surveys in 2007 and 2008, and a further 41 individuals recorded in the surveys between 2010 and 2011. The Grey Seal was sighted throughout the survey period with no apparent increase in frequency of sightings with any particular season. The majority of the grey seal sightings were recorded in the northern half of Aberdeen Bay.

47. Almost equal proportions of Grey and Harbour Seals were recorded during the AOWFL / EOWDC boat surveys carried out during 2010 and 2011.

48. During the HiDef aerial surveys, one Harbour Seal and nine Grey Seal observations were recorded (Table 6-6).

49. Harbour Seals increase in numbers at the estuaries of the Rivers Dee and Don in the winter and early spring and are known to use haul-out sites at Donmouth and the mouth of the Ythan Estuary

at Catterline. Harbour seals have been observed feeding on Salmonids and marine fish in the estuaries of the Dee and Don.

50. The pupping period for Harbour Seals occurs from June to July and moulting occurs from June to September. During these times they spend a higher proportion of their time ashore and in coastal waters (AOWFL, 2012; EOWDC surveys).

51. The 2015 Potential Biological Removal (PBR; i.e. the number of individual seals that can be removed from the population within any one year without causing a decline) for Harbour Seals in the East Coast Management Area (ECMA) is 1 (Thompson *et al.,* 2015).

52. Designated coastal SACs for Harbour Seals along the east coast of mainland Scotland are located in the Dornoch Firth and Morrich Moore in the Moray Firth and the Firth of Tay and Eden Estuary (AOWFL, 2012; EOWDC surveys). It should be noted that these sites are outside the proposed Project area.

53. Grey Seals use haul out sites at Donmouth, the mouth of the Ythan River, Peterhead Harbour, Cruden Bay, Boddam and Catterline. The most well established Grey Seal colony in the area is at Catterline which is adjacent to the proposed site. Grey Seals have been observed feeding on Salmonids and marine fish in the estuaries of the Dee and Don.

54. The pupping period for Grey Seals occurs from October to November and moulting occurs from February to April. During these times they spend a higher proportion of their time ashore and in coastal waters (AOWFL, 2012; EOWDC surveys).

55. The 2015 Potential Biological Removal (PBR; i.e. the number of individual seals that can be removed from the population within any one year without causing a decline) for Grey Seals in the East Coast Management Area (ECMA) is 297 (Thompson *et al.,* 2015).

56. Designated SACs for Grey Seals along the east coast of Scotland include the Isle of May at the entrance to the Firth of Forth. It should be noted that these sites are outside the proposed Development Area and export cable corridor.

57. Figure 6-2 and Table 6-6 below show the total (at-sea and hauled-out) estimated densities of Grey and Harbour Seals around Scotland. The maps can be interpreted as the average number of seals in each 5x5 grid at any point in time.

58. As can be seen from Figure 6-2, around the Kincardine Development Area there is a density of 1-5 grey seals and in the Offshore Export Cable Corridor a density of 5-10. Table 6-6 illustrates that within the Development Area there is a density of 0-1 Harbour Seals and in the Offshore Export Cable Corridor a density of 1-5.

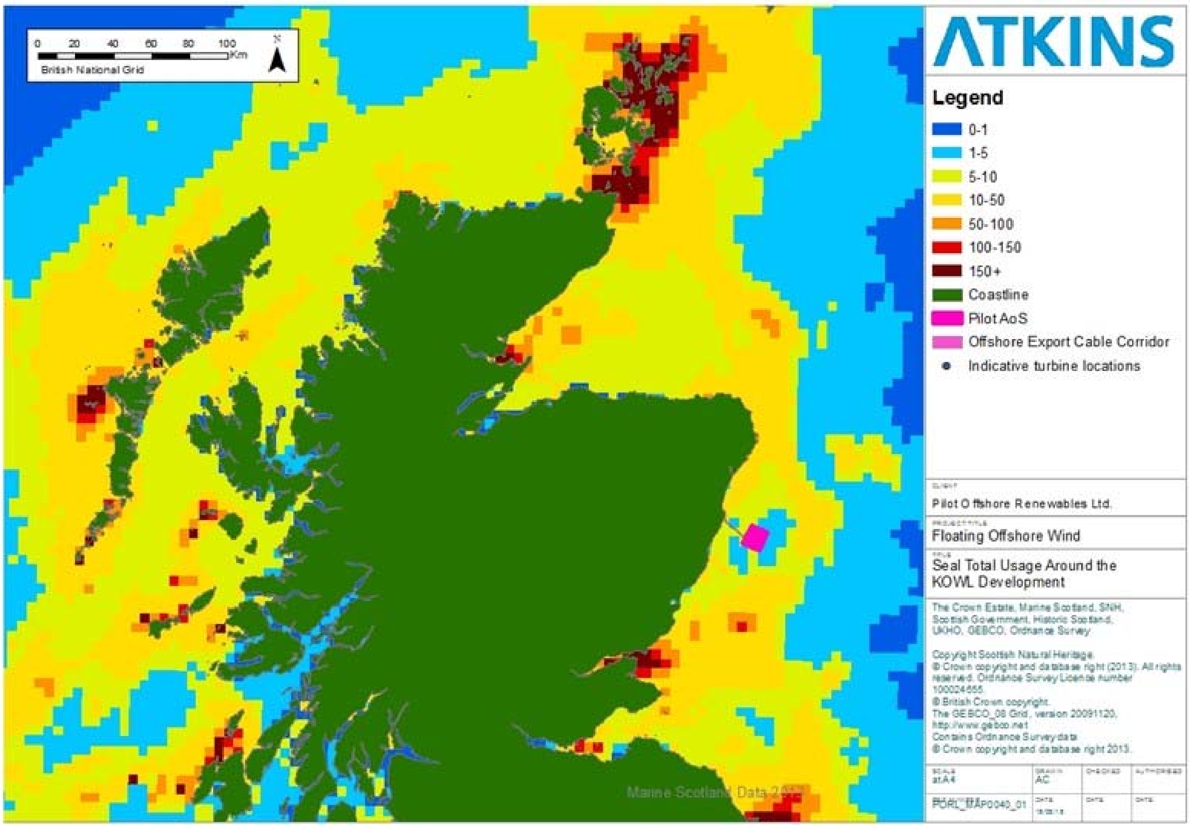

Figure 6-2 Grey Seal usage density

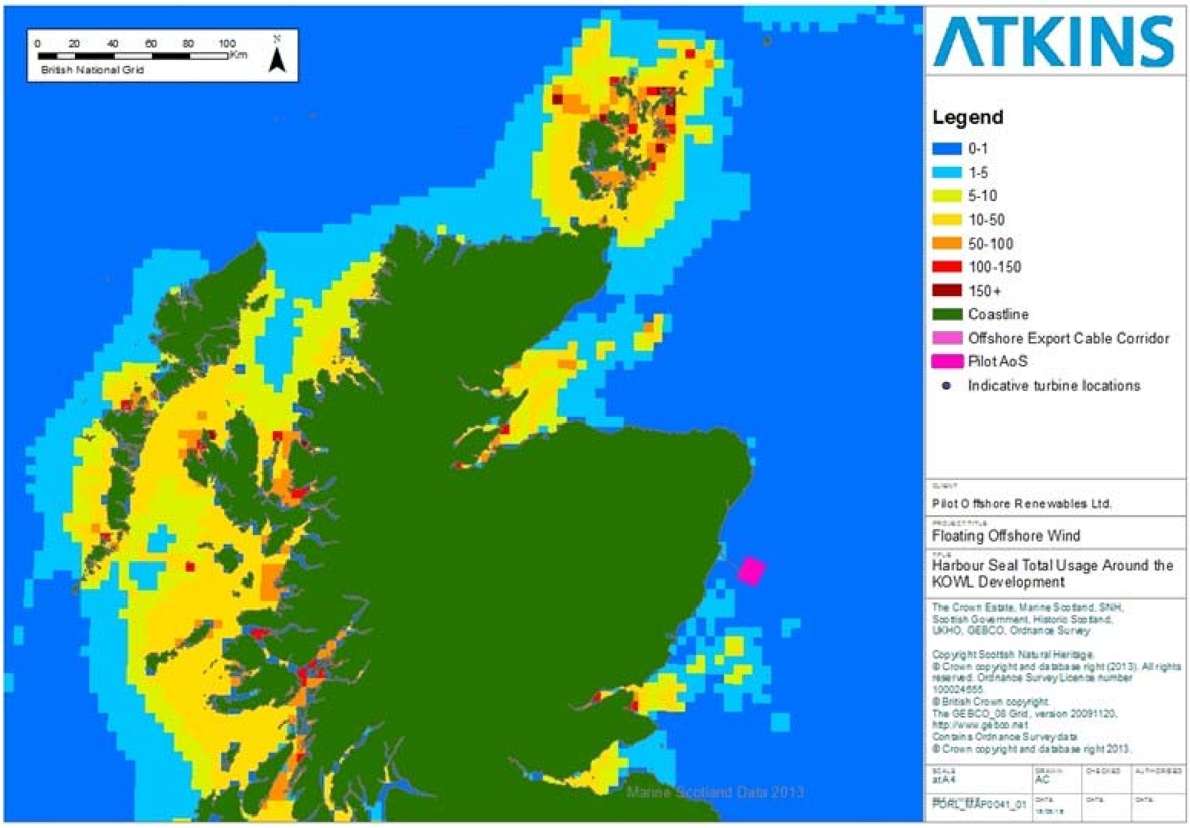

Figure 6-3 Harbour Seal usage density

6.2.3. Management Units

59. Management Units (MUs) provide an indication of the spatial scales at which projects alone, cumulatively and in-combination, should to be assessed for the key marine mammal species in UK waters. A Management Unit typically refers to a geographical area in which the individuals of a particular species are found and for which management of human activities is applied. A MU may be smaller than what is believed to be a population or an ecological unit to reflect spatial differences in human activities and their required management (IAMMWG, 2015). If MUs are defined at a smaller spatial scale than that of the population, it is important that management takes into account the rates of interchange of individuals between MUs; that is, the MUs should not be treated as if they were demographically independent (IAMMWG, 2015).

60. The species identified as being present within the Project site have been considered in relation to the relevant species Management Units (see Table 6-6 to Table 6-7). It should be noted that management units are not available for all of the marine mammal species identified in the project site (i.e. there are no management units defined for seals).

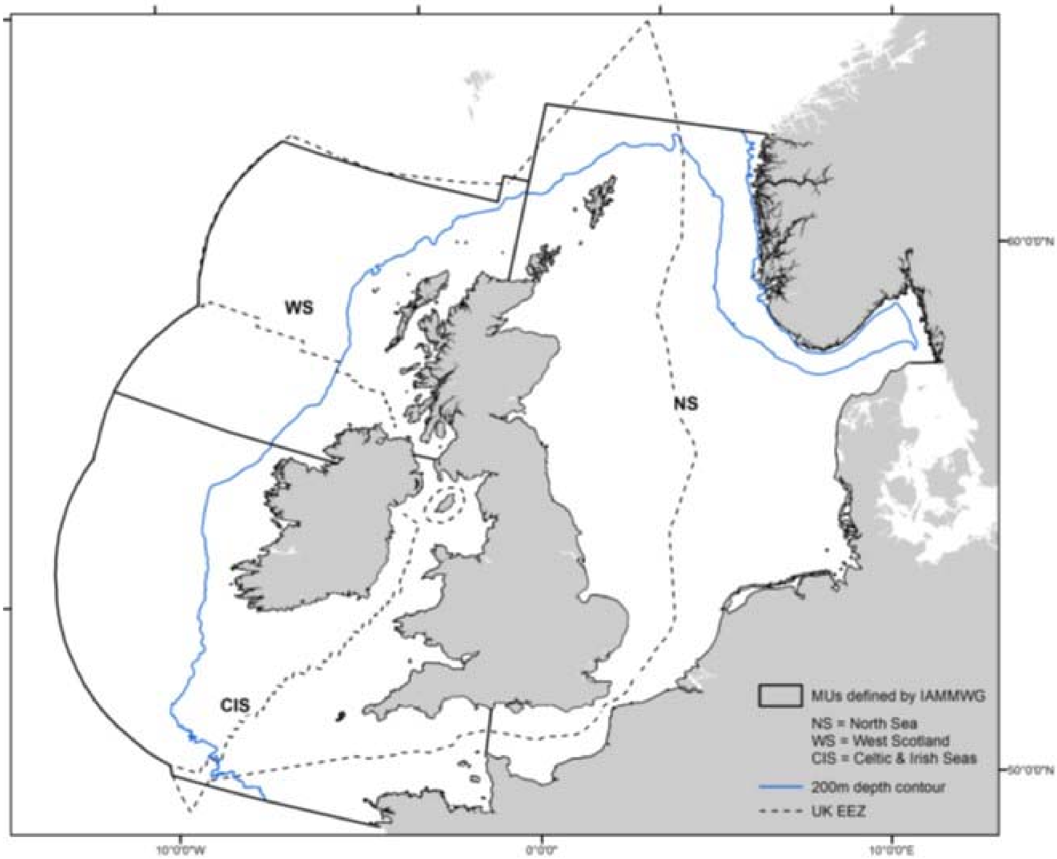

Figure 6-4 Harbour Porpoise Management Unit: North Sea (NS)

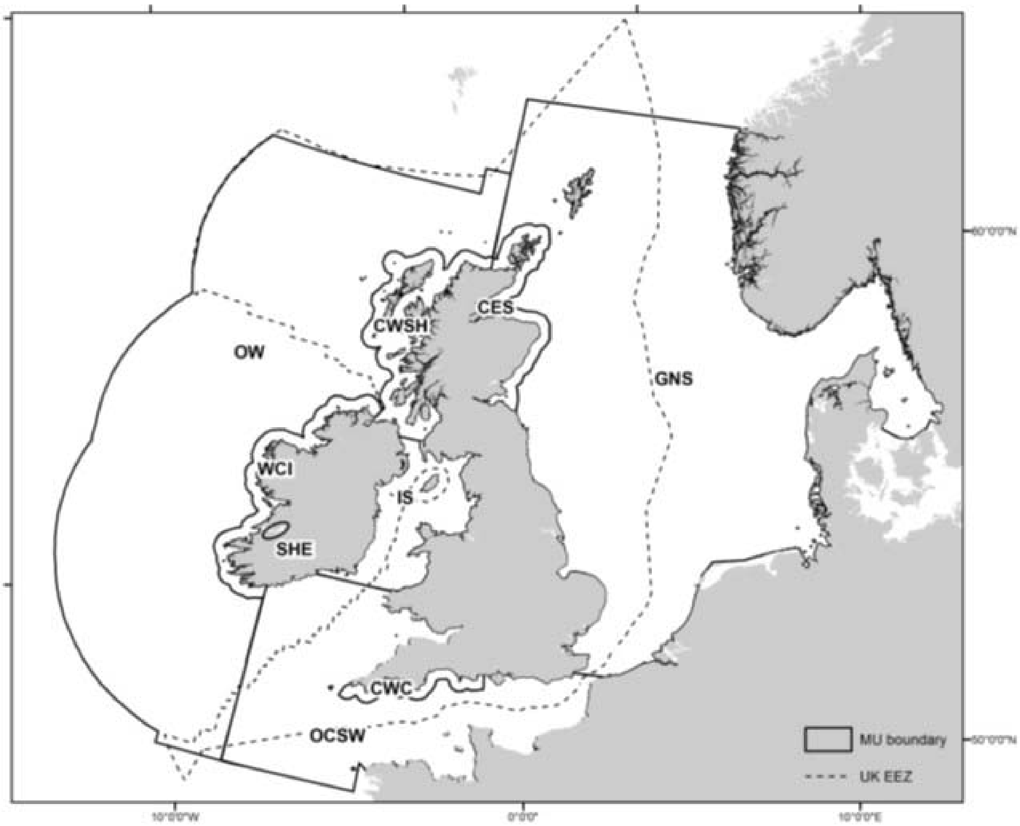

Figure 6-5 Bottlenose Dolphin Management Units: Coastal East Scotland (CES) and Greater North Sea (GNS)

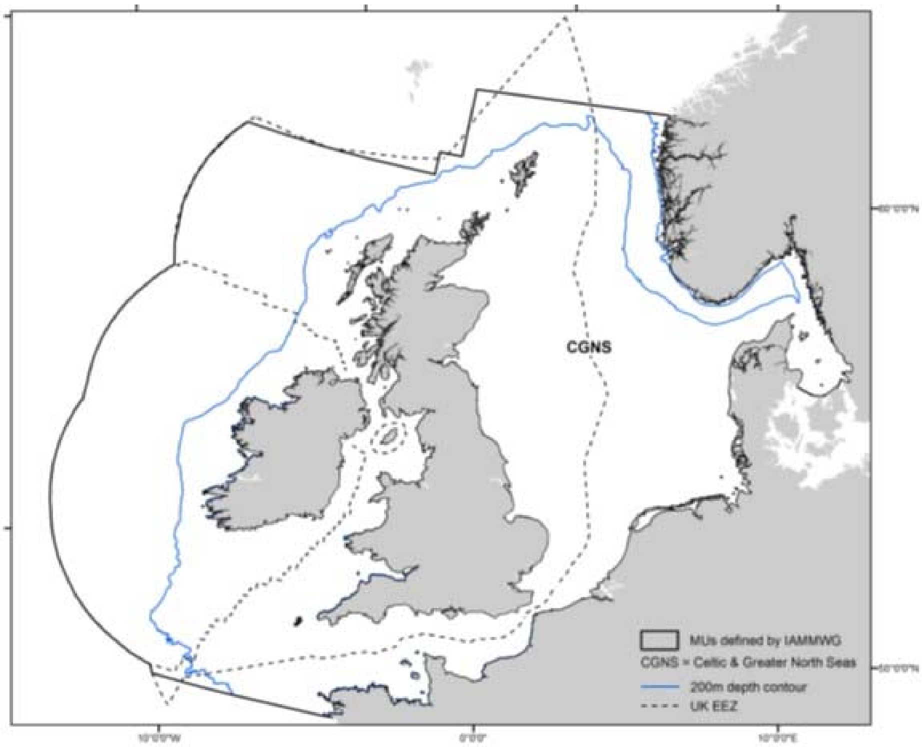

Figure 6-6 White-beaked Dolphin, White-sided Dolphin, Risso's Dolphin and Minke Whale Management Unit: Celtic and Greater North Seas (single MU comprising all UK waters)

61. Abundance estimates for species Management Units relevant to the Project site are given in Table 6-7.

Table 6-7 Estimates of abundance in defined species Management Units (MU) adapted from IAMMWG 2015

Species	MU	Abundance of Animals in MU (CV)	95% Confidence interval for MU	Abundance of animals in the UK portion of MU (CV)	95% Confidence interval for UK portion of MU	Source
Harbour Porpoise	NS	227,298 (0.13)	176,360-292,948	110,433 (0.16)	80,866-150,811	Hammond *et al* 2013
Bottlenose Dolphin	CES	195	162-253	195	162-253	Cheney *et al* 2013
Bottlenose Dolphin	GNS	0	0	0	0	n/a
White-Beaked Dolphin	CGNS	15,895 (0.29)	9,107 – 27,743	11,694 (0.30)	6,578 – 20,790	Hammond *et al* 2013
Risso's Dolphin	CGNS	There is no current abundance estimate available for this species				
Minke Whale	CGNS	23,528 (0.27)	13,989 – 39,572	12,295 (0.28)	7,176 – 21,066	Hammond *et al* 2013

62. Marine Mammal Management Units for species found in the Kincardine survey area represent large parts of the UK marine area. The following paragraphs provide an indication from abundance estimates of the proportion of animals within the Kincardine survey area relative to the overall Management Unit population.

63. The HiDef aerial surveys found densities of Harbour Porpoise to be low in the study area, averaging 0.09 animals/km² over all months and peaking at 0.26 animals/km² on 26 July 2013. When these densities were corrected for availability bias based upon the surfacing behaviour of Harbour Porpoise (as described in section 6.2.1), these densities averaged 0.29 animals/km² over the whole survey period, and peaked in July 2013 at 0.85 animals/km². These densities are higher than those of Hammond *et al.* (2013) who gave a predicted density of 0.2 – 0.3 animals/km² for the coastal area around Kincardine during July 2005. The population estimates of 157 (± 95% CI of 115 – 203, corrected for availability bias) for the Kincardine survey area represent 0.04% of the European population of 375,358, and 0.07% of the North Sea Management Unit of 227,298 (IAMMWG, 2015).

64. Bottlenose Dolphins were not recorded during the HiDef aerial surveys. IAMMWG 2015 provides an estimated abundance of Bottlenose Dolphins in the Greater North Sea Management Unit of 0 and states that very few Bottlenose Dolphin are seen in this area and, although there is no conclusive evidence, those seen are thought to belong to the Coastal East Scotland group. Bottlenose Dolphins tend to stay close inshore and the proposed Development Area is approximately 15km offshore.

65. The HiDef aerial surveys found numbers of White-beaked Dolphin in the Kincardine survey area to be low, with a population estimate of 5 (± 95% CI of 1-11). This represents 0.03 of the Celtic and Greater North Sea Marine Mammal Management Unit.

66. There are currently no abundance estimates available for Risso's Dolphin.

67. Minke Whales were recorded in low numbers in the Kincardine survey area, with a population estimate of 2 (± 95% CI of 0-4). This represents 0.008% of the Celtic and Greater North Sea Marine Mammal Management Unit of 23,528.

68. Comparison of the population estimates recorded during the HiDef surveys and the population estimates given in IAMMWG 2015 for the relevant Marine Mammal Management Units suggests

that at a MU level, the survey area supports relatively low numbers of marine mammals (≤ 0.07% of the MU of all species recorded). This suggests that potential impacts from the Project would affect only a very small proportion of the overall Management Unit population.

6.2.4. Designated Sites and Associated Marine Mammals Species

69. There are a number of Special Areas of Conservation (SACs) on the east coast of Scotland for which marine mammals are classed as an interest feature. These sites include Moray Firth SAC, Dornoch Firth and Morrich More SAC, Firth of Tay and Eden Estuary SAC, Faray and Holm of Faray SAC, Isle of May SAC and Berwickshire and Northumberland Coast SAC.

70. A qualifying feature of the Moray Firth Special Area of Conservation (SAC) is Bottlenose Dolphin *Tursiops truncates*, with the SAC supporting the only known resident population in the North Sea. The Coastal East Scotland Management Unit population of Bottlenose Dolphin is considered as the SAC population, as connectivity has been established on the east coast. The Coastal East Scotland abundance is recorded as 195 animals (Cheney *et al.,* 2013).

71. The Dornoch Firth and Morrich More SAC and the Firth of Tay and Eden Estuary SAC are designated for Harbour Seal (*Phoca vitulina*).

72. The Faray and Holm of Faray SAC, the Berwickshire and Northumberland Coast SAC and the Isle of May SAC are designated for Grey Seal (*Halichoerus grypus*).

Table 6-8 Designated Sites and Qualifying Features

Name	Annex II species that are primary reason for site selection (qualifying feature)	Other Annex II species present as a qualifying feature of the site	Comments
Moray Firth SAC	Bottlenose Dolphin (*Tursips truncates*)	N/A	The Moray Firth in north-east Scotland supports the only known resident population of Bottlenose Dolphin *Tursiops truncatus* in the North Sea. The population is estimated to be around 130 individuals. Dolphins are present all year round, and, while they range widely in the Moray Firth, they appear to favour particular areas.
Dornoch Firth and Morrich More SAC	Harbour Seal (*Phoca vitulina*)	Otter (*Lutra lutra*)	Harbour Seal: The Dornoch Firth is the most northerly large estuary in Britain and supports a significant proportion of the inner Moray Firth population of the Harbour Seal *Phoca vitulina*. The seals, which utilise sand-bars and shores at the mouth of the estuary as haul-out and breeding sites, are the most northerly population to utilise sandbanks. Their numbers represent almost 2% of the UK population. Otter: The River Evelix and the River Oykel, which both feed

Name	Annex II species that are primary reason for site selection (qualifying feature)	Other Annex II species present as a qualifying feature of the site	Comments
			into the site, provide further Otter (*Lutra lutra*) habitat. The area supports a good population of Otters in what is the only east coast estuarine site selected for the species in Scotland.
Firth of Tay and Eden Estuary SAC	Harbour Seal (*Phoca vitulina*)	N/A	The Firth of Tay and Eden Estuary supports a nationally important breeding colony of Harbour Seal *Phoca vitulina*, part of the east coast population of Harbour Seals that typically utilise sandbanks. The Firth of Tay has experienced a dramatic decline in harbour seals (reducing by ~93% between 2000 and 2013) in 2013 the Harbour Seal moult count was at 50 individuals (SCOS, 2014).
Faray and Holm of Faray SAC	Grey Seal (*Halichoerus grypus*)	N/A	These two uninhabited islands in the northern part of Orkney support a well-established Grey Seal *Halichoerus grypus* breeding colony. The seals tend to be found in areas where there is easy access from the shore, and freshwater pools on the islands appear to be particularly important. The islands support the second-largest breeding colony in the UK, contributing around 9% of annual UK pup production.
Isle of May SAC	Grey Seal (*Halichoerus grypus*)	N/A	The Isle of May, lying at the entrance to the Firth of Forth on the east coast of Scotland, supports a breeding colony of Grey Seals *Halichoerus grypus*. The site is the largest east coast breeding colony of grey seals in Scotland and the fourth-largest breeding colony in the UK, contributing approximately 4.5% of annual UK pup production.
Berwickshire and Northumberland Coast SAC	Grey Seal (*Halichoerus grypus*)	N/A	This is an extensive and diverse stretch of coastline in north-east England and south-east Scotland. The north-east England coastal

Name	Annex II species that are primary reason for site selection (qualifying feature)	Other Annex II species present as a qualifying feature of the site	Comments
			section is representative of Grey Seal *Halichoerus grypus* breeding colonies in the south-east of its breeding range in the UK. It is the most south-easterly site selected for this species, and supports around 2.5% of annual UK pup production.

6.3. Assessment Methodology

73. The range of impacts considered in the impact assessment is based on the impacts identified during EIA Scoping (Scoping Report) and any further potential impacts which have been highlighted as the EIA has progressed. The impacts identified are:

- Disturbance and/or displacement
- Noise
- Collision/vessel strikes
- Corkscrew injuries
- Contamination
- Entanglement
- Electromagnetic fields
- Disturbance to prey species

74. To assess the significance of the impacts (see Chapter 1) on marine mammals the sensitivity of the marine mammal receptors and the magnitude of effect have been taken into account. Potential impacts are either direct or indirect, with the latter defined as an impact that affects a receptor that marine mammals rely on, e.g. prey species, as opposed to affecting the marine mammal directly.

75. For the impact assessment for marine mammals, the sensitivity of the identified receptors is defined as either high, moderate or low based on the definitions in Table 6-9 and the magnitude of effect is defined by the criteria in Table 6-10.

Table 6-9 Criteria for sensitivity and value

Sensitivity	Definition
High	Receptor with a very low capacity to accommodate a particular effect with low recoverability or adaptability.
Moderate	Receptor has a low capacity to accommodate a particular effect with some potential for recovery or adaption.
Low	Receptor has some tolerance to accommodate a particular effect or will be able to recover or adapt.

Table 6-10 Criteria for magnitude of effect

Magnitude	Definition
Major	Effect is over a large scale or spatial extent, or occurs long term, or at a medium-high frequency, resulting in extensive temporary change or some permanent change to baseline.
Moderate	Effect is localised, or occurs for a short duration, or at a medium frequency, resulting in temporary changes or limited permanent changes to baseline.
Minor	Detectable disturbance or change to baseline levels and no long term noticeable effects above the level of natural variation experienced.
Negligible	Imperceptible changes to baseline.
Positive	Beneficial change to baseline conditions

76. Impact significance matrices have been utilised throughout the impact assessment. These are based on the magnitude and significance of the potential impact on marine mammals, and use the criteria outlined in Table 6-9 and Table 6-10. The sensitivity of receptor and magnitude of effect are then combined to determine the level of impact (Table 6-11).

77. For this EIA any positive or negative effects which are indicated as 'Major' and 'Moderate/Major' are considered as significant.

Table 6-11 Criteria used for predicting significance of impacts

Magnitude of Effect	Sensitivity of Resource / Receptor		
	Low	**Moderate**	**High**
Positive	Minor	Moderate	Major
Negligible	Negligible / Minor	Minor	Minor / Moderate
Minor	Minor	Minor / Moderate	Moderate
Moderate	Minor / Moderate	Moderate	Moderate / Major
Major	Moderate	Moderate / Major	Major

6.4. Design Envelope

78. The assessment of potential impacts on marine mammals within this chapter is based on the Rochdale Envelope, with the development methodology and parameters being based on the worst case scenario.

79. For the assessment, these scenarios include:

- Consideration of the maximum number of WTGs with the largest footprint, therefore the maximum loss of area (in this case 8 x 6 MW WTGs);
- Worst case positioning of WTGs;
- For the Offshore Export Cable Corridor, it is assumed that two export cables will be required and installed at the shore end via Horizontal Directional Drilling (HDD).

80. Key parameters for the worst case scenario for each potential impact are detailed Table 6-12 below.

Table 6-12 Key parameters for potential impacts

Potential Impact	Worst Case Scenario Assessed in ES
Disturbance / displacement, barrier to movement from WTG numbers and layout	8 x 6 MW WTGs No met masts will be installed There will be no Offshore Substation Platform (OSP)
Seabed disturbance from inter-array cabling. Indirect changes to habitat and distribution / abundance of prey	Maximum 12 cables Cable length 2.5 km each Cable overall diameter 180mm Cables will not be buried Remedial cable protection will be installed where required, e.g. localised burial. Area of habitat loss, total Development Area: 0.129km^2
Seabed disturbance from export cabling. Indirect changes to habitat and distribution / abundance of prey	Maximum 2 cables Cable length 19km each (15 km offshore) Cable overall diameter 180mm Cable to be buried to target depth of 1.5m Where the target burial depth is not reached, remedial cable protection, e.g. concrete mattressing or rock dumping, may be required Area of habitat loss, total Development Area:0.129km^2
Seabed disturbance from mooring system Indirect changes to habitat and distribution / abundance of prey	4 catenary anchors per substructure Drag embedment anchors Mooring lines = anchor chain, cables Mooring line radius = <1km Temporary surface buoys during construction Permanent submersible buoys at seabed for ROV recovery
Electromagnetic Fields (EMF)	Inter array cables will not be buried Remedial cable protection will be installed where required, e.g. localised burial Export cables will be buried to target depth of 1.5m Where the target burial depth is not reached, remedial cable protection, e.g. concrete mattressing or rock dumping, may be required
Corkscrew injuries	Use of vessels with ducted propellers
Marine mammal entanglement	Greatest risk generated by catenary moorings, particularly those containing nylon. Worse case 4x mooring lines per turbine (total 32)
Noise disturbance	No piling will be undertaken Potential operational noise from WTGs will be assessed
Pollution due to leaks and spills at site from vessels / WTGs	Maximum number of vessel movements / pre-defined vessel routes

	Contamination from corrosion / anti-fouling protection Cathodic protection, anti-corrosion coatings, anti-fouling paints and mechanical removal of deposits
Collision risk from vessel movement	Maximum number of vessel movements / pre-defined vessel routes during the construction and operational phase

6.4.1. Embedded Mitigation

81. Mitigation measures to reduce any potential environmental impacts have been incorporated into the design of the windfarm from site selection through to the layout of the turbines and the design of the individual components of the windfarm. The selection of installation and decommissioning techniques has also been chosen to have the lowest environmental impact possible.

82. In addition a range of embedded mitigation measures to minimise environmental effects are captured within the design envelope (Chapter 1). The assessment of effects on marine mammals has taken account of the following embedded mitigation measures:

- Vessels and plant required for the construction, operation and decommissioning phase will follow industry best practice and OSPAR, IMO and MARPOL guidance for pollution at sea, which will be detailed in the final Project Environment Management Plan (PEMP) to reduce and coordinate response to pollution events. The PEMP will also include provision for the storage of pollutants;
- Defined navigational routes will be utilised by vessels to reduce the risk of collision with marine mammals;
- All materials utilised will be safe for use within the marine environment; and
- Export cables will be buried to a depth of 1.5m or protected by other means where burial is not practicable, e.g. rock dumping or concrete mattressing, which will reduce potential for impacts relating to Electromagnetic Fields (EMF).
- In the event of an accident where toxic chemicals are released into the marine environment, emergency procedures will be in place to minimise the environmental effects as much as possible. For example, vessels will be equipped with oil spill kits to enable containment and treatment of spills. In addition, emergency spill procedures specific to the protection of the environment will be outlined in the final Project Environmental Management Plan (PEMP) and fully implemented during construction, operation and decommissioning.
- The mooring lines will be routinely maintained and checked for debris with gear removal programmes put in place where necessary. Furthermore, load cells will be attached to the mooring devices and subsea cables. The load cells will alert the Developer if there is unexpected load on the devices which can then be examined.
- Trained Marine Mammal Observers (MMO) will be present on the vessels when appropriate to advise on environmental best practice and to conduct searches for the presence of marine mammals prior to activities commencing. In addition, the use of acoustic deterrent devices (ADD) (scarers) and / or Passive Acoustic Monitoring (PAM) to detect marine mammals in the area will be considered if necessary and relevant to the species of concern. The use of acoustic warning equipment, if appropriately designed, could prove a valuable mitigation tool, however, any active acoustic warning also represents a new source of sound pollution, specifically intended to alter the behaviour of marine mammals. The use of such devices should therefore be considered carefully to decide whether or not it is appropriate to deliberately add extra-noise to the sea as a precautionary measure.

  It may be possible to programme the construction activities anticipated to result in the most impacts to marine mammals (cable laying / burial, rock placement) outside of the peak periods for marine mammals presence within the vicinity of Development Area (e.g. August and September).

6.5. Impact Assessment

6.5.1. Development Area

83. The key risks to marine mammals within the Development Area have been summarised in Table 6-13.

84. These risks have been assessed for significance of impact in the following sections. Impacts have been assessed to order level (cetaceans and pinnipeds) as detailed information on sensitivity to impacts is not available to a species level. Where one species is known to be more sensitive that others this has been highlighted in the significance of impacts section.

Table 6-13 Key risks to marine mammals within the Development Area

Activity	Risk	Potential Impact	Construction	Operation	Decommissioning
Increased vessel activity, including presence of vessels with ducted propellers	Temporary disturbance and / or displacement of species	• Restricted access to prey sources, breeding grounds or migration routes • Potential for increased competition for resources (where displacement results in a localised increase in marine mammal activity elsewhere) and reduced fitness	X	X	X
	Increased noise leading to hearing damage (temporary and / or permanent) in species	• Distress, disturbance and displacement • Potential for long-term reduction in survival and the ability to find prey, avoid predators and to socially interact	X	X	X
	Collision with species	• Physical injury / long term incapacity / death • Specifically for seals, potential of corkscrew mortality from vessels using ducted propellers	X	X	X
	Contamination of water, e.g. direct spillage from vessels	• Death or physiological injury through toxic and non-toxic contamination of the water	X	X	X
	Disturbance to prey species (indirect impact)	• Reduction in resources therefore reduction in fitness and breeding success	X	X	X
Geophysical survey	Increased noise leading to hearing damage (temporary and / or permanent) in species	• Distress, disturbance and displacement • Potential for long-term reduction in survival and the ability to find prey, avoid predators and to socially interact	X		

	Disturbance to prey species (indirect impact)	• Reduction in resources therefore reduction in fitness and breeding success	X		
	Temporary disturbance and / or displacement of species	• Restricted access to prey sources, breeding grounds or migration routes • Modification in foraging behaviour • Potential for increased competition for resources (where displacement results in a localised increase in marine mammal activity elsewhere) and reduced fitness	X		
WTG operation	Noise generation leading to hearing damage (temporary and / or permanent) in species	• Distress, disturbance and displacement • Potential for long-term reduction in survival and the ability to find prey, avoid predators and to socially interact		X	
Presence of WTGs, substructures and mooring lines	Disturbance and / or displacement of species	• Restricted access to prey sources, breeding grounds or migration routes (habitat loss) • Potential for increased competition for resources (where displacement results in a localised increase in marine mammal activity elsewhere) and reduced fitness		X	
	Entanglement of species	• Physical injury / long term incapacity / death		X	
	Contamination of water, e.g. from antifouling paints, corrosion inhibitors, oil leakage from equipment and accidental pollution events	• Death or physiological injury through toxic and non-toxic contamination of the water		X	
	Habitat loss / disturbance to prey species (indirect impact)	• Reduction in resources therefore reduction in fitness and breeding success		X	
Presence of inter-array cables	Generation of Electromagnetic Fields	• Individual attraction / avoidance, population attraction / avoidance, altered migration routes (temporary or long-term)		X	
	Habitat loss / disturbance to prey species (indirect impact)	• Reduction in resources therefore reduction in fitness and breeding success		X	

6.5.1.1. Disturbance or Displacement

Overview of Impact

85. This pressure relates to disturbance and displacement from the physical presence of vessels and structures but does not include noise as this is covered separately below.

86. An increase in vessel activity may result in a temporary barrier effect due to marine mammal avoidance of vessel traffic, potentially preventing marine mammals from moving through the waters within the regions of the Development Area. This may cause disturbance to marine mammals, especially those which may be transecting or foraging in waters local to the Development Area. In addition, behavioural changes in species due to avoidance during mating and breeding periods may have an impact upon a species as a whole.

87. The presence of WTGs and substructures during the operational phase of the windfarm is also considered a potential barrier to marine mammals. However, a number of recent studies have reported the presence of marine mammals within windfarm footprints (Teilmann *et al.,* 2006; Tougaard *et al.,* 2006; Hammond *et al.,* 2002; SCANS II, 2008) therefore displacement due to the presence of WTGs and substructures was scoped out during the Scoping stage and is therefore not considered further within the EIA.

Characterisation of Impact

88. The level of vessel traffic within the Development Area is deemed as intermediate to moderately busy compared to other regions of UK waters. The current use of the Development Area varies throughout the year. An average of 64 vessels per day passed within 10nm of the Development Area during the summer period, rising to 68 unique vessels per day in the winter period (Appendix C Anatec Kincardine Navigation Risk Assessment). Of these, an average of seven unique vessels a day pass through the Development Area during summer, falling to five during winter (Appendix C Anatec Kincardine Navigation Risk Assessment). The vessel types recorded passing within 10nm of the Development Area included cargo vessels, tugs, tankers, Emergency Response and Rescue Vessels (ERRVs), guard boats, survey vessels and workboats (Appendix C Anatec Kincardine Navigation Risk Assessment).

89. The precise number and type of the vessels to be used for the Project is still to be determined. It is likely that a number of vessels will be used during construction including barges, cable laying vessels, tugs and guard vessels, but as the construction will be undertaken in stages it is likely that only 1-2 vessels would be on site at any one time. It is assumed that one vessel operating five days per week would be required during operation and maintenance (Table 1-3). The additional windfarm related traffic will be confined to pre-defined traffic corridors.

90. Marine mammal behaviour in response to vessels is variable and may depend on the type and speed of the vessel, as well as other factors such as habituation to specific vessels. However, marine mammals in the Project site are already subject to considerable activity by a range of vessels from commercial ships to fishing boats as well as a range of smaller non-commercial craft. Marine mammals in the area thus seem likely to display some degree of habituation to vessel traffic. Consequently, the impact of vessels associated with the construction and operation of the Project may not be as great as in an undisturbed area.

Significance of Impact

91. It is unlikely that increased vessel activity will result in a barrier effect to marine mammals, as they are already used to a medium level of vessel traffic moving throughout the area. Given the presence of marine mammals in an area of moderate shipping it is assumed that their sensitivity to vessel disturbance is low.

92. It is anticipated that species would quickly become used to the presence of what is expected to be a small increase in the number of vessels associated with the construction, operation and decommissioning phases. Any displacement and behavioural changes of marine mammals due to increased vessel activity would be to be short-term (Wilhelmsson et al., 2010).

93. Potential effects from decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed in the construction phase. The decommissioning approach is described in Chapter 2. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 and subject to approval by the Department of Energy and Climate Change (DECC) prior to implementation.

Table 6-14 Impact summary of disturbance of displacement of marine mammals

Impact	Receptor	Sensitivity of Receptor	Magnitude of effect	Significance
Disturbance or displacement from vessel movements	All marine mammals	Low Marine mammals in the Project site are already subject to considerable activity by a range of vessels. Marine mammals display some degree of habituation to vessel traffic.	Negligible It is anticipated that one to two vessel would be operating on the Project at any one time.	Negligible/Minor

6.5.1.2. Increased Noise

Overview of Impact

94. Marine mammals have very good underwater hearing and as a consequence are sensitive to increased underwater noise (Bonar *et al*., 2015). Marine mammals rely heavily on sound to feed, navigate and socially interact (Bonar *et al*., 2015). Sound travels further through water than in air; therefore anthropogenic sources of noise have the potential to affect marine mammals at relatively large distances (Bailey *et al*., 2010). The propagation of noise through water depends on several factors including water depth, with noise travelling further in deeper water (Bailey *et al*., 2010). Seabed topography can also have a strong effect on the propagation of sound in water (Bailey *et al*., 2010).

95. The ability of an individual marine mammal to hear a certain sound in the ocean is a complex task involving at least six abilities and processes:

- Absolute hearing threshold;
- Individual variation in sensitivity;
- Individual motivation;
- Ability to overcome the masking (i.e., obscuring/interference) effect of background sound;
- Sound source localisation;
- Frequency and intensity discrimination (Richardson *et al*., 1995)

Thereafter behavioural responses to a sound, once detected, are known to be strongly influenced by the context of the event and individual factors such as the animal's experience, motivation, conditioning and activity (Nowacek *et al*., 2007; Southall *et al*., 2007; Wartzok *et al*., 2004). Identical sounds may be experienced in very different ways by individual marine mammals of different species. In addition, as in humans and other mammals, variation in hearing ability between individual animals is common.

96. Underwater noise may result in physical harm, temporary or permanent hearing loss, altered behaviours or patterns of movement and loss of habitat, masking of important biological sounds and increased vulnerability to predation and other hazards (Bonar *et al*., 2015). The cumulative cost of these responses can alter the animals' activity budget and energy balance which may have consequences for individual vital rates (survival and reproductive success) and overall population dynamics (Merchant *et al*., 2014).

Characterisation of Impact

97. Details of the proposed Project activities can be viewed in Chapters 1 and 2.

98. Traditional offshore windfarm developments have been the subject of significant underwater noise assessments and regulation due to the impact of piling noise and vessel noise during the extended period of construction (installation of the piles, installation of the monopiles / jackets and the installation of the WTG). Anticipated noise levels associated with the relevant activities of the Project are detailed in Chapter 8.

99. The construction/installation phase will inevitably generate increased noise however, the installation of floating offshore structures removes most site construction noise as the units are constructed in port, towed to the site then moored in position, with no piling activities required. Construction related noise is therefore significantly reduced compared to a traditional piled offshore windfarm.

100. The SPEAR model has been used in Chapter 8 to output an approximate figure that represents the area of ocean which is rendered potentially unusable by a species as a result of a particular activity. The size of the area rendered unusable will vary depending on the species sensitivity to noise, as some species of marine mammal are more sensitive than others. $90dB_{ht}$ (dBs referenced to hearing threshold) is the level at which noise is predicted to cause a strong avoidance reaction in virtually all marine mammal individuals (Nedwell, 2007).

101. As presented in Chapter 8, the $90dB_{ht}$ threshold for all species will only be reached in very close proximity to the activity. For most of the activities, all species of marine mammals would have to be within 100m, of the activity for a significant avoidance response to be seen by all individuals. However, activities such as trenching and the placement of rock, are expected to cause a significant avoidance response over larger distances (approximately 140m) for noise sensitive species such as Harbour Porpoise. Any marine mammals that are exposed to a level of sound above this threshold are likely to experience a startle response and move away from the noise.

102. Although the project will be developed without the use of piled anchors and much of the construction will be carried out in the port, other possible effects of noise have still been considered. Throughout the duration of the project, the likely sources of noise are:

- Pre-construction geophysical survey
- Increased vessel activity (construction, operation and decommissioning)
- WTG operation noise (operation)

Geophysical Survey

103. Pre installation geophysical surveys of the Development Area may be required and it is recognised that geophysical surveys have the potential to cause acoustic disturbance to marine mammals (JNCC, 2010).

104. Geophysical acoustic surveys in marine or coastal waters involve the collection of information on the physical environment by means of sound signal production, reception, analysis and interpretation, to analyse the structure and composition of the seabed substrate. Surveys involve the use of a vessels fitted with specialised equipment or from which such equipment can be deployed or towed.

105. Marine seismic surveys primarily use low-frequency sound to penetrate the sea floor, which can harm marine mammals. The level of environmental impact associated with this acoustic activity is variable depending on a number of factors including the type of the equipment being used, its sound signal and propagation characteristics, and the depth in which it is operating.

106. Acoustic instruments and equipment used in targeted marine geophysical investigations can have very high sound pressure levels (e.g. air guns), however the instruments that are likely to be used for the Project survey (multibeam, single beam, side-scan sonar and sub-bottom profilers) emit energy at a significantly lower levels.

107. The details of the geophysical survey specification are not known yet, however it is anticipated that sub bottom profilers are likely to pose the greatest risk of disturbance to marine mammals. Based on our prior experience we would expect to employ a number of key mitigation measures, as outlined in the JNCC 2010 seismic guidelines, which will be discussed and agreed as part of the consultation prior to the surveys.

108. Similarly, but to a lesser extent, the use of acoustic deterrent devices (ADD), as a mitigation measure, represent the addition of a new sound source to the marine mammal environment designed to elicit a behavioural response. The use of such devices may not be required by the Project, but should they be suggested, they should be considered carefully to decide whether or not it is appropriate to deliberately add extra-noise to the sea as a precautionary measure.

Increased Vessel Activity

109. Construction, operation and decommissioning of the Project will result in increased vessel traffic; therefore an increase in vessel noise is expected during these phases.

110. The frequency and sound levels produced by an increase in vessel movement is dependent on vessel size, type and speed of vessel movement, which may vary during the construction phase.

111. It is likely that during the development, background noise and vibrations from vessel engines will increase within the Development Area and the transport routes to and from the site. Potential for impact on marine mammal species will be dependent on the vessel routes taken to the Development Area. Potential construction ports are yet to be confirmed and therefore transport routes are unknown. However, planned vessel activity relating to construction, operation and decommissioning activities will be discussed and detailed within the final Project Environmental Management Plan (PEMP).

Cable Laying

112. The inter-array cables within the Development Area will be surface laid on the seabed. It is anticipated that this process will take one vessel 14 days to lay.

113. The potential noise impacts for cable laying has been assessed in Chapter 8 Table 8-6. Harbour Porpoise have the largest range for significance avoidance response to this activity at 29m and are expected to show some behavioural response at 220m. Harbour Seals appear to be relatively unaffected by this noise source with impacts ranges of 2m (90 dB_{ht}) 29m (75 dB_{ht}).

WTG Operation

114. The larger wind turbines that are being considered for the Project are in the demonstrator phase and full noise spectrum analysis is not currently available. However, the wind turbine manufacturers predict that the wind turbines would have a noise output of no greater than 110dB(A) at hub height measured according to the IEC 61400-11 standard.

115. Operational WTGs typically produce low frequency noise and vibrations that pass into the water column. Whilst this noise is a lower frequency than that produced during construction and decommissioning, the duration of the noise is longer (Nedwell, 2007).

116. Impacts of sound disturbance from windfarms on long distance communication and navigation among marine mammals, such as whales during migration, is largely unknown (Wilhelmsson *et al*., 2010). Estimates for the distance at which porpoises detect sound from WTGs range between 10 and 100m, while seals may detect wind turbines 360 to 10,000m away (Wilhelmsson *et al*., 2010).

117. The known noise levels from operational WTGs are likely to have small or minimal impacts on marine mammals, e.g. Harbour Porpoise, Bottlenose Dolphin and Harbour Seal, especially considering the already prevailing man-made sources of underwater noise (Wilhelmsson *et al*., 2010). WTG noise is unlikely to cause permanent hearing damage in seals, porpoises or bottlenose dolphins, even at close proximity to the WTGs (Marine Scotland, 2012).

Significance of Impact

118. Noise impacts from vessels used to install the anchors for the WTGs and tow the WTGs to site are expected to be very short term in nature (anchor placement will take eight days total and WTG tows will take three to four days per turbine). The modelling results show that noise from vessels used for the Project will have a very small impact range for all marine mammal. These noise ranges apply equally to vessels used for maintenance during the operation of the windfarm.

119. Given the limited number of marine mammals observed within the aerial surveys (Section 6.2.1), the existing level of vessel movements in the site (Chapter 9) and the relatively small scale of this development, the noise associated with the Project vessel activity is anticipated have only a negligible/minor impact upon marine mammals.

120. The potential noise impacts for cable laying has been assessed to provide the impact ranges for cable laying given in Chapter 8 Table 8-6. Harbour porpoise are shown to have the largest range for significance avoidance response to this activity at 29m and are expected to show some behavioural response at 220m. Harbour seals appear to be relatively unaffected by this noise source with impacts ranges of 2m (90dB_{ht}) 29m (75dB_{ht}).

121. From studies of windfarms to date, there is no evidence of marine mammals avoiding windfarms during operation due to noise, and any long-term avoidance behaviour is considered very localised (Wilhelmsson *et al*., 2010). It is therefore anticipated that operational noise impact to marine mammals would be very limited. To confirm this assumption, operational noise data will be collected on site during the initial phase of operation.

122. Given the low penetration depth into the seabed required for the Project geophysical surveys, they are not anticipated to emit large amounts of noise. However, as the survey specifications have not yet been finalised, further consultation will be undertaken prior to the geophysical surveys, which are planned for the detailed design stage of the Project. The Geophysical surveys will be undertaken in line with the JNCC 2010 seismic guidelines and will include relevant mitigation measures. It is recognised that compliance with the JNCC seismic guidelines will reduce the risk of injury to EPS to negligible levels (JNCC, 2010). The Marine Scotland Licensing Operations Team (MS-LOT) would be consulted regarding the requirement for a European Protected Species (EPS) licence.

123. Generally, any noise generated during construction or decommissioning will be temporary. As the potential noise impact is very limited for offshore floating wind installations and any potential impacts are limited in time and space.

124. Potential effects from decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed in the construction phase. The decommissioning approach is described in Chapter 2. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 and subject to approval by the Department of Energy and Climate Change (DECC) prior to implementation.

Table 6-15 Impact summary of underwater noise on marine mammals

Impact	Receptor	Sensitivity of receptor	Magnitude of effect	Significance
Geophysical survey noise	All marine mammals	Low May elicit a disturbance response in close proximity to the source	Minor Given the low penetration depth into the seabed required for the Project geophysical surveys, they are not anticipated to emit large amounts of noise.	Minor
Vessel noise	All marine mammals	Low Marine mammals in the Project site are already subject to considerable activity by a range of vessels.	Negligible The modelling results show that noise from vessels used for the Project will have a very	Negligible/Minor

Impact	Receptor	Sensitivity of receptor	Magnitude of effect	Significance
		Marine mammals in the area display some degree of habituation to vessel traffic.	small impact range for all marine mammal.	
Cable laying noise	Pinnipeds	Low Modelling suggests that Harbour Seals appear to be relatively unaffected by this noise source with impacts ranges of 2m (90 dB_{ht}) 29m (75 dB_{ht}).	Minor The inter-array cables within the Development Area will be surface laid on the seabed. It is anticipated that this process will take one vessel 14 days to lay.	Minor
Cable laying noise	Cetaceans	Low Modelling suggests Harbour Porpoise will have an avoidance response to this activity at 29m and are expected to show some behavioural response at 220m.	Minor The inter-array cables within the Development Area will be surface laid on the seabed. It is anticipated that this process will take one vessel 14 days to lay.	Minor
WTG operational noise	All marine mammals	Low From studies of windfarms to date, there is no evidence of marine mammals avoiding windfarms during operation due to noise	Negligible Noise levels will be low and very localised	Negligible/Minor

6.5.1.3. Collision / Vessel Strikes

Overview of Impact

125. An increase in vessel activity may lead to an increase in collision risk, with vessel strikes being a known cause of mortality for marine mammals. A number of responses to vessel traffic have been reported in marine mammals, including avoidance, displacement and changes in vocalisation (Carter, 2007).

Characterisation of Impact

126. Research into marine mammals and vessel collisions in general has demonstrated that the likelihood of collision varies, depending on a number of factors, including vessel type, speed, location, species, and behaviour (Laist *et al*., 2001; Van Waerebeek *et al.,* 2007). Studies have shown that the risk of a collision occurring and the likelihood that it will result in severe or lethal injury increases when vessels exceed 10–14 knots (Laist *et al.*, 2001). The influence of vessel type appears to be less significant (Todd *et al.*, 2014).

127. The level of existing vessel traffic within the Project site is deemed as intermediate to moderately busy compared to other regions of UK waters (Appendix C).

128. The vessel types and construction ports to be used during the development of Kincardine Offshore Windfarm are still to be determined. It is likely that a number of vessels will be used including barges, cable laying vessels, tugs and guard vessels, and although the potential for impact on marine mammal species will be dependent on the vessel routes taken to the Development Area, the additional vessel traffic will be confined to pre-defined traffic corridors.

Significance of Impact

129. There is already a medium level of vessel activity occurring in the area, with a high intensity of vessel movements to and from Aberdeen Harbour. Planned vessel activity relating to construction, operation and decommissioning activities will be discussed and detailed within the final Project Environmental Management Plan (PEMP) but is anticipated to be a relatively minor increase in comparison to the existing vessel traffic. Defined navigational routes will be utilised by vessels to reduce the risk of collision with marine mammals.

130. During the construction, operation and decommissioning phases of the project, vessels will be slow moving and predictable, both for safety and operational reasons, therefore it is likely that the vessels will pose little risk of collision to marine mammals, particularly Harbour Porpoise, Dolphins and Seals which were observed most frequently within the Development Area and are all highly mobile species.

131. It is anticipated that species would quickly become used to the presence of what is expected to be a small increase in the number of vessels associated with the construction, operation and decommissioning phases. Any behavioural changes of marine mammals due to increased vessel activity would be to be short-term (Wilhelmsson *et al.,* 2010).

132. Potential effects from decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed in the construction phase. The decommissioning approach is described in Chapter 2. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 and subject to approval by the Department of Energy and Climate Change (DECC) prior to implementation.

Table 6-16 Impact summary of collision/vessel strikes on marine mammals

Impact	Receptor	Sensitivity of receptor	Magnitude of effect	Significance
Collision/vessel strikes – construction, operation and decommissioning	All marine mammals	Moderate Vessel strikes have the potential to cause injury or mortality	Negligible The Project will use low numbers of vessels which will be confined to designated routes, and be slow moving.	Minor

6.5.1.4. Corkscrew Injuries

Overview of Impact

133. Between 2009 and 2014, eighty-six seal carcasses were found in Scottish waters with unusual spiral lacerations (corkscrew injuries). Initial investigations suggested that ships with ducted propellers may be responsible for the injuries and scale model tests appeared to confirm this. The use of ducted propellers (propellers fitted with a non-rotating nozzle and encircled by a duct or passageway) is prevalent within the shipping industry.

134. However, a recent study provides evidence that predatory behaviour by Grey Seals, rather than ship propeller injuries, could be the main cause of corkscrew mortalities (The Scottish Government, 2015; Thompson *et al*., 2015).

Characterisation of Impact

135. The precise nature of the vessels to be used during the construction, operation and decommissioning of Kincardine Offshore Windfarm is still to be determined. It is likely that a number of vessels will be used including barges, cable laying vessels, workboats, tugs and guard boats, which may have ducted propellers. It is anticipated that up to two vessels per day will be used during installation and one vessel operating five days per week would be used for maintenance during operation (Table 1-3).

Significance of Impact

136. The activity associated with vessels transiting to and from the Development Area is considered to be low, and the vessel activity will be more than 4nm from any seal designated sites.

137. The recent evidence of predatory behaviour does not completely eliminate ship propellers, but it is now less likely that they are a key factor (The Scottish Government, 2015).

138. Given the small numbers of Grey and Harbour Seals observed within the Development Area during the aerial surveys, the risk of injury from the use of ducted propellers is considered to be of negligible magnitude.

139. Potential effects from decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed in the construction phase. The decommissioning approach is described in Chapter 2. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 and subject to approval by the Department of Energy and Climate Change (DECC) prior to implementation.

Table 6-17 Impact summary of corkscrew injuries for marine mammals

Impact	Receptor	Sensitivity of receptor	Magnitude or effect	Significance
Corkscrew injury from vessels	Pinnipeds	Moderate Corkscrew injuries have the potential to cause injury or mortality	Negligible Small numbers of seals recorded in the Project Area and low numbers of vessels to be used.	Minor

6.5.1.5. Electromagnetic Fields

Overview of Impact

140. The transmission of electricity through subsea cables generates electric and magnetic fields. It has been suggested that electromagnetic fields (EMF) could affect marine mammals, as they use geomagnetic cues as an aid to navigation; however, the importance of these cues remains unclear (The Scottish Executive, 2007; OSPAR, 2008; Merck & Wasserthal, 2009).

141. The effects on the surrounding environment depend on the cable construction, configuration and orientation in space (The Scottish Executive, 2007). Electric fields produced around the conductor are effectively contained within the cable by the cable sheath and armour wires; however, the materials making up the cable are permeable to magnetic fields, which can permeate into the surrounding environment (The Scottish Executive, 2007).

Characterisation of Impact

142. The nature and strength of the fields produced depends on the system voltage and current passing through (The Scottish Executive, 2007). Electric fields are produced by voltage and increase in strength as voltage increases. Magnetic fields are generated by flow of current and increase in strength as current increases (OSPAR, 2008).

143. The specification, number and length of the inter-array cables will be determined by the WTG placement and spacing. It is anticipated that the cables will be:

- 12 x 2.5km (totalling 30km)
- Diameter: 180mm
- 33kv inter-array cables

Significance of Impact

144. Information on the influence of EMF on marine mammals is very limited and inconclusive. However, there is no evidence to date to suggest a change in marine mammal activity related to EMF from offshore windfarm cabling. It is therefore considered highly unlikely that the small and localised increase in EMF from the windfarm cabling would notably interfere with the navigation systems of marine mammals.

Table 6-18 Impact summary of Electromagnetic fields (EMF) for marine mammals

Impact	Receptor	Sensitivity of receptor	Magnitude of effect	Significance
Inter-array cable EMF	All marine mammals	Low There is no evidence to date to suggest a change in marine mammal activity related to EMF from offshore windfarm cabling	Minor Impacts will be of small scale and very localised	Minor

6.5.1.6. Entanglement

Overview of Impact

145. With the increasing deployment of marine renewable devices, marine mammals are placed at risk of collision or entanglement with mooring lines (Bonar *et al*., 2015).

146. Of greater concern than the entanglement risk presented by the moorings themselves is entanglement with derelict fishing gear which becomes caught / snagged amongst the moorings and devices, known as ‘ghost fishing’ (Benjamins *et al*., 2014).

147. The effects of marine mammal entanglement range from minor recoverable injuries such as abrasions through to temporary or permanent debilitation (internal injuries, surface wounds or damage to delicate organs) to more significant injuries (major cuts, amputations or internal trauma) and mortality (Bonar *et al*., 2015; Wilson *et al*., 2007).

148. Cables, chains and power lines extending up through the water column have a smaller cross-sectional area than vertical support structures therefore produce reduced flow disruption and fewer sensory cues to approaching mammals. Instead of being swept around these structures, marine mammals are more likely to become wrapped around or entangled in them (Wilson *et al*., 2007).

149. Marine mammals are highly mobile underwater, therefore have the capacity to avoid and evade marine renewable energy devices. However, this is dependent on the individual animals having the ability to detect the devices, perceive the devices as a threat and take appropriate action at both long and short ranges (Wilson *et al*., 2007). Several factors may compromise this behavioural action:

- Detection failure;
- Diving constraints;
- Attraction;
- Confusion;
- Distraction; and
- Illogical behaviour

Characterisation of Impact

150. The ability of marine mammals to detect an obstacle and avoid a collision depends on body size, habitat use, foraging tactics, curiosity, underwater agility and sensory capabilities (Bonar *et al*., 2015).

151. The development has the potential to become a fish aggregation device (see Chapter 5) therefore there is potential for the occurrence of larger mammals to be attracted to the Development Area. Larger marine animals (e.g. Minke Whale) are at relatively greater risk of entanglement (Bonar *et al*., 2015; Benjamins *et al*., 2014).

152. It is important to note that entanglement risks associated with Marine Renewable Energy (MRE) developments are not limited to moorings of MRE devices, as animals may also become entangled in power cables or in smaller moorings associated with marker buoys. Furthermore, mooring structures have the potential to accumulate derelict fishing gears, in which a whole range of species may become entangled, including large whales potentially capable of damaging moorings and other structures when trying to break free (Benjamins *et al*., 2014).

153. As a result of 'ghost fishing', Benjamins *et al*. (2014) recommend that Developers routinely monitor their development to check for entanglement, animal behaviour / presence around the site and trapped derelict fishing gear. Regular underwater visual inspection of the conditions of moorings, and subsea cables are likely to be required for operational reasons within the Kincardine Offshore Windfarm. Such inspections will also be used to detect derelict fishing gears and items with a potential risk of mammal entanglement.

154. The mooring lines will be routinely maintained and checked for debris with gear removal programmes put in place where necessary. Furthermore, load cells will be attached to the mooring devices and subsea cables. The load cells will alert KOWL if there is unexpected load on the devices which can then be examined.

155. There are no records of marine mammal entanglements in moorings or any other infrastructure associated with the offshore oil and gas industry, which is the closest parallel to the moorings utilised for marine renewable energy devices (Benjamins *et al*., 2014). It is likely that the Kincardine Offshore Windfarm will require less moorings than that utilised in oil and gas installations.

156. The Kincardine moorings are unlikely to pose a major threat; however, entanglement risk among MRE arrays will likely vary substantially based on device number and spacing, mooring design and array layout. Some mooring designs present a greater risk than others, with the greater risks generated by catenary moorings, particularly those containing nylon. Taut systems represent the lowest risk, with the caveat that pre-tension should be designed to be high enough to prevent slack mooring lines (Benjamins *et al*., 2014).

Significance of Impact

157. Low numbers of mammals were recorded in the survey area during the HiDef surveys and due to the small scale of the development there will be a small number of mooring lines (32) and a relatively small number of inter-array cables.

158. The moorings for Kincardine offshore windfarm are anticipated to pose a relatively modest risk in terms of entanglement for marine mammals, particularly when compared to the risk posed by fisheries (Benjamins *et al*., 2014). It will be particularly important to ensure that cables and moorings are regularly checked to ensure that no debris or fishing gear has become caught. This will reduce the risk of entanglement considerably.

159. Potential effects from decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed in the construction phase. The decommissioning approach is described in Chapter 2. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 and subject to approval by the Department of Energy and Climate Change (DECC) prior to implementation.

Table 6-19 Impact summary of entanglement for marine mammals

Impact	Receptor	Sensitivity of receptor	Magnitude of effect	Significance
Entanglement in mooring lines and cables	All marine mammals	Low Potential injuries range from abrasions through to temporary or permanent debilitation.	Minor Low numbers of mammals recorded in the survey area and mooring lines will be monitored for debris	Minor

6.5.1.7. Contamination

Overview of Impact

160. Marine mammals can be exposed to contaminants either directly through their skin or indirectly through the consumption of contaminated prey species, resulting in illness and in some cases death (García-Alvarez *et al*., 2014). As top predators, marine mammals are particularly at risk of bioaccumulation of contaminants through the food chain. Potential contaminants are heavy metals, persistent organic pollutants (POPs), polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) (Bonar *et al*., 2015; García-Alvarez *et al*., 2014; Tanabe, 1999; Tanabe *et al*., 1994).

161. Chemicals may be released into the marine environment as a result of accidental incidents, for example, vessel collisions and accidental spillages. During routine operation and maintenance of an offshore windfarm, there are risks of pollution from the corrosion of sacrificial anodes, leaking of corrosion inhibitors, antifouling paints, vessel fuel or the loss of hydraulic fluids, which may reduce the health and fitness of a range of marine mammal species (Bonar *et al*., 2015).

162. Environmental contamination by bio-accumulative pollutants such as polychlorinated biphenyls (PCBs) and persistent organochlorine pesticides (POPs) has spread worldwide and the resulting toxicity in marine mammals has been widely noted (Tanabe, 1999; Tanabe *et al*., 1994, García-Alvarez *et al*., 2014). POPs are thought to affect the immune and hormonal systems of marine mammals, thereby have the potential to impact reproductive success. Furthermore, some stranding episodes of marine mammals have been attributed to chemical pollutants (García-Alvarez *et al*., 2014).

Characterisation of Impact

163. The potential for toxic contamination is deemed to be similar throughout all phases of the project (construction, operation and decommissioning) as it is mainly related to vessel movements and general offshore activities.

164. Increased vessel activity may lead to increased risk of vessel collision, which may, in turn, result in an increased risk of the accidental release of fuel and other chemicals. In addition, accidental spillage of chemicals such as lubricants and antifouling agents may occur due to human error or technical failure, without the need for vessel collision.

165. The presence of the offshore windfarm may amplify navigational hazards for vessels which will indirectly increase the risk of oil spills and marine pollution (see Chapter 9). Vessel collision risk is a product of a number of factors, such as vessel traffic, distance to navigational routes, wind, current and weather conditions.

166. Collision risk will be reduced by implementing increased security measures, for example, distribution of Notice to Mariners. In addition, navigational lighting requirements will be deployed as advised by the Northern Lighthouse Board. Formal recommendations for lighting and marking of the windfarm, infrastructure and vessels engaged in operations associated with the windfarm will be given through the formal Marine (Scotland) Act 2010, Part 4 Marine Licensing application process. However, it is anticipated that the Development Area will be marked with buoyage during the construction phase and with Aids to Navigation based on IALA Recommendation O-139 installed on the turbines during the operational phase.

167. Although antifoulants typically release toxic chemicals, recent use is largely regulated towards licensed protective coatings that are low or non-toxic. For example, some wind turbines are painted with glass flake reinforced polyester coatings with no biocide activity, and antifoulants are not typically used (Wilhelmsson *et al*., 2010).

168. The windfarm substructures will require protection against corrosion, which is likely to be via a polyurethane or epoxy coating and / or the use of sacrificial aluminium anodes. The final design will incorporate recommendations arising from corrosion protection in existing offshore windfarms as well as current industry best practice.

Significance of Impact

169. A serious contamination event is considered very unlikely as a result of the development. As with all offshore activities, there is a risk of a major oil spill occurring as a result of a major vessel accident / collision, however the likelihood of this is extremely low due to best practices and appropriate navigational aids being in place.

170. If pollution was to occur as a result of an accidental spill from a vessel associated with the servicing of WTGs, the effects would be localised.

171. All materials used in the construction, operation and maintenance and decommissioning phases will be certified for safe use within the marine environment.

172. Vessels will use predefined routes and will travel at low speeds to reduce risk of accidental collision. As the greatest increase in vessel movements will be during the construction phase, the increased contamination will predominantly be during the construction phase and is therefore of a temporary nature.

173. The effect of a contamination incident will be dependent on the presence of environmental sensitivities in the path of the spill (i.e. marine mammals being present in the vicinity of the spill). Given the presence of low numbers of marine mammals in the Project area, it is likely that if there were to be a contamination incident some individuals would come into contact with it but it is very unlikely to have a population effect.

174. Potential effects from decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed in the construction phase. The decommissioning approach is described in Chapter 2. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 and subject to approval by the Department of Energy and Climate Change (DECC) prior to implementation.

Table 6-20 Impact summary of contamination for marine mammals

Impact	Receptor	Sensitivity of receptor	Magnitude of effect	Significance
Contamination from vessel incident or accidental spill	All marine mammals	Moderate Depending on the source and quantity, contamination can cause illness or death	Negligible The likelihood of a contamination event is extremely low due to best practices and appropriate navigational aids being in place.	Minor

6.5.1.8. Disturbance to Prey Species

Overview of Impact

175. There is the potential for impacts to occur on the prey species of marine mammals, for example, impacts from noise due to increased vessel activity. In addition, the presence of WTGs, substructures and mooring lines may cause disturbance and / or displacement of prey species. Electromagnetic Fields also have the potential to impact prey species.

176. The main prey items for the majority of marine mammals recorded within the study area are fish, although some non-fish species such as cephalopods will be eaten by marine mammals. The main prey items for each of the marine mammal species recorded in the region can be viewed in Table 6-21.

Table 6-21 Prey items for marine mammals within the region

Species	Prey Species
Harbour Porpoise	Sandeel, Whiting, Haddock, Pollock, Trisopterus *sp*.
White-Beaked Dolphin	Herring, Mackerel
Minke Whale	Herring, Sandeel, Cod, Haddock, Saithe
Grey Seal	Sandeel, Cod and Haddock
Harbour Seal	Sandeel, Whiting, Flounder and Cod

177. In addition, the physical presence of the WTGs, substructures and moorings has the potential to cause habitat loss for marine mammal prey species (as discussed in Chapter 5), causing an indirect impact on marine mammals.

<u>Characterisation of Impact</u>

178. Noise may cause disturbance and potential displacement to fish species therefore potentially reducing the availability of prey species to marine mammals. Fish belonging to the Gadidae family, for example, Whiting, Saithe, Cod and Haddock are thought to be moderately sensitive to noise (Nedwell *et al*., 2007). Studies undertaken during seismic surveys indicate that Saithe may leave the area but may return shortly afterwards (ICOL, 2013). For further information regarding the impacts of noise on fish species, see Chapter 5.

179. Habitat disturbance may cause temporary avoidance of the area by prey species during the limited construction period. Although habitat loss leading to a reduction in prey species is a potential indirect impact to marine mammals, a greater abundance of fish have been reported within the vicinity of WTGs once operational compared to surrounding areas (Wilhelmsson *et al.,* 2006).

180. The effects of EMF on fish are largely unknown. Studies to date indicate that EMF emitted by industry standard AC offshore cables are detected by a range of electro-magnetic sensitive fish species such as elasmobranchs (Gill *et al.,* 2005). It has been determined that in close proximity to cables the magnetic component of EMF will be similar to that of the Earth and thus will affect magneto-sensitive species such as pelagic and demersal fish and elasmobranchs (Fisher & Slater, 2010). However, the inter-array cables to be used for the Project are 33kv, with significantly less fields surrounding the cables compared to the 132kv cables used in most offshore windfarms.

<u>Significance of Impact</u>

181. Surveys undertaken at other offshore windfarms indicate that fish numbers within operating windfarms are at least similar to those prior to construction and may be higher.

182. Chapter 5 assesses the impact of noise from the Project on fish and concludes that impacts will be negligible/minor to minor depending on the species. Consequently, no long term impacts on fish which marine mammals prey are predicted.

183. Although habitat loss leading to a reduction in prey species is a potential indirect impact to marine mammals, it is unlikely that the Project will result in a significant loss of marine habitat. The impact of habitat loss due to the presence of WTGs and substructures is considered to be positive, acting as a fish aggregation device.

184. Chapter 5 assesses the impact EMF from the inter-array cables on fish and concludes that impacts will be minor.

185. The sensitivity of marine mammals to disturbance of prey species is considered low for all marine mammal species, due to the minor impacts predicted from the Project on these species, and the variety of prey species targeted (Table 6-22).

186. Potential effects from decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed in the construction phase. The decommissioning approach is described in Chapter 2. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 and subject to approval by the Department of Energy and Climate Change (DECC) prior to implementation.

Table 6-22 Impact summary of disturbance to prey species for marine mammals

Impact	Receptor	Sensitivity of receptor	Magnitude of effect	Significance
Construction noise	All marine mammals	Low Noise modelling shows the sensitivity of prey species to noise is low.	Negligible Localised impacts from noise and a variety of food sources available	Negligible/Minor
Habitat disturbance	All marine mammals	Low Prey species will be able to tolerate some disturbance.	Negligible The project will result in low very levels of localised habitat disturbance	Negligible/Minor
Operation and maintenance vessel noise	All marine mammals	Low Noise modelling shows the sensitivity of prey species to noise is low.	Negligible Localised impacts from noise and a variety of food sources available	Negligible/Minor
Presence of WTG	All marine mammals	Low Noise modelling shows the sensitivity of prey species to noise is low.	Minor Positive Surveys undertaken at other offshore windfarms indicate that fish numbers within operating windfarms are at least similar to those prior to construction and may be higher.	Minor Positive
Cabling EMF	All marine mammals	Low Limited information available, but there is no evidence to date to suggest impacts to prey availability due to EMF from offshore windfarm cabling	Negligible Impacts would be very localised as the footprint of the cables is small. A variety of food sources available	Negligible/Minor

6.5.2. Impact Assessment: Offshore Export Cable Corridor

187. A summary of the key risks to marine mammals within the Offshore Export Cable Corridor have been summarised in Table 6-23.

188. These risks have been assessed for significance of impact in the following section. Impacts have been assessed to order level (Cetaceans and Pinnipeds) as detailed information on sensitivity to impacts is not available to at a species level. Where one species is known to be more sensitive that others this has been highlighted in the significance of impacts section.

Table 6-23 Key risks to marine mammals within the Offshore Export Cable Corridor

Activity	Risk	Potential Impact	Construction	Operation	Decommissioning
Increased vessel activity, including presence of vessels with ducted propellers	Temporary disturbance and / or displacement of species	• Restricted access to prey sources, breeding grounds or migration routes • Potential for increased competition for resources (where displacement results in a localised increase in marine mammal activity elsewhere) and reduced fitness	X	X	X
	Increased noise leading to hearing damage (temporary and / or permanent) in species	• Distress, disturbance and displacement • Potential for long-term reduction in survival and the ability to find prey, avoid predators and to socially interact	X	X	X
	Collision with species	• Physical injury / long term incapacity / death • Specifically for seals, potential of corkscrew mortality from vessels using ducted propellers	X	X	X
	Contamination of water, e.g. direct spillage from vessels, oil leakage from equipment	• Death or physiological injury through toxic and non-toxic contamination of water	X	X	X
	Disturbance to prey species (indirect impact)	• Reduction in resources therefore reduction in fitness and breeding success	X	X	X
Geophysical survey	Increased noise leading to hearing damage (temporary and / or permanent) to species	• Distress, disturbance and displacement • Potential for long-term reduction in survival and the ability to find prey, avoid predators and to socially interact	X		
	Disturbance to prey species (indirect impact)	• Reduction in resources therefore reduction in fitness and breeding success	X		
Presence of export cables	Generation of Electromagnetic Fields	• Individual attraction / avoidance, population attraction / avoidance, altered migration routes (temporary or long-term)		X	
	Disturbance to prey species (indirect impact)	• Reduction in resources therefore reduction in fitness and breeding success		X	

Activity	Risk	Potential Impact	Construction	Operation	Decommissioning
	Entanglement	• Physical injury / long term incapacity / death		X	

6.5.2.1. Disturbance or Displacement

Overview of Impact

189. This pressure relates to disturbance and displacement from the physical presence of vessels and structures but does not include noise as this is covered separately below.

190. A review of the potential impact of disturbance or displacement of marine mammals likely to occur during the construction and operation of the windfarm development area is provided in Section 6.5.1.1. Disturbance from vessels applies equally to the export cable corridor as it does to the development Area.

191. During operation of the windfarm, an increase in vessel activity may result from export cable maintenance, for example, monitoring cable condition and maintaining cable protection, which may cause temporary disturbance to marine mammals.

192. In addition to disturbance from vessels, the installation of the export cable will cause temporary disturbance from trenching through increased suspended sediments.

Characterisation of Impact

193. The cable laying process will likely involve a combined process of dredging (possibly), laying and burial all occurring sequentially along the cable corridor. Therefore the majority of the sediment that is displaced during dredging will be replaced during the burial process. However, there will be some increase in Suspended Sediment Concentrations (SSC) during cable laying.

194. The potential for increased SSC is high during cable laying, however, as the process occurs very gradually along the corridor (approximately 1km per hour for each of the two cables in the corridor), this reduces the overall significance this impact could have. In total, 90,000m^3 of sediment could be disturbed during the laying of each cable. This equates to only approximately 4m^3 per hour being disturbed during the process, which will then settle out before the next 1km section is dredged (Chapter 3 Section 3.4.2.1).

195. Many marine mammals inhabit turbid environments and many use sonar systems to sense the environment around them (Au *et al.,* 2000). There is no evidence to suggest that turbidity affects cetaceans, however pinnipeds, which are not known to produce sonar could be affected and may be disturbed or displaced from the area.

196. Construction activities (trenching) of the cable will be temporary in nature. It is anticipated that a cable laying vessel will be present for two days in transit and three days of operations, totalling five days for both cables (Table 1-3).

Significance of Impact

197. Disturbance from cable laying during construction will be very short term and suspended sediments will settle out quickly and over a limited area.

198. Sediment plumes are generally localised, and many marine mammals often reside in turbid waters, so significant impacts from turbidity are improbable.

199. Maintenance activities will be limited. Should works be required they will be localised and of short term duration. It is unlikely that this temporary increase in vessel activity will result in a barrier effect to marine mammals, as they are already used to a medium level of vessel traffic moving throughout the area.

Table 6-24 Impact summary of disturbance and displacement on marine mammals

Impact	Receptor	Sensitivity of receptor	Magnitude of effect	Significance
Trenching SSC	Cetaceans	Negligible Many marine mammals inhabit turbid environments and many use sonar systems to sense the environment around them. There is no evidence to suggest that turbidity affects cetaceans.	Negligible Disturbance from cable laying during construction will be very short term and suspended sediments will settle out quickly and over a limited area.	Negligible
Trenching SSC	Pinnipeds	Minor Pinnipeds, which are not known to produce sonar could be affected and may be disturbed or displaced from the area.	Negligible Disturbance from cable laying during construction will be very short term and suspended sediments will settle out quickly and over a limited area.	Negligible/Minor
Physical disturbance or displacement from vessel movements	All marine mammals	Low Marine mammals in the area are already subject to considerable activity by a range of vessels. Marine mammals in the area display some degree of habituation to vessel traffic.	Negligible It is anticipated that one to two vessel would be operating on the Project at any one time.	Negligible/Minor

6.5.2.2. Increased Noise

Overview of Impact

200. Marine mammals have very good underwater hearing and as a consequence are sensitive to increased underwater noise (Bonar *et al*., 2015). Marine mammals rely heavily on sound to feed, navigate and socially interact (Bonar *et al*., 2015). Sound travels further through water than in air; therefore anthropogenic sources of noise have the potential to affect marine mammals at relatively large distances (Bailey *et al*., 2010). The propagation of noise through water depends on several factors including water depth, with noise travelling further in deeper water (Bailey *et al*., 2010). Seabed topography can also have a strong effect on the propagation of sound in water (Bailey *et al*., 2010).

201. The ability of an individual marine mammal to hear a certain sound in the ocean is a complex task involving at least six abilities and processes:

- Absolute hearing threshold;
- Individual variation in sensitivity;
- Individual motivation;
- Ability to overcome the masking (i.e., obscuring/interference) effect of background sound;
- Sound source localisation;
- Frequency and intensity discrimination (Richardson *et al*., 1995)

Thereafter behavioural responses to a sound, once detected, are known to be strongly influenced by the context of the event and individual factors such as the animal's experience, motivation, conditioning and activity (Nowacek *et al*., 2007; Southall *et al*., 2007; Wartzok *et al*., 2004). Identical sounds may be experienced in very different ways by individual marine mammals of different species. In addition, as in humans and other mammals, variation in hearing ability between individual animals is common.

202. Underwater noise may result in physical harm, temporary or permanent hearing loss, altered behaviours or patterns of movement and loss of habitat, masking of important biological sounds and increased vulnerability to predation and other hazards (Bonar *et al*., 2015). The cumulative cost of these responses can alter the animals' activity budget and energy balance which may have consequences for individual vital rates (survival and reproductive success) and overall population dynamics (Merchant *et al*., 2014).

<u>Characterisation of Impact</u>

203. Pre installation geophysical surveys along the Offshore Export Cable Corridor may be required and it is recognised that geophysical surveys have the potential to cause acoustic disturbance to marine mammals (JNCC, 2010).

204. Geophysical acoustic surveys in marine or coastal waters involve the collection of information on the physical environment by means of sound signal production, reception, analysis and interpretation, to analyse the structure and composition of the seabed substrate. Surveys involve the use of a vessels fitted with specialised equipment or from which such equipment can be deployed or towed.

205. Marine seismic surveys primarily use low-frequency sound to penetrate the sea floor, which can harm marine mammals. The level of environmental impact associated with this acoustic activity is variable depending on a number of factors including the type of the equipment being used, its sound signal and propagation characteristics, and the depth in which it is operating.

206. Acoustic instruments and equipment used in targeted marine geophysical investigations can have very high sound pressure levels (e.g. air guns), however the instruments that are likely to be used for the Kincardine Project survey (multibeam, single beam, side-scan sonar and sub-bottom profilers) emit energy at a significantly lower levels.

207. The details of the geophysical survey specification are not known yet, however it is anticipated that sub bottom profilers are likely to pose the greatest risk of disturbance to marine mammals. Based on our prior experience we would expect to employ a number of key mitigation measures, as outlines in the JNCC 2010 seismic guidelines, which will be discussed and agreed as part of the consultation prior to the surveys.

208. During construction, noise will be generated from cable installation activities and in particular, burial via trenching.

209. There are two primary approaches to laying a cable on the seabed: simultaneous lay and bury, where the cable is laid in a trench as it is formed using the same machinery; and post lay, where the cable is surface-laid on the seabed and trenched subsequently.

210. It is anticipated that the export cables will take a maximum of five days to install for both cables.

211. Vessel traffic will be the main source of noise during the operation of the windfarm. It is anticipated that 1-2 vessels, working 5 days per week, will provide maintenance for the whole site (Table 1-3).

212. It is likely that during operation, background noise and vibrations from vessel engines will increase within the export cable corridor and the transport routes to and from the site. However, limited numbers of marine mammals are found to be present in the export cable corridor and the increase in vessel traffic compared to background levels is very small (Chapter 9).

213. Trained marine mammal observers and PAM would be deployed to detect marine mammals during installation/construction, as recommended by the JNCC Guidelines, 2010, as well as consideration of the use of acoustic deterrents to ensure that marine mammals are not within the vicinity of the works prior to the activities commencing. The use of acoustic warning equipment, if appropriately designed, could prove a valuable mitigation tool, however, any active acoustic warning also represents a new source of sound pollution, specifically intended to alter the behaviour of marine mammals. The use of such devices should therefore be considered carefully to decide whether or not it is appropriate to deliberately add extra-noise to the sea as a precautionary measure.

Significance of Impact

214. Given the low penetration depth into the seabed required for the Project geophysical surveys, they are not anticipated to emit large amounts of noise. However, as the survey specifications have not yet been finalised, further consultation will be undertaken prior to the geophysical surveys, which are planned for the detailed design stage of the Project. The Geophysical surveys will be undertaken in line with the JNCC 2010 seismic guidelines and will include relevant mitigation measures.

215. Any noise generated during construction from cable trenching operations will be temporary (maximum five days). The sensitivity of marine mammals to this noise source varies with species, as outlined in Chapter 8, with Harbour Porpoise being the most sensitive.

216. As described in Section 6.5.1.2, $90dB_{ht}$ is the level at which the perceived noise level is predicted to cause a strong avoidance reaction in virtually all marine mammal individuals. Trenching has the greatest potential impact range of any Project activity at $90dB_{ht}$ for Harbour Porpoise with a distance of 140m. Unless species are within this range at the time of these activities, it is likely that noise generated by trenching will elicit a startle response and they will avoid the area for the duration of the activities.

217. Pinnipeds are less sensitive to this source of noise with Harbour Seal predicated to have an impact range of 12m for $90dB_{ht}$ and 87m for $75dB_{ht}$.

218. Noise generated from vessel traffic during operation will be intermittent and comparable to background vessel noise levels.

219. Potential effects from decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed in the construction phase. The decommissioning approach is described in Chapter 2. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 and subject to approval by the Department of Energy and Climate Change (DECC) prior to implementation.

Table 6-25 Impact summary of underwater noise on marine mammals

Impact	Receptor	Sensitivity of receptor	Magnitude of effect	Significance
Geophysical survey	All marine mammals	Low May elicit a disturbance response in close proximity to the source	Minor Given the low penetration depth into the seabed required for the Project geophysical surveys, they are not anticipated to emit large amounts of noise.	Minor
Cable trenching	Cetaceans	Low Cetacean may elicit an avoidance or startle response if in close proximity to the noise source	Minor Impacts will be short term and localised	Minor
Cable trenching	Pinnipeds	Low	Minor	Minor

Impact	Receptor	Sensitivity of receptor	Magnitude of effect	Significance
		Pinnipeds may elicit an avoidance or startle response if in close proximity to the noise source	Impacts will be short term and localised	
Vessel noise	All marine mammals	Low Marine mammals in the Project site are already subject to considerable activity by a range of vessels. Marine mammals in the area display some degree of habituation to vessel traffic.	Negligible The modelling results show that noise from vessels used for the Project will have a very small impact range for all marine mammal.	Negligible/ Minor

6.5.2.3. Collision / Vessel Strikes

Overview of Impact

220. An increase in vessel activity may lead to an increase in collision risk, with vessel strikes being a known cause of mortality for marine mammals. A number of responses to vessel traffic have been reported in marine mammals, including avoidance, displacement and changes in vocalisation (Carter, 2007).

Characterisation of Impact

221. Research into marine mammals and vessel collisions in general has demonstrated that the likelihood of collision varies, depending on a number of factors, including vessel type, speed, location, species, and behaviour (Laist *et al*., 2001; Van Waerebeek *et al.,* 2007). Studies have shown that the risk of a collision occurring and the likelihood that it will result in severe or lethal injury increases when vessels exceed 10–14knots (Laist *et al.*, 2001). The influence of vessel type appears to be less significant (Todd *et al.*, 2014).

222. The level of existing vessel traffic within the Project Site is deemed as intermediate to moderately busy compared to other regions of UK waters (Appendix C).

223. The vessel types and construction ports to be used during the development of Kincardine Offshore Windfarm are still to be determined. It is likely cable laying vessels will be used during installation and small/medium vessels will be used for maintenance of the Project.

Significance of Impact

224. There is already a medium level of vessel activity occurring in the area, with a high intensity of vessel movements to and from Aberdeen Harbour. Planned vessel activity relating to construction, operation and decommissioning activities will be discussed and detailed within the final Project Environmental Management Plan (PEMP) but is anticipated to be a relatively minor increase in comparison to the existing vessel traffic. Defined navigational routes will be utilised by vessels to reduce the risk of collision with marine mammals.

225. During the construction, operation and decommissioning phases of the project, vessels will be slow moving and predictable, both for safety and operational reasons, therefore it is likely that the vessels will pose little risk of collision to marine mammals, particularly Harbour Porpoise, Dolphins and Seals which were observed most frequently within the Development Area and are all highly mobile species.

226. It is anticipated that species would quickly become used to the presence of what is expected to be a small increase in the number of vessels associated with the construction, operation and decommissioning phases. Any behavioural changes of marine mammals due to increased vessel activity would be to be short-term (Wilhelmsson *et al.,* 2010).

227. Potential effects from decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed in the construction phase. The decommissioning approach is

described in Chapter 2. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 and subject to approval by the Department of Energy and Climate Change (DECC) prior to implementation.

Table 6-26 Impact summary of collision/vessel strikes on marine mammals

Impact	Receptor	Sensitivity of receptor	Magnitude of effect	Significance
Collision/vessel strikes – construction, operation and decommissioning	All marine mammals	Moderate Vessel strikes have the potential to cause injury or mortality	Negligible The Project will use low numbers of vessels which will be confined to designated routes, and be slow moving.	Minor

6.5.2.4. Corkscrew Injuries

Overview of Impact

228. Between 2009 and 2014, eighty-six seal carcasses were found in Scottish waters with unusual spiral lacerations (corkscrew injuries). Initial investigations suggested that ships with ducted propellers may be responsible for the injuries and scale model tests appeared to confirm this. The use of ducted propellers (propellers fitted with a non-rotating nozzle and encircled by a duct or passageway) is prevalent within the shipping industry.

229. However, a recent study provides evidence that predatory behaviour by Grey Seals, rather than ship propeller injuries, could be the main cause of corkscrew mortalities (The Scottish Government, 2015; Thompson *et al*., 2015).

Characterisation of Impact

230. The precise nature of the vessels to be used during the construction, operation and decommissioning of Kincardine Offshore Windfarm is still to be determined. It is likely that a number of vessels will be used including cable laying vessels and workboats which may have ducted propellers. It is anticipated that up to two vessels per day will be used during installation and one vessel operating five days per week would be used for maintenance during operation (Table 1-3).

Significance of Impact

231. The activity associated with vessels transiting to and from the Development Area is considered to be low, and the vessel activity will be more than 4nm from any seal designated sites.

232. The recent evidence of predatory behaviour does not completely eliminate ship propellers, but it is now less likely that they are a key factor (The Scottish Government, 2015).

233. Given the small numbers of Grey and Harbour Seals observed within the export cable, the risk of injury from the use of ducted propellers is considered to be of low magnitude.

234. Potential effects from decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed in the construction phase. The decommissioning approach is described in Chapter 2. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 and subject to approval by the Department of Energy and Climate Change (DECC) prior to implementation.

Table 6-27 Impact summary of corkscrew injuries for marine mammals

Impact	Receptor	Sensitivity of receptor	Magnitude or effect	Significance
Corkscrew injury from vessels	Pinnipeds	Moderate Corkscrew injuries have the potential to cause injury or mortality	Negligible Small numbers of seals recorded in the Project Area and low numbers of vessels to be used	Minor

6.5.2.5. Entanglement

Overview of Impact

235. With the increasing deployment of marine renewable devices, marine mammals are placed at risk of collision or entanglement with mooring lines and cables (Bonar *et al*., 2015).

236. Of greater concern than the entanglement risk presented by the moorings themselves is entanglement with derelict fishing gear which becomes caught / snagged amongst the moorings and devices, known as 'ghost fishing' (Benjamins *et al*., 2014).

237. The effects of marine mammal entanglement range from minor recoverable injuries such as abrasions through to temporary or permanent debilitation (internal injuries, surface wounds or damage to delicate organs) to more significant injuries (major cuts, amputations or internal trauma) and mortality (Bonar *et al*., 2015; Wilson *et al*., 2007).

238. Marine mammals are highly mobile underwater, therefore have the capacity to avoid and evade marine renewable energy devices. However, this is dependent on the individual animals having the ability to detect the devices, perceive the devices as a threat and take appropriate action at both long and short ranges (Wilson *et al*., 2007). Several factors may compromise this behavioural action:

- Detection failure;
- Diving constraints;
- Attraction;
- Confusion;
- Distraction; and
- Illogical behaviour

Characterisation of Impact

239. The ability of marine mammals to detect an obstacle and avoid a collision depends on body size, habitat use, foraging tactics, curiosity, underwater agility and sensory capabilities (Bonar *et al*., 2015).

240. Entanglement risks associated with Marine Renewable Energy (MRE) developments are not limited to moorings of MRE devices, as animals may also become entangled in power cables or in smaller moorings associated with marker buoys.

241. Mooring structures and cables also have the potential to accumulate derelict fishing gears, in which a whole range of species may become entangled, including large whales potentially capable of damaging moorings and other structures when trying to break free (Benjamins *et al*., 2014).

Significance of Impact

242. Low numbers of mammals were recorded in the Export Cable Corridor.

243. Whereas the cables and moorings within the Development Area will be exposed, it is intended that all export cables will be buried to a target depth of 1.5m and there for will not pose an entanglement hazard to marine mammals. Where it is not possible to achieve the target depth of burial, alternative means of cable protection will be utilised, for example, rock placement or concrete mattressing.

244. Any exposed lengths of export cables (e.g. prior to being buried) will be regularly checked for snagged debris and fishing gear and where appropriate fitted with load cells.

245. Potential effects from decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed in the construction phase. The decommissioning approach is described in Chapter 2. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 and subject to approval by the Department of Energy and Climate Change (DECC) prior to implementation.

Table 6-28 Impact summary of entanglement for marine mammals

Impact	Receptor	Sensitivity of receptor	Magnitude of effect	Significance
Entanglement in export cables	All marine mammals	Low Potential injuries range from abrasions through to temporary or permanent debilitation.	Negligible Low numbers of mammals recorded in the survey area and export cable will be buried	Negligible/Minor

6.5.2.6. Electromagnetic Fields

Overview of Impact

246. The transmission of electricity through subsea cables generates electric and magnetic fields. It has been suggested that electromagnetic fields (EMF) could affect marine mammals, as they use geomagnetic cues as an aid to navigation; however, the importance of these cues remains unclear (The Scottish Executive, 2007; OSPAR, 2008; Merck & Wasserthal, 2009).

247. The effects on the surrounding environment depend on the cable construction, configuration and orientation in space (The Scottish Executive, 2007). Electric fields produced around the conductor are effectively contained within the cable by the cable sheath and armour wires; however, the materials making up the cable are permeable to magnetic fields, which can permeate into the surrounding environment (The Scottish Executive, 2007).

Characterisation of Impact

248. The nature and strength of the fields produced depends on the system voltage and current passing through (The Scottish Executive, 2007). Electric fields are produced by voltage and increase in strength as voltage increases. Magnetic fields are generated by flow of current and increase in strength as current increases (OSPAR, 2008).

249. The specification, number and length of the export cables is anticipated to be:

- Two 33kv export cables
- Length: 15km each
- Diameter: 180mm

250. Because the strength of both magnetic and electric fields rapidly declines as a function of the distance from the cable, a reduction of the exposure of marine mammals to EMF can be achieved by cable burial (Merck & Wasserthal, 2009). The export cables for the Project will be buried to a target depth of 1.5m, Where it is not possible to achieve the target depth of burial, alternative means of cable protection will be utilised, for example, rock placement or concrete mattressing.

Significance of Impact

251. Information on the influence of EMF on marine mammals is very limited and inconclusive. However, there is no evidence to date to suggest a change in marine mammal activity related to EMF from offshore windfarm cabling. Burial of the cables will provide shielding of EMF and therefore reduce the potential of impacts. It is therefore considered highly unlikely that the small and localised increase in EMF from the windfarm caballing would notably interfere with the navigation systems of marine mammals.

Table 6-29 Impact summary of Electromagnetic fields (EMF) for marine mammals

Impact	Receptor	Sensitivity of receptor	Magnitude of effect	Significance
Export cable EMF	All marine mammals	Low There is no evidence to date to suggest a change in marine mammal activity related to EMF from offshore windfarm cabling	Minor Impacts will be of small scale and very localised. Export cable will be buried.	Minor

6.5.2.7. Contamination

Overview of Impact

252. Marine mammals can be exposed to contaminants either directly through their skin or indirectly through the consumption of contaminated prey species, resulting in illness and in some cases death (García-Alvarez *et al*., 2014). As top predators, marine mammals are particularly at risk of bioaccumulation of contaminants through the food chain. Potential contaminants are heavy metals, persistent organic pollutants (POPs), polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) (Bonar *et al*., 2015; García-Alvarez *et al*., 2014; Tanabe, 1999; Tanabe *et al*., 1994).

253. Chemicals may be released into the marine environment as a result of accidental incidents, for example, vessel collisions and accidental spillages. During routine operation and maintenance of an offshore windfarm cable, there are risks of pollution vessel fuel which may reduce the health and fitness of a range of marine mammal species (Bonar *et al*., 2015).

Characterisation of Impact

254. The potential for toxic contamination is deemed to be similar throughout all phases of the project (construction, operation and decommissioning) as it is mainly related to vessel movements.

255. Increased vessel activity may lead to increased risk of vessel collision, which may, in turn, result in an increased risk of the accidental release of fuel and other chemicals.

256. Collision risk will be reduced by implementing increased security measures, for example, distribution of Notice to Mariners. In addition, navigational lighting requirements will be deployed as advised by the Northern Lighthouse Board. Formal recommendations for lighting and marking of the windfarm, infrastructure and vessels engaged in operations associated with the windfarm will be given through the formal Marine (Scotland) Act 2010, Part 4 Marine Licensing application process.

Significance of Impact

257. A serious contamination event is considered very unlikely as a result of the Project. As with all offshore activities, there is a risk of a major oil spill occurring as a result of a major vessel accident / collision, however the likelihood of this is extremely low due to best practices and appropriate navigational aids being in place.

258. If pollution was to occur as a result of an accidental spill from a vessel associated with the servicing of WTGs, the effects would be localised.

259. All materials used in the construction, operation and maintenance and decommissioning phases will be certified for safe use within the marine environment.

260. Vessels will use predefined routes and will travel at low speeds to reduce risk of accidental collision. As the greatest increase in vessel movements will be during the construction phase, the increased contamination will predominantly be during the construction phase and is therefore of a temporary nature.

261. The effect of a contamination incident will be dependent on the presence of environmental sensitivities in the path of the spill (i.e. marine mammals being present in the vicinity of the spill).

Given the presence of low numbers of marine mammals in the Export Cable Corridor, it is likely that if there were to be a contamination incident some individuals would come into contact with it but it is very unlikely to have a population effect.

262. Potential effects from decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed in the construction phase. The decommissioning approach is described in Chapter 2. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 and subject to approval by the Department of Energy and Climate Change (DECC) prior to implementation.

Table 6-30 Impact summary of contamination for marine mammals

Impact	Receptor	Sensitivity of receptor	Magnitude of effect	Significance
Contamination from vessel incident or accidental spill	All marine mammals	Moderate Depending on the source, contamination can cause illness or death	Negligible The likelihood of a contamination event is extremely low due to best practices and appropriate navigational aids being in place.	Minor

6.5.2.8. Disturbance/availability of Prey Species

Overview of Impact

263. There is the potential for impacts to occur on the prey species of marine mammals, due to project activities including increased underwater noise, Electromagnetic Fields and habitat disturbance.

264. The main prey items for the majority of marine mammals recorded within the study area are fish, although some non-fish species such as cephalopods will be eaten by marine mammals. The main prey items for each of the marine mammal species recorded in the region can be viewed in Table 6-21.

Characterisation of Impact

265. Vessel noise may cause disturbance and potential displacement to fish species therefore potentially reducing the availability of prey species to marine mammals. Fish belonging to the Gadidae family, for example, Whiting, Saithe, Cod and Haddock are thought to be moderately sensitive to noise (Nedwell *et al*., 2007). Studies undertaken during seismic surveys indicate that Saithe may leave the area but may return shortly afterwards (ICOL, 2013). For further information regarding the impacts of noise on fish species, see Chapter 5.

266. Habitat disturbance may cause temporary avoidance of the area by prey species during the limited cable installation period.

267. The effects of EMF on fish are largely unknown. Studies to date indicate that EMF emitted by industry standard AC offshore cables are detected by a range of electro-magnetic sensitive fish species such as elasmobranchs (Gill *et al.,* 2005). It has been determined that in close proximity to cables the magnetic component of EMF will be similar to that of the Earth and thus will affect magneto-sensitive species such as pelagic and demersal fish and elasmobranchs (Fisher & Slater, 2010). However, the inter-array cables to be used for the Project are 33kv, with significantly less fields surrounding the cables compared to the 132kv cables used in most offshore windfarms. These cables will be buried to a depth of 1.5m.

Significance of Impact

268. Surveys undertaken at other offshore windfarms indicate that fish numbers within operating windfarms are at least similar to those prior to construction and may be higher.

269. Chapter 5 assesses the impact of noise from the development on fish and concludes that impacts will be negligible/minor to minor depending on the species. Consequently, no long term impacts on fish which marine mammals prey are predicted.

270. Although habitat disturbance leading to a reduction in prey species is a potential indirect impact to marine mammals, trenching of the cable corridor will result in minimal disturbance of marine habitat.

271. Chapter 5 assesses the impact EMF from the export cables on fish and concludes that impacts will be minor.

272. The sensitivity of marine mammals to disturbance of prey species is considered low for all marine mammal species, due to the minor impacts predicted from the Project on these species, and the variety of prey species targeted (Table 6-21).

273. Potential effects from decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed in the construction phase. The decommissioning approach is described in Chapter 2. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 and subject to approval by the Department of Energy and Climate Change (DECC) prior to implementation.

Table 6-31 Impact summary of disturbance to prey species for marine mammals

Impact	Receptor	Sensitivity of receptor	Magnitude of effect	Significance
Vessel noise	All marine mammals	Low Noise modelling shows the sensitivity of prey species to noise is low.	Negligible Small numbers of vessels will be used and impacts will be very localised. A variety of food sources are available	Negligible/Minor
Habitat disturbance	All marine mammals	Low Prey species will be able to tolerate some disturbance	Negligible The project will result in low very levels of localised habitat disturbance	Negligible/Minor
Cabling EMF	All marine mammals	Low Limited information available, but there is no evidence to date to suggest impacts to prey availability due to EMF from offshore windfarm cabling	Negligible Impacts would be very localised as the footprint of the cables is small. A variety of food sources available	Minor/negligible

6.6. Mitigation

274. Measures to reduce the environmental impacts of the Project have been incorporated into the design of the windfarm from site selection through the design of the layout of the turbines and the design of the individual components of the windfarm, and the selection of installation and decommissioning techniques.

275. The assessment of impacts to marine mammals has assessed the worst case scenario impacts of the Project in isolation and cumulatively. This has concluded that impacts to marine mammals will be of no more than a minor impact to identified receptors which are considered acceptable.

276. From the results of this impact assessment, it has been concluded that the Embedded Mitigation described in section 6.4.1 are appropriate to reduce the potential impacts relating directly to marine mammals to an acceptable level.

6.7. Monitoring

277. Monitoring of the Export Cable Corridor, inter-array cables and mooring systems will be undertaken on a regular basis during the operational phase of the Project to ensure they are operating as per the design specifications. Initial surveying will take place twice annually, tailing off during the life cycle of the development if no adverse impacts are identified. These surveys will use ROVs/vessel mounted sensors (i.e. multibeam sonar) to assess the condition of the assets.

278. Aerial surveys will continue following the completion of the initial 16 months of onsite aerial survey and the aerial survey programme will follow the Survey, Deploy and Monitor methodology which is proposed to be extended to the floating offshore windfarm demonstrator programme by the Scottish Government. This will facilitate the more rapid development and deployment of these demonstrator projects and also ensure sufficient on site data is collected as part of an ongoing monitoring programme.

279. Monitoring of underwater noise from the operation of the WTG will be undertaken during the initial phase of deployment as a full noise spectrum for the larger turbines proposed for Project is not currently available. This monitoring will be used to verify the assumption that operational noise impacts to marine mammals and fish will be very limited.

6.8. Cumulative Impacts

6.8.1. The Project

280. The potential cumulative impacts of the Development Area and the Offshore Export Cable Corridor combined are as follows:

- Total increase in disturbance or displacement from construction, operation and maintenance and decommissioning activities;
- Total increase in underwater noise from construction, operation, maintenance and decommissioning activities via increased vessel activity, geophysical surveys and WTG operation;
- Total increase in collision risk via increased vessel activity and presence of ducted propellers;
- Total increase in entanglement risk;
- Total increase in impacts of EMF via the presence of export and inter array cables;
- Total increase in contamination from construction, operation, maintenance and decommissioning activities;
- Indirect impacts from changes in the availability of prey species via disturbance and displacement and EMF.

6.8.1.1. Disturbance or Displacement

281. This pressure relates to disturbance and displacement from the physical presence of vessels and structures but does not include noise as this is covered separately below. The effect of vessel presence is disused in more detail in sections 6.5.1.1 and 6.5.2.1.

282. The combined increase in vessel activity within the Development Area and the Offshore Export Cable Corridor may result in a temporary barrier effect throughout the construction and decommissioning phase due to marine mammal avoidance of vessel traffic and increased suspended sediments, potentially preventing marine mammals from moving through the waters within the regions.

283. The precise nature of the vessels to be used is still to be determined. It is likely that a number of vessels will be used including barges, cable laying vessels and tugs. The additional windfarm

related traffic will be confined to pre-defined traffic corridors. It is unlikely that increased vessel activity will result in a barrier effect to marine mammals, as they are already used to a medium level of vessel traffic moving throughout the area.

284. The cumulative effect of physical barrier to movement from increased vessel presence and suspended sediments; and the presence of WTGs, substructures and mooring lines in the Development Area and the Offshore Export Cable Corridor is considered to be localised, and of no greater impact to marine mammals than that assessed for the Development Area or Export Cable corridor alone.

6.8.1.2. Increased Noise

285. It is considered possible that the combined levels of increased underwater noise within the Development Area and Offshore Export Cable Corridor from construction, operation / maintenance and decommissioning activities, may result in an increased impact on marine mammals with implications of disturbance.

286. Activities anticipated to cause increased levels of underwater noise from the Project are:

- Installation/removal of inter-array cables;
- Installation of possible cable protection;
- Installation/removal of anchor system (anchor handling vessels);
- Installation of WTGs (towing vessels);
- Installation of export cable (installation vessel);
- Export Cable route surveying
- Operation and Maintenance vessels (small);
- Cable repair (if required); and
- WTG operating noise.

287. The effects of underwater noise are discussed further in sections 6.5.1.2 and 6.5.2.2. All of these activities have been predicted to individually have a minor impact on marine mammals due to the very small impact ranges (for significant avoidance response) that will be produced (Chapter 8).

288. The construction programme (Figure 2-8) indicates that it is unlikely that any of the construction activities will happen concurrently, and it is unlikely that the WTG installation vessel and the cable installation vessel will be on site at the same time; therefore the likelihood of increased levels of noise from cumulative construction activities is low.

289. Given the small impact ranges predicted for each of the activities it is expected that in the unlikely situation that construction activities did occur concurrently the noise impact ranges would not overlap and create a larger noise barrier.

290. The cumulative effect of noise from all aspects of the Project is considered to be localised, and of no greater impact to marine mammals than that assessed for the Development Area or Export Cable corridor alone.

6.8.1.3. Collision / Vessel Strikes and Corkscrew Injuries

291. A cumulative effect of the construction, operation / maintenance and decommissioning activities within the Development Area and Offshore Export Cable Corridor is a combined increase in vessel activity, which could potentially lead to a higher risk of collision and/or corkscrew injuries.

292. The construction programme (Figure 2-8) indicates that it is unlikely that any of the construction activities will happen concurrently, and it is unlikely that the WTG installation vessel and the cable installation vessel will be on site at the same time; therefore the cumulative increase in vessel activity will be negligible.

293. Vessels used during construction, operation and decommissioning will utilise a predefined vessel route corridor and will travel at slow speeds thereby maximising detection by marine mammals.

294. It is concluded that the combined effect of increased vessel traffic during all phases of the Project within the Development Area and the Offshore Export Cable Corridor will not be significantly greater than the existing vessel traffic in the region.

6.8.1.4. Entanglement

295. Both the Development Area and the Offshore Export Cable Corridor present a risk of marine mammal entanglement. However, the main risk of entanglement remains within the Development Area, due to the presence of mooring lines connected to each WTG.

296. Subsea export cables will likely pose a very low risk in terms of entanglement for marine mammals as they will be buried to a depth of 1.5m, therefore is deemed unlikely that the combination of the Offshore Export Cable Corridor and the Development Area will increase the risk of entanglement.

297. The cumulative effect of entanglement from the Development Area and the Offshore Export Cable Corridor is considered of no greater impact to marine mammals than that assessed for the Development Area or Export Cable Corridor alone.

6.8.1.5. Electromagnetic Fields

298. It is considered possible cables within the Development Area and the Offshore Export Cable Corridor may result in an increased impact of EMF on marine mammals during operation of the windfarm.

299. Because the strength of both magnetic and electric fields rapidly declines as a function of the distance from the cable, a reduction of the exposure of marine mammals to EMF can be achieved by cable burial (Merck & Wasserthal, 2009).

300. The export cables will be buried to a target burial depth of 1.5m, which is likely to significantly reduce any risk of EMF. Where it is not possible to achieve the target depth of burial, alternative means of cable protection will be utilised, for example, rock placement or concrete mattressing.

301. It is therefore expected that there will be no cumulative increase of EMF experienced as a result of the combined effects of the Development Area and Offshore Export Cable Corridor. The impact of EMF is considered of no greater impact to marine mammals than that assessed for the Development Area or Export Cable corridor alone.

6.8.1.6. Contamination

302. A cumulative effect of the construction, operation / maintenance and decommissioning activities within the Development Area and the Offshore Export Cable Corridor is the combined potential for marine mammals to be exposed to toxic contamination.

303. The potential risk of toxic contamination is deemed to be similar throughout all phases of the project (construction, operation and decommissioning) as it is mainly related to vessel movements and general offshore activities.

304. It is unlikely that the cumulative effect of the Offshore Export Cable Corridor and the Development Area will lead to increased contamination to marine mammals. During construction activities, it is unlikely that the WTG installation vessel and the cable installation vessel will be on site at the same time. In addition all vessels will utilise pre-defined corridors, limiting the risk of collision and accidental spillage.

305. The combined magnitude of effect of toxic contamination to marine mammal species within the Development Area and Offshore Export Cable Corridor is therefore considered to be of no greater impact to marine mammals than that assessed for the Development Area or Export Cable corridor alone.

6.8.1.7. Disturbance/availability of Prey Species

306. It is considered that the cumulative effects of indirect impacts to prey species within the Development Area and the Offshore Export Cable Corridor, for example, habitat disturbance / loss, increased noise activity and EMF, may impact on the availability of marine mammal prey species.

307. Although the distribution and abundance of prey species may change throughout the duration of the Project, it is anticipated that these changes are localised and most likely to occur within the initial construction phase.

308. The potential impacts to marine mammal prey species via habitat disturbance / loss, increased noise activity and EMF resulting from the cumulative impact of the Development Area and Offshore Export Cable Corridor is considered to be of no greater impact to marine mammals than that assessed for the Development Area or Export Cable Corridor alone.

6.8.2. Other Projects

309. As mobile species, it is recognised that marine mammals will spend considerable periods of time outside the Development Area and Offshore Export Cable Corridor. There is therefore potential for marine mammal species to be affected by other offshore developments.

310. The offshore developments identified as having potential cumulative effects on marine mammals are highlighted in Table 6-32 and locations shown in Figure 6-7.

311. The consideration of which projects could result in potential cumulative impacts is based on the results of the project specific impact assessment together with the expert judgement.

Table 6-32 Other offshore developments and potential cumulative effects with Kincardine Offshore Windfarm

Project	Details	Potential Cumulative Effects
Beatrice Offshore Windfarm	Beatrice Offshore Windfarm is an offshore windfarm with a maximum of 227 offshore turbines, generating up to 1,000MW in the outer Moray Firth. Includes an electrical transmission cable along a 65km corridor to the shore at Portgordon and 20km of onshore cable to a new substation at Blackhill hock. Up to five years construction period commencing 2014 so construction timescales may overlap with the Project.	• Underwater noise (piling of foundations will be required at Beatrice Offshore Windfarm) • Increased vessel activity • Reduction of prey availability • EMF • Entanglement with cables • Contamination
Moray Firth R3 Zone 1	Moray Offshore Renewables Limited (MORL) is a joint venture between two leading European Energy Companies: EDP Renewables (EDPR UK) and Repsol Nuevas Energias UK. On 19 March 2014, Moray Offshore Renewables Ltd was awarded consent from the Scottish Government for the construction and operation of up to 62 turbines of 6MW to 8MW capacity on each of three sites totalling a capacity of 1.116MW of offshore wind generation in the Outer Moray Firth. The construction timescales may overlap with the Project.	• Underwater noise (piling of foundations will be required at Moray Firth Zone 1) • Noise impact contours may overlap • Increased vessel activity • Reduction of prey availability • EMF • Entanglement with cables • Contamination
Seagreen Alpha Offshore Windfarm and Seagreen Bravo Offshore Windfarm	Firth of Forth ‘Round 3’ Zone is a development by Seagreen Wind Energy Ltd and is located approximately 25km east of Fife Ness and the Isle of May. The Seagreen Alpha and Bravo developments combined will consist of up to 150 turbines and could generate up to 1050MW. The construction timescales may overlap with the Project.	• Underwater noise (piling of foundations will be required at Seagreen Alpha and Bravo offshore wind farms) • Increased vessel activity • Reduction of prey availability • EMF • Entanglement with cables • Contamination
Inch Cape Offshore Windfarm	Inch Cape Offshore Windfarm is located approximately 15-22km east of the Angus coastline in the Firth of Tay region. It is anticipated to consist of up to 213 wind turbines covering an area of 150km^2 and an estimated capacity of 1,000MW. It received consent from the Scottish government in October 2014 but construction has not started yet. Construction timescales may overlap with the Project.	• Increased vessel activity • Reduction of prey availability • EMF • Entanglement with cables • Contamination
Neart na Gaoithe Offshore Windfarm	Neart na Gaoithe is a windfarm development by Mainstream Renewable Power Ltd. It consists of 75-125 turbines with an installed capacity of 450MW and covering an area of	• Underwater noise (piling of foundations will be required at Neart na Gaoithe Offshore Windfarm)

Project	Details	Potential Cumulative Effects
	105km². It is located in the outer Firth of Forth approximately 15km east of Fife Ness and 16km East of the Isle of May. Construction timescales may overlap with the Project	• Increased vessel activity • Reduction of prey availability • EMF • Entanglement with cables • Contamination
Hywind Demonstrator Site	Hywind proposed floating wind demonstrator project consists of 5 turbines with a capacity of 6MW each. It is located approximately 25km east of Peterhead in an area known as the Buchan Deep. The construction timeframe is currently unknown but it is possible that it may overlap with the Project	• No underwater noise impact is expected as the WTGs will be secured to the seabed utilising a three-point mooring • EMF • Entanglement with cables • Contamination
European Offshore Wind Deployment Centre (EOWDC)	The EOWDC is a new facility currently being developed by Aberdeen Offshore Windfarm Ltd (AOWFL), a joint venture between Vattenfall and Aberdeen Renewable Energy Group (AREG). Scottish Ministers granted approval for the project on 26th March 2013. The 11 turbine scheme located off the Aberdeen coast will have an installed capacity of up to 100MW.	• Underwater noise (piling of foundations will be required at EOWDC) • Noise impact contours may overlap • Increased vessel activity • Reduction of prey availability • EMF • Entanglement with cables • Contamination
Eastern HVDC link from north Aberdeen to Newcastle upon Tyne	A development by National Grid Electricity Transmission and Scottish Hydro Electricity Transmission Ltd. This cable route will go from Sandford Bay Beach, approximately 30km north of Aberdeen to Hawthorn Pit, just south of Newcastle Upon Tyne.	• Increased vessel activity • EMF
Aberdeen Port Expansion, Nigg Bay	Located in Nigg Bay, comprising of dredging (including drilling and blasting), breakwater construction, quay construction and infilling, and placing of pre-cast concrete. Construction proposed between Q4 2016 and Q4 2019.	• Noise propagation from port construction activities (dredging, drilling and blasting) • Increased suspended sediments • Increased vessel activity • Contamination
Aberdeen Harbour	Aberdeen Harbour is a busy port handling around 8,000 vessel arrivals and around five million tonnes of cargo per year. Operation of Aberdeen Harbour includes the requirement for maintenance dredging and disposal.	• Increased suspended sediments • Increased vessel activity • Contamination

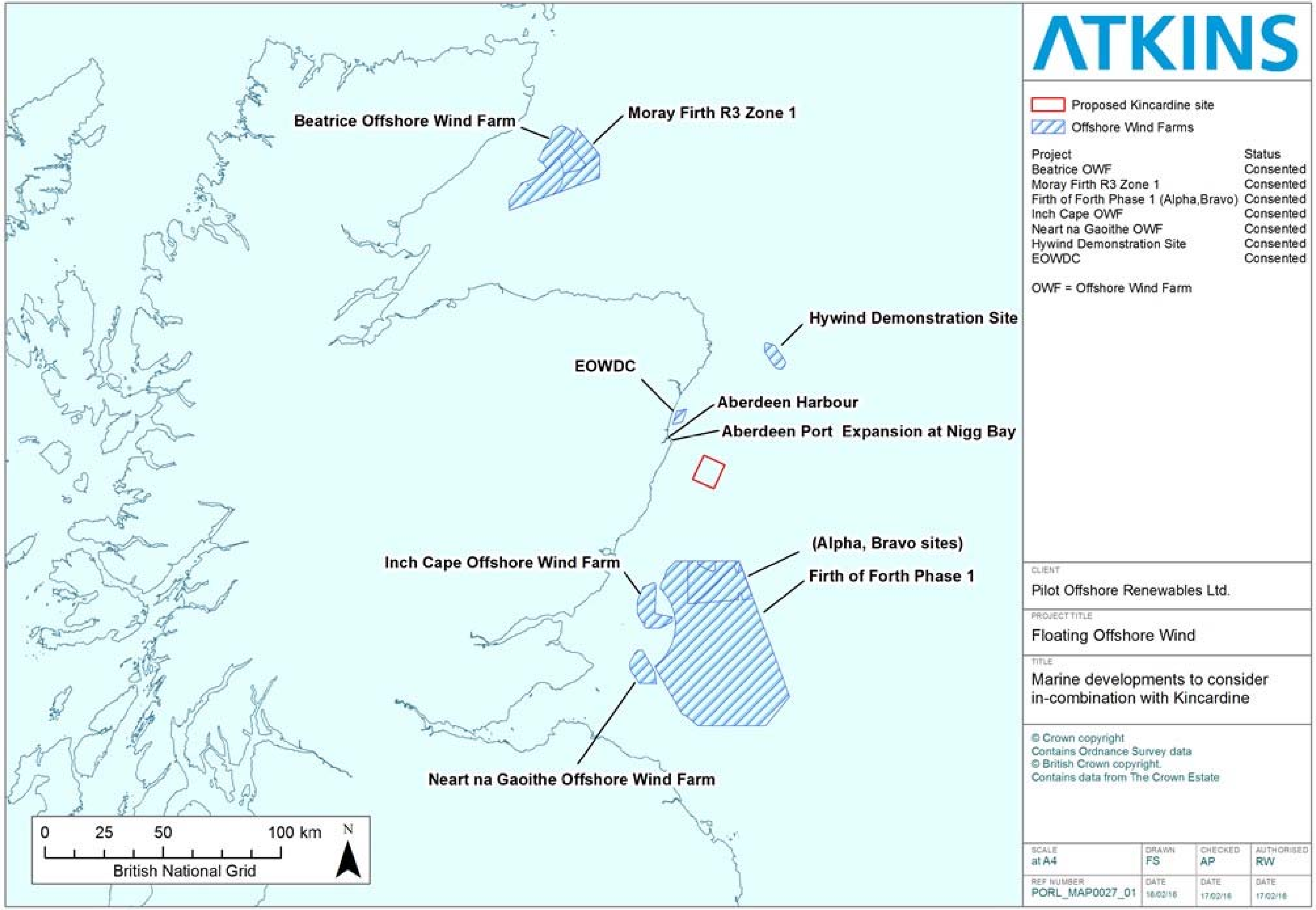

Figure 6-7 Projects considered within the cumulative assessment

6.8.2.1. Disturbance or Displacement

312. The combined increase in vessel activity from Kincardine Offshore Windfarm and other projects identified in Table 6-32 may result in a temporary barrier effect throughout the construction and decommissioning phase due to marine mammal avoidance of vessel traffic, potentially preventing marine mammals from moving through the waters within the regions.

313. The precise nature of the vessels to be used in other projects is unknown but it is likely that it would including barges, cable laying vessels and tugs. Marine Mammals in the locality of the Project would already be used to a medium level of vessel traffic moving throughout the area, and the additional vessel traffic from the projects in Table 6-32 are likely to be confined to pre-defined traffic corridors.

314. The disturbance impact ranges from installation vessels for other projects are likely to be small and therefore the scope for cumulative impact due to disturbance of displacement is minimal. Each project is likely to only disturb small number of animals, and when the disturbance area is compared with the area of the Marine Mammal Management Unit it can be considered unlikely that increased vessel activity will result in a barrier effect to marine mammals.

315. The cumulative effect of barrier to movement is considered to be of no greater impact to marine mammals than that assessed for the Project alone.

6.8.2.2. Collision / Vessel Strikes

316. An increase in vessel activity may lead to an increase in collision risk, with vessel strikes being a known cause of mortality for marine mammals. During the construction, operation and decommissioning phases of the projects listed in Table 6-32, vessels are likely to be slow moving and predictable, both for safety and operational reasons, therefore it is likely that the vessels will pose little risk of collision to marine mammals.

317. It is anticipated that the vessel activity associated with Kincardine Offshore Windfarm will represent a relatively minor increase in comparison to the existing vessel traffic and that attributed to other projects. Defined navigational routes will be utilised by vessels to reduce the risk of collision with marine mammals and therefore the magnitude of effect from collision risk from increased vessel traffic is considered to be minor when considered cumulatively with other projects.

318. The cumulative effect of collision/vessel strikes is considered to be of no greater impact to marine mammals than that assessed for the Project alone.

6.8.2.3. Increased Noise

319. Underwater noise may result in physical harm, temporary or permanent hearing loss, altered behaviours or patterns of movement and loss of habitat, masking of important biological sounds and increased vulnerability to predation and other hazards (Bonar *et al*., 2015).

320. If construction timeframes overlap with other projects in Table 6-32 there is potential for cumulative noise impacts. The impact of piling activities at offshore wind installations is the single largest noise source generated. The distance range that piling noise can reach (at $90dB_{ht}$ (Hearing threshold)) is approximately 750 times greater (Inch Cape 2013a) than any of the construction activities planned for the Project. Due to the distance between the Project and other windfarm projects, noise impacts are not anticipated to spatially overlap.

321. Considering non-windfarm projects, it is possible that there could be cumulative noise impacts from the installation of the export cables and Aberdeen port expansion at Nigg Bay. The construction programme from this development indicates that dredging (including drilling and blasting) and the installation of the large breakwaters could occur at the same time. The maximum range of impact from the trenching activities of the export cables at the $90dB_{ht}$ frequency is 140m for Harbour Porpoise and 640m at the $75dB_{ht}$ frequency. It is anticipated that cable laying activities will be very limited in duration (one week) due to the expected installation speed of the trenching/cable vessels.

322. As installation will not require the use of pilling and much of the construction will be carried out in port, the noise levels emitted during the construction of the Project will be very low. In addition, the noise emitted will be temporary in nature due to the short timeframe that it will take to install up to eight turbines and associated infrastructure.

323. Noise impacts during the operational stage of the Project can be attributed to vessel activity and operation of the wind turbine generators. It is anticipated that the increase in vessel traffic during the operational phase of the Project will not be significantly greater than the levels of marine traffic currently experienced in the region, maintenance activities will be limited therefore vessels will only be present for short durations of time.

324. Operational WTGs produce low frequency noise and vibrations that pass into the water column. Whilst this noise is a lower frequency than that produced during construction and decommissioning, the duration of the noise is longer (Nedwell, 2007). From studies of windfarms to date, there is no evidence of marine mammals avoiding windfarms during operation due to noise, and any long-term avoidance behaviour is considered very local and small (Wilhelmsson *et al.,* 2010).

325. Due to the localised nature of construction and operational noise from the Project, the cumulative effect of noise is considered to be of no greater impact to marine mammals than that assessed for the Project alone.

326. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004. Decommissioning activities would be predicted to have a localised impact, to be of minor magnitude and moderate sensitivity and therefore a minor/moderate impact.

6.8.2.4. Entanglement

327. It is considered that the cumulative impact of the Project and other windfarm projects could lead to a greater risk of marine mammal entanglement.

328. The main risk of entanglement from the Project is from the presence of mooring lines connected to each WTG. As most other windfarms are to be piled and do not use mooring lines, the magnitude of cumulative risk of entanglement is minor.

329. Subsea inter-array and export cables will likely pose a relatively low risk in terms of entanglement for most marine mammals, as most will be buried or protected. It is therefore is deemed that the cumulative effect of entanglement will be of no greater impact to marine mammals than that assessed for the Project alone.

6.8.2.5. Electromagnetic Fields

330. It is considered possible that cables from the Project with other windfarm projects could result in an increased impact of EMF on marine mammals during operation of the windfarm.

331. Because the strength of both magnetic and electric fields rapidly declines as a function of the distance from the cable, a reduction of the exposure of marine mammals to EMF can be achieved by cable burial (Merck & Wasserthal, 2009).

332. The export cables will be buried to a target burial depth of 1.5m, which is likely to significantly reduce any risk of EMF. Where it is not possible to achieve the target depth of burial, alternative means of cable protection will be utilised, for example, rock placement or concrete mattressing.

333. It is therefore expected that the combined EMF effects of the Project with other projects will be of no greater impact to marine mammals than that assessed for the Project alone.

6.8.2.6. Contamination

334. There is the potential for cumulative effects between the Project and other projects for marine mammals to be exposed to toxic contamination from vessel incidents of general offshore activities.

335. All vessels associated with these projects should utilise pre-defined corridors, limiting the risk of collision or accidental spillage. Both Kincardine Offshore Windfarm and all other projects listed in Table 6-32 with have Marine Pollution Contingency Plans in place to reduce the risk of pollution incidents and set out procedures to minimise impacts in the unlikely event that an incident were to occur.

336. It is considered that the cumulative effect of contamination with other projects will be of no greater impact to marine mammals than that assessed for the Project alone.

6.8.2.7. Disturbance to Prey Species

337. It is considered that there could be cumulative impacts with other projects listed in Table 6-32 through indirect impacts to prey species for example, habitat disturbance / loss, increased noise activity and EMF.

338. Chapter 5 assesses the impact on fish of the Project both alone and cumulatively with other projects, and concludes that all impacts will be will be negligible/minor to minor depending on the species. Consequently, no long term impacts on fish which marine mammals prey on are anticipated.

339. The potential impacts to marine mammal prey species via habitat disturbance / loss, increased noise activity and EMF resulting from the cumulative impact with other projects is considered to be of no greater impact to marine mammals than that assessed for the Project alone.

6.9. Summary and Residual Impacts

340. Five species of marine mammal were recorded in the Kincardine survey area in the High Definition Surveys which were undertaking at roughly monthly intervals over a 16 month period from April 2013 to September 2014. The species identified in the survey area were Grey Seal, Harbour Seal, Minke Whale, White-beaked Dolphin and Harbour Porpoise, of these Harbour Porpoise was the most prevalent.

341. The potential impacts on marine mammals were considered in relation to construction and operation, with decommissioning impacts assumed to be the same as construction or lower. The assessment concludes that all impacts will be of minor significance or lower.

342. Cumulative impact were assessed for the different components of the Project (Development Area and Export Cable Corridor). The assessment concludes that all impacts will be of minor significance or lower.

343. Cumulative impacts with other projects have been assessed. The assessment concludes that all impacts will be of minor significance or lower.

344. A summary of the impact assessment and residual impacts are presented in Tables 6-33 – 6-36.

Table 6-33 Summary of Impats and Mitigation – Development Area

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Construction				
Vessel activity disturbance or displacement	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor
Vessel activity noise	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor
Geophysical survey noise	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Cable laying noise	Pinnipeds	Minor	Embedded Mitigation with no additional mitigation	Minor
Cable laying noise	Cetaceans	Minor	Embedded Mitigation with no additional mitigation	Minor
Collision/vessel strikes	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Vessel corkscrew injuries	Pinnipeds	Minor	Embedded Mitigation with no additional mitigation	Minor
Contamination from vessel incident or accidental spill	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Disturbance to prey species from construction noise	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor
Disturbance to prey species from habitat disturbance	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor
Operation and Maintenance				
Vessel activity disturbance or displacement	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor
WTG operational noise	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Vessel activity noise	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor
Collision/vessel strikes	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Vessel corkscrew injuries	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Inter-array cable Electromagnetic fields (EMF)	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Entanglement in Mooring lines and inter-array cables	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Contamination from vessel incident or accidental spill	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Disturbance to prey species from maintenance noise	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor
Disturbance to prey species from WTG noise	All marine mammals	Minor Positive	Embedded Mitigation with no additional mitigation	Minor Positive
Disturbance to prey species from EMF caballing	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor

Table 6-34: Summary of Impats and Mitigation – Offshore Export Cable

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Construction				
Trenching SSC disturbance or displacement	Cetaceans	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor
Trenching SSC disturbance or displacement	Pinnipeds	Minor	Embedded Mitigation with no additional mitigation	Minor
Vessel disturbance or displacement	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor
Geophysical survey noise	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Trenching noise	Cetaceans	Minor	Embedded Mitigation with no additional mitigation	Minor
Trenching noise	Pinnipeds	Minor	Embedded Mitigation with no additional mitigation	Minor
Vessel noise	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor
Collision/vessel strikes	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Vessel corkscrew injuries	Pinnipeds	Minor	Embedded Mitigation with no additional mitigation	Minor
Contamination from vessel incident or accidental spill	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Disturbance to prey species from vessel noise	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor
Disturbance to prey species from habitat disturbance	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor
Operation and Maintenance				

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Vessel disturbance or displacement	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor
Vessel noise	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor
Collision/vessel strikes	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Vessel corkscrew injuries	Pinnipeds	Minor	Embedded Mitigation with no additional mitigation	Minor
Export cable Electromagnetic fields (EMF)	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Export cable entanglement	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor
Contamination vessel incident or accidental spill	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Disturbance to prey species from vessel noise	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor
Disturbance to prey species from caballing EMF	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor

Table 6-35 Summary of Impacts and Mitigation - Cumulative Impacts from the Project

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Construction				
Vessel disturbance or displacement	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Increased noise	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Collision/vessel strikes	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Vessel corkscrew injuries	Pinnipeds	Minor	Embedded Mitigation with no additional mitigation	Minor
Contamination from vessel incident or accidental spill	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Disturbance to prey species	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor
Operation and Maintenance				
Disturbance or displacement	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor
Increased noise	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor
Collision/vessel strikes	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Vessel corkscrew injuries	Pinnipeds	Minor	Embedded Mitigation with no additional mitigation	Minor
Electromagnetic fields (EMF)	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Entanglement in caballing and mooring lines	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor

Contamination from vessel incident or accidental spill	All Marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Disturbance to prey species	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor

Table 6-36 Summary of Impacts and Mitigation - Cumulative Impacts with other Projects

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Construction				
Vessel disturbance or displacement	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Increased noise	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Collision/vessel strikes	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Contamination from vessel incident or accidental spill	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Disturbance to prey species	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor
Operation and Maintenance				
Disturbance or displacement	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor
Increased noise	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Collision/vessel strikes	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Entanglement in mooring lines and cables	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Electromagnetic Fields	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Contamination from Vessel incident or accidental spill	All marine mammals	Minor	Embedded Mitigation with no additional mitigation	Minor
Disturbance to prey species	All marine mammals	Negligible/Minor	Embedded Mitigation with no additional mitigation	Negligible/Minor

6.10. References

Aberdeen Offshore Wind Farm Limited (AOWFL) (2010). European Offshore Wind Deployment Centre – Request for an Environmental Impact Assessment (EIA) Scoping Opinion.

Aberdeen Offshore Wind Farm Limited (AOWFL) (2012). Marine Mammals Baseline Addendum (J-90008/A).

Anderwald, P. and Evans, P.G.H. (2010). Cetaceans of the East Grampian Region. Sea Watch Foundation.

Au, D.W. T., Pollino, C. A.,Wu, R. S. S., Shin, P. K. S., Lau, S. T. F., and Tang, J. Y.M. 2004. Chronic effects of suspended solids on gill structure, osmoregulation, growth, and triiodothyronine in juvenile green grouper Epinephelus coioides. Marine Ecology Progress Series, 266: 255–264.

Bailey, H., Senior, B., Simmons, D., Rusin, J., Picken, G. and Thompson, P.M. (2010). Assessing underwater noise levels during pile-driving at an offshore wind farm and its potential effects on marine mammals. Marine Pollution Bulletin, Volume 60, Issue 6, Pages 888-897.

Benjamins, S., Harnois, V., Smith, H.C.M., Johanning, L., Greenhill, L., Carter, C. and Wilson, B. (2014). Understanding the potential for marine megafauna entanglement risk from renewable marine energy developments. *Scottish Natural Heritage Commissioned Report No. 791*.

Bonar, P.A.J., Bryden, I.G. and Borthwick, A.G.L. (2015). Social and ecological impacts of marine energy development. Renewable and Sustainable Energy Reviews, Volume 47, Pages 486-495.

British Geological Society (2015). About SEA Data. [ONLINE] Available at: http://www.bgs.ac.uk/data/sea/about.html. [Accessed 27 March 15].

Cheney, B., Thompson, P.M., Ingram, S.N., Hammond, P.S., Stevick, P.T., Durban, J.W., Culloch, R.M., Elwen, S.H., Mandleberg, L., Janik, V.M., Quick, N.J., Islas-Villanueva, V., Robinson, K.P., Costa, M., Eisfeld, S.M., Walters, A., Phillips, C., Weir, C.R., Evans, P.G.H., Anderwald, P., Reid, R.J., Reid, J.B. & Wilson, B. (2013). Integrating multiple data sources to assess the distribution and abundance of bottlenose dolphins Tursiops truncatus in Scottish waters. Mammal Review, 43, 71-88.

Department of Energy and Climate Change (2004). Strategic Environmental Assessment 5: Environmental Report. [ONLINE] Available at: https://www.gov.uk/government/publications/strategic-environmental-assessment-5-environmental-report

García-Alvarez, N., Martín, V., Fernández, A., Almunia, J., Xuriach, A., Arbelo, M., Tejedor, M., Boada, L.D., Zumbado, M. and Luzardo, O.P. (2014). Levels and profiles of POPs (organochloride pesticides, PCBs and PAHs) in free-ranging common bottlenose dolphins of the Canary Islands, Spain. Science of the Total Environment, Volume 493, Pages 22-31.

Hammond, P.S., Berggren, P. Benke, H., Borchers, D.L., Collet, A., Heide-Jøtgensen, M., Heimlich, S., Hiby, A., Leoppold, M. and Øien, N. (2002). Abundance of Harbour Porpoise and other Cetaceans in the North Sea and adjacent waters. Journal of Applied Ecology 39(2): 361-376.

Hammond, P.S., Northridge, S.P., Thompson, D., Gordon, J.C.D., Hall, A.J., Sharples, R.J., Grellier, K. and Matthiopoulos, J. (2004). Background Information on Marine Mammals Relevant to SEA5. Technical Report produced for Strategic Environmental Assessment SEA5 to the DTI. Sea Mammal Research Unit.

Hammond, P.S., Macleod, K., Berggren, P., Porchers, D.L., Burt, M.L., Cañadas, A., Desportes, G., Donovan, G.P., Gilles, A., Gillespie, D., Gordon, J., Hiby, L., Kuklik, I., Leaper, R., Lehnert, K., Leopold, M., Lovell, P., øien, N., Paxton, C.G.M., Ridoux, V., Rogan, E., Samarra, F., Scheidat, M., Sequeira, M., Siebert, U., skov, H., swift, R., tasker, M.L., teilmann, J., van canneyt, O. & vázquez, J.A. (2013). Cetacean abundance and distribution in European Atlantic shelf waters to inform conservation and management. Biological Conservation, 164, 107-122

IAMMWG. 2015. Management Units for cetaceans in UK waters (January 2015). JNCC Report No. 547, JNCC Peterborough.

Inch Cape Offshore Limited (ICOL) (2013). Inch Cape Offshore Limited Offshore Environmental Statement. [ONLINE] Available at: http://www.inchcapewind.com/publications/environmental-statement/introduction

Joint Nature Conservation Committee (JNCC) (2010). JNCC guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys.

Laist, D.W., Knowlton, A.R., Mead, J.G., Collet, A.S. and Podesta, M. (2001). Collisions between ships and whales. Marine Mammal Science, 17 (1): 35-75.

Marine Scotland (2012). Offshore Renewables Research Work Package 3: Request for advice about the displacement of marine mammals around operational wind farms. [ONLINE] Available at: http://www.gov.scot/resource/0040/00404921.pdf [Accessed 20 April 15].

Merck, T. and Wasserthal, R. (2009). Assessment of the environmental impacts of cables. OSPAR Commission.

Merchant, N.D., Pirotta, E., Barton, T.R. and Thompson, P.M. (2014). Monitoring ship noise to assess the impact of coastal developments on marine mammals. Marine Pollution Bulletin, Volume 78, Issues 1-2, Pages 85-95.

Nedwell, J.R., Turnpenny, A.W.H., Lovell, J., Parvin, S.J., Workman, R., Spinks, J.A.L. and Howell, D. (2007). A validation of the dB_{ht} as a measure of the behavioural and auditory effects of underwater noise. Subacoustech Report Reference 534R1231. Department for Business, Enterprise and Regulatory Reform.

Nedwell, J.R., Brooker, A.G. and Barham, R.J. (2012). Assessment of underwater noise during the installation of export power cables at the Beatrice Offshore Wind Farm. Subacoustech Environmental Report No. E318R0106.

Nowacek, D. P., Thorne, L. H., Johnston, D. W. and Tyack, P. L. (2007). Responses of cetaceans to anthropogenic noise. Mammal Review 37 (2): 81-115.

OSPAR (2008). Background document on potential problems associated with power cables other than those for oil and gas activities. OSPAR Commission.

Quick, N., Arso, M., Cheney, B., Islas, V., Janik, V., Thompson, P.M., and Hammond, P.S. (2014). The east coast of Scotland bottlenose dolphin population: Improving understanding of ecology outside the Moray Firth SAC. UK Department of Energy and Climate Change's offshore energy Strategic Environmental Assessment programme Document identifier URN: 14D/086

Richardson, W. J., Greene, C. R., Jr., Malme, C. I., & Thomson, D. H. (1995). Marine mammals and noise. New York: Academic Press. 576 pp.

SCANS II (2008). Small cetaceans in the European Atlantic and North Sea. Final Report to the European Commission under project LIFE04NAT/GB/000245, Sea Mammal Research Unit, University of St. Andrews.

SCOS (2014) Scientific Advice on Matters Related to the Management of Seal Populations: 2014

Southall, B. L., Bowles, A. E., Ellison, W. T., Finneran, J. J., Gentry, R. L., Greene., C. R. Jr., Kastak, D., Ketten, D. R., Miller, J. H., Nachtigall, P. E., Richardson, W. J., Thomas, J. A., and Tyack, P. L. (2007). Marine mammal noise exposure criteria: Initial scientific recommendations. Aquatic Mammals 33(4): 411-521.

Tanabe, S. (1999). Butyltin contamination in marine mammals – a review. Marine Pollution Bulletin, Volume 39, Issues 1-12, Pages 69-72.

Tanabe, S., Iwata, H. and Tatsukawa, R. (1994). Global contamination by persistent organochlorines and their ecotoxicological impact on marine mammals. Science of the Total Environment, volume 154, Issues 2-3, Pages 163-177.

Tasker, M., Amundin, M., Andrew, M., Hawkins, A.D., Lang, W., Merck, T., Scholik-Schlomer, A., Teilmann, J., Thomsen, F., Werner, S. and Zakharia, M. (2010). Managing underwater noise in European waters – implementing the Marine Strategy Framework Directive.

Teilmann, J., Tougaard, J. and Carstensen, J. (2006) Summary on Harbour Porpoise monitoring 1999-2005 around Nysted and Horns Rev Offshore Wind Farms. Technical Report to Energi E2 A/S and Vattenfall A/S.

The Inter-Agency Marine Mammal Working Group (IAMMWG) (2015). Management Units for Cetaceans in UK waters. JNCC Report Number 547, JNCC Peterborough.

The Scottish Executive (2007). Scottish Marine Renewables SEA. Environmental Report Section C SEA Assessment: Chapter 18 EMF.

The Scottish Government. (2015). Research into seal deaths [ONLINE] Available at: http://news.scotland.gov.uk/News/Research-into-seal-deaths-1597.aspx [Accessed 17 April 15].

Thompson, D., Morris, C.D. and Duck, C.D. (2015). Provisional regional PBR values for Scottish seals in 2015. Special Committee on Seals Briefing Paper (SCOS-BP) 14/05.

Thompson, D., Onoufriou, J., Brownlow, A. and Bishop, A. (2015). Preliminary report on predation by adult Grey Seals on Grey Seal pups as a possible explanation for corkscrew injury patterns seen in the unexplained seal deaths. Sea Mammal Research Unit Report to The Scottish Government.

Todd,V. L. G., Todd, I. B., Gardiner, J. C., Morrin, E. C. N., MacPherson, N. A., DiMarzio, N. A., and Thomsen, F.Areviewof impacts of marine dredging activities on marine mammals. – ICES Journal of Marine Science, doi: 10.1093/icesjms/fsu187.

Tougaard, J., Tougaard, S., Jensen, R.C., Jensen, T., Teilman, J., Adelung, D., Liebsch, N. and Müller, G. (2006). Harbour Seals at Horns Reef before, during and after construction of Horns Rev Offshore Wind Farm. Final report to Vattenfall A/S.

Wartzok, D., Popper, A. N., Gordon, J., & Merrill, J. (2004). Factors affecting the responses of marine mammals to acoustic disturbance. Marine Technology Society Journal 37: 6-15.

Wilhelmsson, D., Malm, T. and Öhman, M.C. (2006). The influence of offshore wind power on demersal fish. ICES Journal of Marine Science, 63: 775-784.

Wilhelmsson, D., Malm, T., Thompson, R., Tchou, J., Sarantakos, G., McCormick, N., Luitjens, S., Gullström, M., Patterson Edwards, j.K., Amir, O. and Dubi, A. (2010). Greening Blue Energy: Identifying and Managing the Biodiversity Risks and Opportunities of Offshore Renewable Energy. IUCN.

Wilson, B., Batty, R.S., Daunt, F. and Carter, C. (2007). Collision risks between marine renewable energy devices and mammals, fish and diving birds. Report to The Scottish Executive. Scottish Association for Marine Science, Oban.

7. Ornithology

7.1. Introduction

1. This chapter assesses the potential impacts on birds which may result from the Kincardine Offshore Wind Farm Project ('the project').

2. The potential impacts arising from both the Development Area and the associated export cable corridor are described, including an indication of any cumulative impacts. For the purposes of this Chapter assessment, the Development Area comprises the Wind Turbine Generators (WTG) and inter array cabling.

3. The following appendices and chapters should be read in conjunction with this chapter:

- Chapter 4 – Benthic Ecology
- Chapter 5 - Fish and Shellfish
- Chapter 6 - Marine Mammals
- Chapter 16 – Onshore
- Kincardine Offshore Windfarm Habitats Regulations Appraisal (HRA) – Appropriate Assessment.

7.1.1. Policy and Regulations

4. In addition to the 'The Marine Works (Environmental Impact Assessment) Regulations 2007' (the EIA Regulations), key legislation in relation to birds includes:

- The Council Directive on the Conservation of Wild Birds 2009/147/EC (EU Birds Directive).
- The Council Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora 1992/43/EEC (EU Habitats Directive).
- The Nature Conservation (Scotland) Act 2004 (as amended).
- The Wildlife and Countryside Act 1981 (as amended).
- Conservation (Natural Habitats, etc.) Regulations 1994 (as amended).
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 as amended in 2008.
- Conservation of Habitats and Species Regulations 2010.
- The Offshore Marine Conservation (Natural Habitats, etc.) Regulations 2007 (as amended).

EU Birds Directive

5. The Birds Directive (Directive 2009/147/EC) forms the cornerstone of Europe's nature conservation policy with regards to the protection of birds. Under the directive, European member states have the power and responsibility to classify Special Protection Areas (SPAs) for the protection of all wild birds, their nests, eggs and habitats within the European Community. SPAs together with Special Areas of Conservation (SACs) form a network commonly referred to as Natura 2000 sites. These sites are internationally important for threatened habitats and species.

6. In Scotland, the Habitats Directive is implemented inshore and offshore waters through the following legislation:

- The Conservation (Natural Habitats, &c.) Regulations 1994;
- The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2004;
- The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2007;
- The Conservation (Natural Habitats, &c.) Amendment (No. 2) (Scotland) Regulations 2007;
- The Conservation of Habitats and Species Regulations 2010 which replace the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) in England and Wales (and to a limited degree in Scotland - as regards reserved matters) and
- The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 and associated amendments.

7. The regulations are collectively termed the Habitats Regulations for inshore waters and Offshore Marine Regulations (OMR) for offshore waters and give protection to SACs and SPAs.

8. Where a plan or project may affect a Natura site (whether the plan or project is in, adjacent to the site, or regardless of location), the Habitats Regulations require the competent authority to undertake a Habitats Regulations Appraisal (HRA). HRA includes Appropriate Assessment which is required when a plan or project affecting a Natura site:

- Is not connected with management if the site for nature conservation, and
- Is likely to have a significant effect on the site (either alone or in combination with other plans or projects)

9. This applies to any plan or project which has the potential to affect a Natura site, no matter how far away from that site[1].

10. In Scotland, the Scottish Planning Policy document 2 states that Ramsar sites designated under the Ramsar Convention (The Convention on Wetlands (Ramsar, Iran, 1971)) are also Natura sites and protected under the same statutory regimes. However, where the interests of Ramsar sites correspond with overlapping SACs and SPAs there is no need to consider them separately. Sites protected either by law under the Habitats Regulations/OMR or by Government policy are referred to throughout the HRA process as European sites. Candidate SACs (cSACs), potential SPAs (pSPAs) and Sites of Community Interest (SCIs) are also considered in this process.

11. The 'plan or project' in this case is the proposed Kincardine Offshore Windfarm which will have to pass an Appropriate Assessment prior to Marine Scotland determining a Marine License and s36 consent if it is considered that there is potential for the project to adversely affect the conservation objectives of any of the European sites designated along the east coast of Scotland. The assessment will include considerations as to the likely impact of the KOWL either alone or in combination with other plans or projects.

12. HRA is a separate requirement from EIA due to the specific assessment needs for projects that may affect European sites. Although both may be informed by the same information, more detailed survey work may be required to conduct the assessment and provide the confidence levels necessary to satisfy the Natura Tests contained in Articles 6(3) and 6(4) of the Habitats Directive.

13. The Appropriate Assessment undertaken as part of the information to inform an HRA for the project and will accompany this report.

7.1.2. Stakeholder Consultation

14. Key stakeholders were consulted during the scoping phase of the project and subsequently as part of the Habitats Regulations Appraisal (HRA).

15. There were additional meetings with Marine Scotland, SNH and the RSPB as follows:

- **11th November 2015** – Consultation responses received back on the draft HRA Appropriate Assessment.
- **23rd March 2015** - Meeting with Marine Scotland and SNH regarding the HRA Screening Report.
- **15th May 2015** – Webinar with Marine Scotland and SNH regarding Bird impacts and Collision Risk Modelling results.
- **9th July 2015** – Meeting with RSPB in Perth to discuss HRA Appropriate Assessment and CRM and initial displacement assessment results.

[1] SNH Habitats Regulations Appraisal including appropriate assessment http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/international-designations/natura-sites/habitats-regulations-appraisal/

[2] Scottish Government 2010a

16. A summary of the responses to the Environmental Scoping Assessment in relation to ornithology can be viewed in Table 7-1 below.

17. The information received through consultation, together with the formal Scoping Opinion and recognised industry best practice, has informed the methodology and scope for the assessment of the impacts on birds as summarised in this chapter.

Table 7-1 Summary of Consultation Responses and Project Responses

Kincardine Offshore Wind Farm Environmental Scoping Assessment Comments		
Consultee	**Consultee Response**	**Project Response**
Marine Scotland Science (MSS)	Any unilateral decision regarding surveys – e.g. as stated in section 1.6. of the SR: "the pilot will need to be consented on one year's on site bird and marine mammal data (rather than two)" – must be fully explained, as it is MS-LOT who makes these decisions. Existing published information, data, or any other survey information should be used to provide evidence that justifies the feasibility of using only one year's data. Moreover, data resulting from any survey undertaken by PORL should be presented in the context of other available data which may inform future surveys. Please refer to the minutes of our last meeting held at Aberdeen on 5th November 2013: "ID: Pilot's 1 year data should be presented in the ES in the context of other environmental data that is already available e.g. European Seabirds at Sea, Joint Cetacean Protocol etc."	Following discussions with MSS and SNH, it was agreed that an additional four months of bird survey data was required to cover the breeding season. This was done and the resulting data has been used to inform both the HRA and the Ornithology chapter of the ES.
MSS	The SR should include a clear and comprehensive justification of all field survey methodologies – which should have been agreed by Marine Scotland and SNH prior to the work being undertaken. For example, when referring to Aerial Surveys (9.10.1), a description of flight transects, equipment and methods being used, preliminary data, etc., should be presented in the SR.	Done. Marine Scotland and SNH requested an additional four months of aerial survey data following review of the first 12 months. These additional surveys were undertaken and the results are presented in this report (see *Appendix B*)
SNH	There is a notably high density of auks during post breeding dispersal. Additionally, numbers of several species of seabird that are considered vulnerable to collision risk with offshore wind turbines are considerable.	Noted and this information is reflected in this report.
SNH	In order to determine the potential significance of the large number of auks recorded during the post breeding dispersal period, we advise that the developer should carry out further digital aerial surveys during 2014. These surveys should cover the breeding/post breeding period and continue up to and including September 2014.	These surveys were carried out and the results used in both this assessment and the HRA.
SNH	The approach to determining impacts on bird populations for collision risk is correct. However, it appears that less than 2 years bird survey data will be gathered and we advise that it is premature to discount potential displacement and barrier impacts.	Two years of data was collected for the breeding season and the results used in both this assessment and the HRA, as agreed with SNH and MSS.
SNH	The scoping document identifies protected sites in the immediate vicinity of the proposed development, but connectivity does not appear to have been considered on the basis of foraging ranges for birds within the breeding season. Using mean-maximum (+ 1 standard deviation, where appropriate) foraging ranges from Thaxter *et al* (2012) and/or range information from seabird wikispaces (http://seabird.wikispaces.com/) is a minimum requirement to select protected sites and species that may contribute to birds at the development site.	The selection of SPAs was updated based on the mean max foraging ranges from Thaxter *et al* (2012). See Table 7-8 below.

Kincardine Offshore Wind Farm Environmental Scoping Assessment Comments		
Consultee	**Consultee Response**	**Project Response**
SNH	There is inconsistent treatment of the few designated sites that are mentioned. The treatment given to Fowlsheugh in the document (site summary and brief appraisal of species status within the site) should be repeated for others. Buchan Ness to Collieston Coast SPA has just one line of text dedicated to it.	This has been done and updated to include all SPAs within foraging range of the Kincardine Site (see Figure 7-1 A map of the proposed site in relation to designated sites.
SNH	The document states that it is expected that an appropriate assessment will be required for this project, and data gathered to address this. The information and data presented here is not adequate for the purposes of appropriate assessment and HRA.	All the bird data has been updated based on additional aerial surveys being undertaken and an Appropriate Assessment has been carried out that reflects the results of the additional surveys.
SNH	We recommend this section should be revised and that seabird receptors included should be based on foraging ranges and recent published or web-sourced information.	Done.
SNH	The assessment should cover the construction, operation and maintenance works and decommissioning phases of the project, including consideration of the activities involved in each and their impact on the receptor species and sites.	Done.
SNH	Given the large densities of auks found within the project area during their flightless period, further consideration should be given to the accidental release of contaminants.	Done.
SNH	Before collision risk work is undertaken for this project it is expected that the Marine Scotland avoidance rate review will have been completed and may provide revised figures of avoidance rate that should be used.	The avoidance rate figures in this assessment have been updated based on the outcomes of the avoidance rate review.
SNH	It is not clear how barrier or displacement impacts will be assessed, but despite the statements regarding the expected low impact of these effects, there is still a requirement to assess them. If precautionary assumptions as to the impacts on survival and productivity are made and shown to be insignificant then it is unlikely that further sophisticated population modelling will be required.	Noted. See *Section 7.4.4.1* below for the Displacement Assessment.
SNH	Flight heights estimated for some species using the parallax technique (movement of bird relative to sea). This is a HiDef copyrighted technique, but is not effective on windless days or when bird moving with aircraft. Parallax flight estimation can lead to overestimation of flight height (by approximately 25%) under certain combinations of bird direction and wind speed. This tends to add a level of precaution into the flight heights measured on site.	Noted. This level of precaution ensures that a worst case scenario has been assessed.

Kincardine Offshore Wind Farm HRA Appropriate Assessment Comments		
Consultee	**Consultee Response**	**Project Response**
	Identification of designated sites and qualifying interests for HRA	
SNH	Internationally designated sites (SPAs and SACs) are listed in Tables 4.1 and 4.2. This list follows the list of sites recommended by us at scoping. We consider that the list of sites and species is complete. For birds, the list is based on the sites within mean-maximum foraging range of birds as listed in Thaxter et al (2012).	The Project agree that the list of site and species is complete
SNH	The long list of SPAs has been selected using criteria recommended by us at pre-application meetings i.e. mean-maximum foraging range (mmfr) from Thaxter et al (2012) plus 10%. Since those meetings our preference has moved to consider mmfr +/-1SD, as presented in Thaxter et al (2012).	Noted
SNH	We do not expect the long list to change to reflect our most recent advice on mmfr and we leave it to the discretion of the applicant to decide if they wish to make this amendment to reflect our most recent advice.	The project propose to stick to the original list as previously agreed
SNH	Further assessment may be required for these sites if Scottish Ministers approve these for public consultation. If these sites do come forward for public consultation, we will liaise with both Marine Scotland and the developers as to how best to consider if this proposal would require any further HRA assessment.	Noted
	Turbine details and collision risk calculations	
SNH	The project overview provides details of the proposed construction within a Rochdale / design envelope. It is expected that there will be eight 6MW floating wind turbines with semi-submersible bases in an array up to 50MW total generation capacity. There is some confusion over the turbine dimensions and it is not clear what parameters have been used in the collision risk models. This needs clarified across all relevant sections of the report.	When the original draft of the HRA was produced we were still uncertain as to which turbine model we needed to use, we were required to present a selection to give an indication of potential impacts to a range of turbine models and to be as transparent as possible about potential impacts. The project will use turbines of 6MW-8MW capacity with a maximum tip height of 176 m. The collision assessment has been carred out using a 6MW turbine with 176 maximum tip height as the worse case scenario.
SNH	Floating bases for the turbines will be constructed of tubular steel 12m in diameter. The overall length of one side of the triangular base will be 67m. The deck level (on which the turbines are mounted) will be approximately 12m above the waterline. It is this additional 12m elevation that apparently increases the ‘air gap’ of the 6MW turbine to 34m, and that of the 8MW turbine to 52.5m. The chart of flight heights (Figure C1) indicates that the rotor swept area for the 6MW turbine extends from 27m to c.165m, whereas it probably extends from 34m to 180m. In Section 6.2.3., the area between maximum and minimum turbine height is given as 22 and 192m.	The following data has been used in the CRM. The hub height of the WTG is set at 100 m above sea level, the blades are 76 m long and therefore the blade tips extend from 24 m to 176 m and this has been used in the CRM.

Kincardine Offshore Wind Farm HRA Appropriate Assessment Comments		
Consultee	**Consultee Response**	**Project Response**
	Survey Area/ Density Estimates	
SNH	There is inconsistency between the area used in density calculations and the areas given for the site, buffer and site + buffer. It would be helpful if they could provide densities for each of these areas so we can clearly see which values are being used and how they've been derived.	Noted. We were waiting on the final report back from Hi-Def which meant we only had full data (including transect length) for one area. I will include densities from both areas (Kincardine and NE3) in further assessments
SNH	The flight heights are estimated from HiDef data and therefore come directly from the survey area. This information is presented in the form of a summary graph. We recommend these data are presented as a table. This would allow data to be imported into the Band model spreadsheet.	Noted. The tables of bird flight heights that are used in further CRM will be included in the report.
	Use of CRM options and flight height data	
SNH	It is unclear whether the density estimates used in the CRM are all birds, or just adults. If the former, the effect will be overestimated as the effect is compared to the SPA population that is adult breeding birds only. Survey data could be used to estimate the proportion of adult plumaged birds observed, or a stable age structure could be used (but see below).	All birds were used in the modelling, this was due to a lack of confidence in the aerial data on whether the birds were adult or not – a lot of blanks in the raw data. It was considered best to be pre-cautionary and just use the density estimates for all birds. Following the CRM model outputs the data was split into breeding and non-breeding seasons – again it was assumed that all birds present during the breeding season were adults. It was only at the displacement assessment that the proportion of adults was estimated using age distributions from Inch Cape PVA. Is there an appropriate proportion estimate of the number of birds that are likely to be adults that could be applied to the density estimates to make them more realistic and avoid an excessive of precaution (e.g. 100% of all birds are adult)? Could the estimated age distributions from the Inch Cape PVA be used?
SNH	Table 7-2 (page 66 and 67) and information in 7.1.1 (page 62) are not clear with regard to the approaches used for the basic and extended models. To be clear, the basic model has two options: option 1 and 2. Option 1 utilises site specific derived flight height data, Option 2 uses the generic flight height data as presented in the corrigendum for Johnston et al. 2014. The extended model also has two options: option 3 and option 4. Option 3 uses the generic flight height data from the corrigendum for Johnston et al. 2014, while option 4 uses site specific data in the extended model. We have not used option 4 in any offshore wind farm assessment in Scotland, but are	The Project was initially unaware of an option 4, and therefore presented an option 3 for the generic data and another 'option 3' for site specific data (aka option 4). Now the project have been made aware I will re-present the CRM data making the distinction between options 3 and 4 clearer.

Kincardine Offshore Wind Farm HRA Appropriate Assessment Comments		
Consultee	**Consultee Response**	**Project Response**
	content that the applicant can present the option 4 figures alongside option 1, 2 and 3 if they wish to.	
SNH	Table 7-2 presents collision estimates for Options 1, 2 and 3 for each species and WTG size but then two sets of results are presented, one for Kincardine flight height data and the other for Johnston et al data. [Option 1 is site specific data, Option 2 is generic data (i.e. Johnston et al 2014), and option 3 is the Extended version of the model with the generic data, and Option 4 would be the Extended version of the model with site specific data.] Option 1 and 2 estimates should be the same, but in the Table different numbers are presented for Option 2. I would suggest that one set of the results is deleted and a single set of (correct) estimates for Option 2 be presented. The subsequent tables may then also need updating.	As above.
SNH	Table 7-2 needs revision so it clearly shows option 1 (and 4, if desired) under the site specific data and options 2 and 3 under the Johnston et al. 2014 data. We also recommend that this table only presents the collision risk outputs for species of collision risk concern: neither razorbill nor puffin require collision risk modelling. Option 3 has been used for some species, however, we highlight that SNCBs consider that option 3 should not be used for kittiwake and gannet at present.	As above.
SNH	The collision risk modelling for migratory birds has been completed following SOSS methodology. The analyses suggests some large numbers of some species crossing the Kincardine site, however we do not consider that any of these populations are likely to be significantly impacted by collision with turbines during migration.	Agreed.
	Impact Pathways and connectivity	
	Displacement	
SNH	The estimated population size is given in Table 7-9, the values for which are taken from Table A-5 in the appendices. Whereas the estimated population is stated as relating to the 110km2 area, it appears that the original figures in A-5 are calculated on an area of 550km2 (this has been estimated by back calculating the density to the population figures in Table A-5). The number of birds estimated to be displaced has been therefore been over-estimated. If this is the case, the number of kittiwakes displaced from the Kincardine proposal is 12 adult breeding birds, rather than the 76 presented in Table 7-9. Other than clarification regarding the actual numbers of birds involved, the approach to the displacement calculation is suitable.	Noted, the bird population numbers will be corrected. The approach to displacement will remain the same.
SNH	Table 7-9 indicates that the proportion of adults is taken from the ICOL PVA stable age structure. This is not appropriate for kittiwake (or gannet) which disperse over much wider areas, and where the proportion of adult plumaged birds observed during surveys would be more appropriate (accepting that some 'adult' plumaged birds may not be part of the breeding population).	This was used for kittiwake and gannet from Inch Cape to give an indication of the potential displacement impacts of Kincardine. Following consultation with SNH it was recognised that the potential displacement impacts from eight turbines would be relatively minor and using data from another windfarm (in this

Kincardine Offshore Wind Farm HRA Appropriate Assessment Comments		
Consultee	**Consultee Response**	**Project Response**
		case Inch Cape) in a proportional manner relating to the number of birds on the Kincardine site was agreed to be a sensible approach.
SNH	Large numbers of guillemots and razorbills occur in July to September surveys. The estimates of bird density (Table A-5) appear to include these counts, which are then used to assess displacement during breeding season. To be correct, the density estimate should remove these high influx periods and just be confined to the breeding season.	Noted. The project can review the month by month Hi-Def data and do the calculations to work out whether or not these periods have been included. If they have, the Project will remove for guillemots and razorbills from the assessment.
SNH	The assessment of displacement has concentrated on the loss of productivity that could results from birds having to fly extra distance to provision young. Adult mortality aspects have not been included and previously accepted levels of adult mortality for auks have been 50% for large wind farms. For each adult death a breeding attempt has been considered lost. While in some cases a proportion of apparent adult-type plumage birds do not breed (so called sabbatical birds) it is usually assumed that all adult plumage birds are breeding adults. If there is evidence otherwise then it should be presented and agreed with us and Marine Scotland Science.	The Project does not fully understand this comment. In the displacement assessment we have assumed that 100% of displaced adult breeding birds will fail to reproduce. See the note under Table 7-10. Should this figure be 50%? This has been undertaken as per this assumption.
SNH	I do not recall the SNH advice that 50% of adult plumaged gannets should be assumed to be breeding, and the rationale for this is unclear.	50% was not used for gannets. For Gannets it assumed 100% of adult plumaged birds were breeding. The wording under table 7-9 states the following: "For kittiwake (0.606), razorbill (0.712), guillemot (0.667) and puffin (0.677) the proportion of breeding adults is based on age distributions estimated from the Inch Cape PVA (Appendix 15B, Table 15B.6), for gannet it is assumed that all adult plumage birds are breeding (WWT Consulting, 2012); for other species it is assumed that 50% of adult plumage birds are breeding, based on advice from SNH."
SNH	Table 7-9 uses displacement rates that do not appear to follow those advised by the SNCBs e.g. 75% for gannet. Are they based on the ICOL ES or on SNCB advice?	They were based on the Inch Cape ES, as outlined in point 2 below Table 7-9.
SNH	Table 7-12 assumes a 99% AR with the Extended version of the CRM. The BTO recommended ARs and model options should be used	Noted, this will be amended to 98.9%.
	Apportioning of impacts	
SNH	The apportioning of impacts to the SPAs has been done between SPAs only and does not include any birds from areas outside of SPAs. This has therefore overestimated the impact to the SPAs. For gannet, this is likely to be less of an issue than for kittiwake, but for gannet, the population at Troup Head	Noted, the apportionment will include birds from outside of the SPA.

Kincardine Offshore Wind Farm HRA Appropriate Assessment Comments		
Consultee	**Consultee Response**	**Project Response**
	(1810 AON (3620 adults)) should have been included. Although this population is very small compared to Bass Rock, the proximity to Kincardine will mean that that contribution to the onsite population will still count.	
SNH	Appendix G gives the numbers of kittiwakes at all colonies within foraging range of the development, however this information does not appear to have been used in the apportioning of kittiwake impacts.	Noted, These figures will be included in the apportionment.
SNH	We would recommend apportioning of impacts are revaluated to include all breeding birds within mean-max foraging range, regardless of them being in designated sites or not.	Noted.
	Disturbance	
SNH	Disturbance impacts are likely to be limited due to relatively little sea-based construction activity. Boat movements and activity associated with anchor deployment are considered the most important sources of disturbance and provided that these are restricted as far as possible to outwith the most sensitive time (when auks with dependent young are present in large number), the most damaging negative impacts will be avoided.	Noted.
	Habitat loss	
SNH	Habitat loss due to anchors and possibly cable laying and armouring will be very small. It is not likely to impact on the seabirds due to the depth of water. Only guillemot (200m), razorbill (140m) and possibly puffin (70m) would be expected to dive to this depth. The habitat will largely remain unaltered and seabed change will be fairly limited. Some anchor chain movement could also occur but would expect that this will also be minimal damage given the area of habitat available, and unlikely to have a significant effect on prey resource for the seabirds listed.	Agreed.
	Collision Risk	
SNH	The collision impacts to migrating birds were assessed with an arbitrary threshold of 1% of passage population. As stated in the report, this does not have any biological basis. KOWL's own flight height data was gathered by Hi-Def aerial survey and the maximum recorded flight height (if it was above minimum rotor height) was used to indicate possibility of likely significant effect. This approach is appropriate although, as noted above, we require clarification of the turbine parameters used in the models. Underwater collision (with substructures and mooring structures) has also been considered, but is not likely to be of significance for birds. Detailed comments on CRM are provided above (see use of CRM and flight height data).	Noted
	Approach to in-combination effects	
SNH	Section 6-6 considers the in-combination impacts of the proposal. The SPAs (and qualifying interests) identified as having likely significant effects are each considered as part of cumulative assessment, and the treatment follows recommendations from SNH in previous advice.	Noted
	The list of other projects to be considered for in-combination effects includes not only all significant wind farm projects, but also associated NRIP and transmission links. Impacts of other	

Kincardine Offshore Wind Farm HRA Appropriate Assessment Comments		
Consultee	**Consultee Response**	**Project Response**
	offshore development (oil and gas) are not included, but we consider the list sufficiently complete.	

Kincardine Offshore Wind Farm HRA Screening Assessment Comments		
Consultee	**Consultee Response**	**Reponses**
MSS	Figure 2-3 shows example of moorings with three mooring lines, even though the text indicates that four mooring lines will be used, also the bathymetry scale for Figure 3-1 doesn't seem to match that on the figure.	Final design is still unknown. We would hope to optimise mooring lines to three. The Worst case scenario has been assessed (four).
MSS	The HRA process should be conducted by MS-LOT jointly with any other regulators. Atkins' document is presumably just draft material for consideration by MS-LOT. Section 1.1 describes the process. It would have been better for this to stick to the standard terminology	Atkins have updated Section 1.1 to cover this approach as per MSLOT requirements.
MSS	Section 4 - The scoping opinion referred to as an SNH document is actually a document assembled by MS-LOT. It collates not just SNH advice, but advice from other parties including MSS. The advice from MSS was that if the significant effect test on the Dee, South Esk and the Spey SACs indicates likely significant effects, consideration should be given to expanding the net to considering others, further afield.	Following the TLSE stage it was agreed that there would be no LSE from the project on interest features from the Dee, South Esk and Spey SACs.
SNH	A 'most likely' scenario is presented. We advise that HRA calculations should be undertaken for the 'worst case' development scenario rather than a 'most likely' scenario.	Done.
	List of internationally designated sites	
SNH	Fulmar has the quoted range of 440km in the same table. There are a number of seabird sites with fulmar as a qualifying Interest within 400km of the development area. These include Noss, Copinsay, Hoy, Foula, Sumburgh Head, Calf of Eday and West Westray SPAs. Also Noss SPA is within the quoted foraging range for northern gannet so should also be considered for that qualifying interest.	Done
SNH	In the list of SPAs on page 25 of the report Montrose Basin SPA is repeated.	Changed.
SNH	The Forth and Tay Bay Complex pSPA. As northern gannet and Manx shearwater are among the listed interests of the site, these species would be expected to show connectivity with the development.	Noted.
	Bird Populations	
SNH	The population count on site is calculated from the average number of birds seen per km^2 surveyed, over all surveys then multiplied by the total area. These values are indicative of how commonly a species was seen, but are not useful for impact analyses. Large seasonal variations are hidden in these totals.	Seasonal variations in Bird Numbers Included.
SNH	These do not seem to have been applied consistently, but perhaps are a maximum for each species. It appears that for some species the SD given in the table in Thaxter is added, other times it is not.	Changed.
	Foraging Ranges	
SNH	To be consistent the recommended approach is that the summary (all methods) measurements (mean-max value) plus 10%, published in Thaxter *et al* should be used.	Changed.

Kincardine Offshore Wind Farm HRA Screening Assessment Comments		
Consultee	**Consultee Response**	**Reponses**
SNH	It is accepted that seeking a maximum value of all the options would be precautionary, however the 'all methods' value has some of that precaution, plus can be consistently applied.	Noted.
SNH	The table suggests that species from sites with foraging ranges just outside the value quoted in this table would be included by precaution. In that case, guillemot from St Abbs to Fastcastle SPA should be included in the analyses.	Done.
	Bird Counts	
SNH	The 'most recent population counts' used in the table are not always the most recent available. For example the Fowlsheugh SPA kittiwake latest count in the table is 9454 pairs in 2009. However the Seabird Monitoring Programme (SMP) database shows that there is a 2012 count (of 9337 AON). Forth Islands SPA kittiwakes were also counted last year (2014) with a total of 3280 AON (4962 AON from 2008 appears in the table). The SMP kittiwake count for Troup, Pennan and Lion's Head SPA is 14896 AON, although in the table it is given as 14133 AON. These differences indicate that the data should be checked and updated where possible.	Done.
	Pathways for LSE	
SNH	The summaries in the section 6.2 cover the likely mechanisms and correctly identify pathways of impact.	Noted.
SNH	For the calculated footprint of the turbines (the combined base area), the calculation made on page 45 appears to be incorrect. Instead of the 8 platforms covering 15km^2 as stated, it seems more likely that they will cover ~ 1.4 km^2. This also makes more sense as the whole development only has an expected footprint of some 8km^2	Noted.
SNH	Note the text for puffin refers to razorbill,	Text Changed
SNH	No LSE can be concluded for Sandwich tern, eider (non-breeding), lesser black backed gull, pink-footed, barnacle and greylag goose and whooper swan.	Noted.
SNH	Duck, divers and grebe were hardly recorded in the surveys and so the impact on designated sites for these groups will also be small. No LSE can also be concluded for these species.	Noted.
SNH	Table 6-6 assesses each SPA in turn against the maximum population estimate recorded on site. This is a very precautionary approach so we consider it unlikely that species will be overlooked at this stage.	Noted.
SNH	Foraging ranges and the assessed population sizes mean that aspects of the conclusions such as the list of sites and species for consideration will need to be revised.	Done.
SNH	Distinction is needed between the breeding season (colony dependent) period and other periods of the annual cycle.	Done.
	Collision Modelling	
SNH	Details of collision risk modelling and displacement assessment methods for the species identified are required to fully inform the AA.	Done.

Kincardine Offshore Wind Farm HRA Screening Assessment Comments		
Consultee	**Consultee Response**	**Reponses**
SNH	The Collision Risk Modelling (CRM) will follow the methods set out in 'Strategic Assessment of collision risk of Scottish offshore wind farms on migrating birds'. We have agreed to this approach previously.	Done.
SNH	Flight heights are the maximum recorded during aerial surveys. If any flight height data other than previously published distributions are to be used then this should be checked.	Done.
SNH	Band option 3 is not appropriate for predicting collision rates for northern gannet and black-legged kittiwake.	Noted
SNH	Assessment of birds wintering or migrating through the wind farm area should be conducted.	Done using SOSS methodology
	In-Combination Assessment	
SNH	But not Beatrice which should be included, although Beatrice does appear in figure 6-4 which identifies the in combination projects to be considered.	Beatrice included
	Bird Survey Data	
SNH	We consider that further details of survey data and analysis, including details of collision risk modelling and displacement assessment methods for the species selected in the report will be required to fully inform the AA for this development.	Done. (See *Sections 7.4.2* and *7.4.4* below)
SNH	Abundance estimates should be divided into biologically meaningful periods such as colony attendance (breeding season), wintering period and any migration / dispersal periods. A breeding season collision rate and a winter period collision rate / displacement rate should be made.	Done.
SNH	The full, final HiDef survey report should be made available with the finalised HRA.	Done. (See appendix B)
RSPB	Update In-combination to include an avoidance rate of 98.9% for Gannet and Kittiwake to allow comparison.	Done.

7.1.3. Design Envelope

18. The project potential development parameters and scenarios are defined as a Rochdale Envelope and presented in Chapter 1.

19. The assessment of potential impacts on birds within this chapter is based on the Rochdale Envelope, with the development methodology and parameters being based upon the worst case scenario.

20. For the assessment, these scenarios include:

- Consideration of the maximum number of WTGs with the largest footprint, therefore the maximum loss of area (in this case this is 6 x 8 MW WTGs);
- Worst case positioning of WTGs;
- For the offshore export cable corridor, it is assumed that two export cables will be required and installed at the shore end via Horizontal Directional Drilling (HDD).

21. Key parameters for the worst case scenario for each potential impact are detailed in Table 7-2 below.

Table 7-2 Key parameters for potential Impacts – Development Area

Potential Impact	Worst Case Scenario Assessed in ES
Construction (and Decommissioning)	
Temporary disturbance and / or displacement	8 x 6 MW WTGs. No met masts will be installed. There will be no Offshore Substation Platform (OSP). Maximum number of vessel movements / pre-defined vessel routes.
Accidental Release of Contaminants	Maximum number of vessel movements / pre-defined vessel routes. Contamination from corrosion / anti-fouling protection. Cathodic protection, anti-corrosion coatings, anti-fouling paints and mechanical removal of deposits. All materials utilised will be safe for use within the marine environment.
Disturbance to prey species (indirect Impact)	Vessel anchorage disturbance. Maximum number of vessel movements / pre-defined vessel routes.
Operation	
Collision Risk (birds)	All collision risk parameters were based on a worst case scenario to ensure the potential number of collision impacts were the most precautionary figures. These include: - Using the highest densities of birds using the site over two years or survey. - Using the most precautionary avoidance rates - Using the most precautionary flight type - Running Collision Risk Modelling for birds within a worst case foraging range. - Using worst case WTG model parameters (see Table 7-14 below) - Hi-Def Parallax flight estimation can lead to overestimation of flight height (by approximately 25%). This adds a high level of precaution into the flight heights measured on site and used in collision risk modelling. - A range of CRM results presented across a range of avoidance rates and flight height distributions.
Displacement	Displacement area included a worst case of the development area and a 1 and 2km buffer. The most precautionary bird displacement rates were used. The displacement footprint was based on eight turbines, with a maximum area per turbine and maximum spacing between turbines. It was assumed that breeding failure of displaced birds would be 100% The highest number of assumed breeding adults was used.
Disturbance	Vessel anchorage disturbance.

Potential Impact	Worst Case Scenario Assessed in ES
Construction (and Decommissioning)	
Entanglement	Maximum 12 inter array cables. Cable length 2.5 km each. Cable overall diameter 180 mm. Inter array cables will not be buried.
Contamination, e.g. from antifouling paints, corrosion inhibitors, oil leakage from equipment and accidental pollution events.	Maximum number of vessel movements / pre-defined vessel routes. Contamination from corrosion / anti-fouling protection. Cathodic protection, anti-corrosion coatings, anti-fouling paints and mechanical removal of deposits. All materials utilised will be safe for use within the marine environment.
Habitat loss / disturbance to prey species (indirect impact)	Introduction of new substrate which is available for colonisation from the anchor stick-up, chains, floating platforms. Seabed preparation for drag embedment anchors for mooring lines – worst case assumed to be 10 x 10m area per anchor, including pre-tensioning movement. This would give a maximum area (four anchors per WTG = 32 anchors) 3200m^2.

7.1.4. Embedded Mitigation

22. Embedded mitigation measures to minimise environmental effects are captured within the design envelope. The assessment looking at the effects of the development on ornithology has taken account of the following embedded mitigation measures:

- Vessels and equipment during construction, operation and maintenance and decommissioning will follow best practice guidelines for pollution at sea in order to reduce and coordinate the response to pollution events.
- Export cables will be suitably buried or protected by other means when burial is not practicable.
- Vessels and plant relating to the construction, operation and decommissioning phase will follow industry best practice and OSPAR, IMO and MARPOL guidance for pollution at sea, which will be detailed in the final Project Environment Management Plan (PEMP) to reduce and coordinate response to pollution events. The PEMP will also include provision for the storage of pollutants.
- Export cables will be suitably buried or protected by other means where burial is not practicable, e.g. rock dumping or concrete mattressing, which will reduce potential for impacts relating to Electromagnetic Fields (EMF).

7.2. Baseline Environment

23. There are a number of sources of ornithological data covering the coastal, inshore (<12nm) and offshore (>12nm) areas of south-east Scotland and north-east England, obtained from offshore seabird surveying, seabird colony monitoring, Non-Governmental Organisation (NGO e.g. RSPB, BTO & Forth Seabird Monitoring Group) recording (Dean *et al*, 2004; Lewis *et al*, 2008). The search area for the project includes ornithological populations of interest from Fowlsheugh to the south, and the Ythan Estuary and Sands of Forvie in the north.

24. The following baseline data has been collected from the following sources:

Table 7-3 Baseline information – Ornithology

Type/description of data	Source	Status
WWT Aerial Survey Data	WWT	Obtained
European Seabirds at sea (ESAS) database	JNCC http://jncc.defra.gov.uk/page-4469	Obtained
National Seabird Census (Seabird 2000)	JNCC website http://jncc.defra.gov.uk/page-1548	Obtained
Seabird Monitoring Programme	JNCC website http://jncc.defra.gov.uk/page-1550	Obtained
RSPB species-specific surveys	RSPB	Obtained
BTO Data records	BTO	Obtained
Regional database (North-east Scotland, Angus & Dundee, Fife Bird, Isle of May, Lothian, Borders and Northumberland &Tyneside)	Various sources	Obtained
SPA Citations	SNH	Obtained

Desk Based Review of Existing data

7.2.1. Designated Sites

25. North of the Kincardine Site, off the coast of Aberdeen, the Ythan Estuary and Sands of Forvie are particularly sensitive and hold numerous designations for birds including: the Ythan Estuary, Sands of Forvie and Meikle Loch SPA, Ramsar and Important Bird Area (IBA) (important for three species of tern and large numbers of waders, ducks and geese); the Sands of Forvie SAC (several Annex I dune habitats) as well as SSSIs, GCRs, Forvie Biogenetic Reserve and National Nature Reserve (NNR). The Buchan Ness to Collieston Coast SPA and Buchan Coast to Collieston SAC are found just to the north of Forvie. The SPA is an important nesting area for a number of seabird species (gulls and auks) which feed outside the SPA in nearby waters as well as more distantly.

26. Fowlsheugh SPA to the south west is an area of sheer cliffs 30-60m high providing nesting sites for seabirds and supporting major numbers of breeding birds especially gulls and auks which feed outside the SPA in nearby waters and the North Sea. From Fowlsheugh north to Aberdeen there are a number of other sites including Garron Point SAC, several Sites of Special Scientific Interest (SSSI) (Crawton Bay, Fowlsheugh, Garron Point, Findon Moor, Cove and Nigg Bay) and a number of Geological Conservation Review sites which also include Nigg Bay. The River Dee, designated as an SAC enters the North Sea at Aberdeen Harbour. It is important for the Annex II species Freshwater pearl mussel (*Margaritifera margaritifera*), Atlantic salmon (*Salmo salar*) and Otter (*Lutra lutra*).

27. Although the proposed site is not within a designated marine protected area, it was recognised from the outset that the coastal waters surrounding it are abundant in marine life, supporting a rich biology and internationally important bird and marine mammal populations (See *Chapter 6 – Marine Mammals*).

28. In the appendices of their scoping opinion[3], SNH recommended considering impacts to the following European protected sites as part of the HRA (See Figure 7-1 below).

[3] http://www.scotland.gov.uk/Resource/0045/00457478.pdf

SPAs – see Figure 7-1.

- Buchan Ness to Collieston Coast SPA
- Fowlsheugh SPA
- Troup, Pennan and Lions Heads SPA
- Forth Islands SPA
- East Caithness Cliffs SPA
- North Caithness Cliffs SPA
- Ythan Estuary, Sands of Forvie and Meikle Loch SPA
- Montrose Basin SPA
- Fair Isle SPA
- Flamborough head and Bempton Cliffs SPA
- Loch of Strathbeg SPA
- Loch of Skene SPA
- Noss SPA
- Foula SPA
- Sumburgh Head SPA
- West Westray SPA
- Calf of Eday SPA
- Hoy SPA
- Copinsay SPA
- St Abbs Head to Fast Castle SPA

29. The designated features of these sites are outlined in Figure 7-1

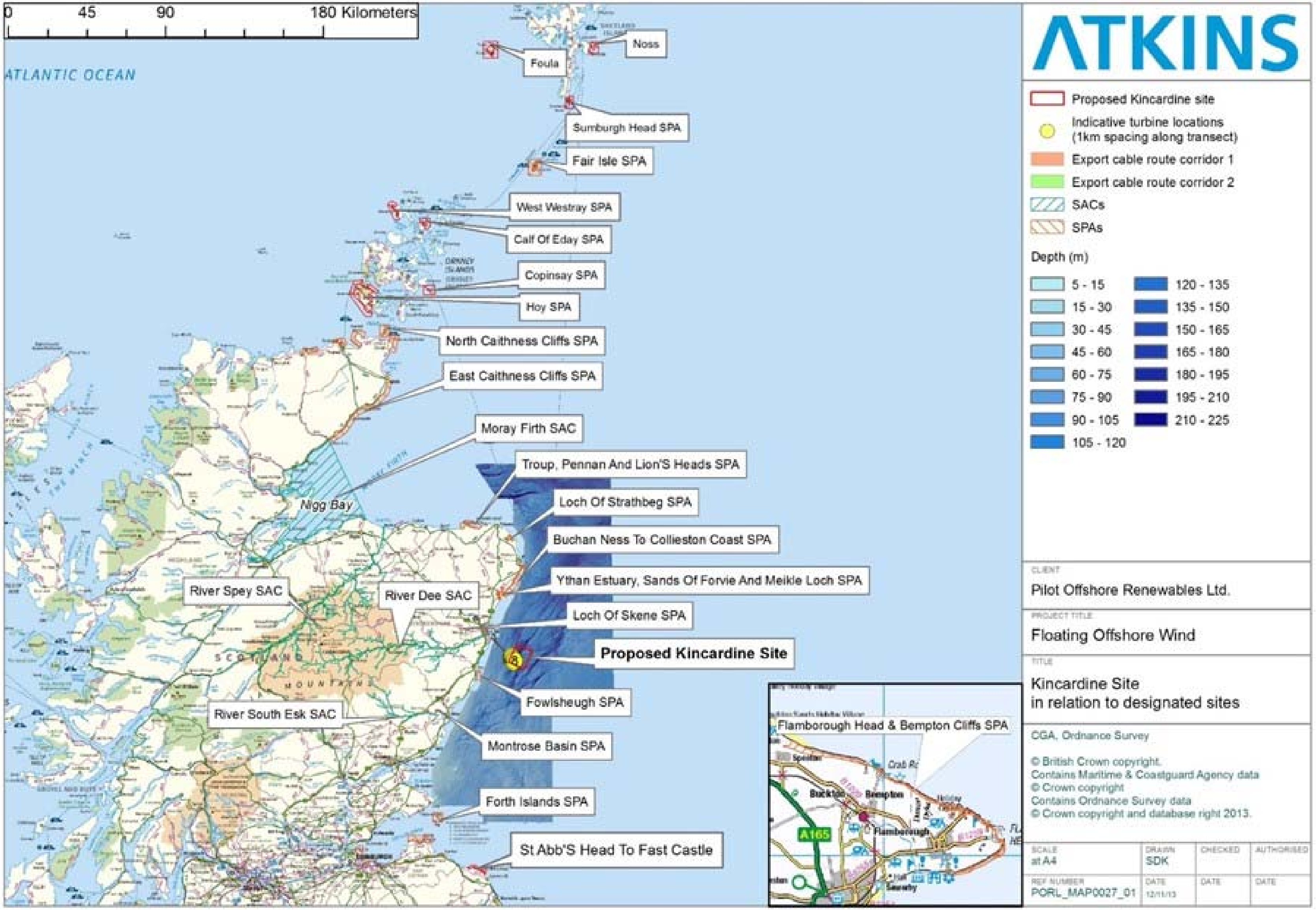

Figure 7-1 A map of the proposed site in relation to designated sites.

Table 7-4 A list of SPAs, along with their designated features and distance from the proposed site.

Nature Conservation Site	Designation	Features	Distance from Scheme
Fowlsheugh	SPA	Fowlsheugh SPA qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. The colony regularly supports 145,000 seabirds. The colony further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: common guillemot *Uria aalge* (56,450 individuals, 5% of GB population, 1.7% of Western European population), and black-legged kittiwake *Rissa tridactyla* (36,650 pairs, 7.5% of the GB population, 1.2 % of World population). The colony also regularly supports nationally important populations of razorbill *Alca torda** (5,800 individuals, 3.9% of the GB population), Northern fulmar* *Fulmarus glacialis* (1,170 pairs, 0.2% of the GB population), and herring gull *Larus argentatus** (3,190 pairs, 2% of the GB population).	16km
Buchan Ness to Collieston Coast	SPA	Buchan Ness to Collieston Coast SPA qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 95,000 seabirds including nationally important populations of the following species: black-legged kittiwake *Rissa tridactyla** (30,452 pairs, 6.2% of the GB population), common guillemot *Uria aalge** (8,640 pairs, 1.2% of GB population), herring *gull Larus argentatus** (4,292 pairs, 2.7% of the GB population), European shag *Phalacrocorax aristotelis** (1,045 pairs, 2.7% of the GB population) and Northern fulmar *Fulmarus glacialis** (1,765 pairs, 0.3% of the GB population).	27km
Loch of Skene	SPA	Loch of Skene qualifies under Article 4.1 by supporting populations of European importance of the following species listed on Annex I of the Directive: Over winter; Whooper Swan *Cygnus cygnus*, 203 individuals representing up to 3.7% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6) This site also qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species: Over winter; Greylag Goose *Anser anser*, 10,840 individuals representing up to 10.8% of the wintering Iceland/UK/Ireland population (5 year peak mean 1991/2 - 1995/6)	32km
Ythan Estuary, Sands of Forvie and Meikle Loch	SPA	This site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive: During the breeding season; Common Tern *Sterna hirundo*, 265 pairs representing up to 2.2% of the breeding population in Great Britain (Count, as at early 1990s); Little Tern *S. albifrons*, 41 pairs representing up to 1.7% of the breeding population in Great Britain (Count, as at early 1990s); Sandwich Tern *S. sandvicensis*, 600 pairs representing up to 4.3% of the breeding population in Great Britain (Seabird Census Register) This site also qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species:	32km

Nature Conservation Site	Designation	Features	Distance from Scheme
		Over winter; Pink-footed Goose *Anser brachyrhynchus*, 17,213 individuals representing up to 7.7% of the wintering Eastern Greenland/Iceland/UK population (winter peak means) Assemblage qualification: A wetland of international importance. The area qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl. Over winter, the area regularly supports 51,265 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including: Redshank *Tringa totanus**, Lapwing *Vanellus vanellus**, Eider *Somateria mollissima**, Pink-footed Goose *Anser brachyrhynchus*.	
Montrose Basin	SPA	This site qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species: Over winter; Greylag Goose *Anser anser*, 1,080 individuals representing at least 1.1% of the wintering Iceland/UK/Ireland population (5 year peak mean, 1987/8-1991/2); Knot *Calidris canutus*, 4,500 individuals representing at least 1.3% of the wintering North-eastern Canada/Greenland/Iceland/North-western Europe population (5 year peak mean 1991/2 - 1995/6); Pink-footed Goose *Anser brachyrhynchus*, 31,622 individuals representing at least 14.1% of the wintering Eastern Greenland/Iceland/UK population (5 year peak mean 1991/2 - 1995/6); Redshank *Tringa totanus*, 2,259 individuals representing at least 1.5% of the wintering Eastern Atlantic - wintering population (5 year peak mean 1991/2 - 1995/6): Assemblage qualification: A wetland of international importance. The area qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl Over winter, the area regularly supports 54,917 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including: Dunlin *Calidris alpina alpina**, Oystercatcher *Haematopus ostralegus**, Eider *Somateria mollissima**, Wigeon *Anas penelope**, Shelduck *Tadorna tadorna**, Redshank *Tringa totanus*, Knot *Calidris canutus,* Greylag Goose *Anser anser,* Pink-footed Goose *Anser brachyrhynchus*.	50km
Loch of Strathbeg	SPA	Loch of Strathbeg SPA qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive: During the breeding season; Sandwich Tern *Sterna sandvicensis*, 530 pairs representing up to 3.8% of the breeding population in Great Britain (5 year mean, 1993-1997) Over winter; Barnacle Goose *Branta leucopsis*, 226 individuals representing up to 1.9% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6); Whooper Swan *Cygnus cygnus*, 183 individuals representing up to 3.3% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6) This site also qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species:	60km

Nature Conservation Site	Designation	Features	Distance from Scheme
		Over winter; Greylag Goose *Anser anser*, 3,325 individuals representing up to 3.3% of the wintering Iceland/UK/Ireland population (winter peak means): Pink-footed Goose *Anser brachyrhynchus*, 39,924 individuals representing up to 17.7% of the wintering Eastern Greenland/Iceland/UK population (5 year peak mean 1991/2 - 1995/6) Assemblage qualification: A wetland of international importance. The area qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl. Over winter, the area regularly supports 49,452 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including: Teal *Anas crecca**, Greylag Goose *Anser anser*, Pink-footed Goose *Anser brachyrhynchus*, Barnacle Goose *Branta leucopsis*, Whooper Swan *Cygnus cygnus*.	
Troup, Pennan and Lions Heads	SPA	The site qualifies under Article 4.2 by regularly supporting over 20,000 individual breeding seabirds. In 1995 the site supported about 150,000 individual seabirds of 9 species. The site qualifies further under Article 4.2 by regularly supporting internationally important breeding populations of the migratory species black-legged kittiwake *Rissa tridactyla** (31,600 pairs in 1995; 6% of the British population and 1% of the total population of the sub-species *R. t. tridactyla*) and common guillemot *Uria aalge* (44,600 individuals in 1995; 4% of the British and 1% of total population of the sub-species *U. a. aalge* and *U. a. albionis*). In addition to the species mentioned above, the assemblage of breeding seabirds includes the regularly occurring migratory species Northern fulmar *Fulmarus glacialis** (4,400 pairs), herring gull *Larus argentatus** (4,200 pairs; 2% of the British breeding population), and razorbill *Alca torda** (4,800 individuals). All figures in brackets are estimates for 1995.	69km
Forth Islands	SPA	Forth Islands SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species Arctic tern *Sterna paradisaea* (mean between 1992 and 1996 of 540 pairs, 1.2% of the GB population), roseate tern *Sterna dougallii* (an average of 8 pairs, 1997 - 2001; 13% of GB population and the most northerly of only six regular British colonies), common tern *Sterna hirundo* (an average of 334 pairs, 1997-2001; 3% of GB population) and Sandwich tern *Sterna sandvicensis* (22 pairs representing at least 0.2% of the breeding population in Great Britain (5 year mean, 1993-1997). Forth Islands SPA further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species; Northern gannet *Morus bassanus* (34,400 pairs representing at least 13.1% of the breeding North Atlantic population (Count, as at 1994)), European shag *Phalacrocorax aristotelis* (2,887 pairs, 2.3% of N Europe biogeographic population), lesser black-backed gull *Larus fuscus* (2,920 pairs, 2.4% of total *L.f. graellsii* biogeographic population) and Atlantic puffin *Fratercula arctica* (21,000 pairs, 2.3% of total *F.a.grabae* biogeographic population). Forth Islands SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. The site regularly supports 90,000 seabirds (three year mean, 1986 – 1988) including nationally important populations of the following species: razorbill *Alca torda** (1,400 pairs, 1.4% of GB population), common guillemot *Uria aalge** (16,000 pairs, 2.2% of GB population), black-legged kittiwake *Rissa tridactyla** (8,400 pairs, 1.7% of GB population), herring gull *Larus argentatus** (6,600 pairs, 4.1% of GB population), great cormorant *Phalacrocorax carbo** (200 pairs, 2.8% of GB	94km

Nature Conservation Site	Designation	Features	Distance from Scheme
		population), Northern gannet *Morus bassanus* (21,600 pairs), lesser black-backed gull *Larus fuscus* (1,500 pairs), European shag *Phalacrocorax aristotelis* (2,400 pairs), Atlantic puffin *Fratercula arctica* (14,000 pairs), Northern fulmar *Fulmarus glacialis** (798 pairs), Arctic tern *Sterna paradisaea* (540 pairs), common tern *Sterna hirundo* (334 pairs), roseate tern *Sterna dougallii* (8 pairs) and Sandwich tern *Sterna sandvicensis* (440 pairs).	
St Abbs to Fast Castle	SPA	St Abb's Head to Fast Castle SPA qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. The site regularly supports 79,560 seabirds including nationally important populations of the following species: razorbill *Alca torda* (2,180 individuals, 1% of the GB population); common guillemot *Uria aalge* (31,750 individuals, 3% of the GB population); black-legged kittiwake *Rissa tridactyla* (21,170 pairs, 4% of the GB population); herring gull *Larus argentatus* (1,160 pairs, 0.7% of the GB population); and European shag *Phalacrocorax aristotelis* (560 pairs, 1% of the GB population).	117km
East Caithness Cliffs	SPA	East Caithness Cliffs SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species peregrine *Falco peregrinus* (6 pairs, 0.5% of the GB population). East Caithness Cliffs SPA further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: common guillemot *Uria aalge* (106,700 individuals, 3.1% of north Atlantic biogeographic population); razorbill *Alca torda* (15,800 individuals, 1.8% of total *A. t. islandica* biogeographic population), herring gull *Larus argentatus* (9,400 pairs, 1.0% of NW European biogeographic population), black-legged kittiwake *Rissa tridactyla* (32,500 pairs, 1.0% of north Atlantic biogeographic population), and European shag *Phalacrocorax aristotelis* (2,300 pairs, 1.8% of the north Europe biogeographic population). East Caithness Cliffs SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 300,000 individual seabirds including nationally important populations of the following species: great black-backed gull *Larus marinus* (800 pairs, 4% of the GB population), cormorant *Phalacrocorax carbo* (230 pairs, 3% of the GB population), Northern fulmar *Fulmarus glacialis* (15,000 pairs, 3% of the GB population), razorbill (15,800 individuals, 11% of the GB population), common guillemot (106,700 individuals, 10% of the GB population), black-legged kittiwake (32,500 pairs, 7% of the GB population), herring gull (9,400 pairs, 6% of the GB population), European shag (2,300 pairs, 6% of the GB population) and Atlantic puffin (1750 pairs, over 10% of the minimum qualifying assemblage of 20,000 individuals.)	158km
North Caithness Cliffs	SPA	North Caithness Cliffs SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species: peregrine *Falco peregrinus* (6 pairs, 0.5% of the GB population). North Caithness Cliffs SPA further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: common guillemot *Uria aalge* (38,300 individuals, 1% of the North Atlantic biogeographic population). North Caithness Cliffs SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. The site regularly supports 110,000 seabirds including nationally important populations of the following species: Northern fulmar *Fulmarus glacialis* (14,700 pairs; 3% of the GB population); black-legged kittiwake *Rissa tridactyla* (13,100 pairs, 3% of the GB population); common guillemot (38,300 individuals, 4% of the GB	180km

Nature Conservation Site	Designation	Features	Distance from Scheme
		population); razorbill *Alca torda* (4,000 individuals, 3% of the GB population) and Atlantic puffin *Fratercula arctica* (1,750 pairs, over 10% of the minimum qualifying assemblage of 20,000 individuals)	
Copinsay	SPA	Copinsay qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 70,000 seabirds including nationally important populations of the following species: common guillemot *Uria aalge* (29,450 individuals, 3% of the GB population), black-legged kittiwake *Rissa tridactyla* (9,550 pairs, 2% of the GB population) greater black-backed gull *Larus marinus* (490 pairs, 3% of the GB population) and Northern fulmar *Fulmarus glacialis* (1,615 pairs, 0.3% of the GB population).	215km
Hoy	SPA	Hoy SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species: red-throated diver *Gavia stellata* (58 territories, 6% of the GB population) and peregrine *Falco peregrinus* (6 pairs, 0.5% of the GB population). Hoy SPA further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: great skua *Stercorarius skua* (1,900 pairs, 14% of the world biogeographic population). Hoy SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 120,000 seabirds including nationally important populations of the following species: Atlantic puffin *Fratercula arctica* (3,500 pairs, 0.7% of the GB population); black-legged kittiwake *Rissa tridactyla* (3,000 pairs, 0.6% of the GB population); Arctic skua *Stercorarius parasiticus* (59 pairs, 2% of the GB population); Northern fulmar *Fulmarus glacialis* (35,000 pairs, 6% of the GB population); great black-backed gull *Larus marinus* (570 pairs, 3% of the GB population); common guillemot *Uria aalge* (13,400 pairs, 2% of the GB population).	227km
Calf of Eday	SPA	Calf of Eday SPA qualifies under Article 4.2 of the EC Wild Birds Directive by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 30,000 seabirds including nationally important populations of the following species: great cormorant *Phalacrocorax carbo carbo* (223 pairs, 3% of the GB population), great black-backed gull *Larus marinus* (938 pairs, 5% of the GB population), common guillemot *Uria aalge* (12,645 individuals, 1% of the GB population), Northern fulmar *Fulmarus glacialis* (1,955 pairs, 0.4% of the GB population) and black-legged kittiwake *Rissa tridactyla* (1,717 pairs, 0.4% of the GB population).	253km
West Westray	SPA	West Westray qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species: Arctic tern *Sterna paradisaea* (1,140 pairs; 3% of the British breeding population). The SPA also qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: common guillemot *Uria aalge* (42,150 individuals, 1.2% of the North Atlantic biogeographic population). The SPA further qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. West Westray regularly supports 113,000 seabirds including nationally important populations of the following species: razorbill *Alca torda* (1,946 individuals, 1% of the GB population); black-legged kittiwake *Rissa tridactyla* (23,900 pairs, 5% of the GB population); Arctic skua *Stercorarius parasiticus* (78 pairs; 2% of the GB population) and Northern fulmar *Fulmarus glacialis* (1,400 pairs, 0.2% of the GB population).	265km

Nature Conservation Site	Designation	Features	Distance from Scheme
Fair Isle	SPA	Fair Isle SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species: Fair Isle wren Troglodytes *troglodytes fridariensis* (33 territorial males, 100% of the GB population) and Arctic tern *Sterna paradisaea* (1100 pairs, 1% of the GB population). Fair Isle SPA further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: common guillemot *Uria aalge* (32,300 individuals, 1.4% of the north Atlantic biogeographic population). Fair Isle SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 180,000 seabirds including nationally important populations of the following species: Atlantic puffin *Fratercula arctica* (23,000 individuals, 2% of the GB population), razorbill *Alca torda* (3,400 individuals, 2% of the GB population), black-legged kittiwake *Rissa tridactyla* (18,160 pairs, 4% of the GB population), great skua *Stercorarius skua* (110 pairs, 1% of the GB population), Arctic skua *Stercorarius parasiticus* (110 pairs, 3% of the GB population), European shag *Phalocrocorax aristotelis* (1,100 pairs, 3% of the GB population), Northern gannet Morus bassanus (1,166 pairs, 0.6% of the GB population), Northern fulmar *Fulmaris glacialis* (35,210 pairs, 7% of the GB population), common guillemot *Uria aalge* (32,300 individuals, 3% of the GB population), and Arctic tern *Sterna paradisaea* (1100 pairs).	270km
Sumburgh Head	SPA	Qualifying Interest (N.B. All figures relate to numbers at the time of classification except where amended by the 2001 SPA Review): Sumburgh Head SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species: Arctic tern *Sterna paradisaea* (700 pairs, 2% of GB). Sumburgh Head SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. The site regularly supports 35,000 seabirds including nationally important populations of the following species: common guillemot *Uria aalge* (16,000 individuals, 1% of GB); black-legged kittiwake *Rissa tridactyla* (1,366 pairs, 0.3% of the GB population); and Northern fulmar *Fulmarus glacialis* (2,542 pairs, 0.5% of the GB population).	319km
Flamborough Head and Bempton Cliffs	SPA	Flamborough Head and Bempton Cliffs SPA qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species: Kittiwake *Rissa tridactyla*, 83,370 pairs representing at least 2.6% of the breeding Eastern Atlantic - Breeding population (Count, as at 1987) Assemblage qualification: A seabird assemblage of international importance The area qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 seabirds During the breeding season, the area regularly supports 305,784 individual seabirds including: Puffin *Fratercula arctica*, Razorbill *Alca torda*, Guillemot *Uria aalge*, Herring Gull *Larus argentatus*, Gannet *Morus bassanus*, Kittiwake *Rissa tridactyla*.	332km

Nature Conservation Site	Designation	Features	Distance from Scheme
Foula	SPA	Foula SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species: Arctic tern *Sterna paradisaea* (up to 1,500 pairs, 2% of GB); Leach's storm-petrel *Oceanodroma leucorhoa* (50 pairs, <0.1% of the GB population); and red-throated diver *Gavia stellaria* (11 pairs in 1994, 1.2% of the GB population). Foula SPA further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: great skua *Stercorarius skua* (2,270 pairs, 17% of world biogeographic population), common guillemot *Uria aalge* (37,500 individuals, 0.8% of the North Atlantic biogeographic population); Atlantic puffin *Fratercula arctica grabae* (48,000 pairs, 5% of the total *F.a.grabae* biogeographic population); and European shag *Phalacrocorax aristotelis* (2,400 pairs, 1.9% of the North Europe biogeographic population). SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 250,000 seabirds including nationally important populations of the following species: black-legged kittiwake *Rissa tridactyla* (3,840 pairs, 0.8% of the GB population); razorbill *Alca torda* (6,200 individuals, 4% of the GB population); Arctic skua *Stercorarius parasiticus* (133 pairs, 4% of the GB population); Northern fulmar *Fulmarus glacialis* (46,800 pairs, 9% of the GB population); Atlantic puffin (48,000 pairs, 11% of the GB population); common guillemot (37,500 individuals, 4% of the GB population); great skua (2,270 pairs, 29% of the GB population); European shag *Phalacrocorax aristotelis* (2,400 pairs, 7% of the GB population); Leach's storm-petrel (50 pairs); and Arctic tern (1,500 pairs).	346km
Noss	SPA	Noss qualifies as a Special Protection Area under Article 4.2 of the EC Wild Birds Directive by regularly supporting populations of European importance of the migratory species: Northern gannet *Morus bassanus* (6,860 pairs, 3% of the western European breeding population); great skua *Stercorarius skua* (420 pairs, 5% of EC, and 3% of western European) and common guillemots *Uria aalge* (38,970 individuals 3% of EC and 1% of western European). The site also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 35,000 seabirds including, in addition to the species listed above, nationally important populations of the following species: Northern fulmar *Fulmarus glacialis* (6,350 pairs, 1% of the GB population) blacklegged kittiwakes *Rissa tridactyla* (7,020 pairs, 1% of the GB population) and Atlantic puffin (2,348 individuals, over 10% of the minimum qualifying assemblage of 20,000 individuals).	354km

7.3. Assessment Methodology

30. The assessment considers the potential impacts of the project on Valued Ornithological Receptors (VORs) with the aim of identifying whether impacts are significant. The process consisted of the following steps:

- Identify VORs (bird species and nature conservation sites designated for birds) which are potentially sensitive to the impacts of the project;
- Assess the sensitivity of VORs based on ornithological importance of the Development Area and the Offshore Export Cable Corridor for these receptors, their conservation status or status as a qualifying interest for a designated site (see Figure 7-1);
- Based on the worst case scenario as identified in the Design Envelope (see Table 2-3 above), establish the magnitude of potential impacts on VORs quantitatively, or qualitatively where sufficient numeric data are not available;
- In determining impact significance for each VOR, consideration was given to the impact magnitude, VOR sensitivity and also to the ecological characteristics of each VOR, embedded mitigation, the spatial extent and likely duration of each impact as well as its timing, frequency and reversibility (as recommended by IEEM guidelines). Where possible, reference was made to available scientific information - from peer reviewed scientific papers, commissioned research reports relevant to seabird ecology and interactions with offshore wind farms, and other sources as appropriate. Where empirical evidence as to a magnitude of effect has not been available, the ecology of the species has been considered and appropriate conservative assumptions made.
- Evaluate the significance of impacts based on the approach above taking account of embedded mitigation measures;
- Identify any additional mitigation measures which would avoid or reduce significant impacts; and,
- Assess residual impacts (post-mitigation).

31. The approach to the impact assessment is described in detail below.

7.3.1. Identifying VORs

32. Valued Ornithological Receptors are considered to be any of the following:

- All species identified in the aerial surveys as using the development site (see Table 7-8 below).
- Migratory species passing through the area (see Table 7-8 below).
- All SPAs within foraging range of species present in the development Site (Table 7-4 above).

7.3.2. Defining the Sensitivity of VORs

33. The sensitivity of each potential VOR was defined according to a range of criteria. These included measures of the importance of the bird populations within the aerial survey area, the conservation status of the species, whether a species is protected under environmental legislation, or is cited as an interest feature of a designated site of national or international importance. The sensitivities range from high to low, as presented in Table 7-5.

Table 7-5 Defining the Sensitivity of Valued Ornithological Receptors

Sensitivity of Valued Ornithological Receptors	Definition
High	Bird species present in internationally important numbers, more than 1% of the relevant international/biogeographic population. Species which are cited as qualifying interests of SPAs (i.e. referred to in the SPA citations) with direct connectivity to the Development Area during the breeding or non-breeding season[1], either as qualifying interests under Article 4.1, or as cited components of an assemblage under Article 4.2. Direct connectivity indicates that there is a degree of certainty that birds from the SPA in question use or pass through the Development Area. Bird species present in nationally important populations (more than 1% of the British population) of a species listed on Annex 1 of the EU *Birds Directive*. A site designated as an SPA or Ramsar site on the basis of supporting internationally important numbers of birds.
Moderate	Bird species not listed on Annex 1 of the EU *Birds Directive* that are present in nationally important numbers (more than 1% of the British population). Species populations of regional importance based on numbers estimated to be utilising the Development Area (more than 1% of the regional population) or distributional context (e.g. occurring at the edge of a species' international or British range). Species which are cited as qualifying interests of UK SPAs (i.e. referred to in the SPA citations) with potential connectivity to the Development Area during the non-breeding season[1], either as qualifying interests under Article 4.1, or as cited components of an assemblage under Article 4.2. This category has been used for situations where a species which is a qualifying interest at a number of UK SPAs may pass through the Development Area and Offshore Export Cable Corridor on migration only, but there is only hypothetical connectivity between particular SPA(s) and birds recorded at the Development Area and Offshore Export Cable Corridor. Species cited as interest features of SSSIs with connectivity to the Development Area and Offshore Export Cable Corridor. Species listed on Annex 1 of the EU *Birds Directive* and/or Schedule 1 of the *Wildlife and Countryside Act 1981* (if not covered above). Red and Amber-listed Birds of Conservation Concern in the UK (Eaton *et al*., 2009), if not covered above. Priority Species of the UK or Local Biodiversity Action Plan (if not covered above).

Sensitivity of Valued Ornithological Receptors	Definition
Low	All other bird species.
[1]. SPA qualifying features have been identified as of high or moderate sensitivity respectively depending on whether there is evidence for direct connectivity to the Development Area or the Offshore Export Cable Corridor during the breeding or non-breeding season. It is recognised that the level of legal protection afforded to SPA species does not differ between the breeding or non-breeding season and it is understood that species which use an SPA for part of a year are subject to protection throughout the year, even when they are not using an SPA.	

34. Regional population estimates for seabird species during the breeding season were defined according to species-specific information on foraging ranges, such that species with larger potential foraging ranges have bigger regions and vice versa. Similarly, connectivity between SPAs for breeding seabirds and the development area was identified based on foraging ranges - i.e. potential impacts on an SPA qualifying seabird species were considered if birds breeding at that SPA might forage within the project survey area, based on available information on their foraging ranges (Thaxter *et al*., 2012). Information on likely connectivity of VORs with SPAs is provided in Table 7-6 below.

7.3.3. Assessing the Magnitude of Impacts

35. The magnitude of each potential impact on a VOR was assessed by adopting a population-based approach according to the criteria in Table 7-6 below.

Table 7-6 Defining the Magnitude of Valued Ornithological Receptors

Assessing the Magnitude of a Potential Impact on Valued Ornithological Receptors	Definition
High	Total loss or major alteration to key elements/features of the baseline conditions. Where a quantitative assessment can be made, a prediction that >1% of the population is affected; or >1% change in demographic rate.
Moderate	Partial loss or alteration to one or more key elements/features of the baseline conditions. Where a quantitative assessment can be made, a prediction that 0.5% – 1% of the population affected; or 0.5% – 1% change in demographic rate.
Low	Minor shift away from the baseline conditions. Prediction that 0.1% – 0.49% of the population affected; or 0.1% – 0.49% change in demographic rate.
Negligible	Very slight change from baseline conditions. Prediction that <0.1% of the population affected; or <0.1% change in demographic rate.

36. Where quantitative assessments were possible (in terms of the number of individuals of a species affected, or predicted changes to mortality rate or breeding success), the relevant population comparison level was assessed on a species by species and species by impact basis. In some cases this was achieved by considering the number of individuals likely to be affected as a percentage of the national or regional population or the population of a designated site (taking a hierarchical approach whereby the highest level of sensitivity appropriate to the Development Area was used – see Table 7-7 below). Where an impact was considered likely to affect the survival of individuals (e.g. collision risk), or the productivity of breeding attempts (e.g. displacement), the predicted change in mortality or productivity was assessed against available information on the background mortality or productivity rate of a species.

37. A precautionary approach has been taken to setting thresholds, reflecting the fact that many of the seabird and estuarine species present at the Development Area are qualifying species of SPAs and therefore are considered as internationally important receptors. Thus a one per cent threshold has been used to identify potential impacts of high magnitude. Although there is no fundamental biological reason for this, one per cent is used as a 'rule of thumb' in relation to the identification of important concentrations of birds, for example in identifying areas for site protection (e.g. JNCC, 2012[4]; BTO, 2012).

38. In relation to demographic parameters such as mortality, it is recognised that changes of one per cent or less may actually not be detectable as one percent will fall within the likely errors of estimates for the values concerned or within fluctuations caused by natural variation. Nevertheless, it is possible that the actual consequence of varying a demographic parameter such as mortality by one per cent might affect the population growth rate of a species, so on a precautionary basis this level has been set to flag up potentially significant impacts where further detailed assessment is required.

7.3.4. Determining the Significance of Impacts

39. In determining the significance of the impacts, the following was taken into account: VOR sensitivity (Table 7-7) impact magnitude (Table 7-6) and IEEM (2010) recommendations that each impact is evaluated according to the parameters below:

- Whether it is negative or positive;
- The spatial extent or area over which it is likely to occur;
- The likely duration;
- Whether it is reversible or not;
- The timing and frequency; and
- The degree of confidence in predictions.

40. Based on a detailed review using the criteria above, four categories (or combinations of categories such as moderate/major where insufficient information was available to confidently define a single impact significance category) were applied to evaluate impacts, based on the definitions shown in Table 7-7 below.

[4] JNCC Seabird Monitoring Programme Database. Available at: http://jncc.defra.gov.uk/smp/

Table 7-7 Defining the Significance of Valued Ornithological Receptors

Criteria for Defining Impacts Based on Further Evaluation Impact	Rationale
Major	An impact that will be measureable in the medium to long term and where changes may be outside acceptable limits – for example leading to a permanent population decline at a regional or larger scale.
Moderate	An impact that will be measureable in the medium term and over a broad scale but will be reversible. It is likely to have a measurable effect on wider ecosystem functioning but still remain within 'acceptable' limits.
Minor	An impact that may result in changes, but these will be small in scale, temporary and within 'acceptable' limits, for example where an adverse change in population growth rate is small, temporary or not considered likely.
Negligible	An impact that is considered likely to produce no effects, or effects well within the limits of natural variation for a VOR.

41. Where possible consideration was given to the likely ability of individual species populations to absorb impacts, which depends on factors such as demographics (whether a species has high or low adult survival and productivity levels) and population trend. Seabirds, for example, are typically long-lived species with low annual productivity, and population trends are more sensitive to changes in adult survival than breeding success or juvenile survival. Thus, a predicted increase of more than one per cent in the mortality rate of breeding adults may be more likely to have an adverse impact on a population than a one per cent increase in breeding failure rate. For the purposes of this assessment, those residual positive and negative effects indicated as Major and Moderate/Major are considered significant.

7.3.5. Extent of Aerial Bird Surveys

42. Sixteen months of aerial bird surveys have been carried out on a monthly basis by Hi-Def (see *Appendix B*), A specialist Aerial Survey Company. The area surveyed includes the proposed project site (named NE3) and an 8km buffer around it (Kincardine site).

43. High resolution and high sensitivity digital video cameras were mounted into an aircraft to sample a 500m-wide strip of the sea, as the aircraft flew seven transects within the study area. A standard process for reviewing video footage was used to detect objects with a high level of quality control to ensure virtually all objects present were detected. The detected objects were assessed by expert ornithologists and marine mammal scientists to identify them, where possible to species level, following the same quality control process. Robust statistical analysis of the data was then used to estimate the abundance and distribution of birds and mammals during the surveys.

44. The survey is typically flown at an aircraft altitude of either approximately 1250ft (~380m) or approximately 1800ft (550m) above sea level. More sensitive species, such as Common Scoter (*Melanitta nigra*) and Manx Shearwaters (*Puffinus puffinus*), which are known to be disturbed when sitting on the sea by aircraft flown at altitudes of less than 1500ft (450m) (Hi-Def, personal observations and A. Webb, personal observations) are rarely present in the identified survey sites (Stone *et al*, 1995).

45. Sixteen surveys were completed from the first survey on 1st May 2013 to the last survey on 26th September 2014. Additional surveys were added covering May, July, August and September. Overall a total of 20,460 birds of 19 species and 93 non-avian animals of six species were recorded during the project. An overall identification rate to species level of 93.1% was achieved.

46. Aerial surveys have the following key advantages over traditional vessel based surveys:

- Large area of survey;
- Increased weather operability;
- Species identification;
- Accurate flight height calculations;
- Abundance estimates;
- Density mapping over a large area;
- Direction of flight (without disturbance);
- Digital record of surveys for review/QA;

47. Flight height selection ensures no flushing of species from survey area.

48. After basic presentation, data were processed for estimating abundance and distribution of the key species and species groups. All confidence levels of species identifications were used in the analysis. Generally, high levels of species identification were achieved during these surveys. However, for species groups where species identification was most difficult (e.g. terns and auks), and lower species identification rates were achieved.

7.3.5.1. Abundance Estimates

49. The abundance of each species observed within the overall survey area and the project area were estimated separately using a design-based strip transect analysis with variance and confidence intervals derived through 10,000 bootstraps. The bootstrapping technique uses total length of transect to limit selection rather than total number of transects. This method has an advantage when transects are of unequal length and provides better precision estimates.

50. In a strip transect analysis each transect is treated as an independent analysis unit, and the assumption is made that transects can be treated as statistically independent random samples from the site. The length of each transect and its breadth (i.e. the width of the field of view of the camera) multiplied together give the transect area; dividing the number of observations on that transect by the transect area gives a point estimate of the density of that species for the site. The density of animals at the site (and hence the population size), the standard deviation, 95% confidence intervals and coefficient of variance are then estimated using a non- parametric bootstrap method with replacement.

51. The exact limits and location of the development area were not know at the start of the survey work, so an area was selected that would sufficiently cover the development area. The survey area covers approximately 991km^2, which includes the development area and an 8km buffer. The NE3 project area itself is approximately 110km^2. The footprint of the development area, based on information on the number of turbines (8) and possible turbine spacing (500m), is expected to be approximately 8km^2 or around 0.8% of the survey area.

52. The density estimate is expressed as the average number of animals per square kilometre surveyed over the whole site, and the population estimate is simply the average density multiplied up to the area of the whole site. The standard deviation is a measure of the variance of the population estimate, standardised by the number of samples (transects). The upper and lower confidence intervals define the range that the population estimate falls within with 95% certainty. For example, the population estimate for the zone or site may be 1000 individuals with a 95% certainty that this estimate lies between 500 and 2000 individuals. The coefficient of variance (CV), also referred to as the relative standard error, is a measure of the precision of the population and density estimates. A CV value of less than 16% allows a 50% decline or 100% increase in abundance between two samples to be detected with greater power than 0.8. This is usually regarded as the minimum precision required for monitoring effects of developments on key species.

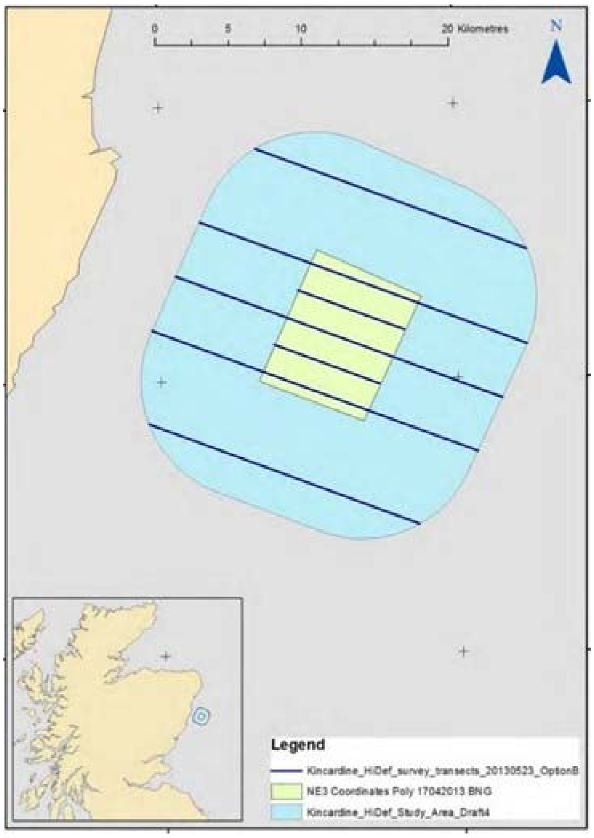

Figure 7-2 Hi-Def flight plan for KOWL showing the survey area (turquoise) and the NE3 Project area (light green)

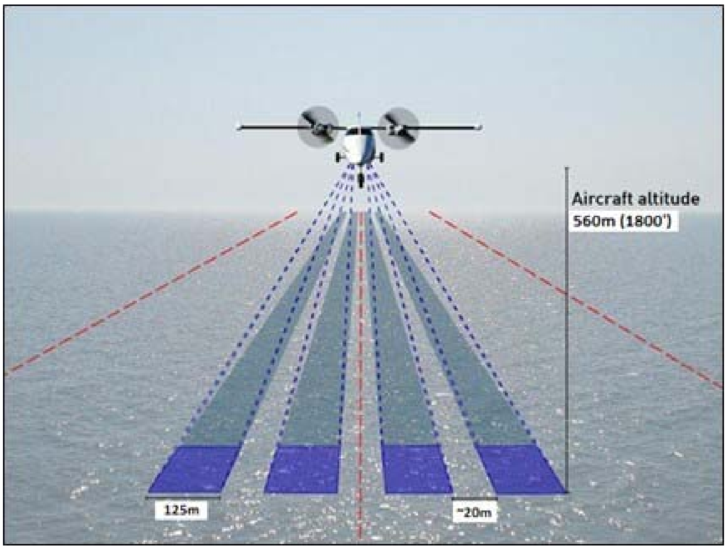

Figure 7-3 Representative view of camera arrangement and orientation and for Hi-Def digital video surveys

7.3.6. Species Accounts – Birds recorded on the Development Site from Aerial Surveys.

7.3.6.1. Kittiwake (*Rissa tridactyla*)

53. Kittiwake is a designated feature of three Special Protection Areas within foraging range from the proposed KOWL site, including one only 16km away (Buchan Ness to Collieston Coast, Fowlsheugh and Troup, Pennan and Lions Heads). They are found on the Kincardine site in large numbers (a maximum estimate of 1,826 individuals) and their maximum flight height is well within the height of the turbine blades.

7.3.6.2. Guillemot (*Uria aalge*)

54. Guillemot is a designated feature of three3 Special Protection Areas within foraging range from the proposed KOWL site, including one only 16km away (Buchan Ness to Collieston Coast, Fowlsheugh and Troup, Pennan and Lions Heads). They are found on the Kincardine site in significant numbers (a maximum estimate of 13,476 individuals) and their maximum flight height is just within the height of the turbine blades.

7.3.6.3. Fulmar (*Fulmarus glacialis*)

55. Fulmar is a designated feature of 14 Special Protection Areas within foraging range from the proposed KOWL site, including one only 16km away (Buchan Ness to Collieston Coast, Fowlsheugh, Troup, Pennan and Lions Heads and Forth Islands) and 10 outside of 100km (see Table 7-8 below). They are found on the Kincardine site in low numbers (a maximum estimate of 189 individuals) and their maximum flight height is just within the height of the turbine blades.

7.3.6.4. Herring gull (*Larus argentatus*)

56. Herring Gull is a designated feature of three Special Protection Areas within foraging range from the proposed KOWL site, including one only 16km away (Buchan Ness to Collieston Coast, Fowlsheugh, Troup, Pennan and Lions Heads). They are found on the Kincardine site in very low numbers (a maximum estimate of 23 individuals) and their maximum flight height is well within the height of the turbine blades.

7.3.6.5. Razorbill (*Alca torda*)

57. Razorbill is a designated feature of one Special Protection Area within foraging range, Fowlsheugh, located 27km away from the site. They are found on the Kincardine site in quite large numbers (a maximum estimate of 503 individuals) but their maximum flight height is below the height of the turbine blades.

7.3.6.6. Puffin (*Fratercula arctica*)

58. Puffin is a designated feature of one Special Protection Area within foraging range, Forth Islands, located 94km away from the site. They are found on the Kincardine site in quite large numbers (a maximum estimate of 232 individuals) but their maximum flight height is below the height of the turbine blades (a max flight height of 20m).

7.3.6.7. Gannet (*Morus bassanus*)

59. Gannet is a designated feature of three Special Protection Areas within foraging range at a distance of 94km, 270km and 332km from the proposed Kincardine site respectively (Forth Islands, Fair Isle and Flamborough Head and Bempton Cliffs).

7.3.6.8. Sandwich tern (*Sterna sandvicensis*)

60. Sandwich tern is a designated feature of one Special Protection Area within foraging range, Ythan Estuary, Sands of Forvie and Meikle Loch, located 32km from the Kincardine site. They were not identified on site or flying through the site in any of the bird surveys and therefore their flight heights were not recorded.

7.3.6.9. Non-breeding eider (*Somateria mollissima*)

61. Non-breeding eider is a designated feature of two Special Protection Areas, Ythan Estuary, Sands of Forvie and Meikle Loch, located 32km from the KOWL site and Montrose Basin, located 50km from the development site. They were not identified on site or flying through the site in any of the bird surveys and therefore their flight heights were not recorded.

7.3.6.10. Lesser black backed gull (*Larus fuscus*)

62. Lesser black backed gull is a designated feature of one Special Protection Area, Forth Islands, located 94km from the development site. They were not identified on site or flying through the site in any of the bird surveys and therefore their flight heights were not recorded.

Non-breeding goose and swan features given consideration during the migratory period

7.3.6.11. Pink-footed goose (*Anser brachyrhynchus*)

63. Pink-footed goose migrate to the UK from Greenland and Iceland, arriving early September and returning mid-April. They are a designated feature of three Special Protection Areas, Ythan Estuary, Sands of Forvie and Meikle Loch, Montrose Basin, and Loch of Skene, located 32km, 50km and 60km respectively from the development site. It has been estimated that approximately 30% of pink-footed goose will fly at collision risk height (Wright et al 2012). They were not identified on site or flying through the site in any of the bird surveys covering the autumn and Spring Migratory periods.

7.3.6.12. Greylag goose (*Anser anser*)

64. Greylag goose is a designated feature of three Special Protection Areas, Loch Skene, Montrose Basin and Loch of Strathbeg, located 32km, 50km, and 60km away from the development site respectively. It has been estimated that approximately 30% of greylag goose will fly at collision risk height (Wright et al 2012). They were not identified on site or flying through the site in any of the bird surveys covering the autumn and Spring Migratory periods.

7.3.6.13. Svalbard barnacle goose (*Branta leucopsis*)

65. Svalbard barnacle goose is a designated feature of one Special Protection Area, Loch of Skene, located 60km from the development site. It has been estimated that approximately 30% of Svalbard

barnacle goose will fly at collision risk height (Wright et al 2012). They were not identified on site or flying through the site in any of the bird surveys covering the autumn and spring migratory periods.

7.3.6.14. Whooper swan (*Cygnus cygnus*)

66. Whooper swan autumn migration takes place from mid-September to November. They are a designated feature of one Special Protection Area, Loch of Skene, located 60km from the development site. It has been estimated that approximately 50% of Whooper Swan will fly at collision risk height (Wright et al 2012).

67. They were not identified on site or flying through the development site in any of the bird surveys covering the autumn and spring migratory periods.

Table 7-8 SPA Seabird Species Identified, the estimated population using the Development Site, their foraging range and associated SPAs and designated populations.

Species	NE3 Pop Estimate (individuals)	Mean Max Foraging Range[1] in Km (Max)	Foraging Range (km) + 10% (rounded to the nearest km)	SPA	Distance from KOWL Site	SPA pop at designation[2]	Most recent pop estimate[3] – Individuals* (date)	
Kittiwake	327	60 (120)	66	Fowlsheugh	16	36,650	9,337 (2012)	⇩ (75%)
				Buchan Ness to Collieston Coast	27	30,452	12,542 (2007)	⇩(59%)
				Troup, Pennan and Lions Heads	69	31,600	14,896 (2007)	⇩(52%)
				Forth Islands	94	8,400	3,339 (2014)	⇩(60%)
Guillemot	2,609	84.2 (135)	93	Fowlsheugh	16	56,450*	44,920 (2012)*	⇩(20%)
				Buchan Ness to Collieston Coast	27	8,640*	19,296 (2007)*	⇧(44%)
				Troup, Pennan and Lions Heads	69	44,600*	16,325 (2007)*	⇩(63%)
				Forth Islands	94	16,000*	24,164 (2014)*	⇧(34%)
				St Abbs to Fast Castle	117	31,750*	34,803 (2013)*	⇧(9%)
				East Caithness Cliffs	158	106,700*	120,798 (1999)*	⇧(12%)
Fulmar	18	400 (580)	440	Fowlsheugh	16	1,170	158 (2013)	⇩(86%)
				Buchan Ness to Collieston Coast	27	1,765	1,370 (2007)	⇩(22%)
				Troup, Pennan and Lions Heads	69	4,400	1,600 (2007)	⇩(64%)
				Forth Islands	94	798	616 (2014)	⇩ (23%)
				East Caithness Cliffs	158	15,000	14,202 (1999)	⇩(5%)
				North Caithness Cliffs	180	14,700	13,237 (1999-00)	⇩(10%)
				Copinsay	215	1,615	1,094 (2012)	⇩(32%)
				Hoy	227	35,000	19,586 (2007)	⇩(44%)
				Calf of Eday	253	1,955	1,842 (2002)	⇩(6%)
				West Westray	265	1,400	677 (2007)	⇩(52%)
				Fair Isle	270	35,210	29,649 (2011)	⇩(16%)
				Sumburgh Head	319	2,542	233 (2009)	⇩(91%)
				Foula	346	46,800	21,106 (2000)	⇩(55%)
				Noss	354	6,350	5248 (2011)	⇩(17%)
Herring Gull	3	61.1 (92)	67	Fowlsheugh	16	3,190	259 (2012)	⇩(92%)
				Buchan Ness to Collieston Coast	27	4,292	3,079 (2007)	⇩(28%)
				Troup, Pennan and Lions Heads	69	4,200	1,597 (2007)	⇩(62%)
Razorbill	79	48.5 (95)	53	Fowlsheugh	16	5,800*	5,260 (2012)*	⇩(9%)
				Forth Islands	94	1,400*	4,347 (2014)*	⇧(68%)
Gannet	59	229.4 (590)	252	Forth Islands	94	21,600	75,259 (2014)	⇧(71%)
				Fair Isle	270	1,166	3,591 (2014)	⇧(68%)
				Flamborough Head and Bempton Cliffs	332	2,501	7,859 (2009)	⇧(68%)

Species	NE3 Pop Estimate (individuals)	Mean Max Foraging Range[1] in Km (Max)	Foraging Range (km) + 10% (rounded to the nearest km)	SPA	Distance from KOWL Site	SPA pop at designation[2]	Most recent pop estimate[3] – Individuals* (date)	
Sandwich tern	No records	49 (54)	54	Ythan Estuary, Sands of Forvie and Meikle Loch	32	600	757 (2014)	⇧(20%)
				Loch of Strathbeg	60	530	0 (2013)	⇩(100%)
Common tern	No records	15.2 (30)	17	Ythan Estuary, Sands of Forvie and Meikle Loch	32	265	1433 'Comic' (2014)	⇧(82%)
Lesser black backed gull	No records	141 (181)	155	Forth Islands	94	1,500	2,525 (2014)	⇧(41%)
Puffin	28	105.4 (200)	116	Forth Islands	94	14,000	52,817 (2013-14)	⇧(73%)

Notes: *Individuals

1. Mean Maximum foraging range from Thaxter *et al*. 2012. In some cases SPAs just outside this range are included on a precautionary basis (e.g. if they fall within or just outside the mean maximum range in Thaxter et al. 2012 + 10%).

2. From SPA citations on SNH sitelink (http://gateway.snh.gov.uk/sitelink/) or JNCC SPA review species accounts (http://jncc.defra.gov.uk/page-1417)

3. Seabird Monitoring Programme http://jncc.defra.gov.uk/smp/sitesBrowser.aspx

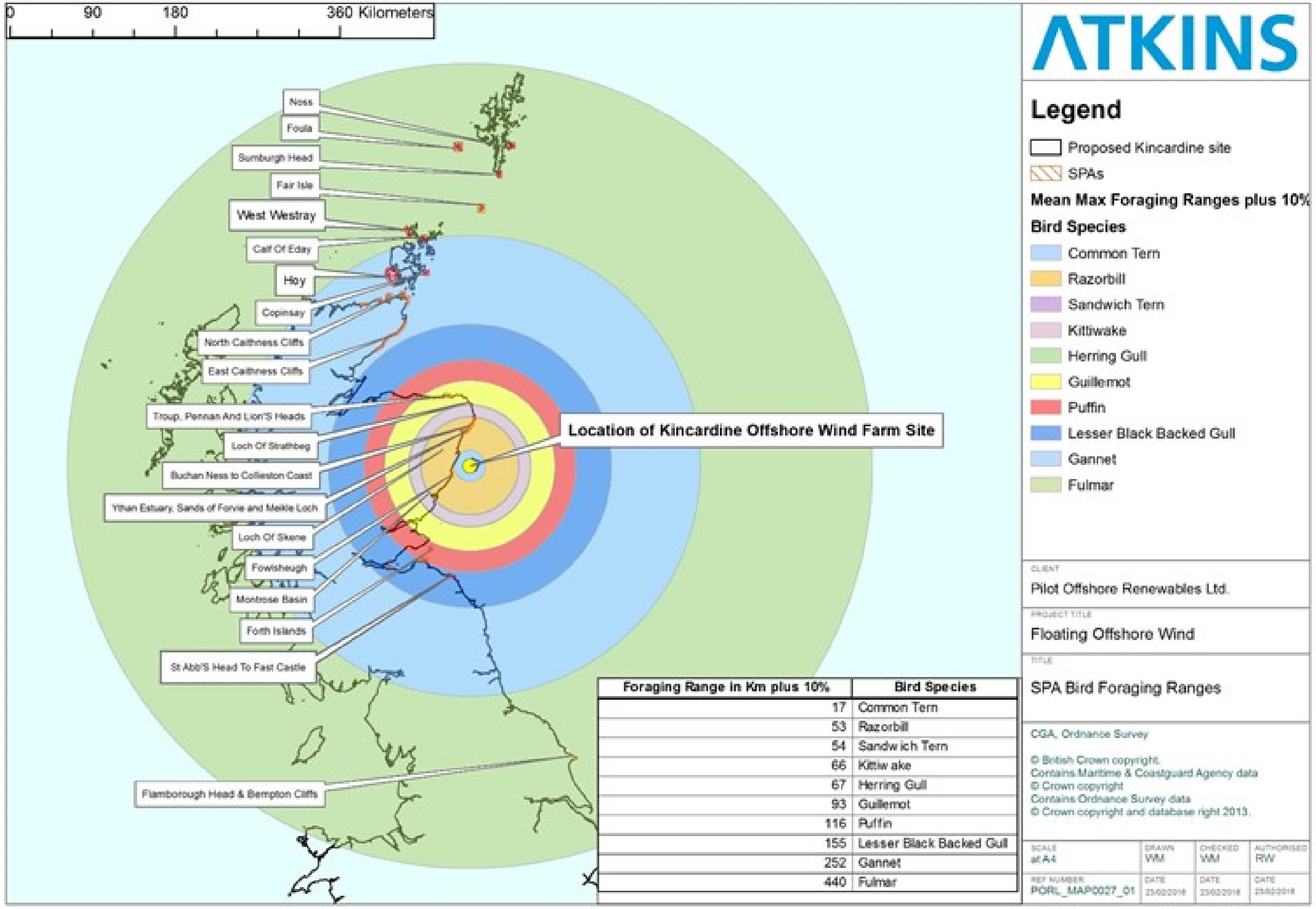

Figure 7-4 Mean Maximum Seabird Foraging Ranges[5] plus 10% in relation to SPAs

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[5] Maximum foraging ranges from Thaxter *et al.* 2012.

7.4. Impact Assessment

68. The Impact will identify the key risks and potential impacts of the scheme, based on the outputs of the Scoping Report (Atkins 2014). These potential impacts will be scoped in or out of the three main stages of the project lifetime. These include Construction, Operation and Decommissioning. The results are outlined in Table 7-9 below and will inform what impacts will be in scope to be assessed against the most sensitive VORs.

69. The sensitivity of VORs has been assessed in Table 7-10 below following the methodology outlined in *Section 7.3.2* above. The sensitivity of VORs are based on numbers of birds present on the site (see Table 7-5 above), whether they are a designated feature of SPAs (Figure 7-1 above), and whether those SPAs are within foraging range of the development site (see Figure 7-4 above).

Table 7-9 Key risks to birds within the development area.

Activity	Risk	Potential Impact	Construction	Operation	Decommissioning
Vessel Disturbance.	Temporary disturbance and / or displacement	• Restricted access to prey sources, breeding grounds or migration routes • Potential for increased competition for resources (where displacement results in a localised increase in marine mammal activity elsewhere) and reduced fitness	X		X
	Accidental Release of Contaminants	• Death or physiological injury through toxic and non-toxic contamination	X	X	X
	Disturbance to prey species (indirect impact)	• Reduction in resources therefore reduction in fitness and breeding success	X		X
WTG operation	Collision Risk	• Direct Impacts to birds leading to increased mortality • Potential for long-term reduction in survival and the ability to find prey, avoid predators and to socially interact		X	
Presence of WTGs, substructures and mooring lines and inter-array cables.	Disturbance and / or displacement	• Restricted access to prey sources, breeding grounds or migration routes (habitat loss) • Potential for increased competition for resources (where displacement results in a localised increase in marine mammal activity elsewhere) and reduced fitness		X	
	Entanglement	• Physical injury / long term incapacity / death		X	
	Contamination, e.g. from antifouling paints, corrosion inhibitors, oil leakage from equipment and accidental pollution events	• Death or physiological injury through toxic and non-toxic contamination		X	
	Habitat loss / disturbance to prey species (indirect impact)	• Reduction in resources therefore reduction in fitness and breeding success		X	

Table 7-10 Sensitivity Assessment Matrix

SPA/Feature	Distance from development Site	Kittiwake	Guillemot	Fulmar	Herring gull	Razorbill	Puffin	Gannet	Sandwich tern	Non-breeding Eider	Lesser black backed gull	Non-breeding Migratory Species			
												Pink-footed goose	Greylag goose	Svalbard barnacle goose	Whooper swan
Fowlsheugh	16km	High	High	High	High	Moderate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Buchan Ness to Collieston Coast	27km	High	High	High	High	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Loch of Skene	32km	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Low	N/A	N/A
Ythan Estuary, Sands of Forvie and Meikle Loch	32km	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Low	Low	N/A	Low	N/A	N/A	N/A
Montrose Basin	50km	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Low	N/A	Low	Low	N/A	N/A
Loch of Strathbeg	60km	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Low	N/A	N/A	Low	Low	Low	Low
Troup, Pennan and Lions Heads	69km	Moderate	High	High	Moderate	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Forth Islands	94km	Low	Low	High	Low	Low	Moderate	High	Low	N/A	N/A	N/A	N/A	N/A	N/A
St Abbs to Fast Castle	117km	Low	Low	N/A	Low	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
East Caithness Cliffs	158km	Low	Low	High	Low	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
North Caithness Cliffs	180km	Low	Low	High	N/A	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copinsay	215km	Low	Low	Moderate	N/A	N/A	N/A	N/A	N/A	N/A	Low	N/A	N/A	N/A	N/A
Hoy	227km	Low	Low	Moderate	N/A	N/A	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Calf of Eday	253km	Low	Low	Moderate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
West Westray	265km	Low	Low	Moderate	N/A	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fair Isle	270km	Low	Low	Moderate	N/A	Low	N/A	Moderate	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sumburgh Head	319km	Low	Low	Moderate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Flamborough head and Bempton Cliffs	332km	Low	Low	N/A	Low	Low	N/A	Moderate	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Foula	346km	Low	Low	Moderate	N/A	N/A	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Noss	354km	Low	Low	Moderate	N/A	N/A	Low	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Bird Numbers on Site (Pop estimate – upper confidence limit)	N/A	1803	12,994	200	33	583	357	238	0 (common tern – 2, Arctic tern – 7)	0	0 (greater black backed gull – 21)	0	0	0	0

Source: Maximum counts and heights of species in the Kincardine Survey Area during combined monthly surveys between May 2013 and September 2014.

N/A – The species is not a designated interest feature of that site, and/or is not present within the Kincardine site.

- High Sensitivity - The species is a designated feature of the site, within foraging range of the Kincardine site and/or is present in nationally important populations
- Moderate Sensitivity – The Species is a designated feature of the site, at the edge of its foraging range and/or is present in low numbers.
- Low Sensitivity - The species is a designated feature of a site, but is **scoped out** based on the limits of its mean max foraging range (including a 10% buffer) and/or the species is not present within or migrating through the site footprint, based on the results of the aerial surveys.

7.4.1. Vessel Disturbance.

7.4.1.1. Temporary Disturbance and / or displacement

70. The existing level of vessel traffic within the area is deemed as intermediate to moderately busy compared to other regions of UK waters (Chapter 9 Marine Navigations) and varies throughout the year. An average of 55 vessels per day passed within 10nm of the Development Area. Of these, an average of five vessels per day passed through the entire site (Chapter 9 Marine Navigation). The vessel types recorded passing within 10nm of the Development Area include cargo vessels, tugs, tankers, Emergency Response and Rescue Vessels (ERRVs), guard boats, survey vessels and workboats (*Chapter 9 - Marine Navigation*).

71. The precise nature of the vessels to be used on the site is unknown, but not include large offshore construction vessels. It is likely that a number of different vessels types will be used including anchor handling vessels, cable laying vessels and tugs.

72. The additional wind farm related traffic (guard and day boats) will be confined to pre-defined traffic corridors from the operations port to the development site. These boats are readily available from Aberdeen Harbour.

73. The Wind Turbines and floating substructures will be completely constructed in a dry dock. Then tug vessels, no bigger than those which operate out of Aberdeen harbour, will tow the completed turbine structures from the construction port to the development area where they will be hooked up to the pre-installed moorings.

74. The moorings will take approximately six hours to install each anchor system and approximately one week to install each WTG (a significant benefit of undertaking all construction and testing work within the construction port for floating semi-submersible WTGs).

75. This level of additional vessel activity is likely to be negligible in relation to the existing vessel traffic in and around the development site. Any disturbance from the additional traffic is also likely to be negligible in Magnitude.

Table 7-11 Assessment of Disturbance Magnitude

Bird Species	Assessment of Impact	Impact Magnitude
Kittiwake	Construction	Negligible
	Decommissioning	Negligible
Guillemot	Construction	Negligible
	Decommissioning	Negligible
Fulmar	Construction	Negligible
	Decommissioning	Negligible
Herring gull	Construction	Negligible
	Decommissioning	Negligible
Razorbill	Construction	Negligible
	Decommissioning	Negligible
Puffin	Construction	Negligible
	Decommissioning	Negligible
Gannet	Construction	Negligible
	Decommissioning	Negligible

7.4.1.2. Accidental Release of Contaminants

76. Chemicals may be released into the marine environment as a result of accidental incidents, for example, vessel collisions and accidental spillages.

77. Environmental contamination by bio-accumulative pollutants such as polychlorinated biphenyls (PCBs) and persistent organochlorine pesticides (POPs) has spread worldwide and poses a potential risk to seabirds.

78. The potential for toxic contamination is deemed to be similar throughout all phases of the project (construction, operation and decommissioning) as it is mainly related to vessel movements and general offshore activities.

79. Increased vessel activity and the installation of the floating WTGs will lead to a small increased risk of vessel collision, which may result in an accidental release of fuel and other chemicals. In addition, accidental spillage of chemicals such as lubricants and antifouling agents may occur due to human error or technical failure, without the need for vessel collision.

80. In the event of an accident where toxic chemicals are released into the marine environment, emergency procedures (Emergency action plan) will be in place to minimise the environmental effects as much as possible. For example, vessels will be equipped with oil spill kits to enable containment and treatment of spills as per current industrial best practice (Chapter 9). In addition, emergency spill procedures specific to the protection of the environment will be outlined in the final Project Environmental Management Plan (PEMP) and fully implemented during construction, operation and decommissioning.

Significance of Impact

81. Serious pollution does not seem likely as a result of the development. If pollution was to occur, the effects would be local and the overall impacts small, provided there were no large accidental oil spills when servicing the WTGs. However, it should be noted that the likelihood of an accidental oil spill is low, due to best practices and appropriate navigational aids being in place.

82. All materials used in the construction, operation and maintenance and decommissioning phases will be certified for safe use within the marine environment.

83. Vessels will use predefined routes to reduce risk of accidental collision. As the greatest increase in vessel movements will be during the construction phase, the increased contamination will predominantly be during the construction phase and is therefore of a temporary nature and guard boats will be used throughout this phase to ensure the temporary construction exclusion zone.

84. The magnitude of effect of accidental release of contaminants to birds from vessels is considered to be Negligible/Low.

Table 7-12 Assessment Magnitude of Accidental Release of Contaminants

Bird Species	Assessment of Impact	Impact Magnitude
Kittiwake	Construction	Negligible/Low
	Operation	Negligible/Low
	Decommissioning	Negligible/Low
Guillemot	Construction	Negligible/Low
	Operation	Negligible/Low
	Decommissioning	Negligible/Low
Fulmar	Construction	Negligible/Low
	Operation	Negligible/Low
	Decommissioning	Negligible/Low
Herring gull	Construction	Negligible/Low
	Operation	Negligible/Low
	Decommissioning	Negligible/Low
Razorbill	Construction	Negligible/Low
	Operation	Negligible/Low
	Decommissioning	Negligible/Low
Puffin	Construction	Negligible/Low
	Operation	Negligible/Low
	Decommissioning	Negligible/Low
Gannet	Construction	Negligible/Low
	Operation	Negligible/Low
	Decommissioning	Negligible/Low

7.4.1.3. Disturbance to Prey Species (indirect Impact)

85. Many of the seabirds present at the Development Area are considered as sandeel specialists, feeding their chicks predominantly on this fish species during the breeding season (Daunt *et al*, 2008). Sandeel abundance in the North Sea is variable and in some years other fish species are of increased importance to seabirds in the breeding season (CEH, 2012; Wanless et al, 2005).

86. If sandeel abundance (see *Chapter 5 – Fish and Shellfish, Section 5.6.4.1.1*) is low, the temporary displacement of some of these fish species from the Development Area may still be of little consequence to breeding birds if they are able to exploit alternative prey that are not displaced and/or locate suitable foraging habitat nearby.

87. The installation of the moorings will not involve any piling and will simply involve attaching mooring lines to the anchors and placing the mooring anchors onto the seabed. Likewise the decommissioning stage will simply involve hauling up the mooring anchors.

88. The WTGs and floating substructures will be constructed in a dry dock and will be towed out directly to the development and these vessels will be no bigger than those which operate out of Aberdeen harbour (possible source of vessel hire).

89. The moorings will take approximately one day each to install and approximately three and half days to install each WTG.

90. Given the short duration and small scale of construction and decommissioning activities, the magnitude of any in-direct impacts from the construction and decommissioning stages of this

project on prey species including sandeel will be negligible (See *Chapter 5 – Fish and Shellfish, Section 5.6.4.1.1*).

Table 7-13 Assessment Magnitude of Disturbance to Prey Species

Bird Species	Assessment of Impact	Impact Magnitude
Kittiwake	Construction	Negligible
	Decommissioning	Negligible
Guillemot	Construction	Negligible
	Decommissioning	Negligible
Fulmar	Construction	Negligible
	Decommissioning	Negligible
Herring gull	Construction	Negligible
	Decommissioning	Negligible
Razorbill	Construction	Negligible
	Decommissioning	Negligible
Puffin	Construction	Negligible
	Decommissioning	Negligible
Gannet	Construction	Negligible
	Decommissioning	Negligible

7.4.2. WTG Operational Impact Assessment

7.4.2.1. Collision Risk

91. The risk of bird collisions with the blades of the turbines of the project were assessed using the Band Model (2012) as recommended by MS LOT and SNH. The Collision Risk Model (CRM) results were presented for both the 'Basic' and 'Extended' Model across a range of recommended avoidance rates for each species (see Table 7-18 below). All collision risk assessment approaches have been undertaken following detailed and continuous input from MS LOT and also SNH and the production of the associated HRA documentation by the Project.

92. A description of the difference between the Band 2012 CRM 'Basic' and 'Extended' Models are outlined below:

<u>Basic Model</u>

93. Option 1 – This assumes a uniform distribution of flight heights and collision risk between lowest and highest levels of the rotors. It uses figures for the proportion of birds at risk height derived from site-specific surveys (see Table F-1 of the HRA for site specific bird flight height distributions derived from Hi-Def aerial bird surveys).

94. Option 2 – This option is similar to Option 1 but the proportion of birds at risk height is derived from modelled flight height data. The corrigendum for Johnston et al (2014) provides the most up to date information on modelled flight heights and effectively supersedes the previous flight height model (Cook et al, 2012).

<u>The 'Extended' model.</u>

95. The extended model also has two options: Options 3 and 4;

96. Option 3 uses the generic flight height data from the corrigendum for Johnston et al. 2014,

97. Option 4 uses site specific data in the extended model (see Table F-1 of the HRA for site specific bird flight height distributions derived from Hi-Def aerial bird surveys).

98. Option 4 has not been used in any offshore wind farm assessment in Scotland, but the option 4 figures have been included alongside options 1, 2 and 3 for information (see Table 7-18 below).

99. The 'extended' model differs methodologically from the 'basic' model in that it does not assume that the density of flying birds is uniform across all heights between the minimum and maximum rotor swept height. Instead, this option uses flight height values for specific height bands (1m flight bands by default) from modelled data to calculate collision rate in each part of the rotor swept area and then integrates that across the rotor disk.

100. It also accounts for a number of factors that change with height across the rotor swept area which together result in the collision risk varying with height. For example, the breadth of the circle (and therefore the number of birds flying through the circle) varies with height and the collision risk on transit through the swept area also depends on height (due to for example, variation in rotor speed across the radius).

101. If the density of birds in flight also varies with height (as observed in most seabird species) rather than being uniform, then the result is a different number of predicted collisions than if the flight height distribution were assumed to be uniform (as in Options 1 and 2). The author (2012) of the Band model has clearly stated that the extended model undertakes the more correct calculation and should be used in preference over the basic model where appropriate flight height data allow (emailed note to Avoidance Rate Review project steering group received 14/5/14). Following the findings of the Marine Scotland Science Avoidance Rate Review, the statutory nature conservation bodies issued advice stating that the extended band model is not appropriate for predicting collisions for northern gannet or black-legged kittiwake at the current time.

7.4.2.2. Collision Risk Model Parameters

102. For the project, the collision risk model required specific parameters to ensure an accurate estimation of collision impact. These parameters relate to the location of the site, the specifications of the turbine model to be used, data relating to bird size, flight speed and type and activity. It also relies on flight height data derived from both modelled data and actual data collected from aerial surveys, as well as data on bird densities for each species.

103. The input parameters for the CRM modelling noted below, underwent a full and detailed review as part of the HRA process and all were agreed as appropriate to undertake the assessment process by both SNH and MS Science.

104. The details of the information used to support each of the Band 2012 collision risk model parameters are outlined below:

<u>Windfarm Data Used for Modelling</u>

105. **Name of windfarm site** – Kincardine

106. **Latitude in degrees** – 57

107. **Number of turbines** – Eight 6MW turbines.

108. **Width of windfarm** – The NE3 site 9.8km wide and the Kincardine site is 25.8km (9.8km wide NE3 site with an 8km buffer = 9.8+8+8 = 25.8)

109. **Tidal offset** – although the tidal offset for a floating windfarm is 0, a figure of 12m has been used to take account of the height of the floating substructure above the waves. This is in line with SNH comment 2.2 (see Appendix D in the HRA).

<u>Turbine Data</u>

110. The Kincardine Turbine Model plan to use a Senvion 6.2 MW 152 model.

111. Average wind speed at Kincardine site: 8.79 – 9.45m/s

Table 7-14 Turbine Specifications

Turbine Manufacturer's data	6 MW Model
Number of blades	3
Rotor Radius	76 m
Hub Height	100 m* (including the 12m substructure)
Tower height	88m
Maximum blade width	4.5
Average pitch	15
Rotation speed	6.4 – 10.1 rpm
Cut-in wind speed	3.5 m/sec
Cut-out wind speed	25 m/sec
Rated wind speed	12 m/sec
Derived mean rotation speed at this site	9.3 rpm

Source: https://www.senvion.com/global/en/wind-energy-solutions/wind-turbines/6xm/62m152/
* The effective hub height used in the CRM modelling will therefore include 88m for the tower and 12m for the substructure

Bird Data

112. **Bird Length and Wingspan** – BTO Birdfacts http://www.bto.org/about-birds/birdfacts

113. **Bird Speed** – Table 4 from Strategic assessment of collision risk of Scottish offshore wind farms to migrating birds, Migratory species collision risk modelling assessments, July 2014 - http://www.scotland.gov.uk/Resource/0046/00461026.pdf

114. Derived from Alerstam T., Rosén M., Bäckman J., Ericson P.G.P., Hellgren O. 2007. Flight speeds among bird species: allometric and phylogenetic effects. PLoS Biol, 5, 1656-1662. DOI:10.1371/journal.pbio.0050197

115. **Nocturnal Activity Factor** - Garthe, S. and Hüppop, O. (2004). Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index. J. Appl. Ecol. 41: 724-734 - http://onlinelibrary.wiley.com/doi/10.1111/j.0021-8901.2004.00918.x/epdf

116. **Flight type – Flapping versus gliding** – Flapping is used as it will result in a slightly more precautionary estimate (i.e. a higher collision estimate) than for gliding flight.

117. **Modelled flight height distributions** ('Flightheight' tab) – spreadsheet that accompanies Cook *et al* 2012 flight height review (see SOSS 02), updated following publication of corrigendum to the peer reviewed paper, Johnston *et al*, 2014.

Bird Survey Data

118. **Daytime bird data** – averages taken per month from Hi-Def bird survey data – monthly estimates of bird density per km^2 for the development site (see *Appendix B*).

119. **Proportion flying at rotor height** - A S C P Cook, L J Wright, N H K Burton. A review of flight heights and avoidance rates of birds in relation to offshore windfarms. BTO on behalf of the Crown Estate (2012). SOSS Website http://www.bto.org/science/wetland-and-marine/soss/projects, see SOSS 02.

120. **Proportion of flights upwind** – Assumed 50%

Hi-Def Kincardine Bird Data

121. The bird data used in the CRM was collected by Hi-Def and outlined in the accompanying Hi-Def final report (see Tables 8 – 41, pages 64 -102 of *Appendix B* for the Kincardine survey area and

Tables 42 – 75, pages 103 -138 for the NE3 survey area) using the methodology outlined in *Section 7.3.5* above.

122. The bird densities used in the modelling were only densities of birds that were in flight during the survey. This figure was calculated by identifying the proportion of birds in flight in each of the surveys and applying this proportion to the densities of all birds (both flying and sitting on the water). The densities of birds in flight are shown in *Appendix F* of the HRA.

123. The Band CRM Model has a limit of only allowing 12 months of density data to be entered. In the Band model guidance it suggests taking an average of two years of data in order to get a good indication of densities for each of 12 months. For this assessment, only 16 months of data has been collected. 12 months of initial data and an additional four months covering the time of year with greatest bird densities (the breeding season period). Following a meeting with SNH and Marine Scotland on the 23rd March 2015, it was agreed that for the four months where two years of data is available, it should be the figure for the year with the highest densities of bird present that should be used in the model. It was recognised that this approach would be the most precautionary in nature and give an indication of the 'worst case' scenario with regards to the impacts of the scheme. Within Table 7-16 and Table 7-17 and the figures highlighted in yellow represent figures that are the higher of two years of bird density data for that month.

124. The methodology used by Hi-Def to determine the densities of Auks that dive a large proportion of the time to feed, such as Guillemots, Razorbills and Gannets, involved manually increasing density levels based on the estimated amount of time these birds may be underwater and therefore may have been 'missed' by the aerial surveys. In order to apply the correction to the density figures based on the proportion of birds flying, it was necessary to first remove this diving correctional factor from the data.

125. The flight height data was collected as part of the Hi-Def surveys and this data was used to calculate flight height distribution curves for each of the species for use in the Band 2012 CRM Options 1 and 4. The flight height distributions were only calculated for birds in flight, so birds that were sitting on the water were excluded from the flight height calculations and not identified as having a flight height of 0 metres. Any birds with a flight height of 0 metres are birds that were flying at a low level above the water and fitted into the 0-1m flight height bracket. A graph of the Hi-Def aerial survey flight height distributions is shown in *Table F-1* of the HRA.

7.4.2.2.1. Number of Adult Birds present

126. While it was previously recommended by SNH to use the Inch cape boat-based adult bird ratios (97% adults for gannet and 87% adults for Kittiwake – ICOL Appendix 15A), the updated Hi-Def final survey report also records the ratios of adult birds (see Table 109 on page 254 of the Hi-Def Final report in *Appendix B*).

127. This data is more accurate for use at this site and is therefore used instead of the ICOL data.

128. The proportion of adult, immature and juvenile birds identified from the Hi-Def surveys are outlined in Table 7-15 below:

Table 7-15 Percentage of Adult Birds using the Kincardine Site

Species	Adult	Immature	Juvenile	Total	Percentage Adults
Gannet	275	59	1	335	82.09%
Guillemot	146	0	146	292	50.00%
Kittiwake	1043	24	29	1096	95.16%
Razorbill	3	0	1	4	75%

Source: Hi-Def Final aerial survey report, Table 109 on page 254.

129. As shown above, the percentage of adult birds for Kittiwake represents a more precautionary figure with 95% of birds present on site being adults, compared to 87% of birds using the Inch Cape site.

7.4.2.2.2. Proportion of birds in flight

130. The proportion of birds in flight has been taken from the final Hi-Def Survey report (Tables 76, page 236 – 92, page 248 of *Appendix B*).

131. The bird densities for each of the two sites (NE3 and Kincardine), along with the proportion of flying birds and the corrected density based on the number of adults, are outlined Table 7-16 and Table 7-17 below.

132. Please note the densities for Guillemot are the adjusted densities that take account of the potential numbers of birds that might have been unavailable for detection (see Tables 111 and 112 in the accompanying Hi-Def final survey report in *Appendix B*).

Table 7-16 Corrected bird densities for the NE3 site.

NE3 Site																
Gannet	Survey Dates															
	8th Jan 2014	7th Feb 2014	26th Mar 2014	15th Apr 2014	1st May 2013	25th May 2013	14th June 2013	26th July 2013	3rd Sep 2013	5th Oct 2013	29th Oct 2013	4th Dec 2013	30th May 2014	15th July 2014	24th Aug 2014	26th Sep 2014
Density (n/km^2)	0	0	0.11	0.26	0.26	0.26	0.68	1.98	0.21	0.26	0	0	1.25	0.73	0.41	5.27
Percentage Flying (%)	0.00	0.00	100.00	60.00	92.68	27.50	80.00	89.77	96.55	61.11	27.27	80.00	50.40	71.11	66.67	56.41
Corrected Density	0.00	0.00	0.11	0.16	0.24	0.07	0.54	1.78	0.20	0.16	0.00	0.00	0.63	0.52	0.27	2.97
Corrected density for percentage of adults	**0.00**	**0.00**	**0.09**	**0.13**	**0.20**	**0.06**	**0.45**	**1.46**	**0.17**	**0.13**	**0.00**	**0.00**	**0.52**	**0.43**	**0.22**	**2.44**
Guillemot	**Adjusted Density Estimates**															
	8th Jan 2014	7th Feb 2014	26th Mar 2014	15th Apr 2014	1st May 2013	25th May 2013	14th June 2013	26th July 2013	3rd Sep 2013	5th Oct 2013	29th Oct 2013	4th Dec 2013	30th May 2014	15th July 2014	24th Aug 2014	26th Sep 2014
Density (n/km^2)	17.33	0.97	3.23	20.62	2.89	28.54	24.03	186.27	55.48	13.94	15.35	3.59	31.2	67.24	12.09	146.32
Percentage Flying (%)	0.12	0.00	27.15	9.88	53.62	9.34	4.24	0.51	0.03	0.58	3.39	0.90	4.18	2.95	0.23	0.84
Corrected Density	0.02	0.00	0.88	2.04	1.55	2.67	1.02	0.95	0.02	0.08	0.52	0.03	1.30	1.98	0.03	1.23
Corrected density for percentage of adults	**0.01**	**0.00**	**0.44**	**1.02**	**0.77**	**1.33**	**0.51**	**0.47**	**0.01**	**0.04**	**0.26**	**0.02**	**0.65**	**0.99**	**0.01**	**0.61**
Kittiwake																
	8th Jan 2014	7th Feb 2014	26th Mar 2014	15th Apr 2014	1st May 2013	25th May 2013	14th June 2013	26th July 2013	3rd Sep 2013	5th Oct 2013	29th Oct 2013	4th Dec 2013	30th May 2014	15th July 2014	24th Aug 2014	26th Sep 2014
Density (n/km^2)	0.47	0.1	0.73	1.56	2.08	10.72	5.21	20	0.31	0.36	1.21	0.31	2.09	4.21	8.31	8.01
Percentage Flying (%)	97.14	47.06	97.87	76.19	83.78	39.03	86.24	67.48	39.68	28.99	79.31	95.83	84.15	63.02	42.73	33.28
Corrected Density	0.46	0.05	0.71	1.19	1.74	4.18	4.49	13.50	0.12	0.10	0.96	0.30	1.76	2.65	3.55	2.67
Corrected density for percentage of adults	**0.43**	**0.04**	**0.68**	**1.13**	**1.66**	**3.98**	**4.28**	**12.84**	**0.12**	**0.10**	**0.91**	**0.28**	**1.67**	**2.52**	**3.38**	**2.54**

Note:

- Cells highlighted in blue represent the additional four months of aerial surveys.
- Cells highlighted in yellow represent the higher of the two years of bird survey to be used in collision risk modelling (as a precautionary measure).

Table 7-17 Corrected bird densities for the Kincardine site (NE3 site with 8km buffer)

Kincardine Site																
Gannet	Survey Dates															
	8th Jan 2014	7th Feb 2014	26th Mar 2014	15th Apr 2014	1st May 2013	25th May 2013	14th June 2013	26th July 2013	3rd Sep 2013	5th Oct 2013	29th Oct 2013	4th Dec 2013	30th May 2014	15th July 2014	24th Aug 2014	26th Sep 2014
Density (n/km^2)	0	0	0.09	0.17	0.64	0.65	0.41	1.51	0.42	0.2	0.19	0.08	2.12	0.76	0.54	3.16
Percentage Flying (%)	0.00	0.00	100.00	60.00	92.68	27.50	80.00	89.77	96.55	61.11	27.27	80.00	50.40	71.11	66.67	56.41
Corrected Density	0.00	0.00	0.09	0.10	0.59	0.18	0.33	1.36	0.41	0.12	0.05	0.06	1.07	0.54	0.36	1.78
Corrected density for percentage of adults	**0.00**	**0.00**	**0.07**	**0.08**	**0.49**	**0.15**	**0.27**	**1.11**	**0.33**	**0.10**	**0.04**	**0.05**	**0.88**	**0.44**	**0.30**	**1.46**
Guillemot	**Adjusted Density Estimates**															
	8th Jan 2014	7th Feb 2014	26th Mar 2014	15th Apr 2014	1st May 2013	25th May 2013	14th June 2013	26th July 2013	3rd Sep 2013	5th Oct 2013	29th Oct 2013	4th Dec 2013	30th May 2014	15th July 2014	24th Aug 2014	26th Sep 2014
Density (n/km^2)	16.54	1.51	2.93	13.82	4.09	43.63	23.36	102.26	64.07	17.18	7.73	9.11	41.1	43.72	14.46	91.21
Percentage Flying (%)	0.12	0.00	27.15	9.88	53.62	9.34	4.24	0.51	0.03	0.58	3.39	0.90	4.18	2.95	0.23	0.84
Corrected Density	0.02	0.00	0.80	1.37	2.19	4.08	0.99	0.52	0.02	0.10	0.26	0.08	1.72	1.29	0.03	0.77
Corrected density for percentage of adults	**0.01**	**0.00**	**0.40**	**0.68**	**1.10**	**2.04**	**0.50**	**0.26**	**0.01**	**0.05**	**0.13**	**0.04**	**0.86**	**0.64**	**0.02**	**0.38**
Kittiwake																
	8th Jan 2014	7th Feb 2014	26th Mar 2014	15th Apr 2014	1st May 2013	25th May 2013	14th June 2013	26th July 2013	3rd Sep 2013	5th Oct 2013	29th Oct 2013	4th Dec 2013	30th May 2014	15th July 2014	24th Aug 2014	26th Sep 2014
Density (n/km^2)	0.58	0.26	0.81	1.07	3.95	7.92	5.29	9.6	1.09	0.36	1.35	0.74	2.78	3.26	7.47	8.2
Percentage Flying (%)	97.14	47.06	97.87	76.19	83.78	39.03	86.24	67.48	39.68	28.99	79.31	95.83	84.15	63.02	42.73	33.28
Corrected Density	0.56	0.12	0.79	0.82	3.31	3.09	4.56	6.48	0.43	0.10	1.07	0.71	2.34	2.05	3.19	2.73
Corrected density for percentage of adults	**0.54**	**0.12**	**0.75**	**0.78**	**3.15**	**2.94**	**4.34**	**6.16**	**0.41**	**0.10**	**1.02**	**0.67**	**2.23**	**1.96**	**3.04**	**2.60**

Note:

- Cells highlighted in blue represent the additional four months of aerial surveys.
- Cells highlighted in yellow represent the higher of the two years of bird survey to be used in collision risk modelling (as a precautionary measure)

7.4.2.2.3. Bird flight height distributions

133. As outlined above, the generic flight height data comes from the corrigendum for Johnston et al[6]. 2014. The CRM uses the 'maximum likelihood' flight height distribution figures.

134. The site specific data for use in options 1 and 4 comes from the Hi-Def final aerial survey report (*Appendix B*). The methodology used by Hi-Def to determine flight heights is outlined in Section 2.7.4 of the report on page 35.

135. The site specific flight height distributions used in the CRM modelling are shown in *Table F-1* in *Appendix C* of the HRA.

7.4.3. Collision Risk Modelling Results

136. The results of the collision risk modelling are outlined in Table 7-18 and Table 7-19 below. Based on the joint SNCB guidance[7], the recommended avoidance rate for Kittiwake and Gannet is 98.9%. For all other species the recommended avoidance rate is 98% apart from Herring Gull, with an avoidance rate of 99% or 99.5% depending on the option used. The joint SNCB guidance also recommends that Option 3 (the 'Extended' model) of the CRM Band Model is not currently appropriate for Kittiwake or Gannet. For all other species the Option 3 model can be used.

137. Taking the above recommendations into consideration, Table 7-18 below shows the predicted number of bird collisions for each species. The additional avoidance rate of 99.2% has been suggested previously for Kittiwake, however, following discussions with SNH it was recommended that this figure not be used.

Table 7-18 Collision Risk Modelling Results for the NE3 and Kincardine (NE3 plus 8km buffer) survey areas for a range of model options (with flight height data type).

Species (avoidance rate)	Survey Area	Option 1 (site specific)	Option 2 (modelled)	Option 3 (modelled)	Option 4 (site specific)
Kittiwake (98.9%)	NE3	79	34	9	35
	Kincardine	75	32	9	33
Gannet (98.9%)	NE3	26	6	2	16
	Kincardine	21	5	1	13
Guillemot (98%)	NE3	14	0	0	5
	Kincardine	13	0	0	4
Fulmar (98%)	Kincardine	0	0	0	2
Herring Gull (99% and 99.5%)	Kincardine	1	1	1	3
Razorbill (98%)	Kincardine	0	0	0	0
Puffin (98%)	Kincardine	0	0	0	0

[6] http://www.bto.org/sites/default/files/u28/downloads/Projects/Final_Report_SOSS02_FlightHeights2014.xls

[7] Joint Response from the Statutory Nature Conservation Bodies to the Marine Scotland Science Avoidance Rate Review, Cook, A.S.C.P., Humphries, E.M., Masden, E.A., and Burton, N.H.K. 2014. The avoidance rates of collision between birds and offshore turbines. BTO research Report No 656 to Marine Scotland Science

Table 7-19 Collision Risk Modelling Results by month

Species (avoidance rate)	Option	Survey Area	Month											
			Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Kittiwake (98.9%)	Option 2	NE3	0	0	1	1	2	5	16	4	3	0	1	0
		Kincardine	1	0	1	1	4	5	7	4	4	3	1	1
Gannet (98.9%)	Option 2	NE3	0	0	0	0	1	1	2	0	2	0	0	0
		Kincardine	0	0	0	0	1	0	1	0	1	0	0	0
Guillemot (98%)	Option 3	NE3	0	0	0	0	0	0	0	0	0	0	0	0
		Kincardine	0	0	0	0	0	0	0	0	0	0	0	0

Migratory Birds

138. Table 7-20 shows the results of the Collision Risk Modelling for migratory species passing through the development area, which was calculated using the SOSS Migratory Impact methodology[8]. The results of this assessment are outlined in *Appendix G* of the HRA.

[8] Strategic assessment of collision risk of Scottish offshore wind farms on migrating birds, Scottish Marine and Freshwater Science, Vol No 12, Marine Scotland. http://www.bto.org/science/wetland-and-marine/soss/projects

Table 7-20 Collision Risk Modelling for Migratory birds crossing the Kincardine site in numbers over 10,000 (Common gull included as a precautionary measure).

Model Parameters: Nocturnal activity factor: 2.5 (out of 5), Flight type: flapping, Width of migration corridor: 9.8km (the width of Kincardine site crossed by the migrating birds)

Species	Number of Migratory Pop crossing Kincardine site.	Body Length	Wingspan	Flight speed	Proportion at flight height	Option 1 - 98% avoidance rate (% of pop crossing Kincardine site)	Number of Birds Identified through Hi-Def surveys (pop estimate)
Pink Footed Goose *Anser brachyrhynchus*	57,992	0.75	1.70	17.1	30	2 (0.003%)	0
Icelandic Greylag Goose *Anser anser*	35,573	0.90	1.80	17.1	30	1 (0.003%)	0
Barnacle Goose (Greenland population) *Branta leucopsis*	32,402	0.70	1.45	17.0	30	1 (0.003%)	0
Manx Shearwater *Puffinus puffinus*	13,651	N/A	N/A	N/A	N/A	N/A	0
Golden Plover *Pluvialis apricaria* (non-breeding)	12,036	0.30	0.83	17.9	25	0	0
Knot *Calidris canutus*	11,630	N/A	N/A	N/A	N/A	N/A	0
Snipe *Gallinago gallinago*	19,437	0.27	0.47	17.1	25	0	0
Common Gull *Larus canus*	9,703	0.41	1.20	13.5	12.7	0	18

Source: Strategic assessment of collision risk of Scottish offshore wind farms on migrating birds, Scottish Marine and Freshwater Science, Vol 5 No 12. 2014. Marine Scotland. http://www.bto.org/science/wetland-and-marine/soss/projects.

Collision Impacts – Breeding vs Non-Breeding

139. For each species the collision impacts have been split between the breeding season (the colony attendance period) and a non-breeding season (outside colony attendance period). The breeding seasons for each species were agreed following consultation with SNH'. These are outlined in Table 7-21 below.

Table 7-21 Breeding Season Periods for SPA species.

Species	Breeding Season Period
Gannet	April - September
Kittiwake	April - August
Herring Gull	April - August
LBBG	April - August
Fulmar	May - September
Puffin	April - August
Guillemot	April - July
Razorbill	April - July
Common tern	May - August
Arctic tern	May – August
Shag	February – September

140. The number of potential bird collision impacts during the breeding and non-breeding seasons are outlined in Table 7-22 below. These figures were derived from the monthly collision risk modelling results, shown in Table 7-19 above.

Table 7-22 Bird Collision Impacts - Breeding vs non-breeding

Species	Avoidance Rate	CRM Option	No. of birds potentially impacted (percentage of total)	
			Breeding Season	Non-Breeding Season
Kittiwake Breeding Season: April - August	98.9%	Option 2	28	6
Gannet Breeding Season: April - September	98.9%	Option 2	6	0
Guillemot Breeding Season: April - July	98%	Option 3	0	0

Source: NE3 survey area CRM results from Table 7-16 above.

Collision Impacts - SPA Apportionment

141. Given that SPA seabird breeding colonies are situated at different distances from the KOWL Site, and that different species have different foraging ranges, a process of apportioning seabird collision impacts to each of the SPAs is required in order to understand the magnitude of impacts to individual SPAs.

142. This apportionment was carried out based on the distance of the SPA from the development site, the bird species colony size and the proportion of foraging range that is out to sea (i.e. in the direction of the Kincardine site). The process of apportioning bird collision impacts to individual SPA breeding colonies within foraging range is shown in Table 7-23 below. This apportionment is a pre-requisite for considering the effects of the wind farm on individual SPAs where these species are qualifying interest features.

143. The results of the collision risk modelling in Table 7-18 above indicate very low collision impacts for Fulmar, Herring Gull, Razorbill and Puffin. It can therefore be considered at this stage that any apportionment to SPAs within foraging range for these species will result in negligible impacts to individual SPAs that would either be no impacts at all (zero birds) or impacts on fractions of a bird.

Table 7-23 Number of breeding bird collisions apportioned to SPAs and sites outside of SPAs within foraging range (see Figure 7-4 above).

Kittiwake							
Site Name	**Count of Adult Birds**	**Distance from Development**	**Proportion of forage range as Sea**	**Resulting Weight**	**Proportional weight**	**Total adult collisions**	**Percentage of Population**
Fowlsheugh SPA	18,674	16	0.6	18.33	0.29	8	0.044%
Buchan Ness to Collieston Coast SPA	25,084	27	0.5	7.20	0.11	3	0.013%
Troup, Pennan and Lions Heads SPA	29,792	69	0.6	1.57	0.02	1	0.002%
Outside of SPAs (16 sites within foraging range of Kincardine)	68,304					16	0.023%

Gannet							
Site Name	**Count of Adult Birds**	**Distance from Development**	**Proportion of forage range as Sea**	**Resulting Weight**	**Proportional weight**	**Total adult collisions**	**Percentage of Population**
Forth Islands SPA	150,,518	94	1	65.69	0.38	2	0.002%
Fair Isle SPA	7,182	270	1	0.37	0.002	0	0.000%
Troup, Pennan and Lions Heads SPA	3,620	69	1	2.93	0.017	0	0.000%
Outside of SPAs (49 sites within foraging range of Kincardine)	401,361					4	0.000%

Guillemot							
Site Name	Count of Adult Birds	Distance from Development	Proportion of forage range as Sea	Resulting Weight	Proportional weight	Total adult collisions	Percentage of Population
Fowlsheugh SPA	44,920	16	0.6	372.65	0.82	0	0.000%
Buchan Ness to Collieston Coast SPA	19,296	27	0.5	46.84	0.10	0	0.000%
Troup, Pennan and Lions Heads SPA	16,325	69	0.6	7.28	0.016	0	0.000%
Outside of SPAs (12 sites within foraging range of Kincardine)	103,322					0	0.000%

Table 7-24 Assessment Magnitude of Collision Impact.

Bird Species	Assessment of Impact	Impact Magnitude
Kittiwake	The results of the collision risk modelling (using option 2 – Table 7-18 above) predict a total annual mortality of 34 Kittiwake through collisions with turbine blades, based on NE3 survey area density estimates and 32 based on Kincardine survey area density estimates (NE3 area with 8km buffer). The predicted annual mortality during the breeding season is 28 kittiwake (see Table 7-22 above). From this total figure of 28 birds, an annual mortality of eight birds has been apportioned to Fowlsheugh SPA, three birds to Buchan to Collieston Coast and 1 bird to Troup, Pennan and Lions Heads SPA (see Table 7-23 above). These figures equate to an increase in breeding adult mortality from collisions of 0.044% of Fowlsheugh SPA, 0.013% of Buchan to Collieston Coasts SPA and 0.002% of Troup, Pennan and Lions Heads SPA populations. Outside of SPAs, collision risk modelling predict an annual mortality of four Kittiwake, which accounts for 0.023% of the Kittiwake population from 16 sites within foraging range but outside of SPAs.	Negligible
Guillemot	The results of the collision risk modelling (using option 3 – Table 7-18 above) predict that no Guillemot will be lost through collisions with turbine blades, based on NE3 and Kincardine (NE3 area with 8km buffer) survey area density estimates. Outside of SPAs no Guillemot will be lost through collision impacts.	Negligible
Gannet	The results of the collision risk modelling (using option 2 - see Table 7.18 above) predict a total annual mortality of six Gannet through collisions with turbine blades, based on NE3 survey area density estimates and five based on Kincardine survey area density estimates (NE3 area with 8km buffer). The predicted annual mortality during the breeding season is six Gannet (see Table 7-22 above). From this total figure of six birds, an annual mortality of two birds has been apportioned to Forth Islands SPA and no birds have been apportioned to either Fair Isle or Flamborough Head and Bempton Cliffs SPAs (see Table 7-23 above). This figure equates to an increase in breeding adult mortality from collisions of 0.002% of Forth Islands SPA population. Outside of SPAs no guillemot will be lost through collision impacts.	Negligible
Fulmar, Razorbill, Herring Gull and Puffin	Collision impacts to other species are considered to be negligible in impact and are not considered further. (see Table 7-18 above)	Negligible

7.4.4. Presence of WTGs, substructures and mooring Lines.

7.4.4.1. Displacement Impacts

144. At a meeting with SNH on the 23rd March 2015, it was agreed that the potential additional level of displacement impacts on adult survival rates and breeding success arising from Kincardine Floating Offshore Windfarm are likely to be minimal. This conclusion was based on the fact that the worst case scenario for Kincardine will be eight turbines and these will be spread over a relatively large site, so the potential for a wind farm of this size and scale to cause any displacement impacts to SPA birds is considered to be low.

145. With this in mind, it was agreed that a 'back of an envelope' approach to calculating the potential impacts on Kittiwake and Auk species through displacement would seem appropriate, given developments size and scale.

Methodology:

146. The NE3 Survey Area is approximately $73km^2$. The area estimated to be covered by the turbines is approximately $9km^2$ ($1.07km^2$ per turbine, including a 500m buffer between each turbine, multiplied by 8 turbines). With the addition of a 1km[9] buffer, this area will be approximately $25km^2$.

147. This area represents approximately 34% of the total NE3 survey area.

Table 7-25 Bird Displacement Assessment

Species	Estimated Breeding Pop size from NE3 survey area[1]	Pop size of turbine coverage area + 1km ($25km^2$), assuming even distribution across the NE3 survey area	Predicted displacement rate[2] (%)	Number of breeding birds displaced from turbine coverage area	Number of breeding adults displaced from turbine coverage area[3]
Kittiwake Breeding Season: April - August	669	229	30	69	66
Gannet Breeding Season: April - September	120	41	75	31	25
Guillemot Breeding Season: April – June (-high influx)	1846	632	50	316	158
Razorbill Breeding Season: April – June (-high influx)	64	22	50	11	8
Puffin Breeding Season: April - August	56	19	50	10	5

1. The NE3 breeding population estimates were calculated using the max mean peak population density estimates from the breeding season months (shown in Table 7-16). Refer to Tables 44-75 on pages 107-138 of the Hi-Def Final Aerial Survey Report for monthly density estimates.
2. Displacement rate based on Inch Cape, the closest of the Forth and Tay wind farms to the development area.
3. The proportion of adults was calculated from the Hi-Def aerial survey data and are outlined in Table 7-15 above. It has assumed that all adult birds present during the breeding season are adult breeding birds. The exception to this is guillemots and razorbills that experience high influx periods between July and September. Following advice from SNH (see comment 5.3 in *Appendix D* in the HRA) the population estimates for these months has been removed from the breeding adult proportion calculations. The proportion of puffins that are adults is assumed to be 50%.

[9] As recommended in 'Population consequences of displacement from proposed offshore wind energy developments for seabirds breeding at Scottish SPAs, Scottish Marine and Freshwater Science, Vol 5 No 13, Final report to Marine Scotland Science, Ref: CR/2012/03'.

Table 7-26 SPA Bird Numbers displaced by the project

Bird Species	Site	Predicted Number of individual breeding adults displaced, apportioned to each Site	% of Adult Breeding Pop displaced	SPA Breeding Pop (pairs) and Annual Breeding Success (chicks per pair per year[1])	Predicted Productivity for SPA pop (no. chicks)	No of Chicks 'Lost'	Predicted Reduction in Breeding Success	Adult mortality due to displacement[2] (% of SPA pop)
Kittiwake	Fowlsheugh SPA	19	0.1%	9,337 0.988	9,225	19	0.1%	10 (0.05%)
	Buchan Ness to Collieston Coast SPA	8	0.03%	12,542 0.695	8,717	6	0.03%	4 (0.015%)
	Troup, Pennan and Lions Heads SPA	2	0.006%	14,896 0.77	11,470	2	0.008%	1 (0.003%)
	Outside of SPAs	37	0.05%	34,152				19 (0.03%)
Gannet	Forth Islands SPA	10	0.006%	75,259 0.77	57,949	8	0.007%	5 (0.003%)
	Outside of SPAs	15	0.004%	200,681				8 (0.002%)
Guillemot	Fowlsheugh SPA	130	0.28%	22,460 0.66	14,824	86	0.29%	65 (0.14%)
	Buchan Ness to Collieston Coast SPA	16	0.08%	9,648 0.66	6,368	11	0.09%	8 (0.04%)
	Troup, Pennan and Lion's Heads SPA	3	0.02%	8,162 0.66	5,387	2	0.019%	2 (0.01%)
	Outside of SPAs	9	0.009%	103,322				5 (0.005%)
Razorbill	Fowlsheugh SPA	8	0.15%	2,630 0.60	1,578	5	0.16%	4 (0.08%)
Puffin	Forth Islands SPA	5	0.005%	52,817 0.60	31,690	3	0.004%	3 (0.003%)

Note: It is assumed that 100% of displaced adult breeding birds will fail to reproduce.

[1] Various sources – see Table 7-27below.

[2]An adult mortality of 50% has been applied following SNH advice (see comment 5.4 in *Appendix D* of the HRA)

Table 7-27 Displacement

Bird Species	Assessment of Impact	Conclusion (Impact Magnitude)
Kittiwake	Breeding success: Annual estimates of the number of fledged chicks produced per nest were available from the Seabird Monitoring Programme (JNCC, 2011[10]) for both SPAs (Fowlsheugh and Buchan Ness to Collieston). **Fowlsheugh SPA** A total of 19 adult breeding kittiwake from Fowlsheugh SPA (0.1% of the SPA population) were predicted to be displaced by the scheme (see Table 7-18 above). Based on the annual breeding success of this SPA and 100% breeding failure of displaced birds, this would equate to 19 chicks being 'lost', which would result in a predicted reduction in breeding success at this SPA of 0.1%. **Buchan Ness to Collieston Coast and Troup, Pennan and Lion's Heads SPA** A total of eight adult breeding kittiwake from Buchan to Collieston Coast (0.03% of the SPA population) and two bird from Troup, Pennan and Lions Heads (0.006% of the SPA population) were predicted to be displaced by the scheme (see Table 7-23). Based on the annual breeding success of this SPA and 100% breeding failure of displaced birds, this would equate to six chicks being 'lost' from Buchan to Collieston Coast SPA, which would result in a predicted reduction in breeding success of 0.03%. Two kittiwake were apportioned to Troup, Pennan and Lions Heads SPA (0.006% SPA population) resulting in two chicks lost and a reduction in breeding success of 0.008%. **Outside of SPAs** A total of 37 kittiwake from 16 sites outside of SPAs (0.05% of the population) were predicted to be displaced by the scheme (see Table 7-26 above). This would result in an adult mortality of 19 kittiwake (0.03% of the population).	Low
Gannet	Breeding success: Annual estimates of the number of fledged chicks produced per nest were available from the Seabird Monitoring Programme (JNCC, 201211) for Bass Rock (Forth Islands SPA). **Forth Islands SPA** A total of 10 adult breeding gannet (0.006% of the SPA population) were predicted to be displaced by the scheme (see Table 7-26 above). Based on the annual breeding success of this SPA and 100% breeding failure of displaced birds, this would equate to eight chicks being 'lost', which would result in a predicted reduction in breeding success at this SPA of 0.007%. **Outside of SPAs** A total of 15 gannet from 49 sites outside of SPAs (0.004% of the population) were predicted to be displaced by the scheme (see Table 7-26 above). This would result in an adult mortality of eight gannet (0.002% of the population).	Negligible
Guillemot	Breeding success: Annual estimates of the number of chicks produced per nest on the Isle of May were used for the period 2007 - 2012 (http://www.ceh.ac.uk/sci_programmes/2012-seabird-breeding-	Low

[10] Source of Data: Seabird Monitoring Project – JNCC - http://jncc.defra.gov.uk/smp/

[11] Source of Data: Seabird Monitoring Project – JNCC - http://jncc.defra.gov.uk/smp/

Bird Species	Assessment of Impact	Conclusion (Impact Magnitude)
	isleofmay.html). The mean (and associated SD) was calculated for those years. No recent data were known to be available from other SPAs, or sites, within the region of interest. **Fowlsheugh SPA** A total of 130 adult breeding guillemot from Fowlsheugh (0.28% of the SPA population) were predicted to be displaced by the scheme (see Table 7-26 above). Based on the annual breeding success of this SPA and 100% breeding failure of displaced birds, this would equate to 86 chicks being 'lost', which would result in a predicted reduction in breeding success at this SPA of 0.29%. **Buchan Ness to Collieston Coast and Troup, Pennan and Lion's Heads SPA** A total of 16 adult breeding guillemot (0.08% of the SPA population) were predicted to be displaced by the scheme (see Table 7-26 above) from Buchan to Collieston Coast SPA and three birds displaced from Troup, Pennan and Lions Heads SPA (0.02% of the SPA population). Based on the annual breeding success of this SPA and 100% breeding failure of displaced birds, this would equate to 11 chicks being 'lost' from Buchan to Collieston Coast SPA and two chicks being lost from Troup, Pennan and Lions Heads SPA. This would result in a predicted reduction in breeding success at Buchan to Collieston Coast SPA of 0.09% and a reduction from Troup, Pennan and Lions Heads SPA of 0.019%. **Outside of SPAs** A total of 9 guillemot from 12 sites outside of SPAs (0.009% of the population) were predicted to be displaced by the scheme (see Table 7-26 above). This would result in an adult mortality of five guillemot (0.005% of the population). It could be the case however that the floating sub-structures, mooring anchor weights and lines act to encourage birds to use the area, rather than displacing them. This could particularly be the case for diving bird species, as the floating sub-structure, mooring anchor weighs and lines could act as artificial reefs and fish aggregation devices, increasing prey species in the immediate area of the turbines and the design of the triangular sub-structures is such that they would provide suitable resting and perching areas for birds. The triangular shape of the structures would also create a central area of open water that could help to provide shelter and protection to bird species during adverse weather and sea conditions.	
Fulmar	Foraging ranges for fulmar are very extensive in comparison to the surface areas of the Kincardine site. In addition, the species has a particularly flexible foraging strategy. Any impacts from displacement of Fulmar are therefore going to be Negligible in magnitude.	Negligible
Herring gull	It is estimated that the project will result in a loss of 0.1% of the foraging area for herring gull originating from Fowlsheugh SPA, 0.2% of the foraging area for herring gull originating from Buchan to Collieston Coast SPA and 2% of the foraging area for herring gull originating from Buchan to Collieston Coast SPA. These figures are substantially lower than other windfarms, which contribute to a total loss of 2% of the foraging area for herring gull originating from Fowlsheugh SPA and Buchan to Collieston Coast SPA. No displaced herring gull were apportioned to Troup, Pennan and Lions Heads SPA due to the distance of the SPA from the development site.	Negligible

Bird Species	Assessment of Impact	Conclusion (Impact Magnitude)
	Herring Gulls are omnivorous and may feed onshore and offshore. Because they forage in a variety of terrestrial, coastal and offshore habitats, including taking discards from fishing vessels, any displacement impacts are not considered likely to cause negative impacts on herring gull populations at any of the SPAs.	
Razorbill	Breeding success: Annual estimates of the number of chicks produced per nest on the Isle of May were used for the period 2007 - 2012 (http://www.ceh.ac.uk/sci_programmes/2012-seabird-breeding-isleofmay.html). The mean (and associated SD) was calculated for those years. No recent data were known to be available from other SPAs, or sites, within the region of interest. **Fowlsheugh SPA** It is estimated that approximately eight adult breeding razorbill will be displaced by the Kincardine site with a 1km buffer. This figure equates to 0.15% of the population of Fowlsheugh SPA. The number of chicks per pair per year for this SPA is 0.60. If eight individual adult breeding birds are displaced there is the potential for five chicks to be 'lost' as a result of displacement. This figure equates to a predicted reduction in breeding success of 0.16%.	Low
Puffin	Breeding success: Annual estimates of the number of chicks produced per nest on the Isle of May were used for the period 2007 - 2012 (http://www.ceh.ac.uk/sci_programmes/2012-seabird-breeding-isleofmay.html). The mean (and associated SD) was calculated for those years. No recent data were known to be available from other SPAs, or sites, within the region of interest. **Forth Islands SPA** It is estimated that approximately five adult breeding puffin will be displaced by the Kincardine site with a 1km buffer. This figure equates to 0.005% of the population of Fowlsheugh SPA. The number of chicks per pair per year for this SPA is 0.60. If five individual adult breeding birds are displaced there is the potential for three chicks to be 'lost' as a result of displacement. This figure equates to a predicted reduction in breeding success of 0.004%.	Negligible

7.4.4.2. Disturbance

148. Standard operational maintenance work on the substructures/WTG would be ongoing and would last the length of the project development. Annual monitoring of the cable condition and maintaining cable protection would be considered to be annual events. An increase in vessel activity may result in the event of significant (major component) WTG or export cable repair. All these activities have the potential to cause temporary disturbance to birds.

149. The precise nature of the vessels to be used during maintenance and operation is currently unknown, but likely be limited to one small boat movement per day. It is likely that a number of vessels will be used including anchor layers, cable laying vessels and tugs will be used during the construction and decommissioning phase of the development. The additional vessel traffic would be confined to pre-defined traffic corridors around the development area.

150. Maintenance activities will be limited to small boat movements. It is unlikely that this increase in vessel activity will result in a barrier effect to marine mammals, as they are already used to a medium level of vessel traffic moving throughout the area.

Table 7-28 Disturbance

Bird Species	Assessment of Impact	Impact Magnitude
Kittiwake	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible
Guillemot	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible
Fulmar	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible
Herring gull	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible
Razorbill	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible
Puffin	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible
Gannet	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible

7.4.4.3. Entanglement

151. Gannet, Puffin, Razorbill and Guillemot have the ability to dive to considerable depths to catch food (34, 70, 140 and 200m respectively[12]), so there is potential for them to become entangled, particularly if 'ghost fishing' gear gets caught on the mooring lines. Derelict fishing gear which becomes caught / snagged amongst the moorings and devices is known as 'ghost fishing'.

152. As a result of 'ghost fishing', Benjamins *et al*. (2014) recommend that Developers routinely monitor their development to check for entanglement, animal behaviour / presence around the site and trapped derelict fishing gear. Load cells on the mooring lines will continually monitor the strain on each line and these are likely to identify any large ghost fishing nets. However, regular underwater visual inspection of the conditions of moorings, and subsea cables is likely to be required and planned for operational reasons. Such inspections will also be used to detect derelict fishing gears and items with a potential risk of mammal entanglement (see *Chapter 6 – Marine Mammals*).

153. All offshore wind farm developments, especially jacket-type fixed structures and potential floating types, have the potential to become a fish aggregation device, by growing algae, seaweed and kelp on the submerged substructure, which in turn provides hiding places and habitat for juvenile fish and invertebrates, which attracts larger fish species. There is, therefore potential for the occurrence of increased numbers of fish such as sandeel in the Development Area which would provide a source of prey to birds. This could have the potential of increasing the risk of entanglement.

[12] Source: Seabird Wikispaces: http://seabird.wikispaces.com

Table 7-29 Entanglement

Bird Species	Assessment of Impact	Impact Magnitude
Kittiwake	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible
Guillemot	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible/Low
Fulmar	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible
Herring gull	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible
Razorbill	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible/Low
Puffin	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible/Low
Gannet	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible/Low

7.4.4.4. Contamination

154. Contamination could come from a variety of sources. E.g. from antifouling paints, corrosion inhibitors, oil leakage from equipment and accidental pollution events.

155. During routine operation and maintenance of an offshore wind farm, there are risks of pollution from leaking of sacrificial anodes, leaking of corrosion inhibitors, antifouling paints, vessel fuel or the loss of hydraulic fluids, which may reduce the health and fitness of a range of marine mammal species (Bonar et al, 2015).

156. Environmental contamination by bio-accumulative pollutants such as polychlorinated biphenyls (PCBs) and persistent organochlorine pesticides (POPs) has spread worldwide and represent a potential risk to seabirds.

157. The potential for toxic contamination is deemed to be similar throughout all phases of the project (construction, operation and decommissioning) as it is mainly related to vessel movements and general offshore activities.

158. Although antifoulants typically release toxic chemicals, recent use is mainly regulated towards licensed protective coatings that are low or non-toxic. For example, some wind turbines are painted with glass flake reinforced polyester coatings with no biocide activity, and antifoulants are not typically used (Wilhelmsson *et al*, 2010).

159. The wind farm substructures will require protection against corrosion, which is likely to be via a polyurethane or epoxy coating and / or the use of sacrificial aluminium anodes. The final design will incorporate recommendations arising from corrosion protection in existing offshore wind farms as well as current industry best practice.

160. The presence of the offshore wind farm may amplify navigational hazards for vessels which will indirectly increase the risk of oil spills and marine pollution. Vessel collision risk is a product of a number of factors, such as vessel traffic, distance to navigational routes, wind, current and weather conditions. Collision risk is further discussed in Chapter 9.

<u>Significance of Impact</u>

161. Serious pollution from the development is unlikely as a result of the Project. If pollution was to occur, the effects would be local and the overall impacts small, provided there were no large accidental oil spills when servicing the WTGs. However, it should be noted that the likelihood of an accidental oil spill is low, due to best practices and appropriate navigational aids being in place.

162. All materials used in the construction, operation and maintenance and decommissioning phases will be certified for safe use within the marine environment.

163. The magnitude of effect of toxic contamination to seabird species is considered to be Negligible.

Table 7-30 Contamination

Bird Species	Assessment of Impact	Impact Magnitude
Kittiwake	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible
Guillemot	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible
Fulmar	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible
Herring gull	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible
Razorbill	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible
Puffin	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible
Gannet	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible

7.4.4.5. Habitat Loss

164. Habitat loss from the presence of WTGs, substructures, mooring lines and the inter-array cables.

165. The project is a floating windfarm, and as such there will be no loss of bird habitat other than the potential for displacement outlined in *Section 7.4.4.1*. The floating substructures consist of three floating pontoons, up to 12m in diameter, connected in a triangular formation. The central area of the triangle will essentially be open sea, meaning that the only loss of potential bird foraging habitat is the footprint of the pontoons, which is negligible in area compared to the foraging ranges of all bird species.

166. There is potential for the floating substructures to act as a ‘high tide’ roost for birds, with a large surface area and long lengths of railings that can be used by birds for perching.

167. There is also potential for the floating substructures to become fish aggregation devices, by growing algae, seaweed and kelp, which in turn provides hiding places and habitat for juvenile fish and invertebrates, which then attracts larger fish species. There is, therefore potential for the occurrence of increased numbers of fish such as sandeel in the Development Area which would provide a source of prey to birds and therefore enhance the area as a potential habitat (See *Chapter 6 – Fish and Shellfish, Section 6.9.2.5*).

Table 7-31 Habitat Loss

Bird Species	Assessment of Impact	Impact Magnitude
Kittiwake	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible
Guillemot	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible
Fulmar	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible
Herring gull	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible
Razorbill	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible
Puffin	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible
Gannet	Presence of WTGs, Substructures, mooring lines and inter-array cables	Negligible

7.5. Cumulative Impacts

168. For the in-combination assessment, it has been agreed with Marine Scotland and Scottish Natural Heritage that the potential impacts of seven offshore wind farms should be considered in-combination with the project, based on their location and distance from the development area, the magnitude of their impacts on birds from SPAs along the coasts and the current stages in their consenting.

169. The cumulative impact Wind farm development sites to be included in the in-combination assessment are as follows (see Table 7-32 below):

1. European Offshore Wind Development Centre (Aberdeen)
2. Seagreen Alpha Offshore Windfarm and Seagreen Bravo Offshore WindfarmHywind Scotland Pilot Park
3. Inch Cape Offshore Wind Farm
4. Neart na Gaoithe Offshore Wind Farm
5. Moray Offshore Renewables Wind Farm (eastern development area)
6. Beatrice Offshore Windfarm Ltd (BOWL)

170. The following sites were not considered necessary to assess in-combination with the project, either due to their distance from the development area, the magnitude and scope of their impacts or the stage in their consenting process.

1. Fife Energy Park Offshore Demonstration Wind Turbine
2. 2B Energy Demonstrator
3. Dounreay Floating Offshore Wind Development Centre
4. All land based wind farm development

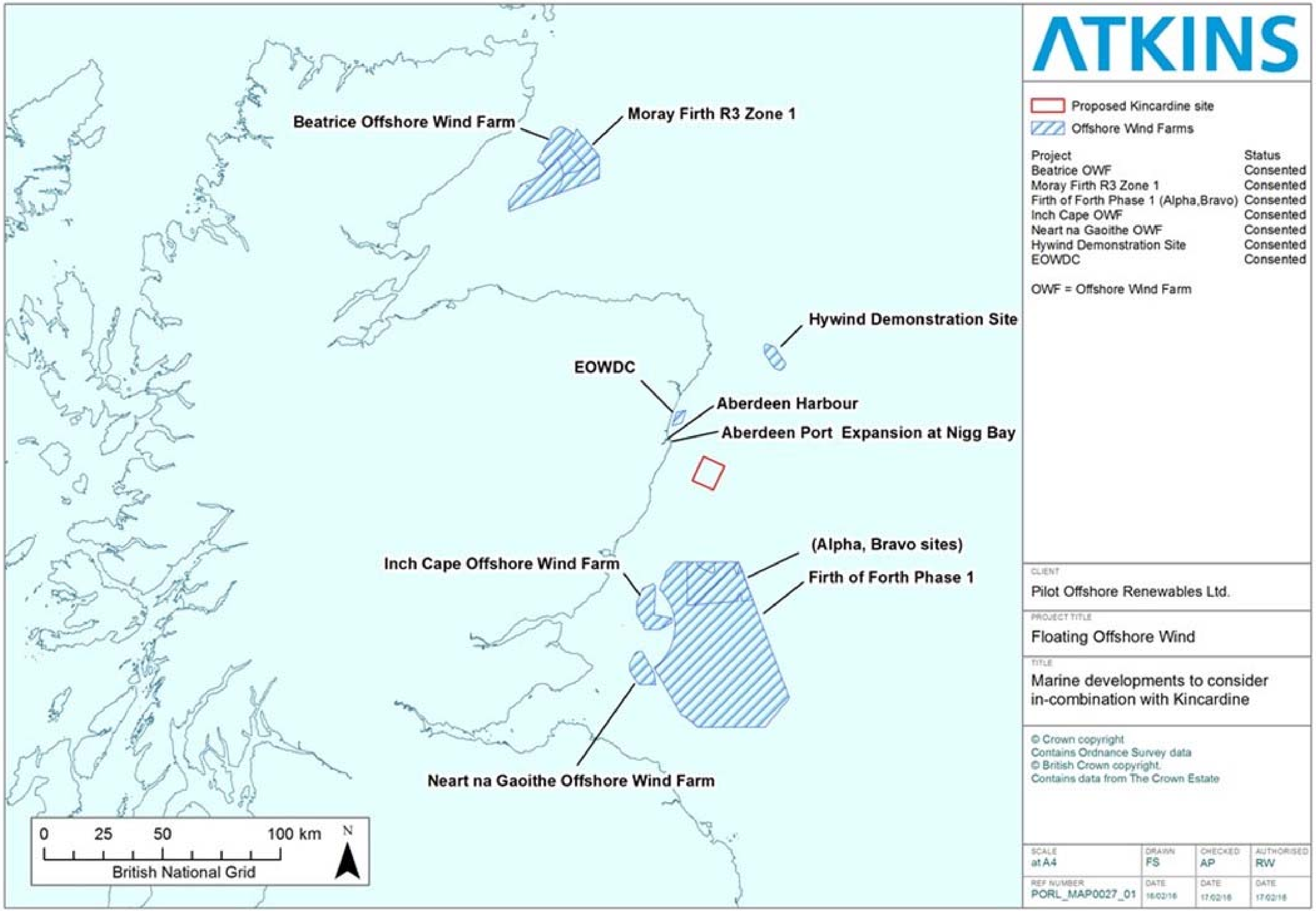

Figure 7-5 Offshore Wind Farm Developments with the potential to act in combination with the KOWL scheme

Table 7-32 Projects considered for in-combination impacts.

	Project name	Distance from Pilot Park	Project developer	High level description	Project status
			Offshore wind farm projects		
1	European Offshore Wind Deployment Centre (EOWFL)	17km	Aberdeen Offshore Wind Farm Ltd	Offshore wind turbine deployment centre for 11 turbines with up to 100 MW capacity.	Consented.
2	Seagreen Alpha Offshore Windfarm and Seagreen Bravo Offshore Windfarm	34km	Seagreen Wind Energy Limited	Offshore wind farm and export cabling to be developed in three Phases with a total target capacity of 3.5 GW. • Phase 1: Alpha and Bravo. 1,050 MW, export cable to Carnoustie in Angus. • Phase 2: Charlie, Delta and Echo. Phase 3: Foxtrot and Golf.	Phase 1 – consented. Phase 2 & 3 – EIA Scoping Opinion issued.
3	Hywind Scotland Pilot Park	45km	Statoil	Pilot project for five 6mw floating wind turbines	Consented.
4	Inch Cape Offshore Wind Farm	47km	Inch Cape Offshore Wind Farm Ltd	Offshore wind farm up to 213 turbines, covering an area of up to 150 km^2 with capacity of approximately 1,000 MW.	Consented.
5	Neart na Gaoithe Offshore Wind Farm	74km	Mainstream Renewable Power	Offshore wind farm, 75 - 125 turbines, 450 MW with 33 km export cable to shore.	Consented. Offshore construction due to begin in 2015 subject to consent.
6	Moray Offshore Renewables Wind Farm (eastern development area)	125km	Moray Offshore Renewables Ltd (MORL)	A 1,500 MW wind farm over an area of 125 km2 in the outer Moray Firth. Includes an export cable approximately 105 km in length offshore to Fraserburgh and 30 km onshore to substation.	1.116 MW consented. Construction planned to begin Q3 2015 to full generation in Q3 2020.
7	Beatrice Offshore Windfarm Ltd (BOWL)	150km	SSE	An offshore wind farm with a maximum of 227 offshore turbines, generating up to 1,000 MW in the outer Moray Firth. Includes an electrical transmission cable along a 65 km corridor to the shore at Portgordon and 20 km of onshore cable to a new substation at Blackhill hock.	Consented.

7.5.1.1. Cumulative Collision Risk

Table 7-33 In-Combination Predicted Annual Collision Mortality during the Breeding Season for SPA Qualifying Species Requiring Further Information to inform an Appropriate Assessment.

Bird Species[5]	Avoidance Rate[1]	CRM Option	Development[3]								
			Inch Cape Offshore Wind Farm	Neart na Gaoithe[2]	Seagreen Alpha Offshore Windfarm	Seagreen Bravo Offshore Windfarm	European Offshore Wind Deployment Centre	Beatrice Offshore Wind Farm (BOWL)	Moray Firth R3, Zone 1 (MORL)	Hywind Scotland Pilot Park[4]	Kincardine Floating Offshore Windfarm (KOWL)
Gannet	99%	Option 3	313	294	438	270	3	54	62	6	2
Kittiwake	98%	Option 3	18	57	189	252	25	124	108	76	17
	98.9%	Option 3	10	32	104	139	14	68	59	23	9
	99%	Option 3	9	29	95	126	13	62	54	17	8

1. Where different avoidance rates were used in published Environmental Statements for developments, these have been adjusted to the avoidance rate given in the table.
2. Published collision estimate was adjusted for difference in definition of gannet breeding season.
3. The Beatrice Demonstrator Wind Farm was in operation at the time that bird survey data for Inch Cape Offshore Wind Farm were being collected, and is considered to be part of the baseline. For a map of all Offshore Wind Farm Developments, see Figure 7-5 above.
4. Annual collision figures displayed for Kincardine are based on using the CRM Option 3 and a 98% and 99% avoidance rate (see Table 7-18 above). This is to ensure an accurate comparison of impacts to other wind farm developments.
5. Collision Impacts to guillemot are considered to negligible in magnitude across all wind farms and therefore have not been considered as part of the in-combination collision assessment.

7.5.1.2. Cumulative Displacement

Table 7-34 Potential Loss of Foraging Range due to in-combination Displacement from Offshore Wind Farms for SPA Qualifying Species Requiring an Appropriate Assessment

Brid Species	SPA	Foraging Area (km²)	Windfarms within foraging area – in addition to the project.	Overlap between Foraging Area and Wind Farms plus 2km buffer as a % of foraging range (km²)	Overlap between Foraging Area and Kincardine Site plus 2km[1] buffer as a % of foraging range (km²)	Assumed Displacement of Bird Species	Predicted % of Foraging Area Lost from Wind Farms	Predicted % of Foraging Area Lost from Kincardine
Kittiwake	Fowlsheugh	11,673	Inch Cape Offshore Wind Farm; European Offshore Wind Deployment Centre; Seagreen Alpha Offshore Windfarm and Seagreen Bravo Offshore Windfarm; Neart na Gaoithe	10.5% (1,228)	0.4% (49)	30%	3%	0.2%
	Buchan Ness to Collieston Coast	15,215	European Offshore Wind Deployment Centre; Seagreen Alpha Offshore Windfarm and Seagreen Bravo Offshore Windfarm	0.9% (132)	0.3% (49)	30%	0.3%	0.16%
Guillemot	Fowlsheugh	33,938	Seagreen Alpha Offshore Windfarm and Seagreen Bravo Offshore Windfarm; Neart na Gaoithe; European Offshore Wind Deployment Centre; Inch Cape Offshore Wind Farm.	3.8% (1291)	0.1% (49)	50%	1.9%	0.07%
	Buchan Ness to Collieston Coast	42,148	Seagreen Alpha Offshore Windfarm and Seagreen Bravo Offshore Windfarm; European Offshore Wind Deployment Centre; Beatrice Offshore Wind Farm; Moray Firth R3 Zone 1 Eastern Development Area (EDA); Neart na Gaoithe; Inch Cape Offshore Wind Farm;	5.1% (2156)	0.1% (49)	50%	2.6%	0.06%
	Troup, Pennan and Lion's Heads	37,041	European Offshore Wind Deployment Centre; Beatrice Offshore Wind Farm; Moray Firth R3 Zone 1 Eastern	2.8% (1,049)	0.1% (49)	50%	1.4%	0.07%

Brid Species	SPA	Foraging Area (km²)	Windfarms within foraging area – in addition to the project.	Overlap between Foraging Area and Wind Farms plus 2km buffer as a % of foraging range (km²)	Overlap between Foraging Area and Kincardine Site plus 2km[1] buffer as a % of foraging range (km²)	Assumed Displacement of Bird Species	Predicted % of Foraging Area Lost from Wind Farms	Predicted % of Foraging Area Lost from Kincardine
			Development Area (EDA); Hywind Buchan Deep Demonstration Site.					
Razorbill	Fowlsheugh	11,743	Seagreen Alpha Offshore Windfarm and Seagreen Bravo Offshore Windfarm; Neart na Gaoithe; European Offshore Wind Deployment Centre; Inch Cape Offshore Wind Farm.	11% (1297)	0.4% (49)	50%	5.5%	0.2%
Puffin	Forth Islands	28,543	European Offshore Wind Deployment Centre; Seagreen Alpha Offshore Windfarm and Seagreen Bravo Offshore Windfarm; Neart na Gaoithe; Blyth Offshore Wind Demonstration Site; Inch Cape Offshore Wind Farm.	4.8% (1377)	0.2% (49)	50%	2.4%	0.09%

Note: gannet and fulmar are considered to be so wide-ranging as to not require further detail on overlap of relatively small impact area versus foraging areas.

1. To allow direct comparison for the in-combination assessment, a 2km buffer has been applied to the Kincardine site. Based on a site that is 3km x 3km, this equates to 7km x 7km, producing a site area with buffer of 49km².

7.5.2. Cumulative Assessment

Table 7-35 Cumulative Assessment

Bird Species	Assessment of Impact	Conclusion (Impact Magnitude)
Kittiwake	Collision risk from seven offshore wind farms in addition to Kincardine are presented in Table 7-33 above. The in-combination impacts through breeding season collision estimates amount to 458 kittiwakes at a 98.9% avoidance rate and using option 3 of the Band model (the only option to allow direct comparison between all wind farms). Kincardine contributes approximately nine adult breeding birds, 1.96% of the total. It is predicted from Table 7-33 above that in-combination displacement from offshore wind farms will result in the effective loss of 3% (0.2% from Kincardine) of the foraging area for Kittiwakes at Fowlsheugh SPA and 0.3% (0.16% from Kincardine) at Buchan Ness to Collieston Coast SPA. This may require birds to travel further to feed, and the breeding success of Kittiwakes may be reduced if they have to travel greater distances. The overall proportion of foraging area predicted to be lost is small compared to the variation in mean maximum foraging distances for this species, which can vary from between 36.7km and a maximum of 120km[13].	Low
Guillemot	The in-combination collision risk from all wind farms to Guillemot is considered negligible, this is largely due to their flight height distributions and maximum flight heights. Guillemot generally have a very low flight height, often flying just a few metres above the water. Due to this, they are very rarely flying at turbine height and therefore have a very low number of predicted collisions. In addition to this, the numbers of individuals at each SPA are high and four out of the six SPAs supporting Guillemot within foraging range of Kincardine are seeing increases in numbers of Guillemot. In some cases quite significant increases (see Table 7-33 above). It is predicted from Table 7-33 above that in-combination displacement from offshore wind farms will result in the effective loss of 1.9% (0.07% from Kincardine) of the foraging area for guillemot at Fowlsheugh SPA, 2.6% (0.06% from Kincardine) at Buchan Ness to Collieston Coast SPA and 1.4% (0.07% from Kincardine) at Troup, Pennan and Lion's Heads SPA. This may require birds to travel further to feed, and the breeding success of guillemots may be reduced if they have to travel greater distances. Guillemot are able to dive to considerable depths and exploit prey throughout the water column. The overall proportion of foraging area predicted to be lost is small compared to the variation in mean maximum foraging distances for this species, which can vary from between 34.1km and a maximum of 135km[22]. (Thaxter *et al*, 2012).	Moderate
Gannet	Collision risk from seven offshore wind farms in addition to Kincardine are presented in Table 7-33 above. The in-combination impacts through breeding season collision estimates amount to 1,442 gannets at a 99% avoidance rate (closest to the 98.9% recommended by the joint SNCB advice) and using option 3 of the Band model (the only option to allow direct comparison between all wind farms). Kincardine contributes approximately 2 adult breeding bird, 0.14% of the total. The foraging range of gannet breeding on the Forth Islands SPA is extensive in comparison to the site footprints of all the offshore wind farms identified for the in-combination assessment (see Table 7-33 and	Low

[13] Thaxter, C.B., Lascelles, B., Sugar, K., Cook, A.S.C.P., Roos, S., Bolton, M., Langston, R.H.W. and Burton, N.H.K. (2012) Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas. Biological Conservation 156: 53-61.

Bird Species	Assessment of Impact	Conclusion (Impact Magnitude)
	Figure 7-5) and the species has a very flexible foraging strategy. In-combination displacement from offshore windfarms is therefore not predicted to negatively affect the gannet population at the Forth Islands SPA.	
Fulmar	The cumulative collision risk to Fulmar from all wind farms considered in-combination with the project is considered to be negligible, few or no bird mortalities predicted through collision risk modelling for all wind farms outlined in Table 7-33 above. Foraging ranges for fulmar are very extensive in comparison to the surface areas of the project and the offshore wind farms identified for the in-combination displacement assessment (*see* Table 7.32 above). In addition, the species has a particularly flexible foraging strategy. Displacement from the project, either alone or in-combination with other offshore windfarms, is therefore not predicted to negatively affect the fulmar population at any of the SPAs.	Negligible
Herring gull	The cumulative collision risk to herring gull from all wind farms considered in-combination with the project is considered to be negligible, few or no bird mortalities predicted through collision risk modelling for all wind farms outlined in Table 7-33. The project would result in a loss of 0.1% of the foraging area for herring gull originating from Fowlsheugh SPA, 0.2% of the foraging area for herring gull originating from Buchan to Collieston Coast SPA and 2% of the foraging area for herring gull originating from Buchan to Collieston Coast SPA. These figures are substantially lower than other windfarms, which contribute to a total loss of 2% of the foraging area for herring gull originating from Fowlsheugh SPA and Buchan to Collieston Coast SPA.	Low/Moderate
Razorbill	The in-combination collision risk from all wind farms to razorbill is considered negligible, this is largely due to their flight height distributions and maximum flight heights. Razorbill generally have a very low flight height, often flying just a few metres above the water. Due to this, they are very rarely flying at turbine height and therefore have a very low number of predicted collisions. In addition to this, the numbers of individuals at Forth Islands SPA have seen significant increases in numbers since designation (a 68% increase, see Table 7-33 above). Fowlsheugh SPA has seen a 9% decrease in the Razorbill population since designation. This could however, be due to individuals joining the colony at Forth Islands SPA. It is predicted from Table 7-33 above that in-combination displacement from offshore wind farms will result in the effective loss of 5.5% (0.2% from the project) of the foraging area for razorbill at Fowlsheugh SPA. This may require birds to travel further to feed, and the breeding success of razorbills may be reduced if they have to travel greater distances. Like Guillemot, Razorbills are able to dive to considerable depths and exploit prey throughout the water column (up to 140m). The overall proportion of foraging area predicted to be lost is small compared to the variation in mean maximum foraging distances for this species, which can vary from between 13.5km and a maximum of 95km (Thaxter *et al*, 2012).	Low/Moderate
Puffin	The in-combination collision risk from all wind farms to Puffin is considered negligible, this is largely due to their flight height distributions and maximum flight heights. Puffin generally have a very low flight height, often flying just a few metres above the water. Due to this, they are very rarely flying at turbine height and therefore have a very low number of predicted collisions. In addition to this, the numbers of individuals at Forth Islands SPA have seen a significant increase in numbers since designation (a 73% increase, see Table 7-33 above).	Low/Moderate

Bird Species	Assessment of Impact	Conclusion (Impact Magnitude)
	It is predicted from Table 7-33 above that in-combination displacement from offshore wind farms will result in the effective loss of 2.4% (0.09% from the project) of the foraging area for Puffin at the Forth Islands SPA. This may require birds to travel further to feed, and the breeding success of Razorbills may be reduced if they have to travel greater distances. Although not as deep as Guillemots and Razorbills, Puffins are still able to dive to considerable depths and exploit prey throughout the water column (up to 70m). The overall proportion of foraging area predicted to be lost is small compared to the variation in mean maximum foraging distances for this species, which can vary from between 59.4km and a maximum of 200km (Thaxter *et al*, 2012).	

7.5.3. Conclusions and Significance of Ornithological Impacts

Table 7-36 Conclusions and Significance of Ornithological Impacts

Bird Species	Assessment of Impact	Impact Significance
Kittiwake	<u>Collision Risk</u> The results of the collision risk modelling (using option 2 – Table 7-18 above) predict a total annual mortality of 34 Kittiwake through collisions with turbine blades, based on NE3 survey area density estimates and 32 based on Kincardine survey area density estimates (NE3 area with 8km buffer). The predicted annual mortality during the breeding season is 28 kittiwake (see Table 7-22 above). From this total figure of 28 birds, an annual mortality of eight birds has been apportioned to Fowlsheugh SPA, three birds to Buchan to Collieston Coast and 1 bird to Troup, Pennan and Lions Heads SPA (see Table 7-23 above). These figures equate to an increase in breeding adult mortality from collisions of 0.044% of Fowlsheugh SPA, 0.013% of Buchan to Collieston Coasts SPA and 0.002% of Troup, Pennan and Lions Heads SPA populations. Outside of SPAs, collision risk modelling predict an annual mortality of four Kittiwake, which accounts for 0.023% of the Kittiwake population from 16 sites within foraging range but outside of SPAs. <u>Displacement</u> With regards to the displacement effects of the project, precautionary assumptions were made for kittiwake of a 30% displacement from the Development area footprint. This footprint assumed that eight turbines would be installed with a 1km buffer. The breeding failure of displaced birds was assumed to be 100%. A total of 66 adult breeding Kittiwake were predicted to be displaced by the scheme (see Table 7-25 above). From these 66 birds, 19 will be displaced from Fowlsheugh SPA (0.1% of the SPA population); eight birds will be displaced from Buchan to Collieston Coast SPA (0.03%); and two birds from Troup, Pennan and Lions Heads SPA (0.006%). Based on the annual breeding success of these SPAs and 100% breeding failure of displaced birds, this would equate to 19 chicks being 'lost' from Fowlsheugh SPA, which would result in a predicted reduction in breeding success at of 0.1% at this SPA; and six chicks being 'lost' from Buchan to Collieston Coast SPA, which would result in a predicted reduction in breeding success at this SPA of 0.03% and two chicks lost from Troup, Pennan and Lions Heads SPA, resulting in a reduction in breeding success of 0.008%. Outside of SPAs, a total of 37 kittiwake from 16 sites outside of SPAs (0.05% of the population) were predicted to be displaced by the	**Minor**

Bird Species	Assessment of Impact	Impact Significance
	scheme (see Table 7-26 above). This would result in an adult mortality of 19 Kittiwake (0.03% of the population). The project would result in a loss of 0.2% of the foraging area for Kittiwake originating from Fowlsheugh SPA and a loss of 0.16% of the foraging area for Kittiwake originating from Buchan to Collieston Coast SPA. These figures are substantially lower than other windfarms, which contribute to a total loss of 3% of the foraging area for Kittiwake originating from Fowlsheugh SPA and 0.3% of the foraging area for kittiwake originating from Buchan to Collieston Coast SPA (see Table 7-26 above). <u>Disturbance</u> Disturbance resulting from the construction or operation of the scheme will be temporary and localised and is not predicted to negatively affect the population viability of kittiwakes. <u>Conclusion</u> Overall the potential impact of the project on kittiwake from Fowlsheugh, Buchan to Collieston Coast and Troup, Pennan and Lions Heads SPAs are considered to be Minor, given the scale and magnitude of the proposal.	
Gannet	<u>Collision Risk</u> The results of the collision risk modelling (using option 2 – see Table 7-18 above) predict a total annual mortality of six Gannet through collisions with turbine blades, based on NE3 survey area density estimates and five based on Kincardine survey area density estimates (NE3 area with 8km buffer). The predicted annual mortality during the breeding season is six Gannet (see Table 7-22 above). From this total figure of six birds, an annual mortality of two birds has been apportioned to Forth Islands SPA and no birds have been apportioned to either Fair Isle or Flamborough Head and Bempton Cliffs SPAs (see Table 7-23 above). This figure equates to an increase in breeding adult mortality from collisions of 0.002% of Forth Islands SPA population. Outside of SPAs no guillemot will be lost through collision impacts. <u>Displacement</u> With regards to the displacement effects of the project, precautionary assumptions were made for gannet of a 75% displacement from the Development area footprint. This footprint assumed that eight turbines would be installed with a 1km buffer. The breeding failure of displaced birds was assumed to be 100%. A total of 10 adult breeding gannet (0.006% of the SPA population) were predicted to be displaced by the scheme from Forth Islands SPA (see Table 7-25 above). Based on the annual breeding success of this SPA and 100% breeding failure of displaced birds, this would equate to eight chicks being ‘lost’, which would result in a predicted reduction in breeding success at this SPA of 0.007%. Outside of SPAs, a total of 15 gannet from 49 sites outside of SPAs (0.004% of the population) were predicted to be displaced by the scheme (see Table 7-26). This would result in an adult mortality of eight gannet (0.002% of the population). Foraging ranges for gannet are very extensive in comparison to the surface area of the project and the offshore wind farms identified for the in-combination displacement assessment (see Table 7-33). In addition, the species has a particularly flexible foraging strategy. Displacement from the project, either alone or in-combination with other offshore windfarms, is therefore not predicted to negatively affect the gannet population at any of the SPAs. <u>Disturbance</u>	**Minor**

Bird Species	Assessment of Impact	Impact Significance
	Disturbance resulting from the construction or operation of the scheme will be temporary and localised and is not predicted to negatively affect the population viability of gannet, either alone or in-combination with other plans or projects. Conclusion Overall the potential impact of the project on gannet from Forth Islands, Fair Isle and Flamborough Head and Bempton Cliffs SPAs are considered to be Minor, given the scale and magnitude of the proposal.	
Guillemot	Collision Risk The results of the collision risk modelling (see Table 7-18 above) predict that no Guillemot will be lost through collisions with turbine blades, based on NE3 and Kincardine (NE3 area with 8km buffer) survey area density estimates. Outside of SPAs no guillemot will be lost through collision impacts. Displacement With regards to the displacement effects of the project, precautionary assumptions were made for guillemot of a 50% displacement from the Development area footprint. This footprint assumed that eight turbines would be installed with a 1km buffer. The breeding failure of displaced birds was assumed to be 100%. A total of 130 adult breeding guillemot (0.28% of the SPA population) were predicted to be displaced by the scheme from Fowlsheugh SPA, 16 guillemot (0.08% of the SPA population) were predicted to be displaced from Buchan to Collieston Coast SPA and three birds (0.02% of the SPA population) displaced from Troup, Pennan and Lions Heads SPA (see Table 7-26 above). Based on the annual breeding success of these SPAs and 100% breeding failure of displaced birds, this would equate to 86 chicks being 'lost' from Fowlsheugh SPA, which would result in a predicted reduction in breeding success at this SPA of 0.29%; 11 chicks being 'lost' from Buchan to Collieston Coast SPA, which would result in a predicted reduction in breeding success at this SPA of 0.09%; and two chicks being lost from Troup, Pennan and Lions Heads SPA, which would result in a predicted reduction in breeding success at this SPA of 0.019%. Outside of SPAs, a total of nine guillemot from 12 sites outside of SPAs (0.009% of the population) were predicted to be displaced by the scheme (see Table 7-26 above). This would result in an adult mortality of five guillemot (0.005% of the population). The project would result in a loss of 0.07% of the foraging area for Guillemot originating from Fowlsheugh SPA, 0.06% of the foraging area for Guillemot originating from Buchan to Collieston Coast SPA and 0.07% from Troup, Pennan and Lions Heads SPA. These figures are substantially lower than other windfarms, which contribute to a total loss of 1.9% of the foraging area for Guillemot originating from Fowlsheugh SPA, 2.6% from Buchan to Collieston Coast SPA and 1.45% from Troup, Pennan and Lions Heads SPA (see Table 7-33). It could be the case however that the floating sub-structures (in similarity to jacket-type fixed offshore WTG installations), mooring anchor weights and lines act to encourage birds to use the area, rather than displacing them. This could particularly be the case for diving bird species, as the floating sub-structure, mooring anchor weighs and lines could act as artificial reefs and fish aggregation devices, increasing prey species in the immediate area of the turbines and the design of the triangular sub-	**Minor**

Bird Species	Assessment of Impact	Impact Significance
	structures is such that they would provide suitable resting and perching areas for birds. The triangular shape of the structures would also create a central area of open water that could help to provide shelter and protection to bird species during adverse weather and sea conditions. Disturbance Disturbance resulting from the construction or operation of the scheme will be temporary and localised and is not predicted to negatively affect the population viability of guillemots, either alone or in-combination with other plans or projects. Conclusion Overall the potential impact of the project on Guillemot from Fowlsheugh, Buchan to Collieston Coast and Troup, Pennan and Lions Heads SPAs are considered to be Minor, given the scale and magnitude of the proposal.	
Fulmar	Collision Risk The results of the collision risk modelling (using option 3 – see Table 7-18 above) predict no fulmar will be impacted from collision risk and as a result there will be no predicted increases to Fulmar mortality rates. Displacement Foraging ranges for fulmar are very extensive in comparison to the surface area of the project and the offshore wind farms identified for the in-combination displacement assessment (see Table 7-33 above). In addition, the species has a particularly flexible foraging strategy. Displacement from the project, either alone or in-combination with other offshore windfarms, is therefore not predicted to negatively affect the Fulmar population at any of the SPAs. Disturbance Disturbance resulting from the construction or operation of the scheme will be temporary and localised and is not predicted to negatively affect the population viability of Fulmar, either alone or in-combination with other plans or projects. Conclusion Overall the potential impact of the project on fulmar is considered to be Minor, given the scale and magnitude of the proposal.	**Minor**
Herring gull	Collision Risk The results of the collision risk modelling (using option 3 – see Table 7-18 above) predict a total annual mortality of one Herring gull through collisions with turbine blades. The project would result in a loss of 0.1% of the foraging area for Herring gull originating from Fowlsheugh SPA, 0.2% of the foraging area for Herring gull originating from Buchan to Collieston Coast SPA and 2% of the foraging area for Herring gull originating from Buchan to Collieston Coast SPA. These figures are substantially lower than other windfarms, which contribute to a total loss of 2% of the foraging area for Herring gull originating from Fowlsheugh SPA and Buchan to Collieston Coast SPA. No displaced Herring gull were apportioned to Troup, Pennan and Lions Heads SPA due to the distance of the SPA from the development site. Displacement Herring Gulls are omnivorous and may feed onshore and offshore. Because they forage in a variety of terrestrial, coastal and offshore habitats, including taking discards from fishing vessels, any displacement impacts are not considered likely to cause negative impacts on herring gull populations at any of the SPAs. Disturbance	**Minor**

Bird Species	Assessment of Impact	Impact Significance
	Disturbance resulting from the construction or operation of the scheme will be temporary and localised and is not predicted to negatively affect the population viability of herring gull, either alone or in-combination with other plans or projects. <u>Conclusion</u> Overall the potential impact of the project on Herring gull from Fowlsheugh, Buchan to Collieston Coast and Troup, Pennan and Lions Heads SPAs are considered to be Minor, given the scale and magnitude of the proposal.	
Razorbill	<u>Collision Risk</u> The results of the collision risk modelling (See Table 7-18 above) predict that no Razorbill will be impacted through collisions with turbine blades. <u>Displacement</u> With regards to the displacement effects of the project, precautionary assumptions were made for razorbill of a 50% displacement from the Development area footprint. This footprint assumed that eight turbines would be installed with a 1km buffer. The breeding failure of displaced birds was assumed to be 100%. A total of eight adult breeding Razorbill (0.15% of the SPA population) were predicted to be displaced by the scheme from Fowlsheugh SPA (see Table 7-26 above). Based on the annual breeding success of this SPA and 100% breeding failure of displaced birds, this would equate to five chicks being 'lost', which would result in a predicted reduction in breeding success at this SPA of 0.16%. The project would result in a loss of 0.2% of the foraging area for Razorbill originating from Fowlsheugh SPA. This figure is substantially lower than other windfarms, which contribute to a total loss of 5.5% of the foraging area for razorbill originating from Fowlsheugh SPA (see Table 7-26 above). It could be the case however that the floating sub-structures (in similarity to jacket-type fixed offshore WTG installations), mooring anchor weights and lines act to encourage birds to use the area, rather than displacing them. This could particularly be the case for diving bird species, as the floating sub-structure, mooring anchor weighs and lines could act as artificial reefs and fish aggregation devices, increasing prey species in the immediate area of the turbines and the design of the triangular sub-structures is such that they would provide suitable resting and perching areas for birds. The triangular shape of the structures would also create a central area of open water that could help to provide shelter and protection to bird species during adverse weather and sea conditions. <u>Disturbance</u> Disturbance resulting from the construction or operation of the scheme will be temporary and localised and is not predicted to negatively affect the population viability of razorbill, either alone or in-combination with other plans or projects. <u>Conclusion</u> Overall the potential impact of the project on Razorbill is considered to be Minor, given the scale and magnitude of the proposal.	**Minor**
Puffin	<u>Collision Risk</u> The results of the collision risk modelling (using option 3 – see Table 7-18 above) predict that no puffin will be impacted through collisions with turbine blades. <u>Displacement</u> With regards to the displacement effects of the project, precautionary assumptions were made for puffin of a 50% displacement from the	**Minor**

Bird Species	Assessment of Impact	Impact Significance
	Development area footprint. This footprint assumed that eight turbines would be installed with a 1km buffer. The breeding failure of displaced birds was assumed to be 100%. A total of five adult breeding Puffin (0.005% of the SPA population) were predicted to be displaced by the scheme from Forth Islands SPA (see Table 7-26 above). Based on the annual breeding success of this SPA and 100% breeding failure of displaced birds, this would equate to three chicks being 'lost', which would result in a predicted reduction in breeding success at this SPA of 0.004%. The project would result in a loss of 0.09% of the foraging area for Puffin originating from Forth Islands SPA. This figure is substantially lower than other windfarms, which contribute to a total loss of 2.4% of the foraging area for Puffin originating from Forth Islands SPA (see Table 7-34 above). Disturbance Disturbance resulting from the construction or operation of the scheme will be temporary and localised and is not predicted to negatively affect the population viability of puffin, either alone or in-combination with other plans or projects. Conclusion Overall the potential impact of the project on Puffin is considered to be Minor, given the scale and magnitude of the proposal.	

Summary Table

Table 7-37 Overall Impact Significance of Kincardine Wind Farm

Species	Activity	Risk	Impact Magnitude	Impact Significance
Kittiwake	Vessel Disturbance	Temporary disturbance and / or displacement	Negligible	Minor
		Accidental Release of Contaminants	Negligible/Low	
		Disturbance to prey species (indirect impact)	Negligible	
	WTG Operation	Collision Risk	Negligible	
	Presence of WTGs, Substructures, mooring lines and inter-array cables.	Disturbance and / or displacement	Negligible/Low	
		Entanglement	Negligible	
		Contamination	Negligible	
		Habitat loss / disturbance to prey species (indirect impact)	Negligible	
Guillemot	Vessel Disturbance	Temporary disturbance and / or displacement	Negligible	Minor
		Accidental Release of Contaminants	Negligible/Low	
		Disturbance to prey species (indirect impact)	Negligible	
	WTG Operation	Collision Risk	Negligible	
	Presence of WTGs, Substructures, mooring lines and inter-array cables.	Disturbance and / or displacement	Negligible	
		Entanglement	Negligible/Low	
		Contamination	Negligible	
		Habitat loss / disturbance to prey species (indirect impact)	Negligible	
Fulmar	Vessel Disturbance	Temporary disturbance and / or displacement	Negligible	Minor
		Accidental Release of Contaminants	Negligible/Low	
		Disturbance to prey species (indirect impact)	Negligible	
	WTG Operation	Collision Risk	Negligible	
	Presence of WTGs, Substructures, mooring lines and inter-array cables.	Disturbance and / or displacement	Negligible	
		Entanglement	Negligible	
		Contamination	Negligible	

Species	Activity	Risk	Impact Magnitude	Impact Significance
		Habitat loss / disturbance to prey species (indirect impact)	Negligible	
Herring gull	Vessel Disturbance	Temporary disturbance and / or displacement	Negligible	Minor
		Accidental Release of Contaminants	Negligible/Low	
		Disturbance to prey species (indirect impact)	Negligible	
	WTG Operation	Collision Risk	Negligible	
	Presence of WTGs, Substructures, mooring lines and inter-array cables.	Disturbance and / or displacement	Negligible	
		Entanglement	Negligible	
		Contamination	Negligible	
		Habitat loss / disturbance to prey species (indirect impact)	Negligible	
Razorbill	Vessel Disturbance	Temporary disturbance and / or displacement	Negligible	Minor
		Accidental Release of Contaminants	Negligible/Low	
		Disturbance to prey species (indirect impact)	Negligible	
	WTG Operation	Collision Risk	Negligible	
	Presence of WTGs, Substructures, mooring lines and inter-array cables.	Disturbance and / or displacement	Negligible/Low	
		Entanglement	Negligible/Low	
		Contamination	Negligible	
		Habitat loss / disturbance to prey species (indirect impact)	Negligible	
Puffin	Vessel Disturbance	Temporary disturbance and / or displacement	Negligible	Minor
		Accidental Release of Contaminants	Negligible/Low	
		Disturbance to prey species (indirect impact)	Negligible	
	WTG Operation	Collision Risk	Negligible	
	Presence of WTGs, Substructures, mooring lines and inter-array cables.	Disturbance and / or displacement	Negligible	
		Entanglement	Negligible/Low	
		Contamination	Negligible	
		Habitat loss / disturbance to prey species (indirect impact)	Negligible	

Species	Activity	Risk	Impact Magnitude	Impact Significance
Gannet	Vessel Disturbance	Temporary disturbance and / or displacement	Negligible	Minor
		Accidental Release of Contaminants	Negligible/Low	
		Disturbance to prey species (indirect impact)	Negligible	
	WTG Operation	Collision Risk	Negligible	
	Presence of WTGs, Substructures, mooring lines and inter-array cables.	Disturbance and / or displacement	Negligible	
		Entanglement	Negligible/Low	
		Contamination	Negligible	
		Habitat loss / disturbance to prey species (indirect impact)	Negligible	

Table 7-38 Cumulative Impact Significance

Species	Impact Magnitude	Impact Significance
Kittiwake	Moderate	Moderate
Guillemot	Moderate	Moderate
Fulmar	Negligible	Minor
Herring gull	Low/Moderate	Minor
Razorbill	Low/Moderate	Minor
Puffin	Low/Moderate	Minor
Gannet	Moderate	Moderate

7.6. Mitigation

173. The assessment of the ornithology has assessed the worst case scenario impacts of the Project in isolation and cumulatively. This has concluded that any potential impacts to birds within foraging range of the development site from project related activities will be of no more than minor impact to the Valued Ornithological Receptors (VORs).

174. From the results of this impact assessment, it has been concluded that the Embedded Mitigation detailed are appropriate to reduce any potential impacts relating to birds to an acceptable level and as such no additional mitigation measures are proposed for the Project.

7.7. Monitoring

175. A monitoring plan will be developed and agreed with the regulatory bodies after consent has been granted, and will be detailed in a Project Environmental Management Plan. Monitoring is required in order to demonstrate the environmental performance of the project.

176. While it is noted above that this scheme will only have no more than minor impacts to VORs, it is recognised that this scheme fits within the Scottish Governments “Survey, Deploy and Monitor” licensing policy for floating wind, wave and tidal projects[14].

177. With this in mind there has been a lot of consultation with Marine Scotland, Scottish Natural Heritage and the RSPB about opportunities to use the project wind turbines and floating sub-structures as platforms for monitoring of seabird populations and their interaction with the wind turbines.

178. The Project offers a unique platform for seabird monitoring due to the triangular shape of the floating sub-structure that not only provides a large surface area for monitoring to take place, but it also provides sufficient space to allow a good viewpoint looking back onto the whole turbine. This would allow very accurate monitoring of bird strike occurrences, that is currently not available from traditional fixed WTG platforms. The size of the substructure provides many opportunities for different seabird monitoring techniques to be undertaken, including mounting a bird radar system that can remotely monitor birds passing through the turbine blades, or monitoring in person by ornithologists from the platform itself.

[14] http://www.scotland.gov.uk/Topics/marine/Licensing/marine/Applications/SDM

7.8. Summary and Residual Impacts

Table 7-39 Summary of Effects and Mitigation

Pathway	Valued Ornithological Receptors (VORs)	Impact Significance	Mitigation	Residual Impact Significance
Construction and Decommissioning				
Temporary disturbance and / or displacement	Kittiwake Guillemot Fulmar Herring gull Razorbill Puffin Gannet	Minor Significance	Embedded Mitigation with no Additional Mitigation	Minor Significance
Accidental Release of Contaminants	Kittiwake Guillemot Fulmar Herring gull Razorbill Puffin Gannet	Minor Significance	Embedded Mitigation with no Additional Mitigation	Minor Significance
Disturbance to prey species (indirect impact)	Kittiwake Guillemot Fulmar Herring gull Razorbill Puffin Gannet	Minor Significance	Embedded Mitigation with no Additional Mitigation	Minor Significance
Operation				
Collision Risk	Kittiwake Guillemot Fulmar Herring gull	Minor Significance	Embedded Mitigation with no Additional Mitigation	Minor Significance

Pathway	Valued Ornithological Receptors (VORs)	Impact Significance	Mitigation	Residual Impact Significance
	Razorbill Puffin Gannet			
Disturbance and / or displacement	Kittiwake Guillemot Fulmar Herring gull Razorbill Puffin Gannet	Minor Significance	Embedded Mitigation with no Additional Mitigation	Minor Significance
Entanglement	Kittiwake Guillemot Fulmar Herring gull Razorbill Puffin Gannet	Minor Significance	Embedded Mitigation with no Additional Mitigation	Minor Significance
Contamination	Kittiwake Guillemot Fulmar Herring gull Razorbill Puffin Gannet	Minor Significance	Embedded Mitigation with no Additional Mitigation	Minor Significance
Habitat loss / disturbance to prey species (indirect impact)	Kittiwake Guillemot Fulmar Herring gull Razorbill Puffin Gannet	Minor Significance	Embedded Mitigation with no Additional Mitigation	Minor Significance

7.9. References

Alerstam T., Rosén M., Bäckman J., Ericson P.G.P., Hellgren O. (2007). Flight speeds among bird species: allometric and phylogenetic effects. PLoS Biol, 5, 1656-1662. DOI:10.1371/journal.pbio.0050197

Benjamins, S., Harnois, V., Smith, H.C.M., Johanning, L., Greenhill, L., Carter, C. and Wilson, B. (2014). Understanding the potential for marine megafauna entanglement risk from renewable marine energy developments. Scottish Natural Heritage Commissioned Report No. 791.

Bonar, P.A.J., Bryden, I.G. and Borthwick, A.G.L. (2015). Social and ecological impacts of marine energy development. Renewable and Sustainable Energy Reviews, Volume 47, Pages 486-495.

BTO (2012). Tracking Lesser Black-backed Gulls. Available at: http://www.bto.org/science/migration/tracking-studies/tracking-lesser-black-backed-gulls

BTO research report No. 656 to Marine Scotland Science. 2014. Joint Response from the Statutory Nature Conservation Bodies to the Marine Scotland Science Avoidance Rate Review, Cook, A.S.C.P., Humphries, E.M., Masden, E.A., and Burton, N.H.K. 2014. The avoidance rates of collision between birds and offshore turbines.

CEH (2012). [Online]. Available at: http://www.ceh.ac.uk/sci_programmes/IsleofMayLong-TermStudy.html.

Cook, A.S.C.P, Wright, L. J, Burton, N. H. K. A review of flight heights and avoidance rates of birds in relation to offshore windfarms. BTO on behalf of the Crown Estate (2012). SOSS Website http://www.bto.org/science/wetland-and-marine/soss/projects, see SOSS 02.

Cook, A.S.C.P., Humphries, E.M., Masden, E.A., and Burton, N.H.K. (2014). The avoidance rates of collision between birds and offshore turbines. BTO research Report No 656 to Marine Scotland Science.

Daunt, F., Wanless, S., Greenstreet, S. P. R., Jensen, H., Hamer, K. C. and Harris, M. P. (2008). The impact of the sandeel fishery closure on seabird food consumption, distribution, and productivity in the northwestern North Sea. Canadian Journal of Fisheries and Aquatic Sciences. 65: 362-381.

Dean, B.J., Webb, A., McSorley, C.A., Schofield, R.A. & Reid, J.B. (2004) Surveillance of wintering seaducks, divers and grebes in UK inshore areas: Aerial surveys and shore-based counts 2003/04. JNCC Report No. 357

Garthe, S. and Hüppop, O. (2004). Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index. J. Appl. Ecol. 41: 724-734 - http://onlinelibrary.wiley.com/doi/10.1111/j.0021-8901.2004.00918.x/epdf

Johnston, A, Cook, A.S.C.P, Wright, L, Humphreys, E. M, and Burton, N. H. K. (2014). Modelling flight heights of marine birds to more accurately assess collision risk with offshore wind turbines, Journal of Applied Ecology, Volume 51, Issue 1, pages 31–41, February 2014, DOI: 10.1111/1365-2664.12191

Lewis, M., Wilson, L.J., Söhle, I., Dean, B.J., Webb, A. and Reid, J.B. (2008). Wintering sea ducks, divers and grebes in UK inshore areas: Aerial surveys and shore-based counts 2006/07. JNCC Report, No. 41448 http://www.thecrownestate.co.uk/round3-announcements - Aerial bird surveys

Scottish Marine and Freshwater Science, Vol 5, No 10. 2014. Strategic assessment of collision risk of Scottish offshore wind farms on migrating birds. Marine Scotland. http://www.bto.org/science/wetland-and-marine/soss/projects

Scottish Marine and Freshwater Science, Vol 5, No 13. 2015. Population consequences of displacement from proposed offshore wind energy developments for seabirds breeding at Scottish SPAs. Final report for Marine Scotland Science Ref CR/2012/03

SOSS 02 - http://www.bto.org/sites/default/files/u28/downloads/Projects/Final_Report_SOSS02_BTOReview.pdf

Stone, C.J., Webb, A., and Tasker, M.L. (1995) The distribution of auks and Procellariformes in north-west European waters in relation to depth of sea. Bird Study, 42:50-56.

Thaxter, C.B., Lascelles, B., Sugar, K., Cook, A.S.C.P., Roos, S., Bolton, M., Langston, R.H.W. and Burton, N.H.K. (2012) Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas. Biological Conservation 156: 53-61.

Wanless, S., Murray, S. and Harris, M. P. (2005). The status of northern gannet in Britain and Ireland in 2003-2004. British Birds. 98: 280-294.

Wilhelmsson, D., Malm, T., Thompson, R., Tchou, J., Sarantakos, G., McCormick, N., Luitjens, S., Gullström, M., Patterson Edwards, J.K., Amir, O. and Dubi, A. (2010). Greening Blue Energy: Identifying and Managing the Biodiversity Risks and Opportunities of Offshore Renewable Energy. IUCN.

8. Underwater Marine Noise

8.1. Introduction

1. Underwater noise has the potential to result in adverse impacts on marine mammals and fish species. At one extreme the loudest noise can generate a substantial pressure that is sufficient to injure or kill an animal. Noise at a lower level can have less extreme effects such as damage to an animal's auditory sense. At the other end of the scale a quieter noise will not cause any harm to an animal but may trigger a behavioural response, which, at sufficient volume, will cause the animal to flee the area to escape the high noise levels.

2. This chapter presents information that has been used to inform the assessment of impacts on underwater noise on fish (in Chapter 5) and marine mammals (in chapter 6).

3. This chapter initially describes the stakeholder engagement and key comments from the EIA scoping opinion that forms the basis of this information. The chapter then focuses on defining the baseline environmental of the site and the perception of noise by a range of marine species.

4. Following the identification of the possible noise sources associated with the development, noise modelling results have been reviewed for different elements of the Project on a range of relevant fish and marine mammal species.

5. The key limitation of the assessment of noise impacts is that due to the demonstrator nature of the floating offshore systems, there is currently no information on the operational noise levels produced from the floating substructure. Monitoring will be carried out during the operation of the windfarm to ascertain the operational noise range of the structures. This is covered under the Survey, Deploy and Monitor policy that floating offshore wind technology can utilise at this stage of the development phase.

8.1.1. Stakeholder Consultation

6. Consultation was undertaken during the production and following the submission of the Scoping Report (KOWL, 2014), with Marine Scotland providing formal feedback in the Environmental Scoping Opinion Report (Marine Scotland, 2014), which included feedback from statutory and non-statutory consultees that responded to the Scoping Report.

7. The information in the Scoping Opinion Report and the comments received from consultation have been used to inform the contents of this chapter (Table 8-1).

Table 8-1 Scoping Opinion comments and response for Noise

Consultees	Scoping Response	KOWL Response
Marine Scotland Science	If impact piling is required a full noise assessment would be required.	No piling is to be undertaken as part of the Project installation approach and therefore a full noise assessment is not required for this development. 90% of construction activity will take place in port, with only limited noise impacts on site associated with the cable laying and installation of anchors.
Marine Scotland Science	HRA - the site is NOT close to any SAC for seals and unlikely to impact on the Moray Firth SAC as long as no noisy construction activities are undertaken.	A noise assessment will not be required to review the impacts on the Moray Firth SAC as part of the HRA process.

Consultees	Scoping Response	KOWL Response
Marine Scotland Science	Sub bottom profiling likely to be considered to pose a risk of disturbance so MSS would require an EPS licence for this activity.	An EPS licence will be obtained prior to the undertaking of sub-bottom profiling and offshore investigations. This work has not currently been undertaken and therefore will be applied for following submission of the ES.
Scottish Natural Heritage	With regard to potential impacts from noise on diadromous fish species, we welcome that piling will not be used. Evaluation of potential noise impacts on fish should include consideration of the migratory behaviour of diadromous fish species (we recognise that there are limited data available on the marine behaviour of these species and their vulnerability to potential impacts from noise, EMF and sedimentation).	Limited data is currently available for noise assessments on diadromous fish. The noise impact anticipated from the construction and O&M approach for the Project is considered to be minimal in the context of the assumed current background noise generated from the transit of vessels in the area. Noise generation from the WTGs and foundations will be measured during the initial installation as per survey, deploy and monitor programme.
Scottish Natural Heritage	Agree with this assessment. Noise from the construction and operation of this development is unlikely to be a significant issue. However, we would need information on the geophysical surveys planned for both the survey area and the cable route, as this could result in acoustic disturbance.	An EPS licence will be obtained prior to the undertaking of sub-bottom profiling. The geophysical surveys are planned for the detailed design stage of the project, and therefore the EPS licence will be applied for following submission of the ES.

8.1.2. Design Envelope

8. The design envelope for the Project is discussed in Chapters 1 and 2. The information presented in this chapter utilises the worst case scenario for this design envelope for the Development Area (location of the WTGs) and the Offshore Export Cable Corridor from the development area to the onshore directional drill location.

9. The Project activities that have been identified as having a possible impact on underwater noise are:

10. Construction and Decommissioning:

- Installation/removal of interarray cables;
- Installation of possible cable protection (rock dumping);
- Installation/removal of anchor system (anchor handling vessels);
- Installation of WTGs (towing vessels);
- Installation of export cable; and
- Export Cable Route surveying.

11. Operational

- Operation and Maintenance vessels (small);
- Cable repair (if required); and
- WTG operating noise.

8.2. Baseline Environment

8.2.1. Background Noise Levels

12. The Project is located within an area of the North Sea that has recently been the subject of several noise baseline surveys/studies. There is consequently a substantial amount of existing baseline data available for the surrounding area, which can be used to gain a direct understanding of the marine noise environment around the site. A review has been undertaken of the relevant data contained within the Environmental Impact Assessments completed in support of the following windfarm developments:

- Hywind Floating Offshore (Hywind 2015);
- Inch Cape Offshore Windfarm (Inch Cape 2013a &b);
- Seagreen Offshore Windfarm (Seagreen 2012); and
- Firth of Forth and Tay Offshore Developers Group.

13. There is no data available specifically for the development area and therefore the data gathered for the projects noted above have been used to provide the baseline data on background levels of underwater noise.

14. The data gathered from these assessments has produced a large database of underwater noise measurements from offshore construction projects in UK territorial waters. These have been obtained over a wide range of sea states, geographical locations and a broad frequency range from one Hertz (Hz) to 120kHz and having a dynamic range in excess of 70 dB re.1μPa^{2}·Hz^{-1}. All of the baseline values in these assessments used data with the absences of precipitation (rainfall), and with no other noticeable sources of underwater noise (such as the presence of shipping), and at sea states between 1 and 3 with a hydrophone (an underwater sound recording device) at the half water depth (typically 10 to 15m).

15. Baseline noise arises from multiple sources, both natural and anthropogenic. These sources include:

- Shipping (significant for the port of Aberdeen, Montrose and Peterhead);
- Industrial Activities;
- Fishing activity;
- Metocean conditions (wind and wave);
- Rain; and
- Biological noise.

16. Background noise levels tend to increase as the sea state rises and becomes rougher. This is demonstrated below (Table 8-2 and Table 8-3) in the comparison of noise between sea state 1 and 3 (Inchcape, 2013a). However, any given sound will be perceived differently by different species since they have differing hearing abilities. Tables 8-2 and 8-3 suggest that unlike fish, marine mammals perceive the noise environment of the sea state 3 as slightly quieter than sea state 1 (Inchcape, 2013a). This is a consequence of variation in frequencies that are audible to marine mammals (higher frequency component) as opposed to fish species (lower frequency component) (Inch Cape 2013a). The fish species within Table 8-2 and Table 8-3 have been selected as representative of the fish species found within the Project site (Chapter 5). The marine mammals within Table 8-2 and Table 8-3 have been used to represent the marine mammals assessed in Chapter 6.

Table 8-2 Background noise levels (sea state 1)

	Unweighted dB re. 1μPa	Cod dBht(Gadus morhua)	Dab dBht(Limanda limanda)	Herring dBht(Clupea harengus)	Salmon dBht(Salmo salar)	Bottlenose Dolphin dBht(Tursiops)	Harbour Porpoise dBht(Phocoen phocoena)	Harbour Seal dBht(Phoca vitulina)
Overall Average Background Noise Levels – sea state 1 (dB)								
Max	126	39	26	42	17	66	74	43
Min	92	1	0	9	0	36	44	21
Mean	111	23	10	28	5	44	54	31

Table 8-3 Background noise levels (sea state 3)

	Unweighted dB re. 1μPa	Cod dBht(Gadus morhua)	Dab dBht(Limanda limanda)	Herring dBht(Clupea harengus)	Salmon dBht(Salmo salar)	Bottlenose Dolphin dBht(Tursiops)	Harbour Porpoise dBht(Phocoen phocoena)	Harbour Seal dBht(Phoca vitulina)
Overall Average Background Noise Levels – sea state 3 (dB)								
Max	132	42	31	47	19	50	60	38
Min	94	3	0	11	0	30	42	7
Mean	112	22	11	28	5	41	52	27

17. Table 8-2 and Table 8-3 show that as the maximum unweighted noise values increase from sea state 1 to 3, there is a corresponding increase in the perceived background noise values from all of the fish species. However, marine mammals show a converse impact as their perceived background noise levels decrease due to their reliance on a variation of frequencies unlike fish.

18. This background data is considered to be generic to UK 12nm terrestrial waters, as this data output is combined from a range of locations and water depths around the UK coastline. Therefore, due to the location of the Project within the 12nm limit and the generic nature of this data, it can be used to provide a baseline for the Project and be used to inform the assessment of impacts on fish (Chapter 5) and marine mammals (Chapter 6).

8.2.2. Underwater Noise and Marine Species

19. The impact of sound on underwater life can have a variety of effects depending on the level of the noise. At one extreme the loudest noise can generate a substantial pressure that is sufficient to injure or kill an animal in the same way as an explosion. Noise at a lower level can have less extreme effects: damage to an animal's auditory sense will occur before any physical injury occurs. At the other end of the scale a quieter noise will not cause any harm to an animal but may trigger a behavioural response, which, at sufficient volume, will cause the animal to flee the area to escape the high noise levels. The term "flee" is a term used synonymously with "move away" and the actual modelled speed of movement is stated separately.

20. Over the past 20 years it has become increasingly evident that noise from human activities in and around underwater environments may have an impact on the marine species in the area. The

extent to which intense underwater sound might cause an adverse environmental impact on a particular species is dependent upon the level of the incident sound, its frequency content, its duration and/or its repetition rate.

21. The sound pressures required for physical injury or mortality are universal across species. However, other effects, for example the noise level required to elicit a behavioural response, are species dependent. The information presented on noise impact ranges in this Chapter has been used to inform the assessment of impacts of underwater noise on fish and marine mammals (see Chapter 5 and Chapter 6).

22. It is recognised that there are four main types of potential effect:

- Fatal effects caused by significant levels of noise in close proximity to the receptor;
- Hearing impairment, which might either be permanent, (and referred to as a Permanent Threshold Shift (PTS)) or temporary, (Temporary Threshold Shift (TTS)). These can impact on the ability of the marine mammal to communicate, forage or avoid predators;
- Behavioural effects such as avoidance, displacement from suitable feeding or breeding areas, changes in travelling routes; and
- Secondary impacts caused by the direct effects of noise on potential prey causing an overall loss of available prey.

8.2.3. Fatal Effects

23. The source peak pressure (normally associated with piling activities) can cause a lethal impact on the species. Damage to soft tissues occurs at 220dB re.1uPa (Palvin et al., 2007).

8.2.4. Hearing Damage

24. Underwater sound has the potential to cause hearing damage in marine mammals. This can either be a Permanent Threshold Shift, in which case there is no recovery in hearing over time or Temporary Threshold Shift, when the hearing will return to its former capability often within hours or a few days (Southall *et al.,* 2007). The potential for either of these conditions to occur is dependent on the hearing bandwidth of the animal, duty cycle and duration of the exposure (Southall *et al.,* 2007, OSPAR, 2009).

25. Sound exposure levels (SEL) is a measure of the energy of sound that can be useful when assessing potential physiological impacts, in particular from activities that may cause a period of prolonged noise exposure and cumulatively with other sound sources, e.g., ongoing piling activities. Sound exposure levels (SEL) with the potential to cause PTS or TTS for cetaceans and pinnipeds based on the Southall *et al.,* (2007) criteria.

8.2.5. Behavioural Change

26. Potential changes in behaviour may occur depending on the sound source levels and the species' and individuals' sensitivities. Behavioural changes can vary and can include changes in swimming direction, diving duration, avoidance of an area and reduced communication. Masking effects may also cause changes in behaviour as the level of sound may impair the detection of echolocation clicks and other sounds that species use to communicate or detect prey which may cause them to alter their behaviour.

8.2.6. Secondary Effects

27. This is the impact that a noise source could have on potential prey species, that results in a change in behaviour of the prey species and has a knock on effect to the predator. Fish belonging to the family Gadidae, e.g., whiting, saithe, cod and haddock are thought to be moderately sensitive to noise (Nedwell *et al*., 2007).

28. Construction surveys from existing windfarms have indicated that fish numbers present within operating windfarms are at least similar to those prior to construction and may be higher (e.g. Jensen *et al*., 2006; Leonhard and Pederson, 2006; Lindeboom *et al*., 2011, Leonhard *et al.,* 2011). Consequently no long-term impacts on fish on which marine mammals prey are predicted following cessation of construction activities.

8.2.7. Species Reactions to Noise

29. The way in which a species reacts to underwater noise relates to the way in which it hears. This can be attributed to variation in the anatomy and physiology of the ears and associated structures. In fish, variation in these parameters is extensive, indicating that different species detect sound in different ways (Popper and Fay (1993), and there is considerable variation in the hearing abilities both in terms of the minimum levels of sound perceptible and the frequency range over which they can hear (e.g. Hawkins (1981); Lovell *et al* (2005); Popper *et al* (2004); Hastings and Popper (2005); Thomsen *et al* (2006) and Madsen *et al* (2006)).

30. In general, fish such as the Herring (*Clupea harengus*), that are considered hearing specialists, are able to perceive sounds in the frequency range 30 Hz to 4 kHz, though at the higher frequencies sensitivity is very low. In comparison, the less sensitive group, termed hearing generalists are only able to perceive sounds between 30 Hz and 400 Hz. This group includes Dab (*Limanda limanda*) and Bass (*Dicentrarchus labrax*). This variation in hearing ability appears to be linked to particular physiological adaptations in the distance of the swim bladder to the inner ear.

31. In contrast to fish, marine mammal species such as the Bottlenose Dolphin (*Tursiops truncatus*) and Harbour Porpoise (*Phocoena phocoena*) are sensitive to a very broad bandwidth of sound. Audiogram data for Harbour Porpoise indicate that they are responsive at frequencies from 100 Hz to 170 kHz.

32. At the highest level, typically during underwater blasting from explosives, sound has the ability to cause injury and, in extreme cases, the death of exposed animals. At noise levels lower than those that cause physical injury, noise may still have important behavioural effects on a species. The most significant effect is avoidance of the noisy area.

33. Many marine animals use sound during their everyday lives to track prey, avoid predators, navigate, and communicate with one another (e.g., Hawkins and Myrberg, 1983). Even species that do not communicate by sound use the acoustic scene (or soundscape) to learn about and exploit their environment (Fay and Popper, 2000). Thus, anything in the environment that interferes with the ability of an animal to detect and use sounds of biological relevance could have an impact on fitness and survival.

34. The ability of an individual to hear a certain sound in the ocean is a complex task involving at least six abilities and processes:

- Absolute hearing threshold;
- Individual variation in sensitivity;
- Individual motivation;
- Ability to overcome the masking (i.e., obscuring/interference) effect of background sound;
- Sound source localisation;
- Frequency and intensity discrimination (Richardson *et al.,* 1995)

Thereafter behavioural responses to a sound, once detected, are known to be strongly influenced by the context of the event and individual factors such as the animal's experience, motivation, conditioning and activity (Nowacek *et al.,* 2007; Southall *et al.,* 2007; Wartzok *et al.,* 2004). Identical sounds may be experienced in very different ways by individual marine mammals of different species. In addition, as in humans and other mammals, variation in hearing ability between individual animals is common.

35. The significance of the effect requires an understanding of its consequences. For instance, avoidance may be significant if it impedes the migration of a species. However, in other cases the movement of species from one area to another may be of no consequence.

36. In order to judge the potential of a noise to cause avoidance, it is necessary to understand the perception of the sound by the species, i.e. how loud the sound appears to individuals of that species. Individuals of species having poor hearing may perceive the level as low, and hence not react to the noise, whereas a species that is sensitive may find the level unbearably loud and react by swimming away. It is therefore key to understand the hearing ability of the species that may be affected.

37. If the level of sound is sufficiently high on the dB_{ht}(*Species*) scale, it is likely that an avoidance reaction will occur. The response from a species will be probabilistic in nature (e.g. at 75 dB_{ht}(*Species*)) one individual from a species may react, whereas another individual may not: the metric indicates the probability of an individual reacting, and may also vary depending upon the type of signal.

8.2.8. Thresholds for Impact

38. The dBht(*Species*) metric (Nedwell *et al* (2007b)) has been developed as a means for quantifying the potential for a behavioural impact of a sound on a species in the underwater environment. The dB_{ht}(*Species*) metric can be understood as the level above the minimum audible sound (threshold of hearing) which a species can hear. A level of 0 dB_{ht}(*Species)* represents the minimum audible sound, hence levels below this will not be perceived by the species.

39. The following responses are predicted from the thresholds modelled based on published literature (e.g. Nedwell *et al.,* 2005; Nedwell *et al.,* 2007b):

- At 75dB_{ht} sound may be heard by the species and might cause some behavioural responses such as some avoidance behaviour;
- At 90dB_{ht} significant avoidance behaviour is predicted; and
- At 130dB_{ht} there is the potential for Temporary Threshold Shift (TTS) and the onset of traumatic hearing damage (Permanent Threshold Shift (PTS)) to occur.

40. Levels at 75dB_{ht} may cause one individual from a species to react, whereas another individual may not. The metric indicates 'loudness' of the noise and this can be related to a probability of an individual reacting.

41. Levels at 90dB_{ht} are considered to cause 100% displacement, meaning all individuals will show a strong avoidance response and remain outwith the 90dB_{ht} zone of impact for the duration of the activities.

42. The dB_{ht}(*Species*) criteria represent noise levels that are audible to each relevant species and reflect an instantaneous noise level. The dB SEL criteria account for the duration of noise production as it reflects the total sound exposure of an animal as it swims away from the noise source.

8.3. Assessment Methodology

43. A number of species of marine mammals, fish and shellfish use sound for prey detection, communication and navigation. Anthropogenic noise, which falls within the audible range of these species and exceeds natural background levels, has the potential to disturb and in extreme cases cause auditory injury.

44. In the context of offshore windfarm construction activities, it is widely accepted that piling operations are likely to be the principal source of noise with the potential to harm or displace marine life. Other construction activities, such as cable laying, rock placement and the transit of vessels to and from the Development Area and the Offshore Export Cable Corridor will also increase the level of anthropogenic noise.

45. dB_{ht}(*Species*) threshold values will be used to provide information on the likely impacts from each of the construction and operational activities that will be undertaken for the Project in the marine environment. Each noisy activity relevant to this Project has been compared to the 90dB_{ht} impact range for relevant species to inform the impact assessment in Chapters 5 and 6.

46. The distance and the amount of displacement each activity has on individual species will be determined. No impact piling will be undertaken for the Kincardine Project but impact piling (from fixed offshore windfarm installations) has been noted in the assessments for reference to demonstrate the significant impact this has on marine species and allow reviewers to put the Kincardine Project activities into context.

8.4. Noise Modelling

47. To inform the assessments in Chapters 5 and 6 of the impacts of underwater noise the worst case scenario for the Project construction and operation parameters has been used in the noise modelling. These can be broken down into two components; the noise related to the development site and the offshore export cable route. These are indicated in Table 8-4 and Table 8-5.

8.4.1. Potential Noise Sources

48. Table 8-4 identifies the noise sources that are likely to be present during the construction and operational phases of the development. The decommissioning impacts are anticipated to be similar to the construction impacts, which will result in similar, if not lower, noise impacts as the decommissioning process is expected to undertake less time, with the same vessel types and therefore only the construction noise impacts are assessed below.

Table 8-4 Noise sources from the Development Area

Potential Impact	Design envelope scenario assessed
Construction Noise	Cable installation (both trenching and cable laying) –medium size vessel Cable protection (if required and very limited) Anchor placement (medium size vessel) Tow vessels (medium size vessel)
Operational Noise	Maintenance vessel (one vessel 5 days per week) Cable repair (medium size vessel) WTG operation

Table 8-5 Noise sources from the Offshore Export Cable Corridor

Potential Impact	Design envelope scenario assessed
Construction Noise	Cable installation (both trenching and cable laying) Cable protection – rock/mattressing (if required)
Operational Noise	Maintenance vessel (one vessel 5 days per week) Cable repair (repair/reburial)

8.4.2. SPEAR Modelled Impact Ranges

49. Site specific noise modelling has not been undertaking for the Project as the construction method does not include impact piling. To assess the noise impacts of the Project the Simple Propagation Estimator and Ranking (SPEAR) model noise range results from Inch Cape offshore windfarm have been used (Inch Cape 2013a and 2013b).

50. The SPEAR model outputs an approximate figure that represents the area of ocean which is rendered potentially unusable by a species as a result of a particular activity when using the 90 dB_{ht}(*species*) criteria which relates to a strong avoidance reaction by virtually all individuals.

51. The information used to validate this model has come from a substantial database of recordings of various noise sources that has been compiled by Subacoustech Ltd over the last 20 years. The model uses estimates from this database of the typical frequency content, source level and transmission losses associated with each type of noise source to calculate the variation of noise level with range from the source. The calculated noise ranges are presented in relation to the seven species which are relevant to the Development Area and Offshore Export Cable Corridor.

52. Figure 8-1 to 8-7 show the SPEAR modelled impact values for seven species for each of the Project construction activities. They are compared to the modelled impact piling noise levels for reference only as impact piling will not be used on the site.

53. The noise modelling specifically considered the likely range at which behavioural response might be expected for four species of fish known to be of particular interest in and around the site – Cod, Dab, Herring and Salmon and three mammal species of relevance to the site Bottlenose Dolphin, Harbour Porpoise and Harbour Seal. These seven species represent a range of hearing sensitivity for both fish and mammal species and can be used as a proxy for the other species found in the area.

54. The SPEAR model outputs demonstrate that the spatial area over which a strong avoidance response would be expected is very small for all fish species with the maximum displacement distance of approximately 10m from each activity (Figure 8-1 to 8-7).

55. The area over which a strong avoidance response is expected from Project activities for marine mammals is shown in Figure 8-1 to 8-7. These ranges are larger than those modelled for fish with the displacement range for trenching activities for Harbour Porpoise being approximately 140m from the activity.

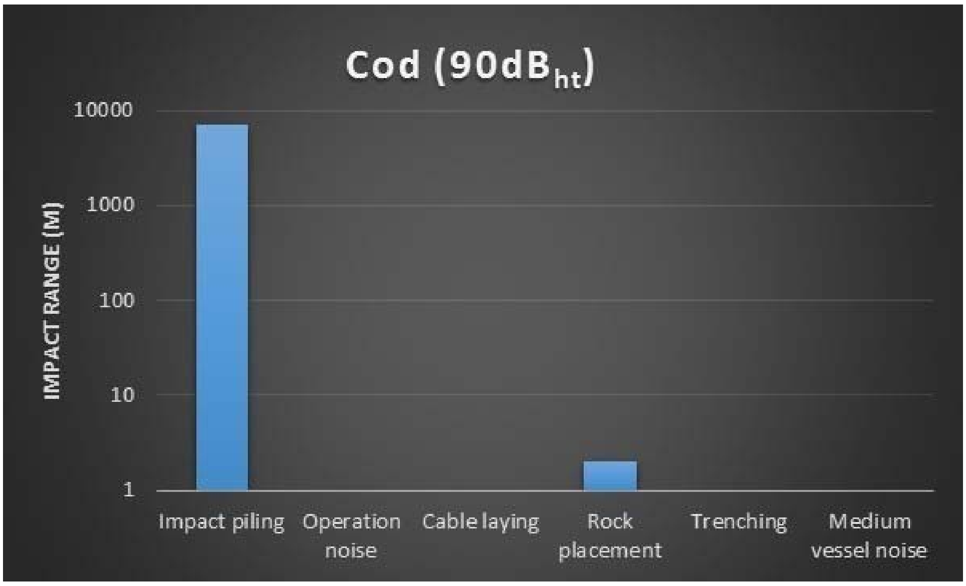

Figure 8-1 Modelled noise ranges of various activities (90dB$_{ht}$) Cod (Inch Cape, 2013).

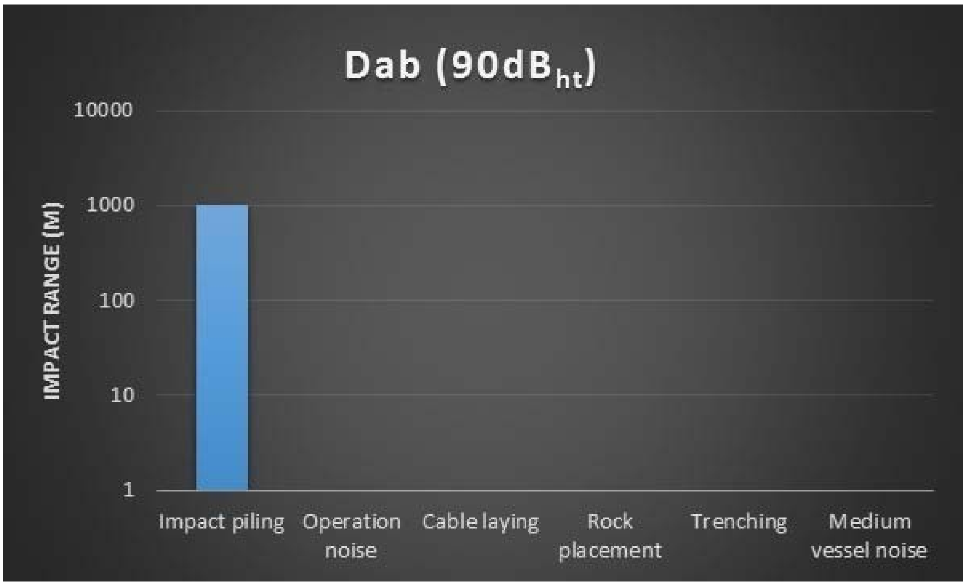

Figure 8-2 Modelled noise ranges of various activities (90dB$_{ht}$) Dab (Inch Cape, 2013).

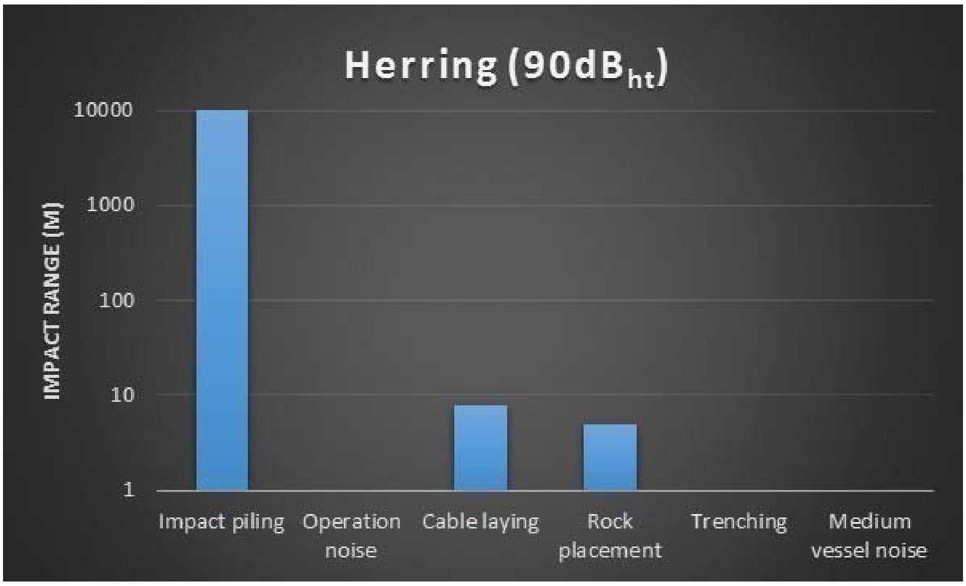

Figure 8-3 Modelled noise ranges of various activities (90dB$_{ht}$) Herring (Inch Cape, 2013).

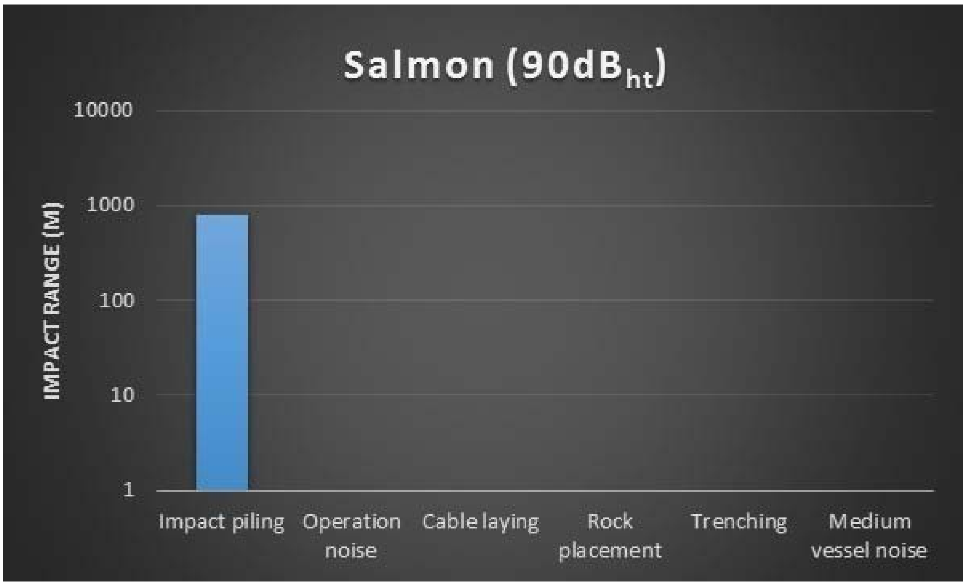

Figure 8-4 Modelled noise ranges of various activities (90dB$_{ht}$) Salmon (Inch Cape, 2013).

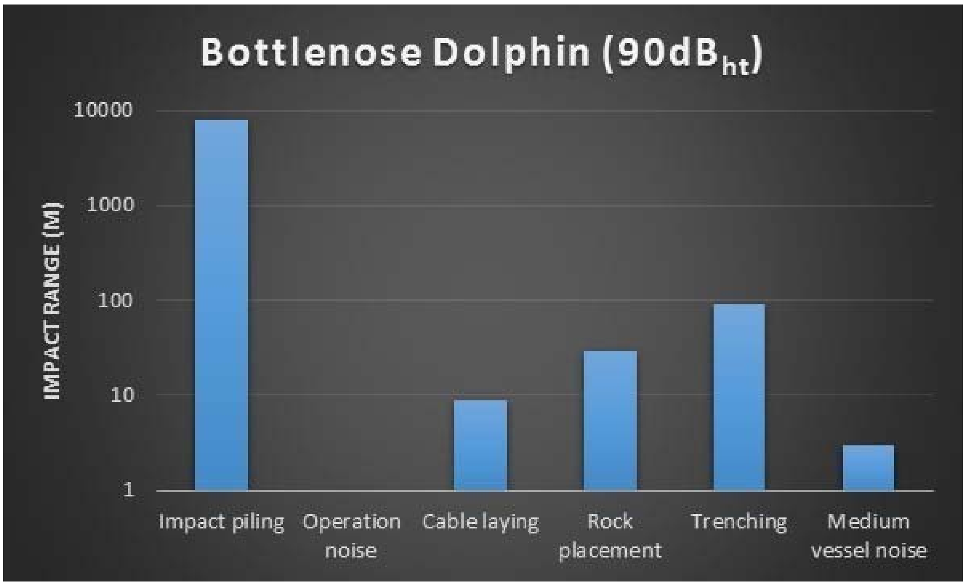

Figure 8-5 Modelled noise ranges of various activities (90dB$_{ht}$) Bottlenose Dolphin (Inch Cape, 2013).

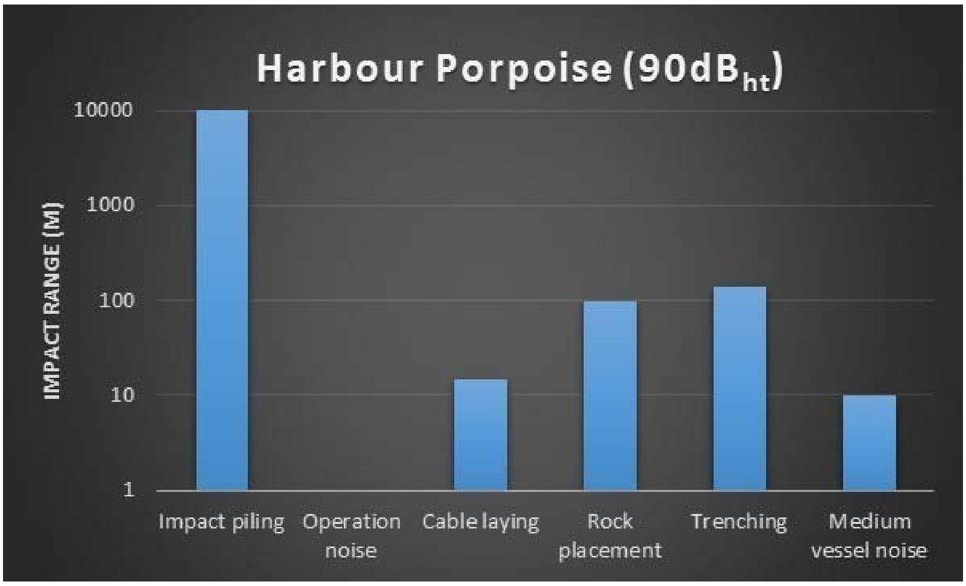

Figure 8-6 Modelled noise ranges of various activities (90dB$_{ht}$) Harbour Porpoise (Inch Cape, 2013).

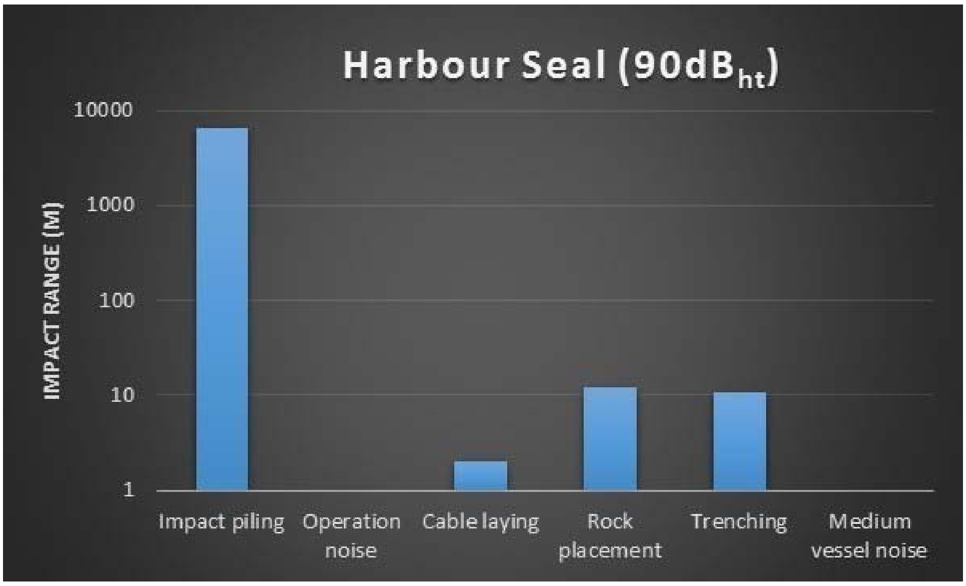

Figure 8-7 Modelled noise ranges of various activities (90dB$_{ht}$) Harbour Seal (Inch Cape, 2013).

56. Table 8-6 to 8-9 tabulate the figures generated by the SPEAR model and set out the 90 dB$_{ht}$ (significant avoidance response) and 75dB$_{ht}$ (some behavioural response) noise ranges for the construction activities included within the Rochdale envelope scenario presented in Table 1-3.

57. A summary table (Table 8-10) of the largest Project noise range for each species demonstrates the small area of displacement each Project activity is predicted to have.

Table 8-6 Maximum ranges from Cable Laying Noise using the dB$_{ht}$ (*Species*) Metric (Inch Cape, 2013a)

Activity: Cable laying	90 dB$_{ht}$(*Species*) range (m)	75 dB$_{ht}$(*Species*) range (m)
Cod	1	20
Dab	<1	1
Herring	8	66
Salmon	<1	1
Bottlenose Dolphin	9	75
Harbour Porpoise	29	220
Harbour Seal	2	29

Table 8-7 Maximum ranges from Rock Placement noise using the dB$_{ht}$ (*Species*) Metric (Inch Cape, 2013a)

Activity: Rock placement	90 dB$_{ht}$(*Species*) range (m)	75 dB$_{ht}$(*Species*) range (m)
Cod	2	25
Dab	<1	4
Herring	6	62
Salmon	<1	4
Bottlenose Dolphin	31	170
Harbour Porpoise	99	550
Harbour Seal	17	99

Table 8-8 Maximum ranges from trenching noise using the dB_{ht} (*Species*) Metric (Inch Cape, 2013a)

Activity: Trenching	90 dB_{ht}(*Species*) range (m)	75 dB_{ht}(*Species*) range (m)
Cod	1	16
Dab	<1	<1
Herring	<1	27
Salmon	<1	2
Bottlenose Dolphin	81	350
Harbour Porpoise	140	640
Harbour Seal	12	87

Table 8-9 Maximum ranges from medium vessel noise using the dB_{ht} (*Species)* Metric (Inch Cape, 2013a)

Activity: Medium Vessel Noise	90 dB_{ht}(*Species*) range (m)	75 dB_{ht}(*Species*) range (m)
Cod	<1	1
Dab	<1	<1
Herring	<1	3
Salmon	<1	<1
Bottlenose Dolphin	4	45
Harbour Porpoise	11	110
Harbour Seal	<1	4

Table 8-10 Summary of most significant impact per species and displacement range ($90dB_{ht}$)

Species	**Loudest activity $90dB_{ht}$**	**Range (m) (SPEAR)**
Cod	Rock placement	2 m
Dab	All comparable	<1 m
Herring	Cable laying	8 m
Salmon	All comparable	<1 m
Bottlenose Dolphin	Trenching	81 m
Harbour Porpoise	Trenching	140 m
Harbour Seal	Rock placement	17 m

8.4.3. Cable Laying

58. The potential noise impacts for cable laying has been assessed against the sensitive receptors noted in Table 8-10 to provide the impact ranges for cable laying given in Table 8-6. Fish are shown to have a small ≤8m impact range for significance avoidance response (90 dB_{ht}) and ≤66m for some behavioural response (75 dB_{ht}). Herring is the most sensitive fish species to this noise source. Harbour Porpoise have the largest range for significance avoidance response to this activity at 29m and are expected to show some behavioural response at 220m. Harbour Seals appear to be relatively unaffected by this noise source with impacts ranges of 2m (90 dB_{ht}) 29m (75 dB_{ht}).

8.4.4. Cable Protection – Rock Placement

59. The export cables will be buried and the inter-array cables will be surface laid. It is anticipated that rock placement will not be required for the Project. However using the worst case for this assessment, it is assumed that up to 10% of the cable could require cable protection (rock or mattressing). The potential noise impacts of installing cable protection has been assessed against the sensitive receptors noted in Table 8-6.

60. Table 8-7 provides the modelled ranges for impact from rock placement associated with cable protection and it is evident that the impact range for all the fish and marine mammals species assessed is very small. The most sensitive species to this source of noise is Harbour Porpoise with a predicted impact range of 99m for significant avoidance response (90dB_{ht}). Table 8-7 shows that fish have a low sensitivity to rock placement with all species predicted to have a ≤6m range where a significance avoidance response would be expected.

8.4.5. Trenching – Cable Installation

61. Trenching will be used to bury the offshore export cable, the inter-array cables will be surface laid. The trenching impacts noted in Table 8-6 have the largest noise impact ranges for cetacean species and for these species it represents the largest noise impact from the Project (Table 8-10).

62. The modelling has identified that trenching will produce the largest overall impact range for the Project for any species. Table 8-11 summarises the results of the SPEAR modelling for trenching activity in terms of M-weighted SELs that Southall (2007) propose are sufficient to induce Permanent Threshold Shift (PTS) in marine mammal species. Assuming that an animal moves away from the noise source at a rate of 1.5 m/s (considered to be a typical cruising speed for a marine mammal), the SPEAR modelling outputs show it is unlikely that a marine mammal will receive a level of noise sufficient to induce auditory injury from any Project construction or operation activity.

63. It can be expected that there would be some short term displacement of cetaceans from trenching operations but this would be over a small spatial area (140m). It is anticipated that trenching will not produce any long term impacts to marine mammals during the installation activities (Table 8-11) due to the limited period this one off operation.

64. Fish appear to be unaffected by this noise source with impact ranges of ≤1m (90 dB_{ht}).

Table 8-11 Summary of the Maximum Ranges from Trenching using the M-weighted SEL Metrics (Inch Cape, 2013a)

Marine Mammal Group - Trenching	Fleeing animal (1.5m/s) Auditory injury range (m)
Low frequency Cetaceans (198 dB re. 1µPa/s2(Mlf)	< 1
Mid frequency Cetaceans (198 dB re. 1µPa/s2(Mmf)	< 1
High frequency Cetaceans (198 dB re. 1µPa/s2(Mhf)	< 1
Pinniped (in water) (186 dB re. 1µPa/s2(Mpw)	< 1

8.4.6. Anchor Placement and Tow Vessels

65. Anchor handling vessels are likely to be used to both install the anchors for the WTGs and also to tow the WTGs from the construction port to the site. These vessels are considered to be medium sized vessel types (construction and heavy lift ships would be considered large vessels).

66. Table 8-9 indicates the modelled noise impact ranges from the use of medium size vessels. The modelling results show that noise from vessels used for the Project will have a very small impact range for both fish and marine mammal species.

67. Towing of WTGs and anchor placement are expected to be very short term in nature (anchor placement will take eight days total and WTG tows will take three to four days per turbine).

8.4.7. WTG Operation

68. Noise emissions from wind turbines can be separated into two categories: aerodynamic and mechanical noise. Aerodynamic noise occurs when the wind is passing the blades and mechanical noise is emitted from the engineering components of the wind turbine such as gearbox and generator. It should be noted that the larger wind turbines that are being considered for the Project are only in the demonstrator phase and full noise spectrum analysis is not currently available. However, the wind turbine manufacturers predict that the wind turbines would have a noise output of no greater than 110dB(A) at hub height measured according to the IEC 61400-11 standard and therefore it is expected that noise impact to marine mammals and fish would be very limited. Operational noise data will be collected on site to confirm the noise outputs of the WTGs during the initial phase of operation at site.

8.4.8. Operational and Maintenance Vessels (Small vessels)

69. The noise profile for Operation and Maintenance (O&M) vessels is currently unknown, but it is assumed to be equal to or less than that modelled for medium sized vessels. The frequency of O&M visits to the site is anticipated to be low (one vessel five days per week).

8.4.9. Decommissioning Noise

70. Decommissioning activities are noted in Chapter 2. Due to the floating nature of the offshore WTG, decommissioning activities are anticipated to require limited onsite activity. Decommissioning activities are anticipated to produce similar or lower noise levels compared to the construction related activities and therefore the construction noise ranges represent the worst case scenario.

71. A decommissioning plan will be submitted to DECC in accordance with the Energy Act 2004.

8.5. Monitoring

72. Noise monitoring will be undertaken during the initial year of operation to gather data on the operational noise characteristics of the semi-submersible floating offshore WTGs during a range of sea states and operational modes. This data will be gathered as part of the survey, deploy and monitor scheme. Data will be published as part of the wider development survey system that is currently planned for the WTGs and substructures that is currently being put forward for a large European level marine impact assessment of floating offshore windfarms.

8.6. Summary

73. The way in which an animal reacts to underwater noise relates to the way in which it hears. There is considerable variation in the hearing abilities of animals, both in terms of the minimum levels of sound perceptible and the frequency range over which they can hear. This results in a range of reactions from different species depending on the noise.

74. dB_{ht}(*Species*) threshold have been used to assess the likely impacts from the construction and operational activities of the Project on a range of fish and marine mammal species known to be of particular interest in and around the site. These species represent a range of hearing sensitivity and have been used as a proxy for the other species found in the area.

75. SPEAR modelling of Project activities shows that the activity identified as having the greatest noise impact range for cetaceans is trenching of the export cable. The Project activity with the greatest noise impact range for pinnipeds is rock placement. The activity causing the greatest impact range for fish is rock placement or cable laying (depending on the fish species). None of the Project activities are considered likely to cause noise at a level that would result in auditory injury.

76. The behavioural response ranges identified through SPEAR modelling of the Project activities represent a tiny impact area when compared to the noise range of impact piling (which is traditionally used for offshore windfarm developments).

77. Operational noise impacts from the substructure (such as wave impact on the structure and ballast water systems) are currently unknown as there has been no previous deployment of such a large floating offshore wind turbine. One of the key aims of the initial deployment period and one of the primary elements of the survey, deploy and monitor scheme will be to undertake noise

measurements. This will include noise measurements of the WTGs and the O&M vessels servicing the site.

78. The information presented in this chapter has been used to inform the assessment of impacts of underwater noise on fish and marine mammals (see Chapter 5 and Chapter 6).

8.7. References

Bailey, H. 2006. Distribution and habitat use of bottlenose dolphins (Tursiops truncates) at varying temporal and spatial scales. PhD thesis.

Fay, R.R., and Popper, A.N. 2000. Evolution of hearing in vertebrates: the inner ears and processing. Hearing Research 149, 1-10.

Hastings M C, and Popper A N. 2005. Effects of sound on fish. Report to the California Department of Transport, under contract No. 43A0139, January 2005.

Hawkins A D. 1981. The hearing abilities of fish. Ed's Tovolga W, Popper A, Fay R. Hearing and sound communication in fishes. Springer Verlag, New York, pp 109-139.

Hawkins, A.D., and Myrberg, A.A. Jr. 1983. Hearing and sound communication underwater. In: Lewis B (ed), Bioacoustics, a comparative approach. Academic Press, London, p 347–405.

Hildebrand J. 2004. Impacts of anthropogenic sound on cetaceans. International Whaling Commission, IWC/SC/56/E13 report, Sorrento, Italy. Available at http://cetus.ucsd.edu/projects/pub/SC-56-E13Hilde.pdf

Hywind 2015 Hywind Scotland Pilot Park Environmental Statement http://www.statoil.com/en/EnvironmentSociety/Environment/impactassessments/NewEnergy/IntWind/Pages/HywindScotland.aspx

Inchcape 2013a. Inchcape Environmental Statement Chapter 11 Underwater noise - http://www.inchcapewind.com/publications/environmental-statement/introduction

Inchcape 2013b Inchcape Environmental Statement Appendix 11A: Underwater noisehttp://www.inchcapewind.com/publications/environmental-statement/introduction

Jensen BS, Klaustrup M, Skov H., 2006 *EIA Report Fish - Horns Rev 2 Offshore Windfarm*, BioConsult A/S.

Leonhard, S.B. and Pedersen, J., 2006. *Benthic communities at Horns Rev before, during and after Construction of Horns Rev Offshore Windfarm*. Vattenfall Report number: Final Report/Annual report 2005, p 134.

Leonhard, S.B., Stenberg, C., and Støttrup, J., 2011. *Effect of the Horns Rev 1 Offshore Windfarm on Fish Communities Follow-up Seven Years after Construction.* DTU Aqua Report No 246-2011.

Lindeboom, H. J., Kouwenhoven, H. J., Bergman, M. J. N., Bouma, S., Brasseur, S., Daan, R., Fijn, R. C., de Haan, Dirksen S.D., van Hal, R., Hille Ris Lambers, R., ter Hofstede, R., Krijgsveld, K.L., Leopold, M., and Scheidat. M, 2011. Short-term ecological effects of an offshore windfarm in the Dutch coastal zone; a compilation. Environmental Research Letters, 6, 035101.

Lovell J M, Findlay M M, Moate R M, and Yan H Y. (2005). The hearing abilities of the prawn (Palaemon serratus). Comp. Biochem. Physiol. A Mol. Integr. Physiol. Vol 140/1 pp 89-100.

Madsen P T, Wahlberg M, Tougaard J, Lucke K, and Tyack P. (2006). Wind turbine underwater noise and marine mammals: Implications of current knowledge and data needs. Marine Ecology Progress Series, Vol. 309: pp 279-295, March 2006.

Nedwell, J.R. and Howell, D. (2004). A review of offshore windfarm related underwater noise sources Subacoustech Report ref. 544R0308.

Nedwell, J.R., Parvin, S.J., Edwards, B., Workman, R., Brooker, A.G. and Kynoch, J.E. (2007a). Measurement and interpretation of underwater noise during construction and operation of offshore windfarms in UK waters. Subacoustech Report No. 544R0738 to COWRIE ISBN: 978-09554279-5-4.

Nedwell, J.R., Turnpenny, A.W.H., Lovell, J., Parvin S.J., Workman R., Spinks. J.A.L., Howell, D. (2007b). A validation of the dBht as a measure of the behavioural and auditory effects of underwater noise. Subacoustech Report Reference: 534R1231, Published by Department for Business, Enterprise and Regulatory Reform.

NNG 2013 Mainstream Chapter Marine Mammals. http://mainstream-downloads.opendebate.co.uk/downloads/Chapter-13---Marine-Mammals.pdf

Nowacek, D. P., Thorne, L. H., Johnston, D. W. and Tyack, P. L. 2007. Responses of cetaceans to anthropogenic noise. *Mammal Review 37 (2): 81-115.*

OSPAR, 2009. *Overview of the impacts of anthropogenic underwater sound in the marine environment*. OSPAR Biodiversity Series.

Parvin, S.J, Nedwell, J.R., and Harland, E., 2007. *Lethal and physical injury of marine mammals and requirements for Passive Acoustic Monitoring*. Subacoustech Report.

Popper A N, and Fay R R. (1993). Sound detection and processing by fish: critical review and major research questions. Brain Behav. Evol. 41, 14-38.

Popper A N, Fewtrell J, Smith M E, and McCauley R D. (2004). Anthropogenic sound: effects on the behaviour and physiology of fishes. Marine Technology Soc. J. 37(4), pp 35-40.

Richardson, W. J., Greene, C. R., Jr., Malme, C. I., & Thomson, D. H. (1995). Marine mammals and noise. New York: Academic Press. 576 pp.

Seagreen 2013. Seagreen Environmental statement http://www.seagreenwindenergy.com/reports.asp

Southall, Brandon L.; Bowles, Ann E.; Ellison, William T.; Finneran, James J.; Gentry, Roger L.; Greene, Charles R.; Kastak, David; Ketten, Darlene R.; Miller, James H.; Nachtigall, Paul E.; Richardson, W. John; Thomas, Jeanette A.; Tyack, Peter L, (2007). Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. Aquatic Mammals, Vol 33 (4).

Thomsen, F., Lüdemann, K., Kafemann, R. and Piper, W. (2006). Effects of offshore windfarm noise on marine mammals and fish, on behalf of COWRIE Ltd.

Tougaard, J., Carstensen, J., Henriksen, O.D., Skov, H., and Teilmann, J. (2003a). Short-term effects of the construction of wind turbines on harbour porpoises at Horns reef. Technical report to TechWise A/S. HME/362-02662. Hedeselskabet, Roskilde, Denmark.

Tougaard, J. Castensen, J., Henriksen, O.D., Teilmann, J. and Hansen, J.R. (2003b). Harbour Porpoises on Horns Reef - Effects of the Horns Reef Windfarm. Annual Status Report 2003 to Elsam Engineering A/S. NERI Technical Report, Roskilde, Denmark.

Wartzok, D., Popper, A. N., Gordon, J., & Merrill, J. (2004). Factors affecting the responses of marine mammals to acoustic disturbance. Marine Technology Society Journal 37: 6-15.

9. Maritime Navigation

9.1. Introduction

1. This chapter summarises the work undertaken by Anatec Limited (hereby referred to as Anatec) to identify the existing vessel activity and navigational features in the vicinity of the proposed Kincardine Offshore Windfarm (hereby referred to as the Project) for construction, operation and maintenance and decommissioning phases. This chapter considers all vessels navigating within the waters in proximity to the Project including recreational craft, commercial ferries, commercial traffic, commercial fishing vessels, marine aggregate extraction vessels, military vessel transits and emergency response activities, it then goes on to assess the impacts to shipping and navigation receptors in line with the following guidance.

2. The navigation risk assessment (Appendix C) principally follows the Department of Energy and Climate Change (DECC) Risk Assessment Methodology (DECC, 2005) and the Maritime and Coastguard Agency's (MCA) Marine Guidance Note 371 (MGN 371) including any subsequent updates (at the time of authoring) approved by the Nautical Offshore Renewable Energy Liaison (NOREL) committee.

3. Due to the specific methodology required by maritime regulators, shipping and navigation, as a receptor has been assessed within this ES. However the methodology is similar to the ES process selected by KOWL, it is centred on risk management and requires a submission that shows that sufficient controls are, or would be, in place for the assessed risk to be reduced to As Low as Reasonably Practicable (ALARP).

9.1.1. Policy and Regulations

4. This section outlines the legislation, policy and guidance relevant to the assessment of potential impacts on shipping and navigation.

9.1.1.1. International

5. In the UK, national procedures comply as a minimum with the following international standards and recommended practices which are referred to in this chapter, namely:

- International Regulations for Preventing Collisions at Sea 1972 (COLREGS), as implemented in the UK through Marine Shipping Notices; and
- International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) – Marking of Man-Made Offshore Structures 0-139 Edition 2 (IALA, 2013).

9.1.1.2. Guidance

6. The guidance documents used during the assessment are:

- 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);
- DECC in Association with MCA - Guidance on the Assessment of Offshore Windfarms - Methodology for Assessing Marine Navigational Safety Risks of Offshore Windfarms (DECC, 2005) 2014 Updates;
- Guidelines for Formal Safety Assessment (FSA) for use in the IMO rule-making process – MSC83/INF.2 (IMO, 2007);
- 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); and
- The RYA's Position on Offshore Energy Developments: Paper 1 – Wind Energy (RYA, 2014).

9.1.2. Stakeholder Consultation

7. The following section presents consultation responses in relation to shipping and navigation for the Project received through the scoping process and other consultation undertaken with relevant stakeholders.

Table 9-1 Summary of Consultation Responses

Consultee (Date received)	Comment	Response / where addressed in ES
Scoping Opinion		
Northern Lighthouse Board (15th May 2014)	I. Formal recommendations for lighting and marking of the windfarm, infrastructure and vessels engaged in operations associated with the windfarm will be given by NLB through the formal Marine (Scotland) Act 2010 Marine Licensing application process.	I. Noted and considered throughout Section 9.3.3 (Embedded Mitigation).
	II. NLB require that the Marine License application include a NRA in accordance with the requirement of MCA MGN 371.	II. MGN 371 has been considered throughout the production of the ES as noted in Section 9.1.1.2 (Guidance).
	III. NLB suggest that as well as shipping density, it is important to take regard of type and cargo, draught and number of persons on board, to assess the likelihood and consequence of any shipping incident relating to the development or accumulation of developments.	III. Collision risk modelling (when undertaken) and baseline data analyses takes into account vessel types and dimensions (see Section 9.2.3 – Marine Traffic Surveys) as well as indications of persons on board.
	IV. NLB note the importance of understanding the proximity to major pots engaged in supply and support to the offshore oil industry, transiting vessels, and the impact of any deviations required.	IV. The activity of ports in proximity to the Project is summarised in Section 9.2.5 (Port Activity). The impact of required deviations are summarised in Section 9.4.3 (Impacts on Commercial Vessel Routeing).
	V. Consideration to work with other developers such as European Offshore Wind Development Centre (Aberdeen) and Hywind at Buchan Deep.	V. Cumulative impacts are summarised in Section 9.6 (Cumulative Impacts).
	VI. The development site would be marked with buoyage during the construction phase, and with Aids to Navigation based on IALA Recommendation O-139 installed on the turbines during the operational phase.	VI. Embedded mitigations, including adherence to IALA O-139, are summarised in Section 9.3.3 (Embedded Mitigation).
	VII. NLB highlighted the importance of appropriate promulgation of information with regards to inter-turbine and export cables.	VII. Embedded mitigations, including promulgation of information, are summarised in Section 9.3.3 (Embedded Mitigation).

Consultee (Date received)	Comment	Response / where addressed in ES
Scottish Royal Yachting Association (SRYA) (16th May 2014)	I. Safety of navigation risks should be assessed and mitigated. II. SRYA wishes to be involved in the NRA as has been the case for other windfarm developments. III. The development should give consideration to the *Offshore Renewable Energy Installations (Wind) Position Paper* which was re-published in 2014. IV. Previous studies on recreational routeing and project marine traffic studies should be used to validate routes contained within the *UK Coastal Atlas of Recreational Boating.*	I. As stated in Section 9.1.1.2 (Guidance) the ES has followed the *DECC Methodology for Assessing Marine Navigational Risks for Assessing Offshore Renewable Energy Installations* which looks to identify, assess and mitigate risks to within ALARP parameters. II. Noted. III. The *Offshore Renewable Energy Installations (Wind) Position Paper* has been considered throughout the production of the ES as noted in Section 9.1.1.2 (Guidance). IV. The *UK Coastal Atlas of Recreational Boating* has been used throughout the baseline assessment as noted in Section 9.2.1 (Data Sources).
MCA (22nd May 2014)	I. The ES should supply detail on navigational issues for both Commercial and Recreational craft including; • Collision Risk, • Navigational Safety, • Visual intrusion and noise, • Risk Management and Emergency response, • Marking and lighting of site and information to mariners, • Effect on small craft navigational and communication equipment, • The risk to drifting recreational craft in adverse weather or tidal conditions, and • The likely squeeze of small craft into the routes of larger commercial vessels. II. A NRA in accordance with the requirement of MCA Marine Guidance Notice 371 should be undertaken. III. Particular attention should be paid to cabling routes and burial	I. Section 9.4 (Impact Assessment) has considered listed issues throughout assessment. II. MGN 371 has been considered throughout the production of the ES as noted in Section 9.1.1.2 (Guidance).

Consultee (Date received)	Comment	Response / where addressed in ES
	depth for which a Burial Protection Index study should be completed and, subject to the traffic volumes, an anchor penetration study may be necessary. IV. Reference should be made to any Marine Environmental High Risk Areas (MEHRAS) established on adjacent coastlines. V. The cumulative and in combination effects require serious consideration, and particularly the adjacent windfarm proposals. VI. Casualty information from the MAIB and RNLI would also be good data sources, in establishing the risk profile for the area. VII. Given that neither the capacity nor structure of the individual wind turbine generators have been decided the principles of the Rochdale envelope should be used in the EIA. Minimum safe air clearances between Mean High Water Springs (MHWS) and turbine blades should be suitable for the vessel types identified in the traffic survey and not less than 22 metres. VIII. The shipping and navigation study should include radar and manual observations in addition to AIS data to ensure vessels of less than 300GT are captured. IX. The offshore human environment should also include recreational and other sport activities. Any application for operational safety zones will need to be carefully assessed and additionally supported by evidence and experience from the construction phase. X. Further discussion would need to be undertaken with UKHO and MCA with regard to charted marking, anchors and ground tackle as exclusion zones are not necessarily appropriate or available.	III. Noted and will be considered throughout final site design. IV. Navigational features, including MEHRAs, in proximity to the development are summarised in Section 9.2.2. V. Cumulative impacts are summarised in Section 9.56 (Cumulative Impacts). VI. Maritime incident data, including MAIB and RNLI data, is summarised in Section 9.2.8 (Maritime Incidents). VII. Embedded mitigations, including a minimum air draught clearance of 22m, are summarised in Section 9.3.3 (Embedded Mitigation). VIII. Marine traffic surveys undertaken, which include radar and visual monitoring to capture all vessel movements, are summarised in Section 9.2.1 (Table 9-2). IX. It should be noted that it is the current intention to apply for operational safety zones, as stated in Section 9.3.3 (Embedded Mitigation). X. Embedded mitigations, including consultation with the UKHO regarding the charting of subsea mooring lines and anchors, is summarised in Section 9.3.3 (Embedded Mitigation).

Consultee (Date received)	Comment	Response / where addressed in ES
ES Consultation.		
RYA (11th June 2015)	I. RYA does not have any significant concerns regarding Project and are content with the proposed 22m air draught clearance during all tidal states. II. RYA objects to operational safety zones as a general principle. If they are to be in place the RYA requires further information on how they will be monitored and enforced.	I. Noted. II. Noted and will be considered throughout operational safety zone application.
Northern Lighthouse Board (16th June 2015)	I. NLB have no major concerns with the Project in general. II. Discussions were held on the lighting and marking of the Project with NLB recommending the corner turbines be marked as significant peripheral structures (10nm range lighting) with intermediate structures marked with a lower intensity (2nm range) light. Due to the design of the floating structure (three buoyancy chambers) the positioning of the lights on the structures requires further consideration as the project progresses. This consideration should also include marking of the floating structure only during the 18 month pre-commissioning phase. III. Two fog signals would be required (one on northern turbine and one on southern) and an AIS aid to navigation. IV. During the construction phase it is likely that four cardinal marks would be used. This requirement would depend on the overall construction period and the overall risk posed to local fishermen. V. NLB highlighted the importance of local Notice to Mariners and Kingfisher awareness charts to warn fishermen of snagging risks and current works. VI. International Notice to Mariners would also be required to cover international shipping operational in the area.	I. Noted. II. Embedded mitigations, including marking of the site throughout the construction and operational phases, are summarised in Section 9.3.3 (Embedded Mitigation). III. Embedded mitigations, including the use of fog signals, are summarised in Section 9.3.3 (Embedded Mitigation). IV. Embedded mitigations, including marking of the construction site, are summarised in Section 9.3.3 (Embedded Mitigation). V. Embedded mitigations, including adequate promulgation of information and fisheries liaison, are summarised in Section 9.3.3 (Embedded Mitigation). VI. Embedded mitigations, including promulgation of information to international bodies, are

Consultee (Date received)	Comment	Response / where addressed in ES
	VII. NLB suggested including emergency towing vessel chartering, from Aberdeen Harbour, within the ERCoP in the event of a structure going adrift.	summarised in Section 9.3.3 (Embedded Mitigation). VII. Embedded mitigations, including the development of an ERCoP, are summarised in Section 9.3.3 (Embedded Mitigation).
SRYA (17th June 2015)	I. SRYA do not have any significant concerns regarding the Project as most members pass inshore of the site or to the east whilst on passage to Northern Isles and/or Peterhead. II. Recreational vessels tend to avoid Aberdeen given high number of vessel arrivals / departures. III. Concurred with findings of the marine traffic survey and highlighted that recreational vessels which did pass in the vicinity of the Project were generally to the east of the proposed turbine locations. IV. No issues regarding under keel clearance with export cables due to water depths. V. Content with the proposed 22m air draught clearance during all tidal states. VI. Indicated that an updated Pilot Book covering the Project is due to be published in 2016. Future revisions of the Pilot Book could include information on the KOWL development. VII. SRYA happy to assist with promulgation of information through member magazines and clubs. VIII. SRYA suggested the greatest level of recreational activity to be at the beginning and end of the season when vessels are transiting to / from the Northern Isles and/or Caledonian Canal. IX. SRYA stated consideration should be given to other lighting in the area throughout development of KOWL navigation lighting.	I. Noted and considered throughout Section 9.4.5 (Impacts on recreational vessels). II. Noted and considered throughout Section 9.4.5 (Impacts on recreational vessels). III. Noted. IV. Noted and considered throughout Section 9.4.5 (Impacts on recreational vessels). V. Noted. VI. Embedded mitigations, including promulgation of information through the use of Pilot Books, are summarised in Section 9.3.3 (Embedded Mitigation). VII. Noted. VIII. Noted and considered throughout Section 9.4.5 (Impacts on recreational vessels). IX. Noted and will be considered throughout development of navigational lighting.
Scottish Fishermen's Federation (SFF)	I. SFF noted that the south west corner had originally been noted as an area of concern for scallop and squid fishing.	I. A number of parameters have been considered in the final site selection; further data on fishing in Section 9.2.7.

Consultee (Date received)	Comment	Response / where addressed in ES
(2nd July 2015)	II. SFF would like to see the cable buried where protected fishing activity must be considered. III. SFF noted they were working with the MCA on updating MGN 371, and that this should be considered. IV. SFF were keen to see safety zones included as operational mitigations, but also had other mitigations for consideration such as fish safe.	II. Noted. III. Relevant guidance at the time of the consent application, including MGN 371, has been considered within the design process. Future changes to MGN 371 published after consent will be considered in conjunction with the relevant stakeholders. IV. Both embedded and additional mitigations have been considered and listed within sections 9.3.3 and 9.5.
Aberdeen Harbour (2nd July 2015)	I. Aberdeen Harbour queried where the 24 hour emergency coordination centre would be located and if there would be line of sight to the Kincardine development. II. Aberdeen Harbour queried the benefit in using a shore based radar system. III. Aberdeen Harbour stated that the Nigg Bay Port Development should be considered throughout the environmental impact assessment for the development but that they didn't have any significant concerns. IV. They stated that their main concern surrounding the Kincardine development was the potential impact on tankers which currently pass in close proximity to the indicative turbine locations. RS stated that these tankers are relatively small (approximately 80m in length) and pass closer to shore due to the increased shelter it affords. RS had concerns over the residual space between the Kincardine development and the shore and suggested that this may create a "pinch-point" for these inshore tanker vessels.	I. KOWL confirmed that it was likely the response centre would be based in Aberdeen. II. KOWL confirmed that some radar coverage will included in the final development, but that the exact parameters were yet to be considered. III. Considered within cumulative impacts in Section 9.6. It was noted that at most one support vessel would be required to maintain the Project, and this may be shared with other developments. IV. Section 9.4.3 shows the impact on commercial vessels. Regular operators are contacted as part of the NRA process.

Consultee (Date received)	Comment	Response / where addressed in ES
MCA Headquarters, Aberdeen Maritime Rescue Coordination Centre and the Aberdeen Royal National Lifeboat Institute (RNLI) (3rd July 2015)	I. MCA would look to mitigate mooring lines risk of failure and requirement for 3rd party verification. Failure of mooring lines should be considered within the NRA. Other non-standard mitigation will be considered as part of the process. II. MCA stated that they would support a safety zone application if a reasonable safety case was demonstrated. III. MCA noted that wear and tear of cables should be considered. IV. MCA were content with the marine traffic surveys and baseline data presented.	I. See additional mitigations in Section 9.5. II. Noted – see section 9.3.3 and 9.5. III. This is an operational issue for the Project and therefore will be part of the inspection and maintenance regime. Side scan sonar surveys of cable route and ROPV inspection of subsea equipment including cables and mooring lines. See additional mitigations in section 9.5. IV. Noted.

9.2. Baseline Environment

8. The following section summarises the baseline environment from a shipping and navigation perspective in the study area (10nm around the Project site, Figure 9-1).

9.2.1. Data Sources

9. As part of the baseline data collection process, a dedicated shore based marine traffic survey was carried out from 31st July – 14th August 2014 (summer) with an effective duration of 14 days, this was then considered with an additional 14 days of AIS data as noted in the following paragraphs. Full details are available in section 6 and section 13 of the Navigational Risk Assessment (Appendix C).

9.2.1.1. AIS and Radar Survey - 14 Days

10. Both AIS and radar track data (non-AIS) of vessel movements was gathered. The objective of the survey was to identify the vessel activity both within, and adjacent to, the Project.

11. AIS is required to be fitted aboard all vessels engaged on international voyages of 300 gross tonnage (GT) and upwards, cargo vessels of 500 GT and upwards not engaged on international voyages and passenger vessels (carrying 12 or more passengers) irrespective of size built on or after the 1st July 2002. During the marine traffic survey, fishing vessels greater than or equal to 15m in length were required to carry AIS.

12. Non-AIS vessels were recorded during the survey by Automatic Radar Plotting Aids (ARPAs). This radar track data was supplemented by manual observation of vessels within visual range to obtain information on type and size. Non-AIS vessels tended to be smaller craft (i.e. recreational vessels and fishing vessels less than 15m in length).

9.2.1.2. AIS Survey – 14 Days

13. In addition to the summer (July – August 2014) AIS and radar marine traffic survey, a further 14 days of AIS only data between 17th January – 31st January 2015 (winter) was collected. The purpose of the inclusion of this winter AIS only data was to verify commercial vessel routeing in the vicinity of the Project taking consideration of the seasonal and tidal differences from the summer data. It is noted that MGN 371 requirements require 28 days of Radar and AIS data, however on agreement with the MCA this was reduced to 14 days AIS and Radar plus 14 days AIS only given the smaller scale of the site.

14. As no radar data was collected throughout the winter period it is likely that small craft movements (i.e. recreational craft and fishing vessels less than 15m in length) are under-represented by this AIS only data set.

15. In addition to the marine traffic survey data, data from other sources have also been used to inform the description of the baseline environment. All sources used are listed below:

- Fourteen days AIS and radar (31st July – 14th August 2014) marine traffic survey data;
- Fourteen days AIS only (17th January – 31st January 2015) marine traffic survey data;
- Maritime incident data from the Marine Accident Investigation Branch (2004 – 2013) and the Royal National Lifeboat Institute (2001 – 2010);
- Fishing Vessel Satellite Data (2009) provided by the MMO;
- Fishing Vessel Sightings Data (2005 -2009) provided by the MMO;
- Ministry of Defence (MOD) exercise areas and explosives dumping grounds (charted information);
- Locations of existing oil and gas platforms and other associated infrastructure such as pipelines and drilling wells from UK Deal (2014);
- Oil and gas fields and 28th Round license blocks from UK Deal (2014);
- Royal Yachting Association (RYA) UK Coastal Atlas of Recreational Boating (RYA, 2009).
- Designated anchorage areas (charted information);
- Marine Environmental High Risk Areas (MEHRAs) from MCA;
- Admiralty Sailing Directions (NP 54);
- UK Admiralty Charts issued by United Kingdom Hydrographic Office (UKHO); and
- UK Coastal Atlas of Recreational Boating (2009) and associated GIS data.

9.2.1.3. Data Limitations

16. The range of both the AIS and radar systems varied depending on a number of factors, including the prevailing weather and atmospheric conditions. For the majority of the time, the radar tracked targets up to 12nm from the survey location and some targets beyond 20nm. The AIS range was typically at least 25nm during the survey period and therefore covered the entire study area.

17. As previously noted, the winter marine traffic survey data comprised AIS only. Therefore as no radar data was collected throughout this period it is likely that small craft movements (i.e. recreational craft and fishing vessels less than 15m in length) are under-represented by this AIS only data set although it is noted that the numbers of such vessels in the area would be expected to be less than observed during a summer survey.

9.2.2. Navigational Features

17. A chart overview of the Project, relative to key navigational features in the area, is presented in Figure 9-2 (Navigational Features).

18. The primary navigational feature is the proximity of the Project to Aberdeen Harbour, which is located approximately 8.6nm north west of the Project. There is a designated anchorage area to the north of the Aberdeen Harbour, established in 2010, located approximately 8.8nm north of the Project. The anchorage is primarily used for vessels awaiting entry to Aberdeen Harbour.

19. A spoil ground is located approximately 5.9nm north west of the Project and is used by Aberdeen Harbour Authority for disposal of spoil from in-harbour maintenance dredging.

20. There are no designated International Maritime Organisation (IMO) routeing measures in proximity to the Project with all located in excess of 100nm from the Project.

21. Figure 10-2 (Navigational Features) also illustrates the position of the Stonehaven Harbour leading light. This aid to navigation is used to assist vessels upon entry to the harbour.

22. There is no existing oil and gas infrastructure within the Project site. The existing oil and gas drilling wells in the vicinity of the Project are plugged and abandoned with the closest well located approximately 11.3nm south east of the site. The closest piece of existing oil and gas infrastructure, located approximately 19.5nm north of the Project, is the Forties oil pipeline which stretches from Cruden Bay to the Forties Oil Field. The closest existing oil and gas surface platform is the Buzzard quarters and utilities platform, located approximately 51.5nm north. Licenses block 20/16, located approximately 28.1nm north east of the Project, and are the closest currently licensed oil and gas block. License block 20/16 is licensed to Sendero Petroleum Ltd. with the license currently set to expire in 2039. Throughout the 28th licensing round, a number of blocks (26/3 (part), 26/4, 26/5, 26/7, 26.8, 26/9, 26/10, 26/13 (part), 27/1 (part), and 27/6 (part)) in close proximity to the Project were granted potential awards to "TGS". The closest of these is license block 26/3, located approximately 3.3nm east of the Project.

23. There are a number of military practice areas in the vicinity of the Project. The "Central Managed Defence Area (D613A)", which is used by the Royal Air Force overlaps with the north eastern extent of the Project site. The "Black Dog" rifle range and "Drums Links" firing range are located approximately 10.1nm and 12.5nm north west respectively.

24. The European Offshore Wind Deployment Centre (EOWDC), situated in Aberdeen Bay, is located approximately 9.1nm north west of the Project. The EOWDC occupies a total area of approximately 5.8nm^2 (20km^2). It is planed that a total of 11 turbines of varying size (maximum anticipated size of 10MW) will be installed, giving a total output of 84MW to a maximum of 100MW. Consent for the EOWDC was authorised on the 26th March 2013 with a date for construction to commence still to be confirmed.

25. The consented Seagreen Firth of Forth Phase 1 Alpha and Bravo offshore windfarms are located approximately 16.5nm south of the Project site. The Seagreen Alpha and Bravo offshore windfarms occupy a total area of approximately 113.5nm^2 (389.2km^2). A maximum of 150 turbines will be installed, giving a total output of approximately 1,050MW. Consent was authorised on the 10th October 2014. Details on the construction schedule are currently not available at time of writing.

26. The consented Inch Cape offshore windfarm is located approximately 25.1nm south west of the Project site. The Inch Cape offshore windfarm occupies a total area of approximately 43.7nm^2 (149.8km^2). A maximum of 110 turbines will be installed, giving a total output of approximately 784MW. Consent was authorised on the 10th October 2014 with construction scheduled due to start in 2016 (dependant on financial close) for a period of approximately four years.

27. Hywind Scotland Limited (is developing a floating windfarm called Hywind Scotland Pilot Park Project in Buchan Deep off Peterhead. The project will consist of five, 6 megawatt floating Wind Turbine Generator Units with a total capacity of up to 30MW. The WTG Units will be attached to the seabed by a three-point mooring spread and will be connected by inter-array cables; this site is located approximately 25nm from the Project.

28. Aberdeen Harbour Authority is currently with an application and consent process for proposed plans to extend the current harbour into Nigg Bay. The development would include an additional 1,700 metres of quay with a minimum draught of 9 metres meaning additional traffic would be moving to the south of the current harbour.

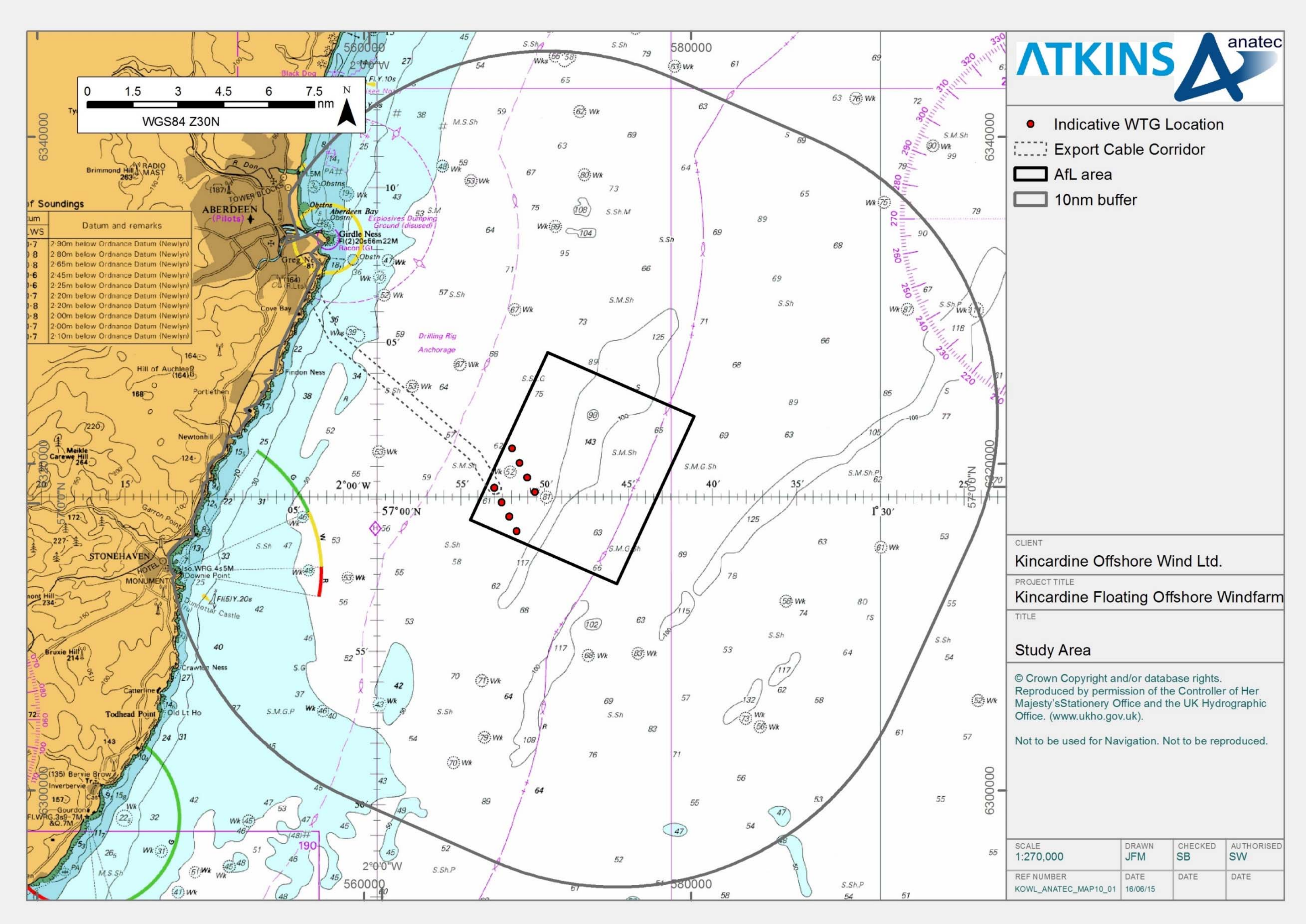

Figure 9-1 Baseline Project site and 10nm study area radius

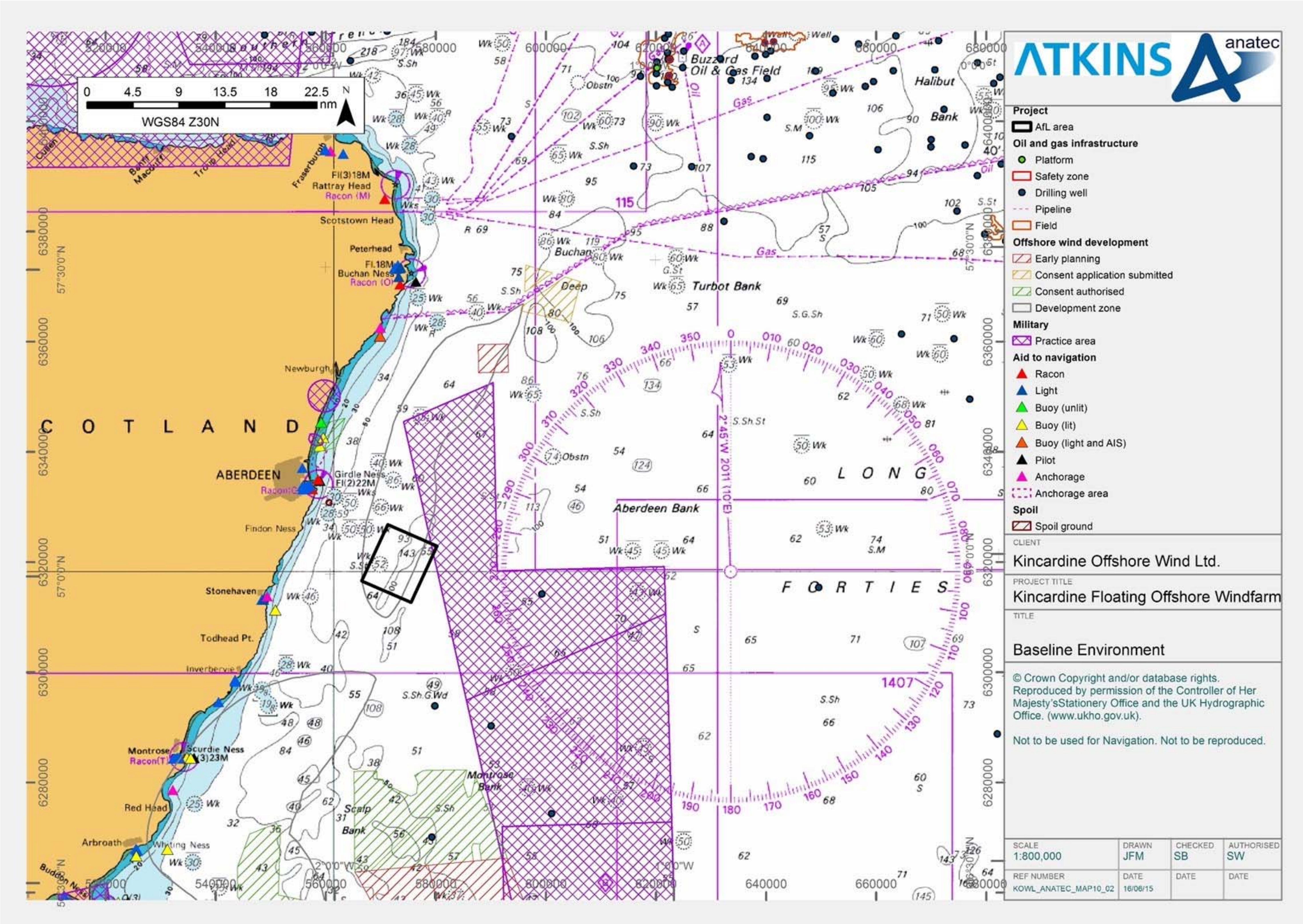

Figure 9-2 Baseline navigation features

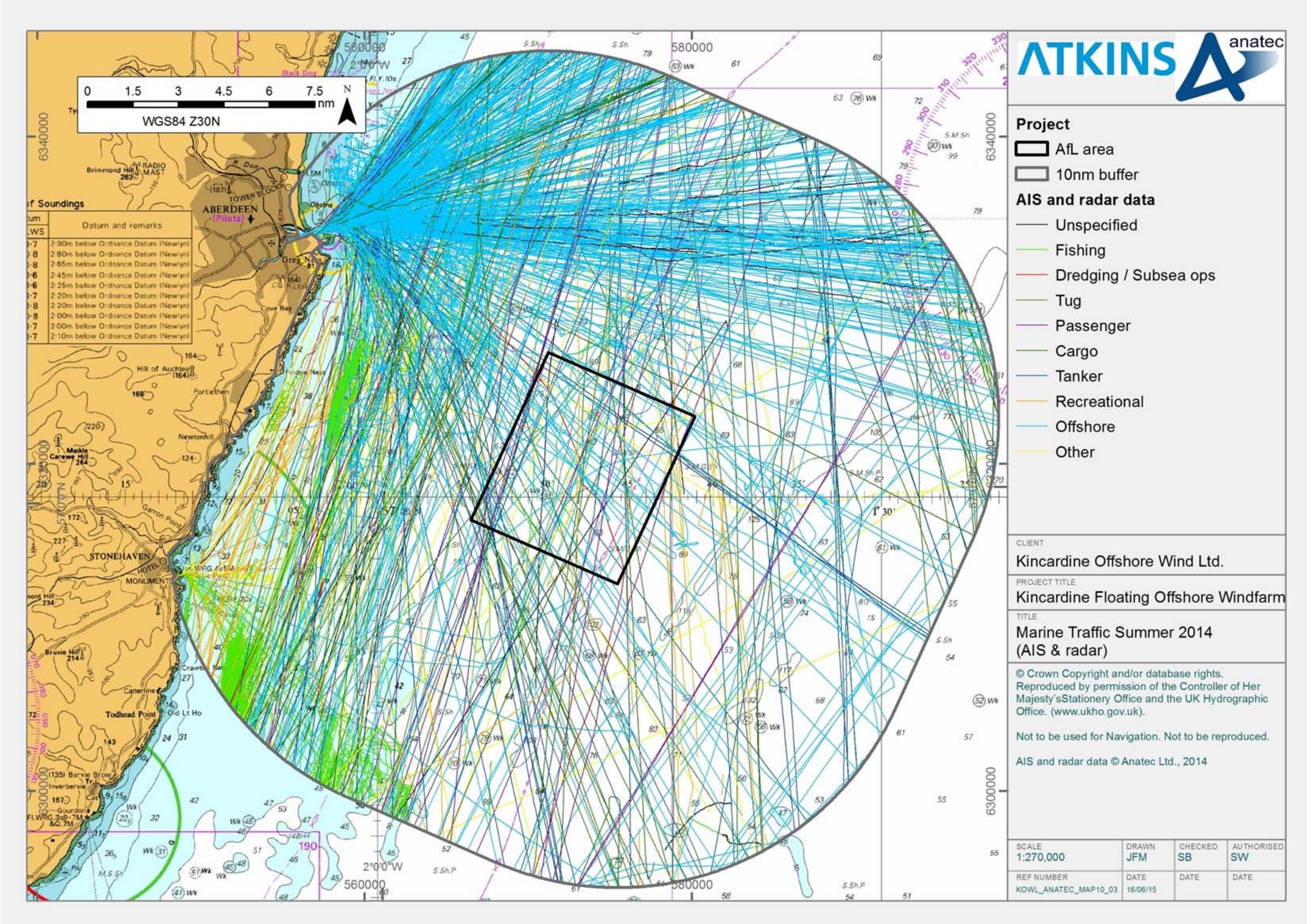

Figure 9-3 Marine traffic (summer)

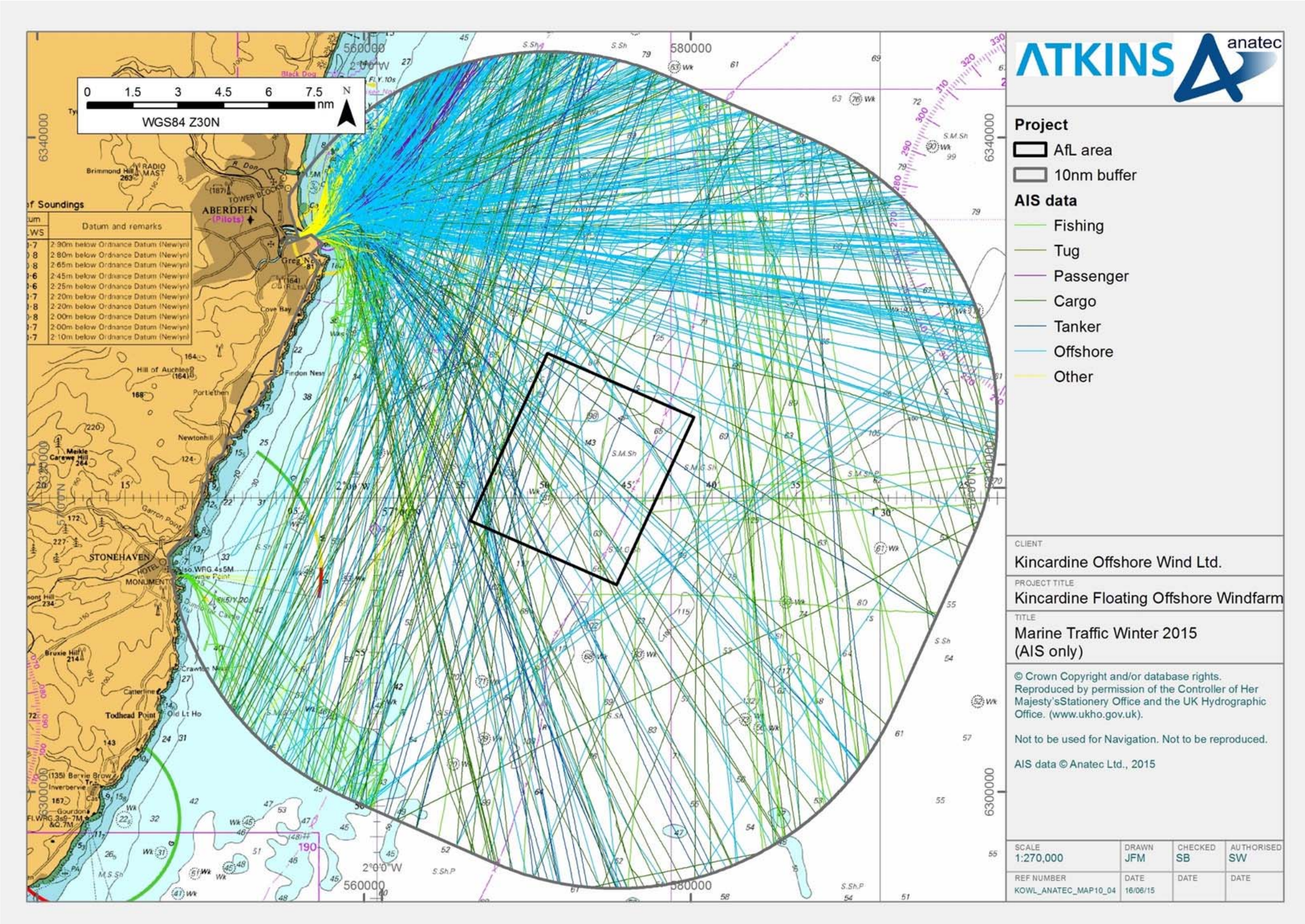

Figure 9-4 Marine traffic (winter)

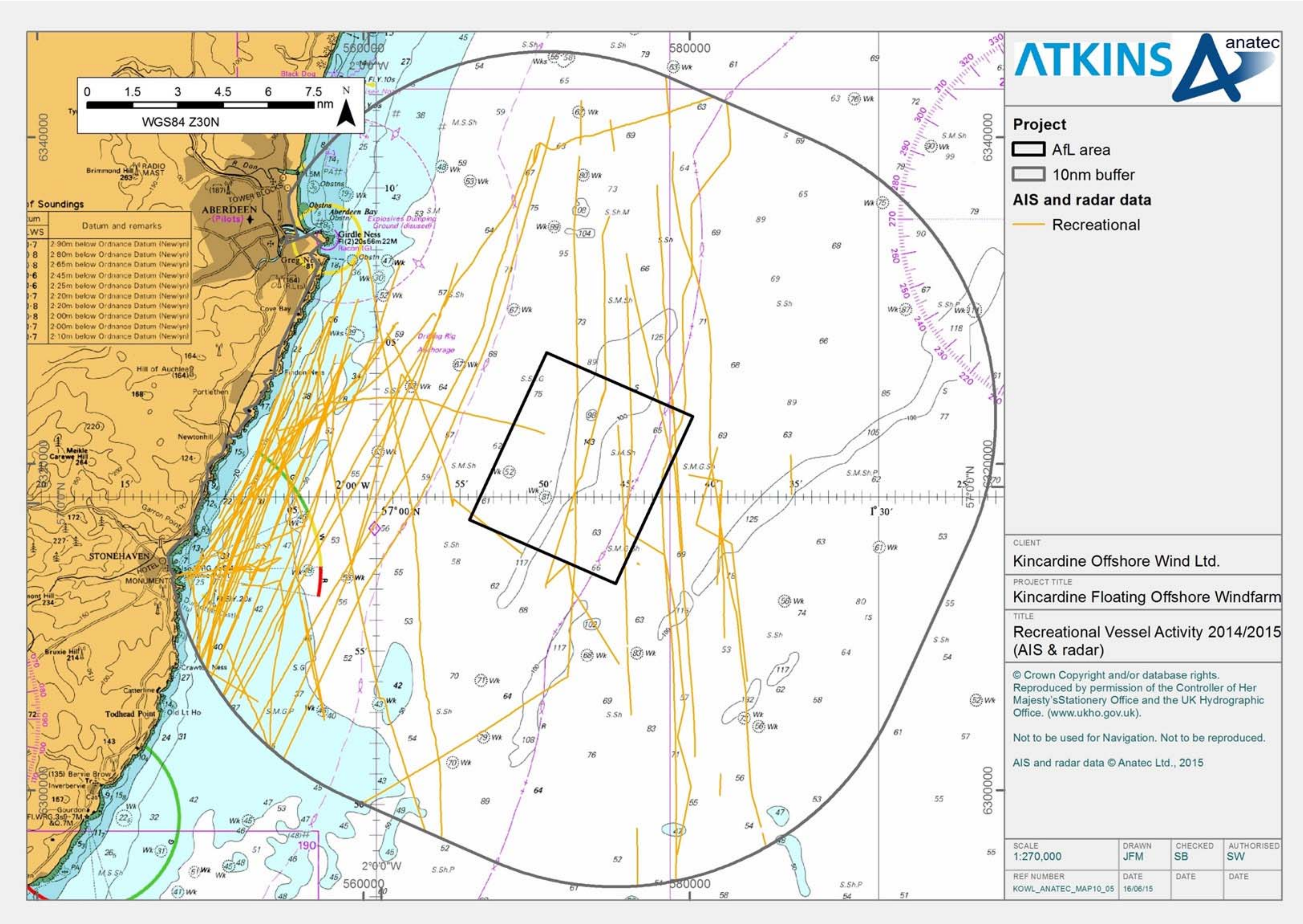

Figure 9-5 Recreational vessel activity

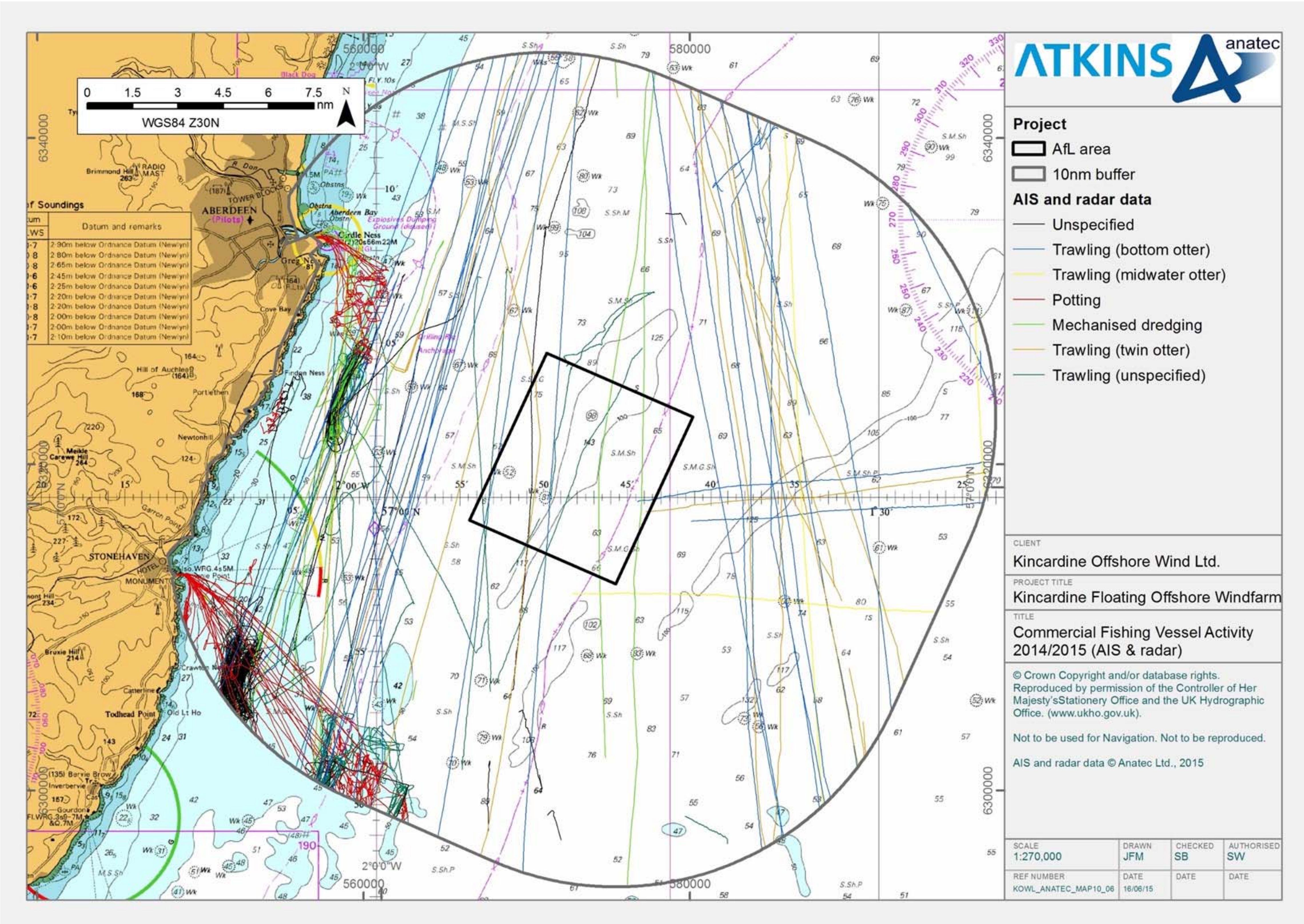

Figure 9-6 Commercial fishing activity

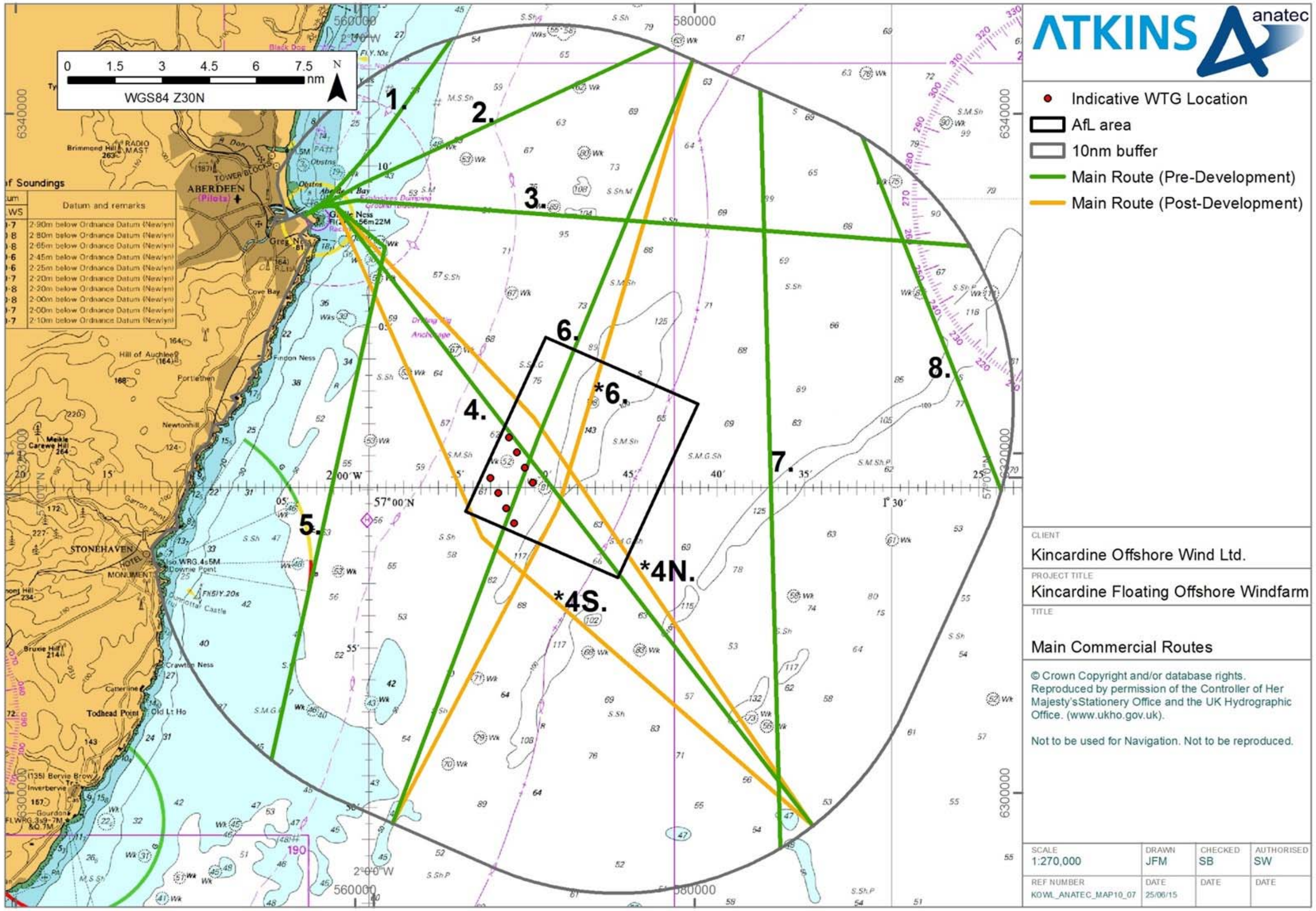

Figure 9-7 Main commercial routes

9.2.3. Marine Traffic Surveys

29. Plots of the marine traffic survey data recorded during the summer 2014 and winter 2015 survey periods are presented in Figure 9-3 (summer) and Figure 9-4 (winter). The vessel tracks have been colour-coded by vessel type.

30. Throughout the summer and winter marine traffic surveys there was an average of 64 unique vessels per day (summer) and 68 unique vessels per day (winter) within the study area, excluding partial days associated with survey set-up and demobilisation. In terms of vessels intersecting the Project Site an average of seven unique vessels per day was recorded intersecting the Project site throughout the summer survey and an average of five unique vessels per day was recorded intersecting the Project site throughout the winter survey. Over the entire survey period, only 9.7% of all marine traffic recorded intersected the Project site.

31. Throughout the summer and winter survey periods the most frequently recorded vessel types within the study area were:

- Offshore oil and gas affiliated vessels, representing 56.6% of marine traffic throughout summer and 62.8% throughout winter;
- Cargo vessels, representing 10.0% of marine traffic throughout summer and 14.8% throughout winter;
- Fishing vessels, representing 9.9% of marine traffic throughout summer and 6.5% throughout winter; and
- Tanker vessels, representing 6.3% of marine traffic throughout summer and 6.8% throughout winter.

32. In terms of seasonality within the study area, there was a marked decrease in the level of recreational traffic (decrease of 6.5%) between the summer and winter survey periods; it is assumed that this is impacted by the winter survey not including radar data. This follows the typical seasonal pattern of recreational vessel activity with higher levels of activity associated with the fairer weather summer months. There was also a slight decrease in the level of fishing vessel activity (decrease of 3.3%) between the summer and winter survey periods. Again this is most likely associated with the weather limitations of fishing vessels and the fairer conditions experienced throughout the summer survey.

33. Throughout the summer and winter survey periods the most frequently recorded vessel types intersecting the Project were:

- Offshore oil and gas affiliated vessels, representing 37.4% of marine traffic throughout summer and 33.3% throughout winter.
- Cargo vessels, representing 15.9% of marine traffic throughout summer and 33.3% throughout winter.
- Tanker vessels, representing 15.9% of marine traffic throughout summer and 22.2% throughout winter.

34. It can therefore be concluded that there is a relatively higher level of cargo and tanker vessel activity within the Project site in comparison to the entire study area. This is due to the moderate volume of both cargo and tanker vessels utilising Aberdeen Harbour and also on north / south bound transits to other UK ports.

35. Furthermore, there is a relatively lower level of offshore oil and gas affiliated vessel activity within the Project in comparison to the entire study area. This is due to the very high volume of offshore oil and gas affiliated vessels transiting between Aberdeen Harbour and oil and gas installations to the north and east. In comparison only a moderate volume of offshore oil and gas affiliated support vessels were recorded on passage between Aberdeen Harbour and oil and gas installations in the Southern North Sea.

36. In terms of seasonality within the study area, there was a marked decrease in the level of recreational traffic intersecting the Project site (decrease of 8.4%) between the summer and winter survey periods for the aforementioned weather limitations and typical seasonal pattern of recreational craft. There was also a marked decrease in the level of passenger vessel traffic intersecting the Project site (decrease of 8.4%) between the summer and winter survey periods; noting the limitations on winter survey data. This is due to the higher number of cruise passenger vessels recorded on passage throughout the summer survey, when the incidence of cruise vessels calling at UK ports is higher during the main tourist season, in comparison to the winter survey.

9.2.4. Commercial Traffic

37. A number of moderately busy commercial shipping routes pass in proximity to the Project site, with the majority of routes transiting to / from Aberdeen Harbour. Commercial traffic (offshore oil and gas affiliated vessels, cargo vessels, passenger vessels, tanker vessels, tugs and dredging / underwater ops vessels) represented the majority of marine traffic recorded throughout both the summer (79.6% of marine traffic within the study area) and winter (93.5% of marine traffic within the study area) surveys. The identification of main shipping routes was undertaken for the study area based on the principles defined in MGN 371 for both the summer and winter marine traffic survey data.

38. A number of main routes, comprising offshore oil and gas affiliated vessels, pass between Aberdeen Harbour and oil and gas installations within the North Sea. In addition, the Northlink Ferries Aberdeen – Lerwick passenger ferry and RoRo cargo service operates from Aberdeen Harbour.

39. There are also a number of commercial shipping routes transiting between ports north of Aberdeen Harbour (e.g. Peterhead, Scrabster and Wick) to ports in mainland Europe (e.g. Rotterdam, Amsterdam and Antwerp), other ports on the east coast of Scotland (e.g. Montrose, Leith and Rosyth) and other ports on the east coast of England (e.g. Immingham, Redcar and Teesport) which pass through the study area. Figure 9.7 presents the mean route position of identified commercial main routes relative to the Project site. Following this, Table 9-2 provides a summary of these main commercial routes.

Table 9-2 Summary of Main Commercial Shipping Routes

Route Number	Destination	Vessel Type	Number of Vessels per day
1	Aberdeen – Orkney waters / northern oil and gas installations (e.g. Captain, Ninian and Athena fields). Including Northlink Aberdeen to Kirkwall/Lerwick.	75% offshore oil and gas affiliated. 15% cargo. 10% passenger.	8
2	Aberdeen – Norway and north eastern oil and gas installations (e.g. Kittiwake, Andrew and Brent fields)	90% offshore oil and gas affiliated. 10% cargo.	10
3	Aberdeen – eastern oil and gas installations (e.g. Elgin, Curlew, Pierce North and Janice fields)	100% offshore oil and gas affiliated.	8
4	Aberdeen – southern UK / mainland Europe.	40% offshore oil and gas affiliated. 35% cargo. 35% tanker.	4
5	Aberdeen – east coast Scottish ports (e.g. Montrose, Dundee and Leith).	60% offshore oil and gas affiliated. 25% tanker. 10% cargo. 5% other.	2

Route Number	Destination	Vessel Type	Number of Vessels per day
6	Northern ports (e.g. Invergordon, Inverness and Lerwick) – Firth of Forth ports (e.g. Leith, Rosyth and Grangemouth) / Montrose.	30% offshore oil and gas affiliated. 30% cargo. 20% tanker. 10% passenger.	5
7	Transient traffic between northern ports (e.g. Peterhead, Scrabster, Lerwick and Wick) – southern ports (e.g. Rotterdam, Immingham and Blyth).	50% cargo. 30% tanker. 20% offshore.	1
8	Northern ports (e.g. Peterhead, Inverness and Reykjavik) to Tees / Humber.	80% cargo. 20% tanker.	1

40. In terms of commercial vessel routes passing through the Project site, Route 4 and Route 6 (see Figure 9.7 and Table 9-2) intersect the Project site. Approximately four vessels per day transit Route 4 on passage between Aberdeen and other ports in the UK and also mainland Europe. Offshore oil and gas affiliated vessels, cargo vessels and tanker vessels frequent Route 4. The mean route position of Route 4 intersects the south western corner of the Project site, in proximity to the indicative turbine locations, and therefore it is likely that a degree of re-routeing will be required for vessels transiting Route 4.

41. Approximately five vessels per day transit Route 6 on passage between ports on the north coast of Scotland (e.g. Invergordon, Inverness and Lerwick) and ports within the Firth of Forth (e.g. Leith, Rosyth and Grangemouth) and also Montrose. Offshore oil and gas affiliated vessels, cargo vessels, tanker vessels and passenger vessels frequent Route 6. The mean route position of Route 6 intersects the western extent of the Project site, in proximity to the indicative turbine locations, and therefore it is likely that a degree of re-routeing will be required for vessels transiting Route 6.

9.2.5. Port Activity

42. The nearest principal port to the Project is Aberdeen Harbour, located approximately 8.6nm north west. Aberdeen harbour is a large commercial port having handled 7,937 vessel arrivals and 4.75 million tonnes of cargo throughout 2014. Aberdeen harbour is used as the primary service base for oil and gas platforms within the North Sea and thus a large proportion of vessel arrivals (69.3%) throughout 2014 were oil and gas affiliated vessels. Cargo vessels (6.4% of vessel arrivals throughout 2014) and tanker vessels (3.7% of vessel arrivals throughout 2014) are also known to frequent Aberdeen Harbour (Aberdeen Harbour, 2014). The Northlink Ferries Aberdeen – Lerwick passenger ferry also operates from Aberdeen Harbour, with one vessel per day transiting on this route.

43. Stonehaven harbour is also located approximately 9.8nm southwest of the Project. Stonehaven harbour is now primarily a recreational harbour with 140 regular moorings for recreational craft and an additional 550m of berthing space on the quays. A number of small inshore fishing vessels also operate from Stonehaven.

44. It is noted that a port for the operation and maintenance of the Project has not yet been defined, but could result in an increase in traffic to and from the chosen port although this would be expected to be a very low number of movements overall.

9.2.6. Recreational Vessel Activity

45. Based on the RYA published data (RYA, 2009), there are two medium use cruising routes passing through the Project site (Figure 9-5). Both of these routes are pass from Rattray Head (northern Scotland) to the sea area north of Eyemouth and to the north of Sunderland. In addition, a number

of medium-use cruising routes pass inshore of the Project site. These inshore routes travel from Stonehaven and Aberdeen to other ports both to the north and the south.

46. There are a number of clubs, training centres and marinas for recreational vessels located on the Aberdeenshire coastline. Stonehaven harbour is the closest recreational marina to the Project located approximately 9.8nm south west.

47. During the summer marine traffic survey, a total 52 unique recreational vessels were recorded within the study area, corresponding to an average of five recreational vessels per day. A plot of the tracks of these vessels is presented in Figure 9.5. Of these vessels, nine were recorded intersecting the Project site. The majority of recreational transits were recorded inshore of the Project. No recreational vessel activity was recorded throughout the winter survey noting again the limitations with the data set.

9.2.7. Fishing Vessel Activity

48. Fishing vessel activity was monitored during the both the summer and winter survey periods (Figure 9-6). During the summer AIS and radar survey, approximately 69.7% of fishing vessel activity was recorded using radar and 30.3% using AIS thus confirming the aforementioned caveat that small fishing vessel activity is under-represented by the winter AIS-only survey data. This is due to the high number of local inshore fishing vessels (of less than 15m in length and therefore not required to carry AIS) which are known to operate in the study area.

49. Where possible, fishing vessels tracked by radar were identified by visual observation. In most cases it was possible to identify the primary gear type of the fishing vessel but not the vessel name or Port Letter Number (PLN).

50. The tracks of fishing vessels recorded throughout both the summer and winter survey periods, colour-coded by primary gear type, are presented in Figure 9.6.

51. Bottom otter trawls and unspecified trawls (unable to determine specific trawling method) were the most frequently recorded fishing vessel gear types recorded throughout the summer and winter surveys representing 24.2% and 17.4% of fishing vessel activity respectively. Other trawling methods, twin otter and midwater otter were also recorded within the study area but to a lesser extent, representing 9.4% and 2.0% of fishing vessel activity respectively. Potters were also frequently recorded within the study area, representing 16.8% of fishing vessel activity.

52. A greater level of fishing vessel activity was recorded throughout the summer survey (59.1% of total fishing vessel activity) in comparison to the winter survey (40.9%). Throughout the summer survey an average of six unique fishing vessels per day was recorded within the study area. This decreased to an average of four unique fishing vessels per day throughout the winter survey.

53. The vast majority of fishing vessels recorded throughout the marine traffic surveys were on passage. However a proportion of fishing vessels were recorded directly engaged in fishing operations. The majority of this activity was recorded within shallower (less than 50m) waters in closer proximity to the shore. Four distinct fishing hot spots were recorded throughout the marine traffic surveys:

- Approximately 5.5nm west of the Project site, concentrated within a trench of deeper water (approximately 55m) bounded by shallow (approximately 35m) rocky outcrops, mechanised dredging and trawling (bottom otter) fishing activity was recorded. Part of this area of activity overlaps with the export cable corridor.

- Approximately 6.4nm north west of the Project site, in close proximity to the Offshore Export Cable Corridor, the potter *Skua II (A17)*, was recorded setting and retrieving pots in depths ranging from approximately 30m to a maximum of 50m. The *Skua II (A17)* was the only fishing vessel recorded fishing in this area and operates primarily from Aberdeen Harbour. It should be noted that on occasion the *Skua II (A17)* also operates as a crew transfer vessel.

- Approximately 9.1nm south west of the Project site, a high level of fishing activity (including mechanised dredging, potting and unspecified fishing), in depths of approximately 40m was recorded.

- Approximately 9.2nm south of the Project site, a high level of trawling and potting was recorded in depths of approximately 40 – 50m. The potting activity recorded was carried out exclusively by the *Dalwhinnie* which operates from Stonehaven.

- During consultation with SFF they noted that the area is popular with squid and scallop fishing including the deeper trench running through the Area for Lease.

9.2.8. Maritime Incidents

54. Maritime incident data from the MAIB (2004 – 2013) and RNLI (2001 – 2010) has been analysed in order to provide a general indication as to whether the sea area surrounding the Project site is currently a low or high risk area in terms of maritime incidents. It should be noted that the same incident may be recorded within both the MAIB and RNLI data.

55. A total of 96 incidents were reported to the MAIB within the study area, corresponding to an average of nine to ten incidents per year. It should be noted that the majority (84.4%) of these incidents were reported to have occurred within Aberdeen Harbour. The most frequently reported incidents were accident to person (43.8%), machinery failure (16.7%) and contact (15.6%). No incidents were reported to have occurred within the Project site. The closest reported incident (approximately 1.2nm north) to the Project was an accident to a person which occurred on-board an offshore oil and gas affiliated vessel during a period of adverse weather. The incident occurred on the 24th November 2008.

56. A total of 113 incidents were responded to by the RNLI within the study area, corresponding to an average of 11 incidents per year, between 2001 and 2010. The most frequently recorded casualty types were “person” (49.6%), “personal craft” (14.2%) and “fishing vessels” (13.3%). Two incidents were recorded within the Project site: A machinery failure on board a large fishing vessel was responded to by the Aberdeen all-weather lifeboat, which rendered assistance on the 18th April 2001; and A yacht which was experiencing adverse weather conditions, was responded to by the Aberdeen all-weather lifeboat, which towed the yacht to harbour, on the 1st April 2003. The majority (97.3%) of incidents were responded to by the Aberdeen station which is located within Aberdeen Harbour.

9.3. Assessment Methodology

57. The following section defines the assessment methodology used within the maritime navigation chapter for the Project.

9.3.1. Study Area

58. The study area is based on a 10 nautical mile (nm) buffer around the proposed Project site which also covers the associated offshore cable works. For the purposes of cumulative impact this has been extended where applicable to encompass vessel routeing.

9.3.2. Worst Case Scenario

59. For shipping and navigation receptors one worst case layout has been assessed. A total of eight wind turbine generators (WTGs) have been considered throughout the worst case layout, the positions of which are presented in Figure 9.1. WTGs are spaced a minimum of 1,000m (NNW / SSE orientation) and 2,200m (north / south orientation).

Table 9-3 Rochdale Envelope

Type	Assessed Parameters
WTG	6MW to 8MW
MW Capacity	Under 50 MW
WTG Hub Height (to centre line of Hub)	LAT + 100m
WTG Blade Length	76m
Blade Clearance	22m maintained at all tidal states
Effective Tip Height	+176m
Foundation	Semi-Submersible Geometry equilateral 3 or 4 sided
Elevation of Foundation above the Waterline	Max 12m
Maximum Excursion Area of WTGs	25m
Access	Two boat landings
Mooring Point	Up to 4 Mooring lines/points. Catenary Anchor -drag embedment anchors, torpedo anchors, gravity based anchors Anchor Chain, mooring cables and polyester mooring lines. Anchors and mooring system present on the seabed for up to 18 months prior to turbine installation Permanent submersible buoys at seabed for ROV recovery
Mooring Line Radius	Max 9 x Water Depth and touchdown within 250 metres
Export Cable	Max 2
Export Cable Length	Max 15km
Export Cable Burial and Protection	Target depth 1.5m Localised burial, rock dump or mattressing
Inter Array Cable	Max 12
Inter Array Cable Lengths	Max 2.5km
Operational Life	25 Years
Construction Base and Tow Route	Potential construction base of Nigg within the Cromarty Firth.
Operations Base	Not yet confirmed.

9.3.3. Embedded Mitigation

60. Embedded mitigation or standard industry which will be applied to minimise navigational impacts are presented below within Table 9-4. These have been assumed as embedded mitigation in the initial ranking of each impact. Additional Project specific (enhanced) mitigation measures identified during consultation and assessment are then presented, specific to each impact, and used to estimate the residual risk.

Table 9-4 Embedded Mitigation

Description	Definition
24hrs emergency coordination centre	KOWL are committed to the development, including integration into existing oil and gas facilities located within Aberdeen, of a 24hrs monitoring and emergency contact facility. This will ensure that the turbines are monitored and any mooring issues are noted immediately.
AIS carriage on support vessels	All support craft associated with the development will carry AIS.
Application and use of rolling safety zones of up to 500m during construction, operations & maintenance and decommissioning	Where required 500m rolling safety zones would be used around current areas of constructions, major maintenance and decommissioning.
Operational safety zones	A minimum of 50m operational safety zones will also be applied for given the subsea mooring of the structures and potential excursion of the WTGs.
Cable protection	Export cables would be protected appropriately taking into account fishing and anchoring practices and an appropriate burial protection index study. Positions of cables would be promulgated and charted by appropriate means. As per the requirements of MGN 371 any cable protection used will be risk assessed to ensure it does not present an under keel clearance risk to vessels transiting over the top. This in particular is required in shallow waters areas where deep keeled recreational craft may transit.
Cardinal marker buoys deployed during construction / decommissioning.	Cardinal markers buoys will be deployed around the site to mark the construction (and decommissioning area) of the turbine development. It is assumed that these cardinal buoys will remain in situ for the approximate 18 month period when the cables and mooring installation will be in place without the surface structures.
Compliance with MCA's MGN 371 including Annex 5	Annex Five specifies 'standards and procedures for generator shutdown and other operational requirements in the event of a Search and Rescue, counter pollution or salvage incident in around an Offshore Renewable Energy Installations (OREI)'.
Development and implementation of an Emergency Response Cooperation Plan (ERCoP)	An Emergency Response Cooperation Plan (ERCoP) would be developed and implemented for the construction, operational & maintenance and decommissioning phases. The ERCoP would be based on the standard MCA template and would consider the potential for self-help capability as part of the ongoing process.
Fisheries Liaison	The FLOWW (Fishing Liaison with Offshore Wind and Wet Renewables Group) best practice guidance for fisheries liaison will be followed, including the establishment of a fishing liaison plan. An FLO has been appointed for the Project and will continue in this role during construction.

Description	Definition
Guard vessels during construction	Guard vessels would be used during construction, and significant maintenance to both protect the installations and workers on the wind turbines, particularly in areas in proximity to main traffic routes. Their role would be to both alert vessels to the development activity and provide support in the event of an emergency situation. A guard vessel will be present for the period when the export cables, inter array cables and mooring structures will be in situ.
Marked on admiralty charts	The windfarm would be charted by the UK Hydrographic Office (UKHO). This would include wind turbines, offshore cable corridor (specific location of export cables) and inter-array cables for the appropriate scale charts. Discussions will also be held with the UKHO in collaboration with the MCA regarding the charting of subsea mooring lines and anchors.
Minimum blade clearance	Wind turbines would be constructed to ensure that a constant rotor blade clearance (air draught) of 22m above all tidal states is maintained; due to the floating nature of the turbines.
Monitoring	Active monitoring of development to ensure that the structures and / or cables would not become a hazard to navigation over time, for example, export cables becoming exposed.
Navigational marking and lighting	Structures within the windfarm would be marked and lit in accordance with International Association of Lighthouse Authorities (IALA) Recommendation O-139 on the Marking of Man-Made Offshore Structures (IALA, 2013), but may also include the use of other visual and sounds aids (e.g. Fog horns and AIS aids to navigation) to navigation as agreed with the Northern Lighthouse Board (NLB). This includes use of standard marine colours.
Promulgation of information	Appropriate liaison and dissemination of information and warnings through Notices to Mariners and other appropriate media, (e.g. Admiralty Charts, fishermen's awareness charts and Pilot Books) would enable vessels too effectively and safely passage plan around the Project (including inter-array cables) and the offshore cable corridor. It is noted that this will include international promulgation of information.
Safety Management System (SMS)	The developer/operator of KOWL will have a SMS in place throughout all phases of the project. This would include procedures such as adverse weather protocols.
Towing risk management plan	A management plan for the towing operation will be developed by the towage company; this will follow standard and international marine procedures.
Works vessel coordination	All on site traffic associated with the construction and decommissioning will be controlled through a Works Vessel Coordination/Control centre.
Single line of orientation within final agreed layout.	Recent changes to marine guidance (MGN 371) require all offshore windfarm sites to maintain at least one direction of orientation to assist surface craft navigation and to be used as search and rescue corridors.
ID numbering	Individual OREI marking should conform to a spreadsheet layout, i.e. lettered on the horizontal axis and numbered on the vertical axis. The detail of this will depend on the shape and geographical orientation of the final layout. Each WTG shall be marked with a unique ID number.

9.3.4. Scope of the Assessment

61. The maritime navigation impact assessment follows a different assessment process from the Environmental Impact Assessment (EIA), although the approaches are very similar. The result is an assessment of the risk posed by the Project to navigation and the mitigation required to minimise those risks. As such, the approach does not follow the assessment methodology laid out in Chapter 1 but follows the requirements laid out by the MCA through the DECC Methodology (DECC, 2013) .

62. The assessment has a baseline data gathering phase broadly similar to the EIA, which included marine traffic surveys, desk-based research and consultation to allow the identification of higher risk areas. This phase is followed by a FSA in line with the IMO FSA Process (IMO, 2007) and DECC guidance (DECC, 2013).

63. A shipping and navigation receptor can only be sensitive if there is a pathway through which an impact could be transmitted between the source and the receptor. When a receptor is exposed to an impact, the overall ‘severity of consequence’ to the receptor is determined and the process incorporates a degree of subjectivity and professional judgement. Consequence assessments for shipping and navigation receptors use the following criteria, in line with baseline data and expert opinion, to assess:

- Outputs of stakeholder consultation;
- Vessel type (including persons / cargo on board) and routes proximity to structures; and
- Lessons learnt from existing developments.

64. The impacts that have a clear pathway of effect on receptors have been considered as part of the FSA process and are therefore detailed within this chapter. Impacts which do not have a pathway have then been scoped out at this stage are to be covered within the baseline section of the assessment.

15.1.1 Severity of Consequence and Frequency of Occurrence

65. The following tables show the consequence (Table 9-5) and frequency (Table 9-6) bands used within the assessment.

Table 9-5 Consequence Bands

Description	Definition
Negligible	• No injury to persons • No significant damage to infrastructure or vessel • No environmental impacts (marine pollution) • No significant operational impacts
Minor	• Slight injury(s) to person • Minor damage to infrastructure or vessel • Tier 1 pollution assistance (marine pollution) • Minor operation impacts
Moderate	• Multiple moderate or single serious injury to persons • Moderate damage to infrastructure or vessel • Tier 2 pollution assistance (marine pollution) • Considerable operational impacts
Serious	• Serious injury or single fatality • Major damage to infrastructure or vessel • Tier 2 pollution assistance (marine pollution) Major national business, operation or reputation impacts

Description	Definition
Major	• More than one fatality • Extensive damage to infrastructure or vessel • Tier 3 pollution assistance (marine pollution) • Major international business, operation or reputation impacts

Table 9-6 Frequency Bands

Description	Definition
Negligible	Only likely to happen in exceptional circumstances.
Extremely Unlikely	Unlikely to happen but not exceptional throughout all phases of the project.
Remote	Likely to happen throughout phases of the project.
Reasonably Probable	Extremely likely to happen throughout phases of the project.
Frequent	Would occur daily throughout phases of the project.

9.3.5. Risk Ranking

66. Consequences have then been assessed against frequency to identify the overall tolerability ranking for the impact, as detailed in Table 9-7.

Table 9-7 Risk Matrix

Frequency	Frequent	Tolerable	Tolerable	Unacceptable	Unacceptable	Unacceptable
	Reasonably Probable	Broadly Acceptable	Tolerable	Tolerable	Unacceptable	Unacceptable
	Remote	Broadly Acceptable	Broadly Acceptable	Tolerable	Tolerable	Unacceptable
	Extremely Unlikely	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable	Tolerable
	Negligible	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable
		Negligible	Minor	Moderate	Serious	Major
		Consequence				

67. Following assessment and risk ranking, further mitigation (beyond the embedded mitigations) may be required to reduce the impact and bring it within ALARP parameters. As noted below (Table 9-8), risks that are ranked tolerable or unacceptable will require additional mitigation to reduce the residual risk.

Table 9-8 Risk Ranking

	Broadly Acceptable	Risk ALARP with no additional mitigations or monitoring required above embedded mitigations.
	Tolerable	Risk acceptable but may require additional mitigation measures and monitoring in place to control and reduce to ALARP.
	Unacceptable	Significant risk mitigation or design modification required to reduce to ALARP.

9.4. Impact Assessment

68. The impact assessment has been divided into sections dealing with the impact on different shipping and navigation receptors. The following sections first identify the receptors and then the impacts by phase.

9.4.1. Identification of Receptors

69. Following assessment of the preliminary hazard analysis (PHA) and the further assessment work undertaken as part of the EIA the following receptors have been identified for the Project:

- Commercial vessels safe operations;
- Commercial vessels routeing;
- Fishing vessel safe operations;
- Recreational craft (2.5m to 24m);
- Vessel engaged in port activities; and
- Emergency response.

70. The above receptors have been identified as potentially being impacted during the construction, including the period in which the mooring equipment will be installed and left, the fully commissioned operational phase and the decommissioning phase. This impact assessment includes both the Development Area and the Offshore Export Cable Corridor.

9.4.2. Impacts on commercial vessel safe operations

71. The Project is located close (8.6nm south east) to the port of Aberdeen Harbour and therefore there are associated commercial vessel movements through or within close proximity to the Project site. However the Project site shows lower levels of traffic compared to areas to the north and east of the site, centred upon the entry and to the north east of Aberdeen harbour where most vessels then proceed outwards to North Sea oil and gas installations / Scandinavian ports (Figure 9-6).

72. Two moderate level regular main routes (as per principles of MGN 371) intersect the Project site whilst on passage to other UK and mainland European ports (see Section 9.2.4). Vessels on these routes comprise of offshore oil and gas affiliated vessels, cargo vessels, tanker vessels and passenger vessels.

73. The most frequently recorded vessel types within the study area were offshore oil and gas affiliated vessels, representing 56.6% of marine traffic throughout summer and 62.8% throughout winter. Cargo vessels (representing 10.0% throughout summer and 14.8% throughout winter) and tanker vessels (representing 6.3% throughout summer and 6.8% throughout winter) were also frequently recorded. Throughout the summer survey passenger vessels were also recorded, representing 2.6% of marine traffic within the study area. A number of passenger (cruise) vessels were recorded transiting through and in close proximity to the Project. The commercial vessel type distribution within the study area was broadly similar through both the summer and winter survey periods.

74. A commercial main route was recorded throughout the marine traffic surveys transiting to / from Aberdeen harbour (Route 4 of Figure 9.7 and Table 9-2), the mean position of which intersected the Project site. In addition, a further commercial main route was recorded intersecting the Project site with vessels undertaking longer transits from northern ports to ports on the east coast of the UK and west coast of mainland Europe (Route 6 of Figure 9.7 and Table 9-2).

75. Vessels currently transiting Route 4 between Aberdeen Harbour and destinations to the south of Aberdeen will be able to either transit between the site and the coast, corresponding to a 0.6nm

deviation (2.3% of total route length within study area), or deviate offshore of the Project site corresponding to a 0.1nm deviation (0.3% of total route length within study area). The route chosen (inshore or offshore of the Project) is likely to be dictated by the prevailing conditions (i.e. adverse weather), vessel characteristics (e.g. overall length and manoeuvrability), the potential for interaction with other marine traffic and the final destination. Vessels currently transiting Route 6 between northern ports and Firth of Forth ports / Montrose will most likely pass offshore of the Project, corresponding to a 0.1nm deviation (0.4% of total route length within study area).

76. A number of tankers were noted awaiting both entrance to Aberdeen Harbour and orders for onward passages to offshore Floating Production, Storage and Offloading (FPSO) installations within and in proximity to the Project site. Throughout the summer and winter marine traffic surveys, an average of one tanker vessel every two days was recorded at anchor within the study area, the majority of which were recorded at anchor in close proximity to Aberdeen Harbour, approximately 6.5nm North West of the Project site.

77. In addition, a number of offshore oil and gas affiliated vessels were recorded anchoring both within and in close proximity to the Project (average of one offshore oil and gas affiliated vessel every four days within 2.5nm of Project) whilst awaiting orders. However this anchoring activity represents a very small proportion (2.7%) of the total level of anchoring activity, with the majority of anchoring occurring in close proximity to Aberdeen Harbour.

78. Although once fully constructed the site will still allow for vessels to anchor / stem the tide near the Aberdeenshire coast but it is noted that they may decide not to given the additional allision risk presented by the presence of the WTGs and also the additional risk associated with the cable / mooring systems.

79. For the overall UK area it was noted that both MAIB incidents and RNLI incidents were lower out with the port of Aberdeen and beach front area indicating that the area is generally low risk due to the limited traffic movements.

Construction and decommissioning

80. Although the development of the Project will see an increase in vessel activity, the risk will be mitigated through the construction planning which will include Work Vessel Coordination, meaning that vessel movements associated with the development will be coordinated and promulgated through a control centre to ensure that they do not increase risk for third party vessels within the area. Safety zones (including around the cable installation vessel) and buoyed construction areas will also be in place to advise mariners of safe passing distances and current areas of activity; all of this information along with site updates and current operations will be promulgated through methods such as Kingfisher Bulletins and Local Notice to Mariners.

81. As noted within the worst case scenario the current construction plan would see the export cables, inter array cables and mooring systems in situ for a period of time prior to the surface structures (the WTGs) being installed. However KOWL have committed to the presence of a guard vessel during this period as well as the presence of cardinal buoys (to be agreed with Northern Lighthouse Board) to ensure that risk to vessels is mitigated by a 24 hrs on site presence and clear visual aids to navigation.

82. The WTGs will be constructed at a mainland port (mostly likely Nigg within the Cromarty Firth) and towed to site. Towage companies undertaking this operation will be established companies with extensive experience in offshore towing and therefore will have safety plans established within their work procedures to ensure that risk to third parties is mitigated. There are also standard marine regulations such as COLREGS - the International Convention for the Prevention of Collisions at Sea which both identify and give priority to vessels engaged in towing operations when they are Restricted in their Ability to Manoeuvre (RAM). A towing risk management plan would also be developed by the towage company and is considered an embedded mitigation.

83. The following impacts have been identified for commercial vessel safe operations during the construction and decommissioning phase:

- Increased collision and allision risk with construction and decommissioning vessels and activities.

- Impacts associated with the installed cable and mooring systems for a period of up to 18 months.
- Impacts associated with towing of the structures to site including encounter / collision risk.

84. The overall severity of consequence for commercial vessels safe operations during the construction and decommissioning phase is considered to be **moderate**, assuming the potential for damage to a vessel associated with the towing and installation of the infrastructure. The overall frequency of occurrence will be **extremely unlikely** given the embedded mitigations in place including the presence of a guard vessel. Therefore the potential impact is assessed to be **broadly acceptable** (Table 9-8).

Operation

85. The vast majority of anchoring activity (97.3%) was recorded over 2.5nm from the Project site, with the majority recorded in designated anchorage areas to the north of Aberdeen Harbour. An average of ten unique vessels per day at anchor was recorded within the study area throughout the combined summer and winter survey periods. The majority (91.2%) of vessels recorded at anchor within the study area were offshore oil and gas affiliated vessels. Tankers (5.4%) and cargo vessels (2.4%) were also recorded at anchor within the study area.

86. The tankers were noted to be at anchor in proximity to the Project site whilst awaiting both entrance to Aberdeen Harbour and orders for onward passages to offshore FPSO installations. Throughout the summer and winter marine traffic surveys, an average of one tanker vessel every two days was recorded at anchor within the study area, the majority of which were recorded at anchor in close proximity to Aberdeen Harbour, approximately 6.5nm North West of the Project.

87. In addition, a number of offshore oil and gas affiliated vessels were recorded anchoring both within and in close proximity to the Project (average of one offshore oil and gas affiliated vessel every four days within 2.5nm of Project) whilst awaiting orders. However this anchoring activity represents a very small proportion (2.7%) of the total level of anchoring activity, with the majority of anchoring occurring in close proximity to Aberdeen Harbour.

88. It is noted that embedded mitigations include that the cable will be buried or protected to ensure that it does not present a snagging hazard to anchoring vessels; this will include consideration of the under keel clearance risk for transiting vessels as per the embedded mitigations.

89. Following consideration of the marine traffic in the area and the embedded mitigations in place (including 24 hrs monitoring) the following impacts have been identified for commercial vessel safe operations during the operation phase:

- Increased collision risk to transiting vessels associated with the presence of the windfarm.
- Allision risk to transiting vessels if the device breaks free and becomes a 'floating hazard'.
- Impacts on adverse weather routeing and anchoring.
- Snagging and anchoring risks to vessels - associated with both the site and export cable route.

90. The overall severity of consequence for commercial vessels safe operations during the operation phase is considered to be **serious**, assuming the potential for damage to a vessel associated with the a WTG coming free of its mooring. The overall frequency of occurrence will be **extremely unlikely** given the embedded mitigations in place including the 24 hrs control room to monitor the site. Therefore the potential impact is assessed to be **Tolerable** (Table 9-8).

91. Further mitigations to reduce the risk during the operational phase should include:

- A standby contract for either a towage vessel or guard vessel to be quickly deployed from a local port to either retrieve or standby any free floating equipment and promulgate information to any third party users.
- Tracking device (design to be confirmed) to be installed on the turbine structure, so that if it float free it can be located again quickly.
- Operational safety zones of up to 500m given the excursion of the WTGs from a central point and the risks associated with subsea cables and mooring lines.

- Inspection and maintenance regime to ensure that the cables and mooring lines (including anchor spread) do not quickly deteriorate over time and pose a hazard including snagging or underwater allision.

92. With this mitigation in place the risk could be reduced to ALARP parameters of **tolerable with mitigation.**

Table 9-9 Impact assessment on commercial vessel safe operations in the Project site

Receptor	Potential Impact	Severity of Consequence	Frequency of Occurrence	Impact
Construction and Decommissioning				
Commercial Vessel Safe Operations	Increased collision and allision risk with construction / decommissioning vessels and activities	Moderate Increase in vessel activity	Extremely Unlikely Embedded mitigation Guard vessel	Broadly Acceptable
	Impacts associated with the installed cable and mooring system for a period of 18 months.			
	Impacts associated with towing of the structures to site including encounter / collision risk.			
Operation				
Commercial Vessel Safe Operations	Increased collision risk to transiting vessels associated with the presence of the windfarm.	Serious Potential for damage to vessels if WTG was to come free from the mooring	Extremely Unlikely Embedded mitigation 24hr control room monitoring the site	Tolerable
	Allision risk to transiting vessels if the device breaks free and becomes a 'floating hazard'			
	Impacts on adverse weather routeing and anchoring			
	Snagging and anchoring risks to vessels - associated with both the site and export cable route			

9.4.3. Impacts on commercial vessel routeing

93. The physical presence of the Project is likely to result in deviations for two commercial vessel main routes, Route 4 and Route 6 (see Table 9-2), identified throughout the baseline assessment.

94. A revised vessel routeing pattern following the construction of the Project has been estimated based on the baseline vessel routeing assessment. For the purposes of the re-routeing assessment, a worst case 1nm passing distance (mean route position) from the WTG locations for routes displaced by the Project has been used. Re-routeing has been undertaken giving consideration to known developments and routeing measures as well as the vessels final destination port.

95. Approximately four vessels per day transit Route 4 on passage between Aberdeen and other ports in the south of the UK and also mainland Europe. Offshore oil and gas affiliated vessels (60% of marine traffic on Route 4), tankers (25%) and cargo vessels (10%) were the main vessel types recorded operating on Route 4. No regular commercial ferry operations utilise Route 4. As the mean route position of Route 4 intersects the south western corner of the Project site, in proximity to the indicative turbine locations, a degree of vessel re-routeing will be required for vessels transiting Route 4. Vessels currently transiting Route 4 between Aberdeen Harbour and destinations to the south of Aberdeen will be able to either transit between the site and the coast, corresponding to a 0.6nm deviation (2.3% of total route length within study area and less than four minute time increase), or deviate offshore of the Project corresponding to a 0.1nm deviation (0.3% of total route length within study area and less than one minute time increase). The route chosen (inshore or offshore of the Project) is likely to be dictated by the prevailing conditions (i.e. adverse weather), vessel characteristics (e.g. overall length and manoeuvrability), potential for interaction with other marine traffic and the final destination.

96. Approximately five vessels per day transit Route 6 on passage between ports on the north coast of Scotland (e.g. Invergordon, Inverness and Lerwick) and ports within the Firth of Forth (e.g. Leith, Rosyth and Grangemouth) and also Montrose. Offshore oil and gas affiliated vessels (30% of marine traffic on Route 6), cargo vessels (30%), tankers (20%) and passenger vessels (10%) were the main vessel types recorded operating on Route 6. No regular commercial ferry operations utilise Route 6. As the mean route position of Route 6 intersects the western extent of the Project site, in proximity to the indicative turbine locations, a degree of vessel re-routeing will be required for vessels transiting Route 6. Vessels currently transiting Route 6 will most likely pass offshore of the Project, corresponding to a 0.1nm deviation (0.4% of total route length within study area and less than one minute time increase).

97. The only regular commercial ferry operations recorded within the study area are the Northlink Ferries Aberdeen – Lerwick passenger ferry and RoRo cargo service, which form part of Route 1 (see Table 9-2). Therefore the development of the Project is anticipated to have no impact on the routeing of the Northlink Ferries commercial operations from Aberdeen.

Construction and decommissioning

98. The construction and decommissioning phase, including installation of the cables are likely to have the most significant effects on vessel routeing; given the safety zones and working areas established around both the installation of the cables of construction of the site. As noted previously within this chapter there will be a period of up to 18 months where the export cable, inter array cables and mooring systems will be left without surface structures. During this period and both the initial construction phase and WTG installation phase (less than a month, but over an annual cycle) there is the potential for disruption to regular routes.

99. The following impacts have been identified for commercial vessel routeing during the construction and decommissioning phase:

- Deviations associated with the position of the development for commercial regular operators/users and who may be excluded from the sea by the presence of construction or decommissioning areas.

100. The overall severity of consequence for commercial vessels routeing during the construction and decommissioning phase is considered to be **minor**, due to the limited deviations associated with the both the construction area of both the windfarm and export cable including construction zones. However the overall frequency of occurrence will be **frequent** given that a vessel being deviated would occur daily through the construction phase. The potential impact is assessed to be **Tolerable;** noting that this impact is commercial and does not consider any further risks to safe navigation (Table 9-10).

101. Further mitigations would be required to reduce to this to tolerable include:

- The use of advanced promulgation of information (targeted to specific regular operators) and efficient construction planning to ensure safety zones are managed effectively.

102. This would reduce the impact to **broadly acceptable** by allowing vessels to effectively passage plan in advance of their arrival at the Development Area.

Operation

103. The overall Development Area of the turbines is small (approximately 5.5nm^2) and although there will be 500 metre operational safety zones associated with the Project due to the subsea hazards associated with the mooring equipment this operational deviation for vessels required to navigate around the site will be limited (maximum increase of 0.6nm, 2.3% of total route length within study area, for vessels operating on Route 4 and transiting inshore of Project). As mentioned above within the impact on commercial vessel safe operations (Section 9.4.2) there is the potential that in adverse weather vessels may choose to navigate to the seaward side of the site, particularly with reduced visibility, however these would still be within lower levels (maximum increase of 0.1nm, 0.3% of total route length within study area, for vessels operating on Route 4 and transiting offshore of the Project site).

104. The following impacts have been identified for commercial vessel routeing during the operation phase:

- Deviations associated with the position of the development for regular operators and routes that have been displaced by the location of the operational site.

105. The overall severity of consequence for commercial vessels routeing during the operation phase is considered to be **negligible,** due to the minimal deviations associated with the small size of the development. However the overall frequency of occurrence will be **reasonably probable** given that a vessel being deviated would occur on a regular basis. The potential impact is assessed to be **Broadly Acceptable** with no further mitigation required (Table 9-10).

Table 9-10 Impact assessment on commercial vessel routeing in the Project site

Receptor	Potential Impact	Severity of Consequence	Frequency of Occurrence	Impact
Construction and Decommissioning				
Commercial Vessel Routeing	Deviations associated with the position of the development for commercial regular operators/users and who may be excluded from the sea by the presence of construction or decommissioning areas.	Minor Limited deviations associated with both the Development Area and Offshore Cable Corridor	Frequent Deviations will be daily throughout construction	Tolerable
Operation				
Commercial Vessel Routeing	Deviations associated with the position of the development for regular operators and routes that have been displaced by the location of the operational site.	Negligible Minimal deviations due to small scale of the Project	Reasonably Probable Deviations will occur regularly	Broadly Acceptable

9.4.4. Impacts on fishing vessel safe operations

106. Both the marine traffic and satellite fishing data showed that there were limited fishing vessels movements within the site area, and those that were recorded were on transit rather than engaged in fishing activities. SFF consultation however did indicate that historical squid and scallop fishing had occurred within the Area for Lease, but did not return every year therefore may not be clearly identified within the data sets analysed.

107. Bottom otter trawls and unspecified trawls (unable to determine specific trawling method) were the most frequently recorded fishing vessel gear types recorded throughout the summer and winter surveys representing 24.2% and 17.4% of fishing vessel activity respectively. Other trawling methods, twin otter and midwater otter were also recorded within the study area but to a lesser extent, representing 9.4% and 2.0% of fishing vessel activity respectively. Potters were also frequently recorded within the study area, representing 16.8% of fishing vessel activity.

108. A greater level of fishing vessel activity was recorded throughout the summer survey (59.1% of total fishing vessel activity) in comparison to the winter survey (40.9%). Throughout the summer survey an average of six unique fishing vessels per day was recorded within the study area. This decreased to an average of four unique fishing vessels per day throughout the winter survey noting the limitations with the winter survey data.

109. The vast majority of fishing vessels recorded throughout the marine traffic surveys were on passage. However a proportion of fishing vessels were recorded directly engaged in fishing operations. The majority of this activity was recorded within shallower (less than 50m) waters in closer proximity to the shore. Four distinct fishing hot spots were recorded throughout the marine traffic surveys, two of which interacted with the proposed export cable corridor, as detailed in Section 9.2.7. All fishing vessels recorded passing through the Project site were on passage; again noting that historical data shown in the SFF consultation indicated that squid and scallop fishing did occur.

Construction and decommissioning

110. With the embedded mitigations in place including safety zones, promulgation of information and guard vessels in place the construction and decommissioning phases of the Project are not considered to result in an overall increase risk for fishing vessels. Although there will be an increase in traffic movements in the area associated with the development these will be managed by the Marine Coordination Centre and information regarding the current area of development will be effectively promulgated to fishing vessels.

111. As noted within the worst case scenario the current construction plan would see the export cables, inter array cables and mooring systems in situ for a period of up to 18 months prior to the surface structures (the WTGs) being installed. However KOWL have committed to the presence of a guard vessel during this period as well as the presence of cardinal buoys (to be agreed with NLB) to ensure that risk to vessels is mitigated by a 24 hrs on site presence and clear visual aids to navigation. This will enable any fishing vessel to seek guidance on transits in proximity to the site and assistance if required should they become disabled.

112. The WTGs will be constructed at a mainland UK port (potentially Nigg within the Cromarty Firth) and towed to site. Towage companies undertaking this operational will be established companies with extensive experience in offshore towing and therefore will have safety plans and mitigations established within their work procedures. There are also standard marine regulations such as COLREGS - the International Convention for the Prevention of Collisions at Sea which both identify and give priority to vessels engaged in towing operations when the towage vessel is considered to be RAM. The vessel would be able to liaise with fishing vessels engaged in towage operations to ensure they could both take early action to prevent a collision situation.

113. The following impacts have been identified for fishing vessel safe operations during the construction and decommissioning phase:

- Increased collision and allision risk with construction and decommissioning vessels and activities.
- Impacts associated with the installed cable and mooring systems for a period of 18 months.
- Impacts associated with towing of the structures to site including encounter / collision risk.

114. The overall severity of consequence for fishing vessels during the construction and decommissioning phase is considered to be **serious,** due to the risk posed by the mooring and anchoring cables. However the overall frequency of occurrence will be **negligible** given the number of fishing vessels in the area, but also the embedded mitigation in place, such as guard vessels, to minimise the likelihood of any allisions occurring. The potential impact is assessed to be **Broadly Acceptable** with no further mitigation required (Table 9-11).

Operation

115. The inshore fishing vessels are likely to be of a smaller size and potentially constructed of a Glass Reinforced Plastic (GRP) material; meaning that should any allisions occur they would be significant and could affect the stability and water tight integrity of the vessel. Smaller vessels are also likely to be a risk from the support bar between the foundation ballast tanks, which at an approximate height of 12 metres, could mean that a small vessel could accidently transit/drift under

the bar and into the central area of the foundation piece risking the overall safety of the vessel and presenting an increased allision risk (both mast and keel).

116. Fishing vessels, especially those towing gear, are at risk from snagging hazards associated with the export cable but also the anchor and mooring spread which extends approximately 9 x water depth from the turbine (noting that touchdown will be within 250m).

117. The following impacts have been identified for fishing vessel safe operations during the operation phase:

- Increased collision risk to transiting vessels and/or vessels engaged fishing;
- Allision risk for fishing vessels including if the device breaks free and becomes a 'floating hazard';
- Allision risk, including air draft and keel issues should a fishing vessel allide with the foundation structure including a potential allision with vertical gear;
- Transit deviations associated with the position of the Project for fishing vessels including recreational vessels which may be excluded from preferred coastal transit areas by the presence of operational safety zones (including adverse weather periods);
- Snagging risks to fishing vessels associated with the mooring and anchoring equipment; and
- Anchoring risks to fishing vessels associated with both the inter array and export cable route.

118. The overall severity of consequence for fishing vessels during the operational phase is considered to be **serious,** due to the risk posed by the mooring and anchoring cables (including them parting and a turbine floating free) but also the air/draught allision risk posed by the design of the turbine. However the overall frequency of occurrence will be **remote** given the number of fishing vessels in the area especially within the winter season. The potential impact is assessed to be **tolerable** with further mitigation required (Table 9-11). Therefore the potential impact is assessed to be tolerable with the following mitigations in place to reduce the risk during the operational phase:

- A standby contract for either a towage vessel or guard vessel to be quickly deployed from a local port to either retrieve or standby any free floating equipment and promulgate information to any third party users;
- Operational safety zones of up to 500 metres given the excursion of the WTGs from a central point and the risks associated with subsea cables and mooring lines. This will be charted to ensure that the mariner is away of the risk and advised by law not to enter the area due to the risk of air draft and under keel clearance issue;
- Warning signs noting under keel clearance risk should also be placed on the cross bars between the floatation chambers;
- Extensive information promulgation of information to the fishing community to ensure that the subsea hazards are clear; including liaison with the United Kingdom Hydrographic Office, Kingfisher and consideration for use of Fish Safe system (see annex 2 of the NRA, Hazard Log);
- Inspection and maintenance regime to ensure that the cables and mooring lines (including anchor spread) do not quickly deteriorate over time and pose a hazard including snagging or underwater allusion; and
- Tracking device (design to be confirmed) to be installed on the turbine structure, so that if it float free it can be located again quickly.

119. With this mitigation in place the risk could be reduced to ALARP parameters of **tolerable with mitigation.**

Table 9-11 Impact assessment on fishing vessel safe operations in the Project site

Receptor	Potential Impact	Severity of Consequence	Frequency of Occurrence	Impact
Construction and Decommissioning				
Fishing Vessel Safe Operations	Increased collision and allision risk with construction and decommissioning vessels and activities. Impacts associated with the installed cable and mooring systems for a period of 18 months. Impacts associated with towing of the structures to site including encounter / collision risk.	Serious Presence of moorings and cables increases risk of collision	Negligible Limited number of fishing vessels in the site Guard vessel	Broadly Acceptable
Operation				
Fishing Vessel Safe Operations	Increased collision risk to transiting vessels and/or vessels engaged fishing. Allision risk for fishing vessels including if the device breaks free and becomes a 'floating hazard' Allision risk, including air draft and keel issues should a fishing vessel allide with the foundation structure including a potential allision with vertical gear. Transit deviations associated with the position of the development for fishing vessels including recreational vessels which may be excluded from preferred coastal transit areas by the presence of operational safety zones (including adverse weather periods). Snagging risks to fishing vessels associated with the mooring and anchoring equipment. Anchoring risks to fishing vessels associated with both the inter array and export cable route.	Serious Inshore fishing vessels are GRP Snagging hazards Turbine could become free from mooring	Remote Limited number of fishing vessels in the area	Tolerable

9.4.5. Impacts on recreational vessels

120. Recreational movement in the Project site are seasonal with limited movements during the winter period due to the exposed nature of the coastline with an increase in activity during summer months mostly associated with a general increase in recreational cruising around the UK coast.

121. During the summer marine traffic survey, a total of 52 unique recreational vessels were recorded within the study area, corresponding to an average of five recreational vessels per day. Of these vessels, nine were recorded intersecting the Project site. The majority of recreational transits were recorded inshore of the Project and therefore in close proximity to the proposed Offshore Export Cable Corridor. It was noted in consultation with the SRYA that they do not have any significant

concerns regarding the Project as most SRYA members pass inshore of the site or to the east whilst on passage to Northern Isles and/or Peterhead. It was also noted that recreational vessels tend to avoid passing in close proximity to Aberdeen given the high number of vessel arrivals / departures. The SRYA also concurred with findings of the marine traffic survey.

No recreational vessel activity was recorded throughout the winter survey, noting the limitations on the winter data set. Further information, including seasonal variation, noting that the SRYA indicated that early and season may be peaks given the vessels en-route to the Caledonian Canal and Scottish Isles. These routes are picked up in the cruising routes identified in the NRA (section 13.6).

Construction and decommissioning

122. Given the embedded mitigations in place there are not expected to be significant increases in risk associated with the construction and decommissioning periods. Although there will be an increase in traffic movements in the Project site these will be managed by the Marine Coordination Centre and information regarding the current area of development will be effectively promulgated to recreational users.

123. During cable installation there are likely to be some deviations for recreational craft potentially 'pushing' them further offshore than their normal coastal route. The current construction area, especially during cable installation, will be limited to the extent of the safety zone around the current area of construction and rolled with the area of activity. Although the overall construction area is likely to be marked by cardinal buoyage, it will allow transits both seaward and landward of the development area with restrictions being limited. The information regarding current areas of construction will be promulgated to ensure that all mariners have the ability to effectively passage plan their route including consideration of weather to ensure they can safely passage plan, noting that this impact would be temporary during certain periods (inshore) of the construction and decommissioning phases.

124. As noted, KOWL have committed to the presence of a guard vessel during this period as well as the presence of cardinal buoys (to be agreed with NLB) to ensure that the risk to vessels is mitigated by a 24hrs on site presence and clear visual aids to navigation. This will enable any recreational mariner to seek guidance on transit in proximity to the site and assistance should they become disabled.

125. The WTGs will be constructed at a mainland UK port (potentially Nigg within the Cromarty Firth) and towed to site. Towage companies undertaking this operation will be established companies with extensive experience in offshore towing and therefore will have safety plans and mitigations established within their work procedures. There are also standard marine regulations such as COLREGS - the International Convention for the Prevention of Collisions at Sea which both identify and give priority to vessels engaged in towing operations; including priority over vessels under sail when the towage vessel is considered to be Restricted in its Ability to Manoeuvre.

126. The following impacts have been identified for recreational vessels during the construction and decommissioning phase:

- Increased collision and allision risk with construction and decommissioning vessels and activities. This includes both allisions under power and drifting;
- Deviations associated with the position of the development for recreational vessels including recreational vessels which may be excluded from preferred coastal transit areas by the presence of construction safety zones and buoyed construction areas;
- Impacts associated with the installed cable and mooring systems for a period of up to 18 months prior to the installation of the WTGs; and
- Impacts associated with towing of the structures to site including increased encounter / collision risk.

127. The overall severity of consequence for recreational vessels during the construction and decommissioning phase is considered to be **moderate** due to deviations associated with the safety zones and construction areas in place meaning that recreational vessels will not be able to follow the more inshore routes, which are most commonly used, (including in adverse weather). However the overall frequency of occurrence will be **negligible** given the low number of recreational vessels in the area and also the embedded mitigation in place, such as guard vessels, to minimise the

collision risk. The potential impact is assessed to be **Broadly Acceptable** with no further mitigation required (Table 9-12).

Operation

128. Recreational vessels are noted to be active within the Project site. It should be noted that a greater level of recreational activity is recorded in proximity to the Offshore Export Cable Corridor than the Development Area. Recreational vessels are likely to be of a smaller size and most likely a GRP construction; meaning that should any allisions (drifting or under way) occur they could affect the stability and water tight integrity of the vessel. Smaller vessels are also likely to be at risk from the support bar between the foundation ballast tanks, which at an approximate height of 12 metres could allow a small vessel to accidently transit/drift under the bar and into the central area of the foundation piece. Thus increasing the overall risk to safety of the vessel and presenting an increased allision risk, including the risk of de-masting.

129. Given the maintained 22m blade clearance at all tidal heights there are not assessed to be any risks associated with yacht mast and blade allision.

130. The following impacts have been identified for recreational vessels during the operation phase:

- Increased collision risk to transiting vessels and/or vessels engaged in other marine activities. This includes both allisions under power and drifting;
- Allision risk for recreational vessels including if the device breaks free and becomes a 'floating hazard';
- Allision risk, e.g. potential de-masting / vertical gear allision or keel allision, should a recreational vessel allide with the foundation structure; and
- Deviations associated with the position of the development for recreational vessels including recreational vessels which may be excluded from preferred coastal transit areas by the presence of operational safety zones (including adverse weather periods).

131. Further information on recreational impacts can be found in the NRA and the hazard log, which was developed in conjunction with regular stakeholders including the RYA. This hazard log also includes impacts that were screened out, as not considered at a significant level for consideration with the ES.

132. The overall severity of consequence for recreational vessels during the construction and decommissioning phase is considered to be **serious,** due to the air draught allision risk posed by the design of the turbine (supporting cross beam between ballast tanks). However the overall frequency of occurrence will be **extremely unlikely** given the low number of recreational vessels in the area, especially within the winter season. The potential impact is assessed to be **Tolerable** with further mitigation required (Table 9-12).

133. Further mitigations to reduce the risk during the operational phase should include:

- A standby contract for either a towage vessel or guard vessel to be quickly deployed from a local port to either retrieve or standby any free floating equipment and promulgate information to any third party users. This vessel could also be deployed as a search and rescue asset (in communication with the MCA) should a recreational vessel be drifting towards the site;
- Operational safety zones of up to 500 metres given the excursion of the WTGs from a central point and the risks associated with subsea cables and mooring lines. This will be charted to ensure that the mariner is away of the risk and advised by law not to enter the area due to the risk of air draft and under keel clearance issues; and
- Warning signs noting under keel clearance risk should also be placed on the cross beams between the floatation chambers.

134. With this mitigation in place the risk could be reduced to ALARP parameters of **tolerable with mitigation.**

Table 9-12 Impact assessment on recreational vessels in the Project site

Receptor	Potential Impact	Severity of Consequence	Frequency of Occurrence	Impact
Construction and Decommissioning				
Recreational Vessels	Increased collision and allision risk with construction and decommissioning vessels and activities. Deviations associated with the position of the development for recreational vessels including recreational vessels which may be excluded from preferred coastal transit areas by the presence of construction safety zones and buoyed construction areas. Impacts associated with the installed cable and mooring systems for a period of 18 months prior to the installation of the WTGs. Impacts associated with towing of the structures to site including increased encounter / collision risk.	Moderate Recreational vessels will not be able to follow the more inshore routes, which are most commonly used due to deviations	Negligible Low number of recreational vessels in the area Embedded mitigation Guard vessel	Broadly Acceptable
Operation				
Recreational Vessels	Increased collision risk to transiting vessels and/or vessels engaged in other marine activities. Allision risk for recreational vessels including if the device breaks free and becomes a 'floating hazard'. Allision risk, e.g. potential de-masting / vertical gear allision or keel allision, should a recreational vessel allide with the foundation structure. Deviations associated with the position of the development for recreational vessels including recreational vessels which may be excluded from preferred coastal transit areas by the presence of operational safety zones (including adverse weather periods).	Serious Air draught allision risk posed by the design of the turbine	Extremely Unlikely Low number of recreational vessels in the area	Tolerable

Receptor	Potential Impact	Severity of Consequence	Frequency of Occurrence	Impact
	Anchoring risks to vessels - associated with both the site and export cable route.			

9.4.6. Impacts on vessels engaged in port operations

135. The nearest principal port to the Project is Aberdeen Harbour located approximately 8.6nm north west. Pilotage is compulsory for all vessels greater than or equal to 60m in length with no operational bow thrusters or 75m in length for vessels which are fitted with at least one fully operational bow thruster. Pilot Exemption Certificates (PEC's) can be issued where it is satisfied that sufficient skill, experience and local knowledge have been demonstrated. In order to satisfy the requirement of satisfactory local knowledge, a minimum of 24 voyages to and from Aberdeen Harbour (12 arrivals and 12 departures) must have been carried out throughout the previous 12 months. In the case of offshore oil and gas affiliated vessels, between 75m and 85m in length, a minimum of 12 voyages (six arrivals and six departures) is required.

136. Pilots from Aberdeen harbour are typically boarded in the vicinity of the Fairway Buoy. Throughout the summer and winter marine traffic surveys, the pilot boats *Sea Sheppard* (18m in length) and *Sea Haven* (15m in length), operated by Aberdeen Harbour, were recorded transiting to and from Aberdeen Harbour to drop off pilots to incoming vessels. These vessels were recorded operating in close proximity to the entrance to the harbour, approximately 8.9nm north west of the Project site.

137. In addition, the crew transfer vessel *Sea Cab* (12m catamaran) operated by Greenhowe Marine Services, was also recorded during the summer and winter marine traffic surveys. This vessel was recorded transiting farther from Aberdeen Harbour, typically to vessels at anchor to the north of Aberdeen Harbour. However on occasion the *Sea Cab* was also recorded transiting to the south east of Aberdeen Harbour to carry out crew transfers, at a closest point of approach of 6.5nm to the Project. As previously stated, the fishing vessel *Skua II (A17)* is also known to carry out crew transfers for Greenhowe Marine Services on occasion.

Construction and decommissioning

138. Due to the size of the Project there will be a limited increase in vessel movements within the area. However any increase in movement will be controlled though both the KOWL Marine Coordination Centre and the Aberdeen Harbour Vessel Traffic Services (VTS). With the embedded mitigations in place therefore there is not expected to be an increase in risk for vessels engaged in port operations.

139. The following impacts have been identified for vessels engaged in port operations during the construction and decommissioning phase:

- Increased collision risk to vessels engaged in port operations.

140. The overall severity of consequence for vessel engaged in port operations during the construction and decommissioning phase is considered to be **minor,** due to the embedded mitigations in place. The overall frequency of occurrence will be **extremely unlikely** due to the limited port traffic recorded in proximity to the development site. The potential impact is assessed to be **Broadly Acceptable** with no further mitigation required (Table 9-13).

Operation

141. The following impacts have been identified for vessels engaged in port operations during the operation phase:

- Increased collision risk to vessels engaged in port operations.

142. The overall severity of consequence for vessel engaged in port operations during the operation phase is considered to be **minor** due to the embedded mitigations in place, including the marine coordination centre and the commitment to cooperate directly with Aberdeen port services. The overall frequency of occurrence will be **extremely unlikely** due to the limited port traffic recorded in proximity to the development site. The potential impact is assessed to be **Broadly Acceptable** with no further mitigation required (Table 9-13).

Table 9-13 Impact assessment on vessels engages in port operations in the Project site

Receptor	Potential Impact	Severity of Consequence	Frequency of Occurrence	Impact
Construction and Decommissioning				
Vessels engaged in port operations	Increased collision risk to vessels engaged in port operations.	Minor Limited increase in vessel movements	Extremely Unlikely Limited port traffic recorded in proximity to Project site	Broadly Acceptable
Operation				
Vessels engaged in port operations	Increased collision risk to vessels engaged in port operations.	Minor Limited increase in vessel movements	Extremely Unlikely Limited port traffic recorded in proximity to Project site	Broadly Acceptable

9.4.7. Impacts on marine emergency response

143. Inverness airport is the closest Search and Rescue (SAR) helibase to the Project. The Inverness helibase is operated by The Bristow Group and began operations during April 2015. Two Agusta Westland AW189's, with a range in excess of 200nm and max cruising speed of 145 knots, are operated from Inverness. Therefore the Project is well within the maximum range of the AW189 aircraft. The AW189 aircraft are equipped with a range of state of the art SAR and safety technology, including night vision, mission management and increased on-board medical capabilities.

144. The RNLI maintains an active fleet of over 340 lifeboats of various types at 236 stations around the coast of the UK and Ireland. At each of these stations, crew and inshore lifeboats and / or all-weather lifeboats are available on a 24hr basis throughout the year. The closest RNLI stations to the Project are Aberdeen (approximately 8.6nm north west) and Stonehaven (approximately 9.8nm south west). Aberdeen operates both an all-weather lifeboat (Severn class) and an inshore lifeboat (D class). The Severn class all-weather lifeboat, 17.3m in length, has a maximum speed of 25 knots and a maximum range of 250nm. The D class inshore lifeboat has a maximum speed of 25 knots and a maximum range of three hours. Stonehaven operates an inshore lifeboat only (B Class - Atlantic 75). The B Class – Atlantic 75 has a maximum speed of 32 knots and range of 2.5 hours. Therefore the Project is within range of all lifeboats at Aberdeen and Stonehaven stations.

Construction and decommissioning

145. Due to the size of the Project there will be a limited increase in vessel movements within the area. However any increase in movement will be controlled though both the KOWL Marine Coordination Centre and the Aberdeen Harbour Vessel Traffic Services (VTS) thus reducing the risk of an incident involving a works vessel occurring. In addition, the onsite guard vessel throughout the construction phase will be able to forewarn passing vessel of ongoing construction works further reducing the risk of an incident. Furthermore, all works vessels shall be equipped with a level of emergency response equipment to facilitate a degree of self-help appropriate for the Project. The self-help capability, as well as liaison agreements with emergency response providers, shall be detailed within the ERCoP.

146. The following impacts have been identified for marine emergency response during the construction and decommissioning phases:

- Impacts on emergency response associated with increased activity during the construction and decommissioning phases.

147. The overall severity of consequence for marine emergency response during the construction and decommissioning phase is considered to be **minor,** due to the embedded mitigations in place (24 hrs marine coordination and emergency response centre, onsite guard vessel, ERCoP and provision of self-help facilities). Furthermore, the close proximity of national facilities such as the RNLI Aberdeen and Stonehaven lifeboat stations reduces the overall potential consequence. The overall frequency of occurrence will be **extremely unlikely** due to the limited scale of the Project, provision of self-help facilities and measures to limit the risk of an incident occurring (KOWL Marine Coordination Centre and onsite guard vessel). The potential impact is assessed to be **Broadly Acceptable** with no further mitigation required (Table 9-14).

Operation

148. The following impacts have been identified for marine emergency response during the operation phase:

- Impacts on emergency response associated with increased activity, during periods of major maintenance, and potentially new navigational safety hazards.

149. The overall severity of consequence for the impact upon marine emergency response during the operational phase is considered to be **minor,** due to the embedded mitigations in place (24 hrs marine coordination and emergency response centre, ERCoP and provision of self-help facilities) as well as the close proximity of national facilities such as the RNLI Aberdeen and Stonehaven lifeboat stations. The overall frequency of occurrence will be **extremely unlikely** due to the provision of self-help facilities and measures to limit the risk of an incident occurring (KOWL Marine Coordination Centre and onsite guard vessel). The potential impact is assessed to be **broadly acceptable** with no further mitigation required (Table 9-14).

Table 9-14 Impact assessment on marine emergency response in the Project site

Receptor	Potential Impact	Severity of Consequence	Frequency of Occurrence	Impact
Construction and Decommissioning				
Marine Emergency Response	Impacts on emergency response associated with increased activity during the construction and decommissioning phases.	Minor Limited increase in vessel activity Close proximity of lifeboat stations	Extremely Unlikely Limited scale of the Project Self-help facilities and measures	Broadly Acceptable
Operation				
Marine emergency response	Impacts on emergency response associated with increased activity, during periods of major maintenance, and potentially new navigational safety hazards.	Minor Limited increase in vessel activity Close proximity of lifeboat stations	Extremely Unlikely Limited scale of the Project Self-help facilities and measures	Broadly Acceptable

9.5. Mitigation

150. Following the impact assessment the list below indicates the additional mitigations required by KOWL to ensure that all impacts associated with the development are within ALARP parameters.

- A standby contract for either a towage vessel or guard vessel to be quickly deployed from a local port to either retrieve or standby any free floating equipment and promulgate information to any third party users;
- Operational safety zones of up to 500 metres given the excursion of the WTGs from a central point and the risks associated with subsea cables and mooring lines. This will be charted to ensure that the mariner is away of the risk and advised by law not to enter the area due to the risk of air draft and under keel clearance issues.
- Warning signs noting air clearance risk should also be placed on the cross bars between the floatation chambers.
- Extensive information promulgation of information to the fishing community to ensure that the subsea hazards are clear; including liaison with the United Kingdom Hydrographic Office, Kingfisher and updates to Fish Safe systems;
- Inspection and maintenance regime to ensure that the cables and mooring lines (including anchor spread) do not quickly deteriorate over time and pose a hazard including snagging or underwater allision. This should also include 3rd party verification of the mooring systems as requested by the MCA; and
- Tracking device (design to be confirmed) to be installed on the turbine structure, so that if it float free it can be located again quickly. This may include an excursion alarm to notify an extreme excursion (value to be defined) from its central point.

9.6. Cumulative Impacts

151. Cumulative impacts have been considered for shipping and navigation receptors, this includes other offshore developments, as well as in combination activities associated with other marine operations such as Nigg Bay construction and operation. It should be noted that fishing and recreational transits have been considered as part of the baseline assessment.

152. A number of projects and marine activities were scoped out of the assessment with regards to vessel movement as these were considered to be part of the baseline marine environment for vessel traffic. This includes traffic associated with fishing activity and recreational craft transits. The following table (Table 9-15) notes developments in proximity to the Project and indicates if they have been considered throughout the cumulative impact assessment.

153. There are not considered to be any transboundary impacts with a cumulative impact with the Project.

Table 9-15: Cumulative Screening

Development	Distance from Project (nm)	Status	Data Confidence	Screened In
MOD Marine Activities: Drum Links Firing Range (X5722), Black Dog Rifle Range (X5703), Central Managed Defence Area (D613A)	Various	On Going	Medium	No- No cumulative impact anticipated.
28th Round Oil and Gas Potential Award License Blocks: 26/3 (part), 26/4, 26/5, 26/7, 26.8, 26/9, 26/10, 26/13 (part), 27/1 (part), and 27/6 (part).	3.3 (closest)	Early Planning	Medium	No- No cumulative impact anticipated.
Nigg Bay (Aberdeen) port development.	8.1	Early Planning	High	Yes- Potential for cumulative impact

Development	Distance from Project (nm)	Status	Data Confidence	Screened In
				on port operations and vessel routeing. Potential overlaps in construction activity
European Offshore Wind Development Centre (Aberdeen)	9.1	Consent Authorised	High	Yes- Potential for cumulative impact during towage of WTGs from Nigg (Cromarty Firth).
Seagreen – Alpha and Bravo Offshore Windfarms	16.5	Consent Authorised	High	Yes- Potential for cumulative impact upon vessel routeing.
Forties – Cruden Bay Oil Pipeline	19.5	Fully Commissioned	High	No- No cumulative impact anticipated.
Hywind Floating Offshore Windfarm	24.6	Consent Application Submitted	High	Yes- Potential for cumulative impact upon vessel routeing and during towage of WTGs from Nigg (Cromarty Firth).
Inch Cape Offshore Windfarm	25.1	Consent Authorised	High	Yes- Potential for cumulative impact upon vessel routeing.
27th Round Oil and Gas Current License Blocks: 20/16	28.1	Early Planning	Medium	No- No cumulative impact anticipated.
Neart na Gaoithe Offshore Windfarm	40.5	Consent Authorised	High	Yes- Potential for cumulative impact upon vessel routeing.
Fife Energy Park Offshore Demonstration Wind Turbine	60.9	Fully Commissioned	High	No- No cumulative impact anticipated.
2B Energy Demonstrator	61.3	Early Planning	High	No- No cumulative impact anticipated.
Moray Offshore Windfarm	67.7	Consent Authorised	High	Yes- Potential for cumulative impact during towage of WTGs from Nigg (Cromarty Firth).
Beatrice Offshore Windfarm	68.9	Consent Authorised	High	Yes- Potential for cumulative impact during towage of WTGs from Nigg (Cromarty Firth).

Development	Distance from Project (nm)	Status	Data Confidence	Screened In
Dounreay Floating Offshore Wind Development Centre	115.3	Early Planning	Low	No- No cumulative impact anticipated.

154. The following subsections summarise potential cumulative impacts for shipping and navigation and a summary is provided in Table 9-16.

9.6.1. Cumulative impacts on commercial vessel routeing

155. As shipping and navigational receptors have the potential to transit over a large area there is potential for a particular route to be cumulatively impacted by a number of offshore developments. It has been concluded that the Nigg Bay Port Development, the Seagreen – Alpha and Bravo Offshore Windfarms, the Hywind Floating Offshore Windfarm, the Inch Cape Offshore Windfarm and the Neart na Gaoithe Offshore Windfarm were considered to have a cumulative routeing impact.

156. The following cumulative impacts on commercial vessel routeing have been identified:

- Deviations associated with the position of cumulative developments for routes that have been displaced by the location of cumulative developments.

157. Routes which have the potential to be cumulatively impacted are Route 4 (Aberdeen – southern UK / mainland Europe) and Route 6 (northern ports, e.g. Invergordon, Inverness and Lerwick – Firth of Forth ports (e.g. Leith, Rosyth and Grangemouth) and Montrose).

158. The overall severity of consequence for the cumulative impact upon commercial vessel routeing is considered to be **negligible**, due to the small (as in distance and time) deviations associated with cumulative developments and the embedded mitigation measure of promulgation of information which will facilitate passage planning to take account of all cumulative developments early within the passage planning process. However the overall frequency of occurrence will be **reasonably probable** given the high volume of traffic operating on Route 4 and Route 6. The potential impact is assessed to be **broadly acceptable** with no further mitigation required.

9.6.2. Cumulative impacts on marine emergency response

159. There is likely to be a collective increased requirement on emergency response providers within the central North Sea due to the development of cumulatively screened-in projects. However, it is highly probable that each individual development shall develop its own self-help capability (including KOWL development). Potentially there may be some overlap in resources between developments but this would be considered at a commercial and local level between project developers. In addition, there is also the potential for the development of cumulatively screened-in projects to restrict SAR activities within the central North Sea.

160. The following cumulative impacts have been identified for marine emergency response:

- Collective increased burden on emergency response providers; and
- Restriction of SAR activities within central North Sea.

161. The overall severity of consequence for the cumulative impact upon emergency response provision is considered to **minor**, due to the embedded mitigations for each project which will be in place (ERCoP and provision of self-help facilities). Furthermore, the close proximity of national facilities reduces the overall potential consequence. The overall frequency of occurrence will be **remote**, due to the embedded mitigations for each project which will be in place (24hrs marine coordination, onsite guard vessels throughout construction, decommissioning and significant periods of maintenance). The potential impact is assessed to be **Broadly Acceptable** with no further mitigation required.

9.6.3. Cumulative impacts associated with tow route

162. As previously stated the WTGs will be constructed at a mainland port (most likely Nigg within the Cromarty Firth) and towed to the Project site. As a result there is potential for cumulative impacts associated with other screened-in projects located in proximity or on the tow route. It has been concluded that the European Offshore Wind Deployment Centre, the Hywind Floating Offshore Windfarm, Moray Offshore Windfarm and Beatrice Offshore Windfarm were considered to have a cumulative impact associated with the tow route.

163. The following cumulative impacts associated with the tow route have been identified:

- Cumulative impacts associated with towing of the structures to site including increased encounter / collision risk.

164. The cumulative presence of the WTGs under tow and construction / operation and maintenance activities of the aforementioned developments, and the increase in vessel traffic, could result in an increased allision and collision risk for third party vessels however there it is likely that as part of the tow plan, the vessel Master will ensure that they route away from cumulative developments and associated work vessels. The overall severity of consequence of the cumulative impact associated with the tow route upon third party vessel safe navigation is considered to be **serious**, due to the potential for vessel damage, serious injury or fatality to crew and impact on operations. However, the overall frequency of occurrence will be **extremely unlikely** given that the towage companies undertaking this operation will be established companies with extensive experience in offshore towing and therefore will have safety plans and mitigations established within their work procedures. There are also standard marine regulations such as COLREGS - the International Convention for the Prevention of Collisions at Sea which both identify and give priority to vessels engaged in towing operations; including priority over vessels under sail when the towage vessel is considered to be Restricted in its Ability to Manoeuvre. The potential impact is assessed to be **Tolerable with mitigation**; with no additional mitigations being required,

9.6.4. Cumulative impacts associated with Nigg Bay Port development and operation

165. The Nigg Bay Port development is a proposed extension of Aberdeen Harbour within Nigg Bay, approximately 8.1nm north west of the Project and 1.3nm north of the export cable landfall. The development would involve constructing a harbour on the north side of the bay. The south part of the bay would largely be undeveloped, although a breakwater may be developed from the southern point at Greg Ness. The construction of the Nigg Bay Port development may impact upon vessel routeing to and from Aberdeen Harbour due to its close proximity to the harbour entrance and main shipping routes (Route 2 and Route 4) passing south in proximity to the Project. The construction of the Nigg Bay Port development in addition to the presence of the Project may also restrict available sea room for vessel anchoring.

166. The following cumulative impacts associated with the Nigg Bay Port development have been identified:

- Potential cumulative impact on vessel arrivals, particularly for vessels transiting inshore to / from Aberdeen Harbour, and vessel anchoring activity in proximity to Aberdeen Harbour; and
- Potential snagging risk with export cables due to increased vessel activity in proximity of export cables.

167. The overall severity of consequence of the cumulative impact associated with the Nigg Bay Port development is considered to be **moderate**, due to the small overall development spread of both the Project and the Nigg Bay Port development corresponding to a minor reduction in the available sea room for anchoring. Furthermore, as previously noted, the majority of anchoring activity occurs to the north of Aberdeen Harbour and therefore the cumulative impact on the ability of a vessel to anchor is limited. In addition, the embedded mitigation measure of promulgation of information will facilitate anchoring planning to take account of both developments thus minimising the potential impact. A vessel snagging on the export cable is also considered to be of moderate consequence, due to the potential for damage to the vessel / export cable and the impact on operations. The overall frequency of occurrence will be **extremely unlikely** due to the embedded mitigation of promulgation of information, thus ensuring mariners are aware of the presence of both developments. The charting and production of Kingfisher awareness charts of the position of the export cables will also minimise the risk of vessel snagging. It is anticipated that throughout the construction of the Nigg Bay Port development, all vessels employed by the developer shall be

made aware of the presence of existing subsea infrastructure, including the Project export cables, as a matter of best practice thus decreasing the likelihood of a vessel snagging. The potential impact is assessed to be **Broadly Acceptable** with no further mitigation required.

9.6.5. Cumulative impacts associated with oil and gas development

168. Due to the proximity of both potentially awarded and current license blocks to the Project, there is potential for a reduction in available searoom and increased congestion due to oil and gas exploration / development of infrastructure, in combination with the development of the Project, leading to increased allision and collision risk for third party vessels.

169. The following cumulative impacts have been identified:

- Increased allision and collision risk for third party vessels due to reduced searoom and increased congestion.

170. Oil and gas exploration and development could include vessels engaged in surveying, construction, operation and decommissioning of offshore oil and gas installations. This could include their supply and support involving movement of vessels to the site as well as access and manoeuvrability issues whilst on site. However, no scoping work has yet been carried out by the license holders.

171. Should any works be considered pre or post consent, as per planning requirements this would be subject to marine licensing or consent requirements, of which the Project would be considered. Therefore no cumulative impacts are anticipated.

Table 9-16 Cumulative impact assessment summary

Receptor	Potential Impact	Severity of Consequence	Frequency of Occurrence	Impact
Cumulative Impacts				
Commercial vessel routeing	Deviations associated with the position of cumulative developments for routes that have been displaced by the location of cumulative developments.	Moderate Only small deviations associated with cumulative developments	Reasonably Probable High volume of traffic operating Route 4 and Route 6	Broadly Acceptable
Marine emergency response	Collective increased burden on emergency response providers. Restriction of SAR activities within central North Sea.	Minor Limited increase in vessel activity Close proximity of lifeboat stations	Remote Embedded mitigation for each project	Broadly Acceptable
Associated with tow route	Increased encounter and collision / allision risk.	Serious Potential vessel damage, serious injury or fatality to crew and impacts on operations	Extremely Unlikely All companies have extensive experience in offshore towing Safety plans	Tolerable with Mitigation (embedded)
Associated with Nigg Bay Port development and operation	Potential cumulative impact on vessel arrivals, particularly for vessels transiting inshore to / from Aberdeen Harbour, and vessel anchoring activity in proximity to Aberdeen Harbour. Potential snagging risk with export cables due to increased vessel activity in proximity of export cables.	Moderate Overall small development spread of both the Project and Nigg Bay Minor reduction in in available sea room for anchoring Most anchoring activity is to the North of Aberdeen Harbour	Extremely Unlikely Embedded mitigation of promulgation of information Charting and production of Kingfisher awareness charts	Broadly Acceptable

9.7. Summary and Residual Impacts

172. Following consideration of the outputs of the environmental impacts assessment, six different receptors were identified within this chapter that had the potential to be impacted by the Project. The following table (Table 9-17) summarises the residual impact and mitigation measures identified.

Table 9-17 Summary of residual impacts to marine navigation post mitigation

Receptor	Potential Impact	Severity of Consequence	Frequency of Occurrence	Impact	Mitigation	Residual Impact
Construction and Decommissioning						
Commercial Vessel Safe Operations	Increased collision and allision risk with construction / decommissioning vessels and activities	Moderate	Extremely Unlikely	Broadly Acceptable	No further mitigation required.	Broadly Acceptable
	Impacts associated with the installed cable and mooring system for a period of 18 months.					
	Impacts associated with towing of the structures to site including encounter / collision risk.					
Commercial Vessel Routeing	Deviations associated with the position of the development for commercial regular operators/users and who may be excluded from the sea by the presence of construction or decommissioning areas.	Minor	Frequent	Tolerable	The use of advanced promulgation of information (targeted to specific regular operators) and efficient construction planning to ensure safety zones are managed effectively.	Broadly Acceptable
Fishing Vessel Safe Operations	Increased collision and allision risk with construction and decommissioning vessels and activities.	Serious	Negligible	Broadly Acceptable	No further mitigation required.	Broadly Acceptable
	Impacts associated with the installed cable and mooring systems for a period of 18 months.					
	Impacts associated with towing of the structures to site including encounter / collision risk.					

Receptor	Potential Impact	Severity of Consequence	Frequency of Occurrence	Impact	Mitigation	Residual Impact
Recreational Vessels	Increased collision and allision risk with construction and decommissioning vessels and activities.	Moderate	Negligible	Broadly Acceptable	No further mitigation required.	Broadly Acceptable
	Deviations associated with the position of the development for recreational vessels including recreational vessels which may be excluded from preferred coastal transit areas by the presence of construction safety zones and buoyed construction areas.					
	Impacts associated with the installed cable and mooring systems for a period of 18 months prior to the installation of the WTGs.					
	Impacts associated with towing of the structures to site including increased encounter / collision risk.					
Vessels engaged in port operations	Increased collision risk to vessels engaged in port operations.	Minor	Extremely Unlikely	Broadly Acceptable	No further mitigation required.	Broadly Acceptable
Marine Emergency Response	Impacts on emergency response associated with increased activity during the construction and decommissioning phases.	Minor	Extremely Unlikely	Broadly Acceptable	No further mitigation required.	Broadly Acceptable
Operation						

Receptor	Potential Impact	Severity of Consequence	Frequency of Occurrence	Impact	Mitigation	Residual Impact
Commercial Vessel Safe Operations	Increased collision risk to transiting vessels associated with the presence of the windfarm. Allision risk to transiting vessels if the device breaks free and becomes a 'floating hazard' Impacts on adverse weather routeing and anchoring Snagging and anchoring risks to vessels - associated with both the site and export cable route	Serious	Extremely Unlikely	Tolerable	A standby contract for either a towage vessel or guard vessel to be quickly deployed from a local port to either retrieve or standby any free floating equipment and promulgate information to any third party users. Operational safety zones of up to 500m given the excursion of the WTGs from a central point and the risks associated with subsea cables and mooring lines. This should include 3rdparty verification. Tracking device (design to be confirmed) to be installed on the turbine structure, so that if it float free it can be located again quickly.	Tolerable with mitigation
Commercial Vessel Routeing	Deviations associated with the position of the development for regular operators and routes that have been displaced by the location of the operational site.	Negligible	Reasonably Probable	Broadly Acceptable	No further mitigation required	Broadly Acceptable
Fishing Vessel Safe Operations	Increased collision risk to transiting vessels and/or vessels engaged fishing. Allision risk for fishing vessels including if the device breaks free and becomes a 'floating hazard'.	Serious	Remote	Tolerable	A standby contract for either a towage vessel or guard vessel to be quickly deployed from a local port to either retrieve or standby any free floating equipment and promulgate information to any third party users.	Tolerable with mitigation

Receptor	Potential Impact	Severity of Consequence	Frequency of Occurrence	Impact	Mitigation	Residual Impact
	Allision risk, including air draft and keel issues should a fishing vessel allide with the foundation structure including a potential allision with vertical gear. Transit deviations associated with the position of the development for fishing vessels including recreational vessels which may be excluded from preferred coastal transit areas by the presence of operational safety zones (including adverse weather periods). Snagging risks to fishing vessels associated with the mooring and anchoring equipment Anchoring risks to fishing vessels associated with both the inter array and export cable route.				Operational safety zones of 500 metres given the excursion of the WTGs from a central point and the risks associated with subsea cables and mooring lines. This will be charted to ensure that the mariner is away of the risk and advised by law not to enter the area due to the risk of air draft and under keel clearance issues. Warning signs noting air clearance risk should also be placed on the cross bars between the floatation chambers. Extensive information promulgation of information to the fishing community to ensure that the subsea hazards are clear; including liaison with the United Kingdom Hydrographic Office , Kingfisher and consideration for use of Fish Safe system. Inspection and maintenance regime to ensure that the cables and mooring lines (including anchor spread) do not quickly deteriorate over time and pose a hazard including snagging or underwater allision. Tracking device (design to be confirmed) to be installed on the turbine structure, so that if it float free it can be located again quickly.	

Receptor	Potential Impact	Severity of Consequence	Frequency of Occurrence	Impact	Mitigation	Residual Impact
Recreational Vessels	Increased collision risk to transiting vessels and/or vessels engaged in other marine activities. Allision risk for recreational vessels including if the device breaks free and becomes a 'floating hazard'. Allision risk, e.g. potential de-masting / vertical gear allision or keel allision, should a recreational vessel allide with the foundation structure. Deviations associated with the position of the development for recreational vessels including recreational vessels which may be excluded from preferred coastal transit areas by the presence of operational safety zones (including adverse weather periods). Anchoring risks to vessels - associated with both the site and export cable route.	Serious	Extremely Unlikely	Tolerable	A standby contract for either a towage vessel or guard vessel to be quickly deployed from a local port to either retrieve or standby any free floating equipment and promulgate information to any third party users. Operational safety zones of up to 500 metres given the excursion of the WTGs from a central point and the risks associated with subsea cables and mooring lines. This will be charted to ensure that the mariner is away of the risk and advised by law not to enter the area due to the risk of air draft and under keel clearance issues. Warning signs noting air clearance risk should also be placed on the cross beams between the floatation chambers.	Tolerable with mitigation
Vessels engaged in port operations	Increased collision risk to vessels engaged in port operations.	Minor	Extremely Unlikely	Broadly Acceptable	No further mitigation required.	Broadly Acceptable
Marine emergency response	Impacts on emergency response associated with increased activity, during periods of major maintenance, and potentially new navigational safety hazards.	Minor	Extremely Unlikely	Broadly Acceptable	No further mitigation required.	Broadly Acceptable
Cumulative Impacts						

Receptor	Potential Impact	Severity of Consequence	Frequency of Occurrence	Impact	Mitigation	Residual Impact
Commercial vessel routeing.	Deviations associated with the position of cumulative developments for routes that have been displaced by the location of cumulative developments.	Moderate	Reasonably Probable	Broadly Acceptable	No further mitigation required.	Broadly Acceptable
Marine emergency response	Collective increased burden on emergency response providers. Restriction of SAR activities within central North Sea.	Minor	Remote	Broadly Acceptable	No further mitigation required.	Broadly Acceptable
Associated with tow route	Increased encounter and collision / allision risk.	Serious	Extremely Unlikely	Tolerable with Mitigation (embedded)	No further mitigation required.	Tolerable with Mitigation (embedded)
Associated with Nigg Bay Port development and operation	Potential cumulative impact on vessel arrivals, particularly for vessels transiting inshore to / from Aberdeen Harbour, and vessel anchoring activity in proximity to Aberdeen Harbour. Potential snagging risk with export cables due to increased vessel activity in proximity of export cables.	Moderate	Extremely Unlikely	Broadly Acceptable	No further mitigation required.	Broadly Acceptable

9.8. References

DECC (2005): *Methodology for Assessing Marine Navigational Safety Risks of Offshore Windfarms*. **Department of Energy and Climate Change**. November 2005.

IALA (2013): *IALA Recommendation O-139 on The Marking of Man-Made Offshore Structures*. **International Association of Marine Aids to Navigation and Lighthouse Authorities**. Edition 2. December 2013.

IMO (2007): *Guidelines for Formal Safety Assessment (FSA) for use in the IMO Rule Making Process*. **International Maritime Organisation.** Edition 3. May 2007.

MCA (2008a): *Marine Guidance Note 371, Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response Issues*. **Maritime and Coastguard Agency.** August 2008.

MCA (2008b): *Marine Guidance Note 372, Offshore Renewable Energy Installations (OREIs) – Guidance to Mariners Operating in the Vicinity of UK OREIs*. **Maritime and Coastguard Agency**. August 2008.

RYA (2009): *UK Coastal Atlas of Recreational Boating*. **Royal Yachting Association**. 2009.

RYA (2014): *The RYA's Position on Offshore Energy Developments.* **Royal Yachting Association**. September 2014.

10. Military & Aviation

10.1. Introduction

1. The Construction and operation of wind turbines, both onshore and offshore, can lead to adverse impacts on the aviation activity in the surrounding area. Such impacts can include:

- Impact (collision) on the WTG structures;
- Interference with navigational equipment (signal output);
- Interference with aviation radar (commercial);
- Interference to military radar systems; and
- Electromagnetic obstruction and reflection from towers and blades

2. Therefore the any potential impacts from the KOWL WTGs must be assessed against these possible impacts. This chapter initially outlines the key policy regulations that must be considered, assessment of the baseline conditions both for the military and civilian stakeholders, an impact assessment of the likely outcomes of the placement of the WTGs at the development site, the likely mitigation measures that could be required to achieve consent and finally a review of possible cumulative impacts from other offshore wind installations.

10.1.1. Policy and Regulations

3. The list below details the most significant guidance documents with regard to the potential impacts of the Project on aviation. Other documents exist that relate to this topic and specific guidance is available from other parties, notably NATS (which provides self-assessment maps for aviation issues) and the MOD (which provides a preplanning service advising of potential aviation issues for wind developments).

- Scottish Government (2009): National Planning Framework for Scotland;
- Scottish Government (2010): Scottish Planning Policy;
- Civil Aviation Authority (2006): CAP 738: Safeguarding of Aerodromes, 2nd edition;
- Civil Aviation Authority (2014): CAP 393: Air Navigation. The Order and the Regulations, 3rd edition;
- Civil Aviation Authority (2011): CAP 168: Licensing of Aerodromes, 9th edition; and
- Civil Aviation Authority (2013): CAP 764: CAA Policy and Guidelines on Wind Turbines, 5th edition.

10.1.2. Stakeholder Consultation

4. Consultation was undertaken during and following the submittal of the KOWL Environment Scoping Report (KOWL 2014), with MS-LOT providing formal feedback in the Environmental Scoping Opinion Report (MS-LOT 2014). This included feedback from statutory and non-statutory consultees that responded to the Scoping Report. From this document three key stakeholders were identified:

- Aberdeen Airport
- Ministry of Defence (MOD)
- National Air Traffic Service (NATS)

5. The information in the Scoping Opinion report and the subsequent key scoping responses (Table 1) has been used to inform the baseline environmental review and the subsequent assessment methodology.

Table 10-1 KOWL Scoping Opinion response comments.

Consultees	Scoping Response	KOWL Response
MOD	MOD object to proposal as they are 51.4 km from the AD radar at RAF Buchan	KOWL note this response and this will be addressed by a site specific assessment undertaken by SERCO (complete) and additional discussions with the MOD
NATS	Undertake self-assessment exercise	NATS self-assessment undertaken
NATS	Submit radar assessment application	Ongoing
Aberdeen Airport	Review of location of windfarm against airport for physical infringements into flight safety.	WTG locations and dimensions sent to Aberdeen airport and initial discussions indicate no issue from the Project on the airport operations.
Aberdeen Airport	Second technical assessment - via NATS	NATS self-assessment undertaken
Aberdeen Airport	Submit to Aberdeen Airport	NATS assessment report to be sent to Aberdeen Airport.

6. KOWL have noted the formal response to the scoping response and highlights how the project has sought to manage and respond to each comment in turn

10.2. Baseline Environment

7. With regard to aviation and radar concerns for offshore wind developments, the main issue identified is the long range radars (both military and civil) in the area. From the KOWL scoping assessment it has been identified that no helicopter routes pass in the vicinity of the proposed development and therefore this receptor has been removed from the assessment (for the operational phase of the project). However, there would be a potential impact to helicopter routes during the towing phase and this has been has been assessed within this Chapter. In the case of this Project, the affected sensors have been identified as:

- A single military air defence radar (Buchan) located approximately 4 km south of Peterhead;
- Two civil en-route radar (Allanshill and Perwinnes) located approximately 9 km southwest of Fraserburgh and 6 km north of Aberdeen respectively; and
- Helicopter routes from the mainland over the North Sea.

8. The Buchan radar is safeguarded by the UK MOD. It is a Type-92 long-range air defence radar manufactured by Lockheed Martin, designed to provide 360 degree, low level through to high level, primary surveillance coverage as one of a network of six static homeland defence radars.

9. The two civil long range radar are safeguarded by NATS and are designed to provide radar surveillance for aircraft in the en-route phase of flight, including helicopters operating over the North Sea.

10. The Project turbines will be towed from the construction port to their final positions and installed directly. The maximum height of the tow above the sea surface will be 176 m and the likely maximum tow speed 3.5 knots (1.8 m/s). Radar interference is highly unlikely to be significant during the tow because of the low speed, which will allow the radar returns to be filtered out. During the tow the turbines will present a temporary obstruction. Therefore, details of the tow route and the times at which the tow will take place will be made available to NATS and the helicopter operators prior to the tow taking place (these will be weather dependent).

10.2.1. Substructure Movement

11. The movement of the turbine / substructure is a key component of the radar assessment work and therefore having this knowledge is vital to allow the appropriate review process to take place. The

Project have accessed the data obtained during initial tank tests of the Windfloat design prior to the development of the Windfloat demonstration project in Portugal. Since then the results of the tank test have been calibrated by data from the demonstration project in Portugal and this information has been applied to the Project WTG systems. This forms a key assessment criteria for the SERCO radar assessment that is required by the MOD.

12. Additionally, further design work has been undertaken for Windfloat equipped with different turbines for three separate projects which provides the required design envelope for the appropriate assessment to be undertaken. These are:

- Windfloat Atlantic a 3 x 8 MW project off the coast of Portugal;
- Windfloat Pacific a 5 x 6 MW project off the coast of Oregon in the USA; and
- Kincardine an 8 x 6 MW project of the coast of Aberdeenshire in Scotland

13. The movement of the Windfloat installed at the Demofloat project in Portugal is summarised in Figure 10-1 and Table 10-2 below.

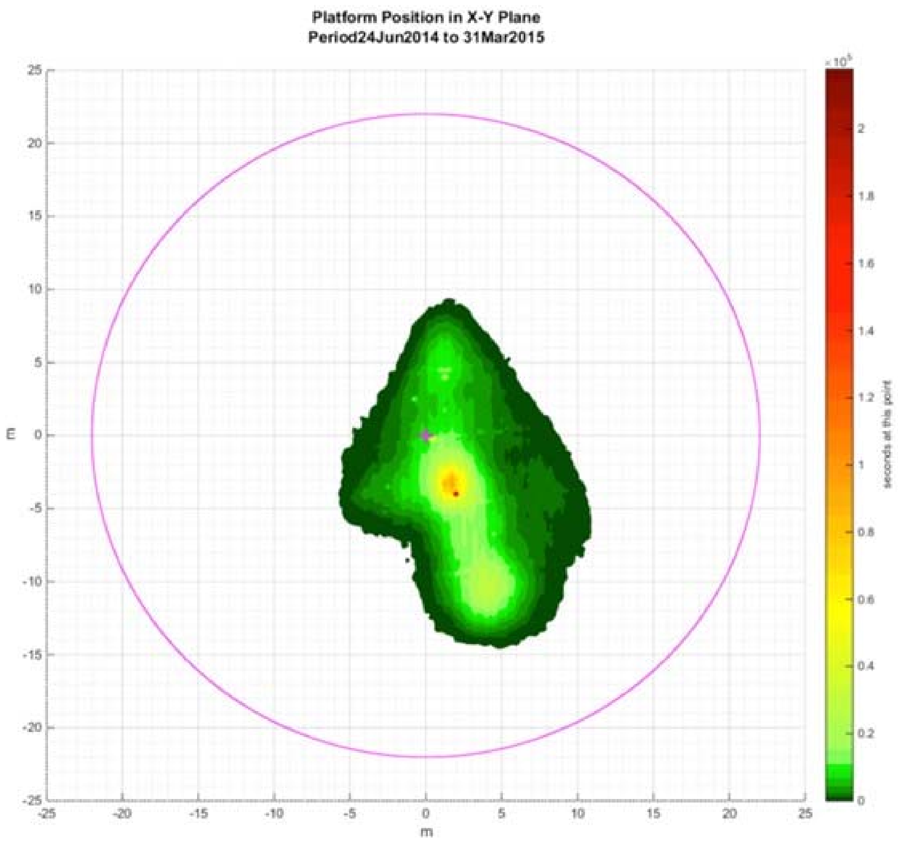

Figure 10-1 Excursion limits for substructure during operations (Windfloat 2013)

14. Figure 10-1 shows the platform position in the X-Y plane during the period from 24th June 2014 to 31st March 2015. It shows that during the period the total amount of time that the machine spent outside the yellow zone at the centre of the period was less than 20 hrs.

15. Following discussions with SERCO PPI looked at the worst-case scenario under extreme conditions: platform movement in a 50 year storm. The results of this analysis are noted in Table

10-2 detailing the displacement and acceleration data for these conditions aligned and misaligned conditions.

Table 10-2 Excursion limits for substructures during modelled operations (extreme 50 year event).

90 degree variable	Minimum	Maximum	Mean	Standard Deviation
X (m) at End B	23.70	26.97	25.80	0.63
Y (m) at End B	19.03	31.93	26.66	2.58
Z (m) at End B	180.47	183.49	181.99	0.49
GX-Velocity (m/s) at End B	-0.60	0.43	-0.01	0.17
GY-Velocity (m/s) at End B	-1.32	1.22	0.02	0.52
GZ-Velocity (m/s) at End B	-0.84	0.62	0.00	0.22
180 degree variable	Minimum	Maximum	Mean	Standard Deviation
X (m) at End B	6.76	20.42	13.96	2.63
Y (m) at End B	0.00	0.01	0.00	0.00
Z (m) at End B	181.20	184.48	182.98	0.60
GX-Velocity (m/s) at End B	-1.66	1.67	-0.01	0.58
GY-Velocity (m/s) at End B	0.00	0.00	0.00	0.00
GZ-Velocity (m/s) at End B	-0.92	0.74	0.00	0.25

The results of these simulations are illustrated below in Figure 10-2.

16. Starting at the top left and moving clockwise the pictures show:

- Surge on horizontal X axis v Sway on perpendicular Y axis at 90 degrees
- Sway on horizontal Y axis v Heave on perpendicular Z axis at 90 degrees
- Surge on X horizontal axis v Sway on perpendicular Y axis at 180 degrees
- Sway on Y horizontal axis v Heave on perpendicular Z axis at 180 degrees

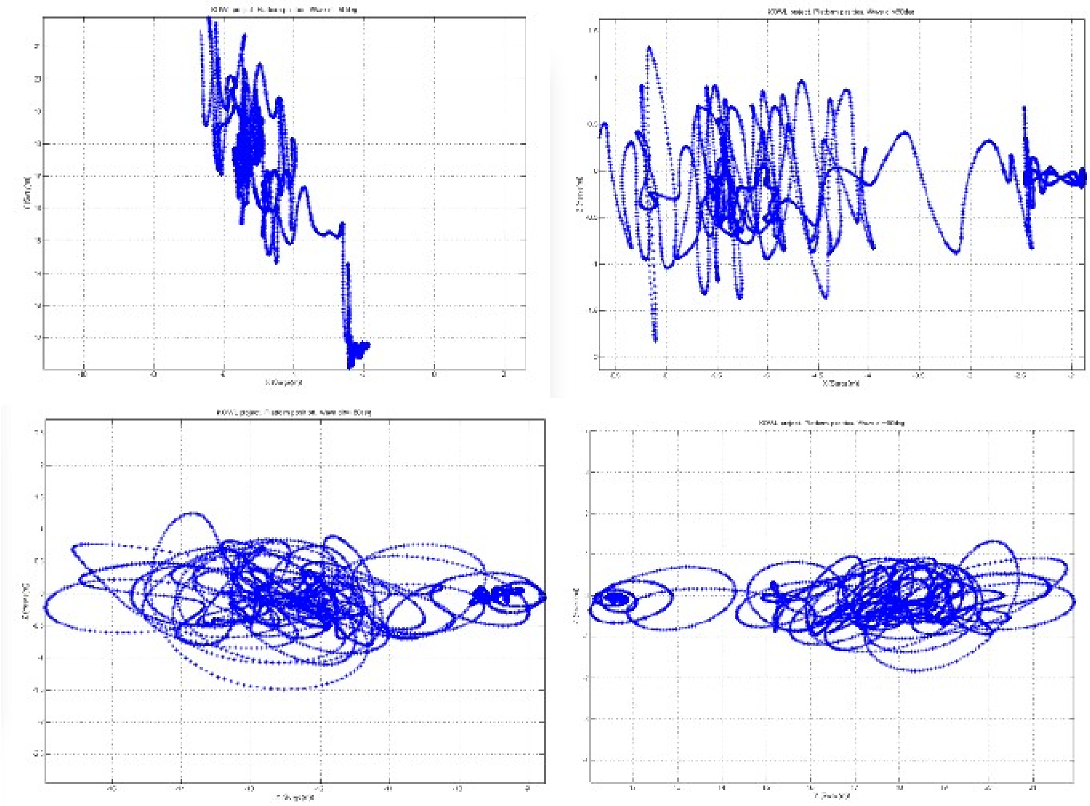

Figure 10-2 Outline excursion plots for extreme event for WTG (modelled)

10.3. Assessment Methodology

17. Two separate approaches have been used in the assessment approach, with the civilian and military radar/aviation risks split into two separate assessments:

- NATS self-assessment and review
- SERCO assessment for the MOD

18. The civilian assessment is undertaken by using the NATS a self-assessment and pre-planning tools to allow the Project to identify the possible impacts on civilian aviation issues which is supplied to both Aberdeen airport and also NATS for their own internal assessment.

19. The second is to use the MOD preferred assessment approach which is undertaken by SERCO which produces a bespoke mitigation modelling report for the development that assesses the possible mitigation solutions for the site against the current MOD radar envelop.

20. The magnitude of an effect is based on four key considerations, and has been quantified where possible. Effects are defined as either positive, negligible, low, moderate and high (Table 10-3). The four key considerations for determining the magnitude of effects are:

- Spatial extent (the geographical range of the effect);
- Duration (how long the effect lasts);
- Frequency (how often the effect occurs); and
- Severity (the degree of change).

Table 10-3 Definitions of the magnitude of effect for the impact assessment on the marine historic environment

Magnitude	Description
Positive	Positive change from baseline conditions
Negligible	Very slight change from baseline conditions
Low	Slight or minor change from features of the baseline conditions
Moderate	Partial loss or changes to one or more of the key features of baseline conditions
High	Complete loss or very major changes to key features of baseline conditions

21. The determination of each factor of sensitivity of each receptor will vary according to the specific receptor and is defined on a receptor by receptor basis using expert judgement and industry best practice.

22. The sensitivity of the identified receptors are defined as high, moderate, low or uncertain based on the following definitions in table below.

Table 10-4 Definitions of receptor sensitivity for the impact assessment on the military and aviation

Sensitivity	Definition
High	Direct impact on the radar/aviation system. Caused significant radar returns and would impact on use of such systems
Moderate	Would have some direct impact on the radar systems, but limited by distance from receptor.
Low	Limited impact on the receptor and no direct impact on operation of system

10.4. Impact Assessment

22. From the NATS self-assessments (using the outline turbine locations in Table 1-5) it is possible to map the turbine locations in relation to the relevant primary and secondary radars in the development area (Figure 10-3).

23. This assessment has been undertaken using the following base inputs:

- Up to 8 x WTGs
- Blade tips height maximum of 176m.

24. It should be noted that the higher the turbine blade, the greater the potential impacts it can have the radar systems and therefore the Project has used the worst case option to be conservative in the self-assessment.

Table 10-5 Indicative turbine locations used in the NATS self-assessment.

Turbine	Easting (BNG)	Northing (BNG)	Longitude (WGS84)	Latitude (WGS84)
1	407317.94	790468.60	-1.881151	57.005315
2	407766.44	789574.82	-1.873794	56.997279
3	408214.95	788681.04	-1.866440	56.989242
4	408663.46	787787.26	-1.859090	56.981205
5	408453.48	792841.79	-1.862377	57.026615
6	408901.99	791948.01	-1.855020	57.018577
7	409350.49	791054.23	-1.847666	57.010540
8	409799.00	790160.45	-1.840316	57.002501

Table 10-6 Summary of the potential risks and impacts to identified MOD and Commercial radar systems in close proximity to the Development Area during construction, operation and decommissioning

Activity	Risk	Potential Impact	Construction	Operation	Decommissioning
Buchan Air defence Radar	Impact on radar system by giving false returns from the WTGs.	• Increase in the number of false return from WTG rotation		X	
Allanshill civilian radar	Impact on radar system by giving false returns from the WTGs.	• Increase in the number of false return from WTG rotation		X	
Perwinnes civilian radar	Impact on radar system by giving false returns from the WTGs.	• Increase in the number of false return from WTG rotation		X	
Helicopter route	Helicopter route could be impacted during construction transit to site.	• Helicopter route could be changed/cancelled depending on weather conditions	X		X

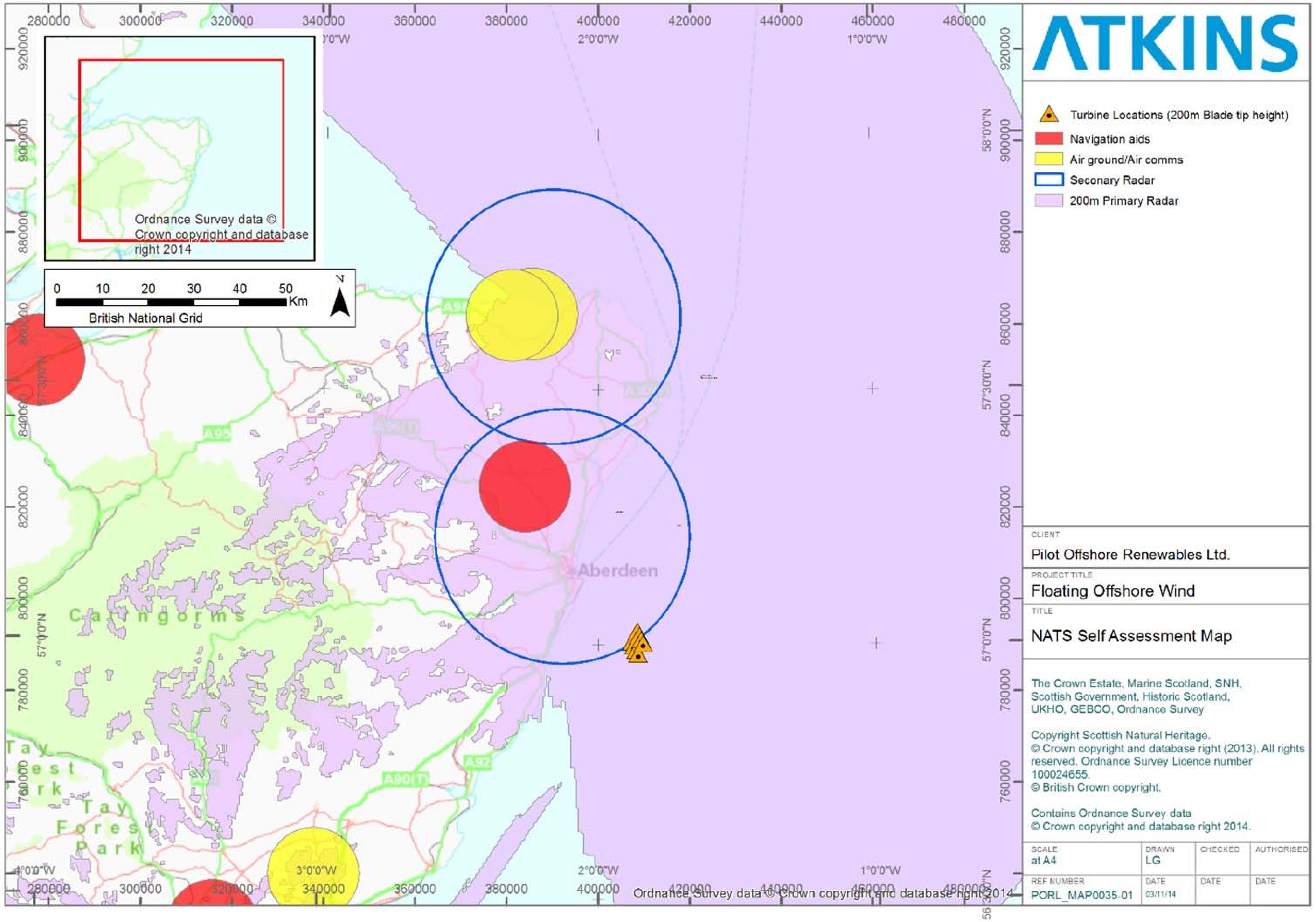

Figure 10-3 NATS self-assessment map for radar systems.

10.4.1. Impacts – Construction Phase

25. Wind turbines can cause radar interference by interacting with the transmitted radar signal. With regard to the air defence radar at Buchan and the civil radars at Allanshill and Perwinnes the concern is primarily with regard to false returns. False returns are caused by the rotating turbine blades appearing as targets on the radar screen. When the blades are stationary or moving slowly, they will not create false returns. During the construction, once the turbines are on site they will not be rotating. The turbines will be towed to their final positions from an assembly site. The maximum speed during the tow will be 3.5 knots (1.8 m/s), which is highly unlikely to lead to a false return.

10.4.2. Impacts – Installation Phase

26. Wind turbines can cause radar interference by interacting with the transmitted radar signal. With regard to the air defence radar at Buchan, the concern is primarily with regard to false returns. This can occur when the moving wind turbine blade reflects the radar signal back towards the receiver. Because the blade is moving, it can be detected and displayed as a target on the radar screen, giving the impression that there is an aircraft at the WTG location when in fact there is not. This is known as a false return. When a number of WTG Units are located in close proximity to one another, these false returns can appear contiguous and produce what looks like an aircraft track on the radar screen or cause an actual aircraft track to deviate. Additionally, an increased number of false returns in an area can cause increased internal radar processing, raising the noise threshold of the area and potentially leading to a decrease in probability of detection. The self-assessment concluded that the radar would be highly likely to be able to detect all the WTG Units.

10.4.3. Impacts – Mid-life Maintenance

27. If mid-life major component repairs/replacement (blades/gearbox) is required for the Project WTG units it is likely that they will be towed to a local port to undertake all the necessary maintenance and therefore during this phase, as similar to the construction phase, there will be some limited impacts on radar returns. False returns are caused by the rotating turbine blades appearing as targets on the radar screen. When the blades are stationary or moving slowly, they will not create false returns. During the maintenance phase, once the turbines are removed from site they will not be rotating and therefore the impacts are significantly lower. Following the maintenance the turbines would be towed to back to their positions from reconnection to the grid and anchor systems. The maximum speed during the tow will be 3.5 knots (1.8 m/s), which is highly unlikely to lead to a false return. This is likely to require a bespoke review process at the time due to the possible changes in available ports as Aberdeen Nigg Bay could be available at this point.

10.4.4. Impacts – Decommissioning Phase

28. The decommissioning phase will closely match the construction phase and the same impacts will be in place for both. This will also require approval from DECC at this stage.

10.4.5. Radar Interference – Buchan Military air defence radar

29. As identified in the NATS self-assessment it is noted that the development site is highly likely to have an impact on the Buchan radar system. This can occur when the moving wind turbine blade reflects the radar signal back towards the receiver. Because the blade is moving, it can be detected and displayed as a target on the radar screen, giving the impression that there is an aircraft at the WTG location when in fact there is not. This is known as a false return. When a number of WTG Units are located in close proximity to one another, these false returns can appear contiguous and produce what looks like an aircraft track on the radar screen or cause an actual aircraft track to deviate. Additionally, an increased number of false returns in an area can cause increased internal radar processing, raising the noise threshold of the area potentially leading to a decrease in probability of detection.

10.4.6. Radar Interference – Allanshill civilian en-route radar

30. NATS Allanshill radar, the concern is primarily with regard to false returns. This can occur when the moving wind turbine blade reflects the radar signal back towards the receiver. Because the blade is moving, it can be detected and displayed as a target on the radar screen, giving the impression that there is an aircraft at the WTG location when in fact there is not. This is known as a false return. When a number of WTG Units are located in close proximity to one another, these false returns can appear contiguous and produce what looks like an aircraft track on the radar screen.

31. The Project are currently in discussion with NATS to confirm the possible impacts on this site to during the installation process, as the site is outside of the development envelop. It is expected that the impact during the tow process will cause an impact, but due to the slow speed of the tow the resulting level of impact is negligible as the radar returns can be removed due to slow speed (the blades will not turn during transit).

10.4.7. Radar Interference – Perwinnes civilian en-route radar

32. NATS Perwinnes radar, the concern is primarily with regard to false returns. This can occur when the moving wind turbine blade reflects the radar signal back towards the receiver. Because the blade is moving, it can be detected and displayed as a target on the radar screen, giving the impression that there is an aircraft at the WTG location when in fact there is not. This is known as a false return. When a number of WTG Units are located in close proximity to one another, these false returns can appear contiguous and produce what looks like an aircraft track on the radar screen.

Table 10-7 Results of the impact assessment from the Development Area on the identified receptors

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Impact
Radar Interference	Buchan Air defence Radar	Moderate to high as the Project WTGs can produce false returns during operation and they are within the area covered by this air defence radar	Moderate to high as they are within the search zone of the air defence radar	High
	Allanshill civilian radar	Low impact as the NATS assessment shows the WTGs are outside of the area covered by the radar systems.	Low as the Project is outside of the area covered by the radar system.	Low
	Perwinnes civilian radar	Moderate impact as the NATS assessment shows the WTGs are just outside of the area covered by the radar systems.	Moderate as the Project is just outside of the area covered by the radar system.	Moderate

10.5. Mitigation

10.5.1. Buchan Military air defence radar

33. SERCO have produced a detailed assessment of the Project WTG impacts on this radar system and this has been supplied to the MOD for consideration. The findings from this assessment indicate that would be a potential impact on the current radar system, but this can be significantly mitigated with an upgrade to the system. This report is confidential and cannot be shared as part of this assessment process.

34. This will allow the MOD to make an informed decision on the possible impacts and the possible mitigation measures that can be used to reduce the possible impact to an acceptable level. The project are aware that this has been undertaken on a large number of onshore and offshore windfarm developments already and the method of impact reduction involves an upgrade to the current Buchan radar system. The Project are currently seeking to input into this upgrade programme that would allow the impacts from the development to be acceptable to the MOD.

10.5.2. Allanshill civilian en-route radar

35. The Project needs to undertake further discussions with NATS to confirm the possible impacts and mitigation measures for the Allanshill radar system. However as the impacts to the radar system will only occur during the transit period it is expected the level of impact will be negligible.

10.5.3. Perwinnes civilian en-route radar

36. The Project are currently in discussion with NATS to confirm the possible impacts on this site as the location of the site is currently just on the outer limit of this site (Figure 10-3). Following a review of the Hywind NATS assessment it is clear that there is a software upgrade to the radar that will allow all radar returns within the specific area to be removed from the radar display. Therefore the potential level of impact from the site on the Perwinnes radar system is expected to be negligible.

10.5.4. Helicopter routes – Construction phase (Tow)

37. There is potential for helicopter routes to be impacted during the construction phase as the WTG units are towed from the construction port to the site. As the tow will occur during fair weather conditions there is expected to be very limited impact on these services. However the Project will undertake significant liaison (NATS and Aberdeen Airport) during creation of the detail installation plan to ensure all risks are managed and the resulting impacts are expected to be negligible.

10.6. Cumulative Impacts

38. KOWL has been in consultation with Marine Scotland to identify a list of other projects which together with the development may result in potential cumulative or in-combination impacts. The list of these projects including details of their status at the time of the EIA and a map showing their location is provided in Chapter 2.

39. The cumulative impacts review the possible in combination impacts on aviation and radar caused by planned and consented offshore windfarms (as agreed by MS LOT). In combination impacts are impacts on aviation and radar as a result of offshore windfarms (and their associated activities) combined with impacts from other marine activities or users of the sea.

40. The closest wind turbine development, the European Offshore Wind Deployment Centre is located 20 km from the Project and it is currently expected that no cumulative or in-combination impacts are expected from this site. All other sites are considered to be of sufficient distance from the development site that they would have no impact on the in-combination impacts from the development WTG installations. This will require confirmation following the full NATS assessment for the development site.

10.7. Summary and Residual Impacts

41. Table 10-8 summaries the possible impacts and likely impact significance after mitigation measures have been undertaken by the development. As noted, the MOD Buchan military radar is the one which is likely to suffer significant impact if the mitigation measures (upgrade of the radar system) are not undertaken. The Project recognise that this issue has been resolved by onshore developers and the mitigation cost/timelines are consistent with the development timelines. This is subject to confirmation from the MOD after the full submittal and review of the SERCO assessment which has been submitted to the MOD for consideration.

Table 10-8 Summary of the residual significance of the identified impacts to military and civilian aviation

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Construction and Decommissioning				
Impact to Helicopter routes	Helicopter routes	Low	No mitigation	Low
Operation and Maintenance				
Interference	Buchan Military radar	High	Upgrade of radar system (combined onshore/offshore windfarm remediation)	Low
	Allanshill radar	Low	No mitigation	Low
	Perwinnes radar	Moderate	Upgrade software likely	Low

10.8. References

SERCO 2015 Kincardine Offshore Wind Farm Mitigation Modelling Report (UKTPS/WMMR/01318) (Confidential).

11. Landscape, Seascape & Visual Impact Assessment

11.1. Introduction

1. This chapter of the ES considers the potential visual impact of the Project on identified seascapes and landscapes.

2. As described in Chapter 1, The Kincardine Floating Offshore Windfarm is made up of three components (Development Area, Offshore Export Cable Corridor and Onshore Area). This chapter only makes reference to the Development Area and the Offshore Export Cable Corridor as defined below. The Onshore Area (cable landing pit to the Redmoss substation) is not considered in this assessment as this will be part of a separate onshore consent (Aberdeen City Council) application. The Onshore Area is discussed further in Chapter 16.

   a. The Development Area – the windfarm area including the Wind Turbine Generators (WTG), floating substructures and inter-array cables.
   - The Offshore Export Cable Corridor – the area within which the proposed export cables will be laid, from the perimeter of the Development Area to the Onshore Area at MHWS.
   - These areas combined are referred to as the Project.

3. For the purposes of this assessment the following definitions are considered:

   - Seascape is defined as 'the visual and physical conjunction of land and sea which combines maritime, coast and hinterland character' (SNH, 2012);
   - Landscape is defined as 'an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors.' (Council of Europe, 2000); and
   - Assessment of visual impacts considers 'the effects on specific views and on the general visual amenity experienced by people' (IEMA, 2013).

4. Therefore, the Seascape, Landscape and Visual Impact Assessment (SLVIA) considers potential effects on;

   - Seascape character caused by changes in the key characteristics and qualities of the seascape as a result of the WTGs and floating sub-structures;
   - Landscape character caused by changes in the key characteristics and qualities of the landscape as a result of the WTGs and floating sub-structures;
   - Seascape character caused by changes in the key characteristics and qualities of the seascape as a result of construction of the Offshore Export Cable Corridor;
   - Landscape character caused by changes in the key characteristics and qualities of the landscape as a result of construction off the Offshore Export Cable Corridor;

5. This chapter shares linkages with the following chapters:

   - Chapter 9: Maritime Navigation;
   - Chapter 12: Marine Historic Environment
   - Chapter 15: Other Marine Uses; and
   - Chapter 16: Onshore.

11.1.1. Policy and Regulations

6. The following guidance has been taken into consideration whilst undertaking the SLVIA for the Project:

- Guidelines for Landscape and Visual Impact Assessment (The Landscape Institute and the Institute of Environmental Management and Assessment (IEMA), 2013);
- Visual Representation of Windfarms Version 2.1 (SNH, 2014);
- Offshore Renewables – guidance on assessing the impact on coastal landscape and seascape (SNH, 2012a);
- Assessing the Cumulative Impacts of Onshore Wind Energy Developments (SNH, 2012b);
- An assessment of the sensitivity and capacity of the Scottish seascape in relation to windfarms (SNH, 2005); and
- Guidance on Landscape/Seascape Capacity for Aquaculture (SNH, 2008);

11.1.2. Stakeholder Consultation

7. The consultation process is outlined below:

- The Scoping Report for the Kincardine Floating Offshore Windfarm was written by Atkins and submitted for review in April 2014 (Atkins, 2014).
- The Scoping Opinion was produced by Marine Scotland (MS) in response to the Scoping Report. This collated responses from MS, Marine Scotland Licencing Operations Team (MS-LOT), Statutory consultees and non-statutory consultees.

8. In addition to the formal Scoping Opinion, further informal consultation has been undertaken in relation to the assessment of the impacts of the Project with relevant stakeholders. The information received through this consultation and the formal Scoping Opinion has informed the methodology and scope for the assessment of the impacts on seascapes and landscapes presented in this chapter.

9. As part of this additional consultation with Marine Scotland, Aberdeen City Council, Aberdeenshire Council and SNH, the viewpoints used for the impact assessment were agreed.

10. A summary of the comments received in response to the Environmental Scoping Opinion in relation to the SLVIA are presented in Table 11-1. Also shown are the Project responses which outlines the action to be taken/not taken in reply to the comments.

Table 11-1 Consultation summary responses related to the SLVIA

Consultee	Comment	Project Response
Aberdeen City Council	It is considered important the potential visual impacts of the turbine from locations within the city are fully considered by the ES, including consideration of cumulative impact.	SNH report No 80 (Aberdeen) was utilised to identify the landscape and seascapes to be assessed as part of this study.
Aberdeenshire Council	It is considered that landscape/seascape and visual effects are the issues which are of a high significance for Aberdeen Council. The issue of cumulative effects of wind energy development needs to be fully addressed. There are other wind energy proposal and implemented schemes that have the potential to been seen in combination with the proposed development, and this aspect of the potential visual effects of the project needs to be fully addressed. Particularly for the onshore element of the proposed development, the proposal at	As noted above, Aberdeen City Council have been consulted. The developments at Nigg Bay (Aberdeen Harbour expansion) have been taken in account, and the proposal for the northern cable route has been removed as a result of that project being approved and technical challenges associated with the offshore and onshore cable routing. A cumulative impact assessment has been undertaken as part of this study to account for the identified offshore wind energy proposals and implemented schemes and the Aberdeen Harbour expansion at Nigg Bay.

Consultee	Comment	Project Response
	Altens and Nigg Bay, Aberdeen City Council will need to be consulted.	
	Panoramas, photomontages and wire frame models should be produced of the proposal with accompanying assessment of seascape, landscape and visual effects. In relation to communication from the Scottish Government it may be appropriate to also include single frame photomontage information from key sensitive receptors.	Zones of theoretical visibility have also been produced at maximum blade height (200m) and at the height of the top of the floating substructure above MSL (12m). As agreed with Marine Scotland photographs from all the agreed viewpoints were taken. Wire line images have been produced for all sites and photomontages have been produced for six of the agreed viewpoints, and the assessment of the remainder of the viewpoints and identified landscapes and seascapes has been based on the site photos and wire line drawings.
	In terms of agreeing a list of viewpoints/receptors, SNH should be consulted as well as Aberdeen City and Aberdeenshire Councils.	Consultation with Marine Scotland, Aberdeen City Council, Aberdeenshire Council and SNH took place before final confirmation of viewpoints with Marine Scotland.
	The applicant needs to fully address the issue of cumulative impact. This proposed development will be seen in combination with other wind energy development in Kincardine and Mearns, other part of Aberdeenshire, the North Sea as well as potentially in Aberdeen City, and this issue needs to be fully addressed. Records of up to date wind energy planning applications and scoping requests for this area of the North Sea, Kincardine and Mearns, as well as other appropriate Aberdeenshire Development Management areas and Aberdeen City should be checked by the applicant to ensure that all potential publicly known wind energy development are taken into consideration in accordance with guidance. For the cumulative impact assessment, appropriate common viewpoints and sensitive receptors that may have been used for other wind energy applications should also be identified and assessed for the cumulative assessment of this project.	A cumulative impact has been undertaken which considers the standalone impact of the development of the Project as well as a cumulative impact assessment with existing, consented and proposed windfarms within a 70km radius. Common viewpoints have been used as agreed with Marine Scotland where relevant. Due to the prescribed viewing angles of the photos points (centred on the development) it was not possible to include the Inchcape and Seagreen offshore windfarm turbines. These visualisation can be found within the respective Environmental Statements for direct comparison.
SNH	The Scoping Report notes that the visual impact from the demonstrator project will be *'minimal due to the limited number of wind turbines and the distance from shore and sensitive receivers'*. This makes an assumption before SLVIA has taken place. Experience shows that turbine height and distance offshore are critical to visual impact. It is insufficient to conclude prior to assessment that a distance of 12.8 km offshore will result in a minimal impact. Albeit outside of the study area for this EIA,	A maximum blade height of 200m has been used for the assessment in this study to be conservative. A cumulative assessment has been considered also, but it should be noted that the expected maximum height of the turbine above the water surface is 176m.

<table>
<tr><th>Consultee</th><th>Comment</th><th>Project Response</th></tr>
<tr><td></td><td>assessors should be aware of two existing Beatrice Demonstrator Turbines (BDT), 151 m to blade tip located on average 25 km offshore from Caithness. Both the BDT and five offshore platforms (that rise to a height of 106 m) are visible from many points along the east coast. Views out to these give a good ‘rule of thumb’, some indication of the vertical scale of how 150 m turbines look from that east coast at 25 km distance.</td><td></td></tr>
<tr><td></td><td><u>Viewpoint selection</u>

Please be aware that the visualisations and other illustrative material should be viewed in hard copy only. In relation to the viewpoint selection:
Both cumulative and individual zones of theoretical visibility (ZTVs) are necessary in viewpoint selection, as well as trends of theoretical visibility;
The choice of all viewpoints should be informed by the cumulative ZTV as well as the individual ZTV. Although it is possible to add supplementary viewpoints as part of a cumulative VIA, it is preferable to use all or some of the same viewpoints for both the individual and cumulative VIA.</td><td>Viewpoints were agreed with Marine Scotland after consultation with Aberdeenshire Council, Aberdeen City Council and SNH, and were assessed against previous viewpoint selections for proposed and consented windfarms within the study area.</td></tr>
<tr><td>Historic Scotland</td><td>We note that data sources for the terrestrial historic environment are listed as being obtained from SNH. Please can this be amended to show Historic Scotland as a data source for the historic environment? We can provide up to date GIS datasets under the licence for scheduled monuments, listed building, and gardens and designed landscapes and battlefields.</td><td>The GIS files for scheduled momentums, listed buildings, gardens, designed landscapes and battlefield were accessed for assessments outlined in Chapter 12 and Chapter 16; only the agreed viewpoints and identified landscapes/seascapes were used for this assessment.</td></tr>
<tr><td></td><td><u>Dunnottar Castle</u>
In order to assess this impact and provide our view on the development, we request the production of wireframes and photomontages of the proposed windfarm from various viewpoints from the castle and its wider setting. We note that there is one photo location proposed, which is located nearby but not the actual site, it would therefore be helpful to provide the following viewpoints/photomontage locations:
One photo viewpoint taken from the grounds of Dunnottar Castle
And at least another one taken from the main approach to the castle, which will show the castle in its wider setting with the windfarm in the background.
Potential cumulative impact should also be considered in relation to the potential cumulative and or in-combination impacts</td><td>Due to health and safety restrictions limiting the commercial use of photography within the grounds of the castle, two separate viewing locations points were selected to incorporate the castle within the assessment. The initial one was located within the castle carpark area and the second one is located to the south of the castle on the coastal path.

Cumulative impacts on the castle has been undertaken as part of this study.</td></tr>
</table>

Consultee	Comment	Project Response
	setting impacts on Dunnottar Castle from other wind developments and other marine environment development. We consider that due to the 17km distance between the windfarm and the coastline, we would not have significant concerns with regards to potential adverse impact on coastal sites other than on Dunnottar Castle and its setting. These could therefore be scoped out from the assessment.	
Sports Scotland	It will be important to consult with the Ramblers, possibly mountaineering organisations.	Noted, however, an open invitation was announced to the Public Meeting held December 2014 regarding the project, and no objections or comments were received from any rambling or mountaineering organisations to date.
	We are concerned by the apparent focus on tourism interest with limited assessment of recreation impacts, as distinct from tourism. We recognise however that impacts on recreation are considered throughout sections 10 and 11 of the assessment e.g. landscape impacts on North Sea trail and Aberdeenshire coastal path. It is perhaps worth making this point in the scoping report or to clearly cross reference such impacts in any section on tourism and recreation in the EIA.	Noted. This chapter shares linkages with Chapter 15 and Chapter 16 as receptor groups, such as tourists and recreational visitors are considered as part of this assessment. This will include marine users who will observe the Project during their activities within the marine environment.

11.2. Baseline Environment

11.2.1. Definition of Study Area

11. Visibility assessment of seascape units includes calculating zones of theoretical visibility (ZTV) of a particular development scenario and some reasonable distance limit needs to be applied. The recommended distances of ZTV for various WTG heights are shown in Table 11-2 (Benson *et al.,* 2004). It is worth noting that this guidance is for up to 100m blade tip, whereas the maximum effective tip height used in this assessment is 192m. Therefore, 40km was used for the ZTV distances as shown in the figures below The ZTV is then used as a tool to inform the visual impact assessment.

12. ZTV maps were produced to identify the parts of the SLVIA Study Area which may be impacted by the presence of the WTGs (maximum tip height 192m) and floating substructures (substructure height 12m). These are shown in Figure 11-1 and Figure 11-2. The floating substructures were assessed separately as they will be yellow in colour for marine navigational purposes, whereas the WTGs will be a matt grey colour.

Table 11-2 Recommended ZTV distances

Height of Turbine (including rotors), m	Recommended ZTV Distance, km
50	15
70	20
85	25
100	30

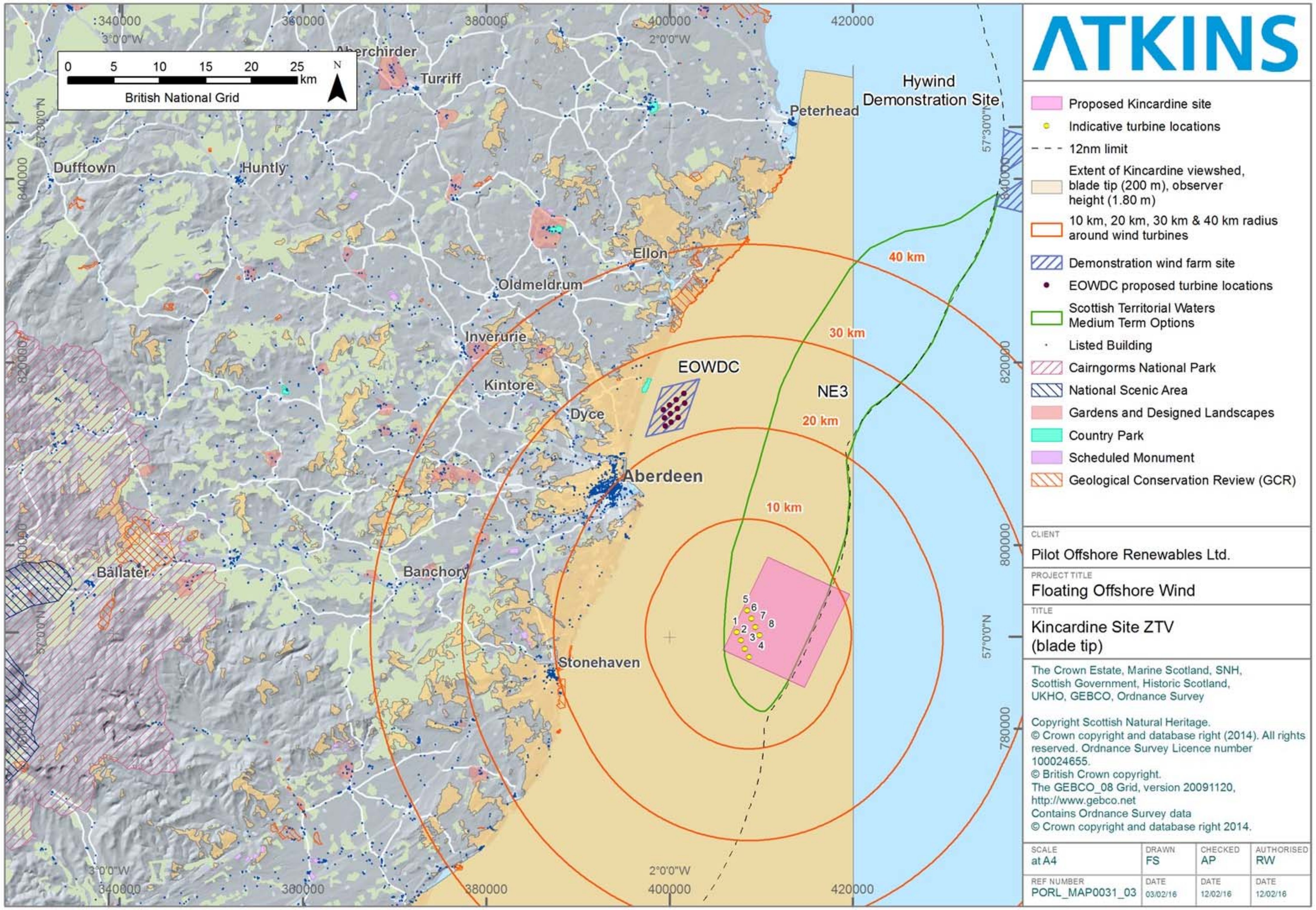

Figure 11-1 Blade Tip (200m) ZTV

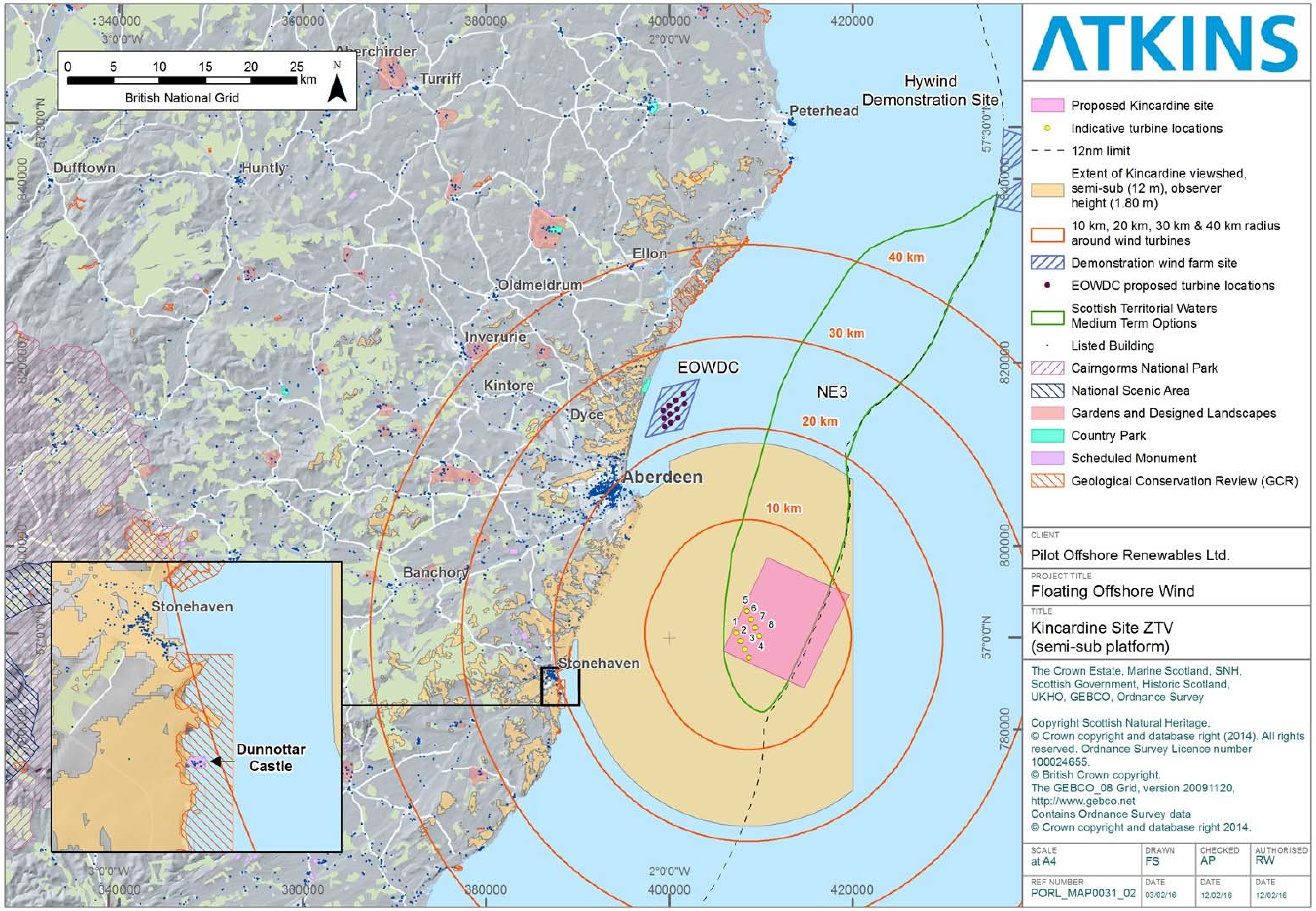

Figure 11-2 Floating substructure (12m) ZTV

11.2.2. Study Area Characteristics

13. Once the study area was defined from the ZTVs, the next stage of the assessment was to review the existing landscape, seascape and visual amenity (viewpoints) within the study area. The baseline was prepared by desk study review of the existing Seascape and Landscape Character Assessments published by SNH (SNH 1996 and 1998 and Scott *et al.,* 2005). Viewpoints within the identified Seascape and Landscape Character Areas were then chosen during consultation with MS, SNH, Aberdeenshire Council and Aberdeen City Council and included mutual viewpoints considered for other consented and proposed windfarms in close proximity. Landscapes were also considered as part of Chapter 16, which noted that there are no landscape designations within or adjacent to landfall point of the Offshore Cable Corridor (onshore consent is being sort separately from the marine consent).

11.2.2.1. Seascape Character Types

National Seascape Unit

14. The Project falls within the National Seascape Unit 4 'North East Scotland' as identified in SNH Commissioned Report no 103 (Scott *et al.,* 2005).

National Seascape Character Types

15. Within the National Seascape Unit there are two national seascape character types that apply to the study area as identified in SNH Commissioned Report no 103 (Scott *et al.,* 2005):

- Type 2 Mainland rocky coastline with open sea views
- Type 3 Mainland deposition coastline with open views

Coastal Character Areas

16. For the purposes of this assessment the Coastal Character Areas (CCAs) are in line with the coastal areas identified in the Landscape Character Assessment (see the below sections). Five coastal characters areas have been identified within South and Coastal Aberdeenshire and Aberdeen;

- Formartine Links and Dunes
- Aberdeen Links
- Girdle Ness/ Nigg Bay
- Doonies/Cove Coast
- Kincardine Cliffs
- Kincardine Links

11.2.2.2. Landscape Character Types

17. Within the study area, review of the South and Coastal Aberdeenshire and Aberdeen Landscape Character Assessments (SNH, 1998 and 1996) has identified the following Landscape Character Types and Areas (Table 11-3) fall within the ZTV for the Project as shown in Figure 11-.

Table 11-3 Landscape Character Types and Areas for South and Coastal Aberdeenshire

Landscape Character Type	Area
Coastal	Formartine Links and Dunes Kincardine Cliffs Kincardine Links
Agricultural Heartlands	Garvock and Glenbervie Formartine Lowlands Central Wooded Estates Kincardine Plateau

18. Within Aberdeen there are 27 identified landscape character types as outlined Table 11-4 below.

Table 11-4 Landscape Character Types and Areas for Aberdeen

Landscape Character Type	Area
Coastal	Aberdeen Links Girdle Ness/ Nigg Bay Doonies/Cove Coast
Hills	Tyrebaggar Hill/Kirkhall Brimmond Hill Gairnhill Kincorth and Tullos Hills
Valleys	Dyce Lower Don Valley Upper Don Valley Dee Valley
Open Farmland	Perwinnes Potteron Murcar Den of Leggart Loirston East Elrick Newhills Maidencraig Kingshill/ Bogskeathy Anguston/Leuchar/Easter Ord Clinterty
Wooded Farmland	Breas of Don Craibstone Kingswells Hazelhead Countesswells/Milltimber/Kennerty

11.2.2.3. Viewpoints

19. A total of 23 viewpoints were identified with Marine Scotland, Aberdeen City Council, Aberdeenshire Council and SNH. The identified viewpoints are detailed Table 11-5 below and shown Figure 11-3 to Figure 11-6.

20. The selected viewpoints are considered to be representative of the main sensitive receptors or receptor groups in the study area. The viewpoints have also decided upon in conjunction with the viewpoints used for the SLVIA carried out for the Hywind Scotland Pilot Park in order to ensure that they provide representative coverage of potential cumulative visibility and related effects.

11.2.3. Receptors

21. Within the SLVIA study area there is a range of seascape, landscape and visual amenity receptors and these are defined in Table 11-3.

22. Seascape receptors are defined as all regional seascape characters in the SLVIA study area from which the WTGs and floating substructures are predicted to be visible.

23. Landscape receptors are defined as all Landscape Character Areas in the SLVIA study area from where the WTGs are predicted to be visible.

24. Visual amenity receptors are defined as individuals or groups of people within the SLVIA study area which are predicted to have views of the WTGs and floating substructures. The main groups of visual receptors include;

- Residents;
- Walkers and climbers; tourists, visitors or users of recreational facilities;
- Road and rail users; and
- Marine based receptors including people taking part in water-based recreational activities, and commercial and cruise ships.

Table 11-5 Details of viewpoints and main receptors to the Project

Viewpoint Number and Name		Altitude (m)	Longitude (WGS84)	Latitude (WGS84)	Distance to Nearest Turbine (km)	Bearing to Kincardine Windfarm °	Seascape Unit / Landscape Character Area	Receptors
1	Newburgh (carpark to links)	5	-1.997978°	57.313096°	35	168	Seascape	Visitors/ Walkers/ Residents
2	Balmedie (access to beach)	5	-2.038044°	57.251598°	29	161	Seascape	Visitors/ Walkers/ Residents
3	Regular ferry routes (deck height)	10	-2.036940°	57.153835°	19	150	Seascape	Travellers
4	Eastern Boulevard Aberdeen	10	57.153461°	-2.079295°	21	144	Seascape	Visitors/ Walkers
5	East side of Castlehill	30	57.148400°	-2.089505°	20	142	Landscape	Residents
6	Torry Battery/ Girdleness Point*	10	57.138591°	-2.047009°	18	146	Seascape	Visitors/ Walkers
7	Doonies Farm *	20	-2.057460°	57.121353°	17	140	Seascape	Visitors/ Walkers
8	Coastal path - Finhon (area of Geological interest)	40	-2.094151°	57.069199°	15	119	Seascape	Visitors/ Walkers
9	Portlethen (railway station bridge)	75	-2.127612°	57.061775°	16	113	Seascape	Residents
10	Downies*	35	-2.122324°	57.046574°	15	107	Seascape	Residents
11	Cookney (Inland settlement)	150	-2.205491°	57.033102°	20	99	Landscape	Residents
12	Newtonhill	30	-2.144238°	57.031692°	16	100	Seascape	Residents
13	Muchalls	60	-2.160640°	57.021017°	17	96	Seascape	Residents

Viewpoint Number and Name		Altitude (m)	Longitude (WGS84)	Latitude (WGS84)	Distance to Nearest Turbine (km)	Bearing to Kincardine Windfarm °	Seascape Unit / Landscape Character Area	Receptors
14	Railway (bridge of Muchalls)	50	-2.168478°	57.011932°	18	92	Seascape	Travellers
15	A90 Trunk Road	80	-2.183353°	56.992482°	18.3	86	Seascape	Travellers
16	Stonehaven Golf Course (Garrow Point)*	50	-2.189160°	56.979569°	19	81	Seascape	Visitors/ Walkers
17	Stonehaven Harbour Pier*	3	-2.200258°	56.960465°	20	75	Seascape	Residents
18	Stonehaven War Memorial*	77	-2.202816°	56.954898°	20	74	Seascape	Visitors/ Walkers
19	Dunnottar Castle (carpark)	65	-2.205985°	56.945255°	21	71	Seascape	Visitors/ Walkers
20	Dunnottar Castle (South of castle on coastal path)*	40	-2.197459°	56.942948°	22	71	Seascape	Visitors/ Walkers
21	Catterline (south)	26	-2.217323°	56.893389°	24	59	Seascape	Visitors/ Walkers/ Residents
22	Gourdon (eastern end of village at coastal path carpark)	3	-2.278887°	56.829341°	31	50	Seascape	Visitors/ Walkers/ Residents
23	Johnshaven (beach)	2	-2.326180°	56.796081°	36	49	Seascape	Visitors/ Walkers/ Residents

*Denotes the six viewpoints for which wirelines and photomontages were produced for use in the impact assessment

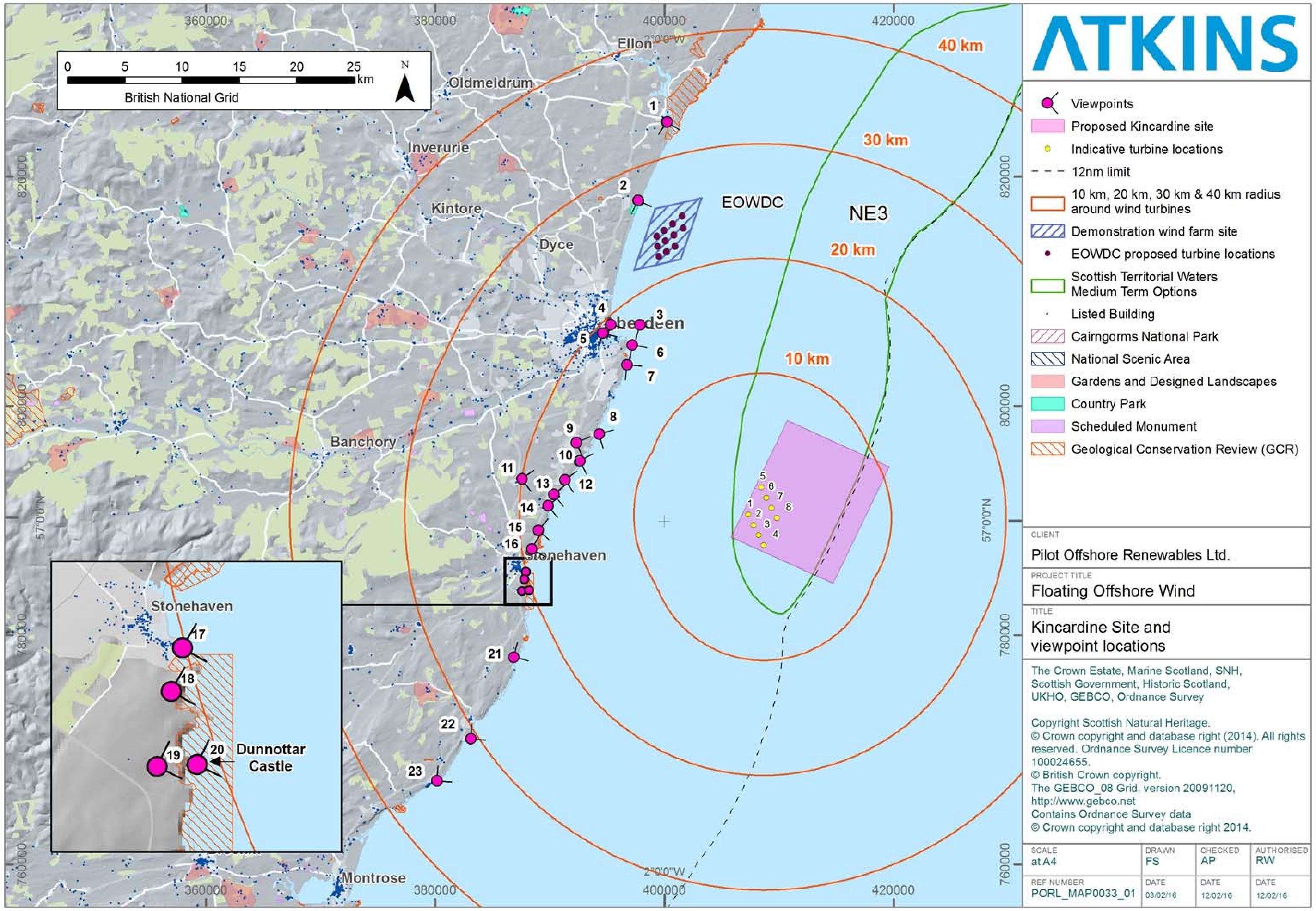

Figure 11-3 All viewpoint locations in relation to the 40km radius from the Project site showing viewing angle

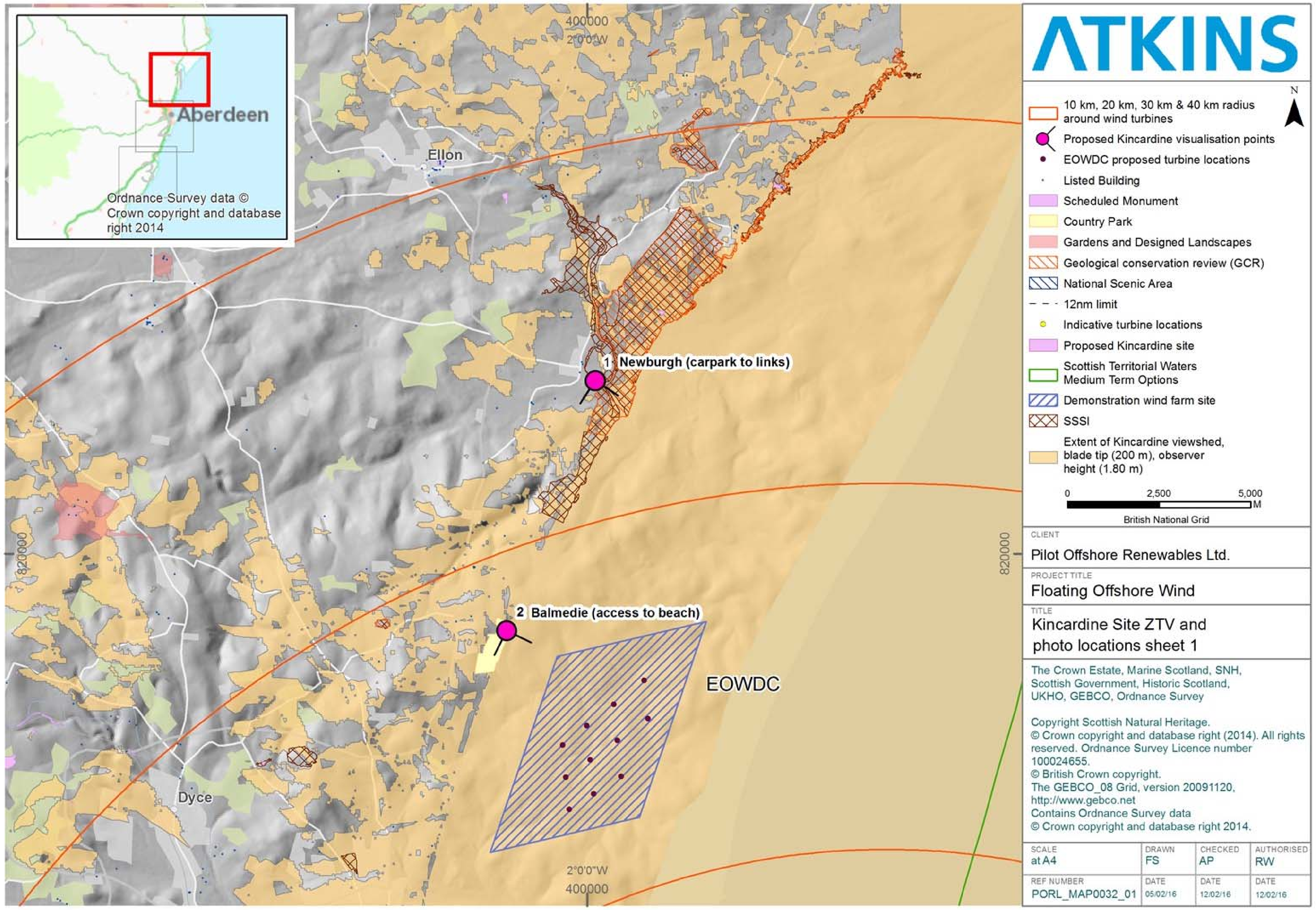

Figure 11-4 Smaller scale image of identified viewpoints 1 and 2 showing viewing angle to Project site

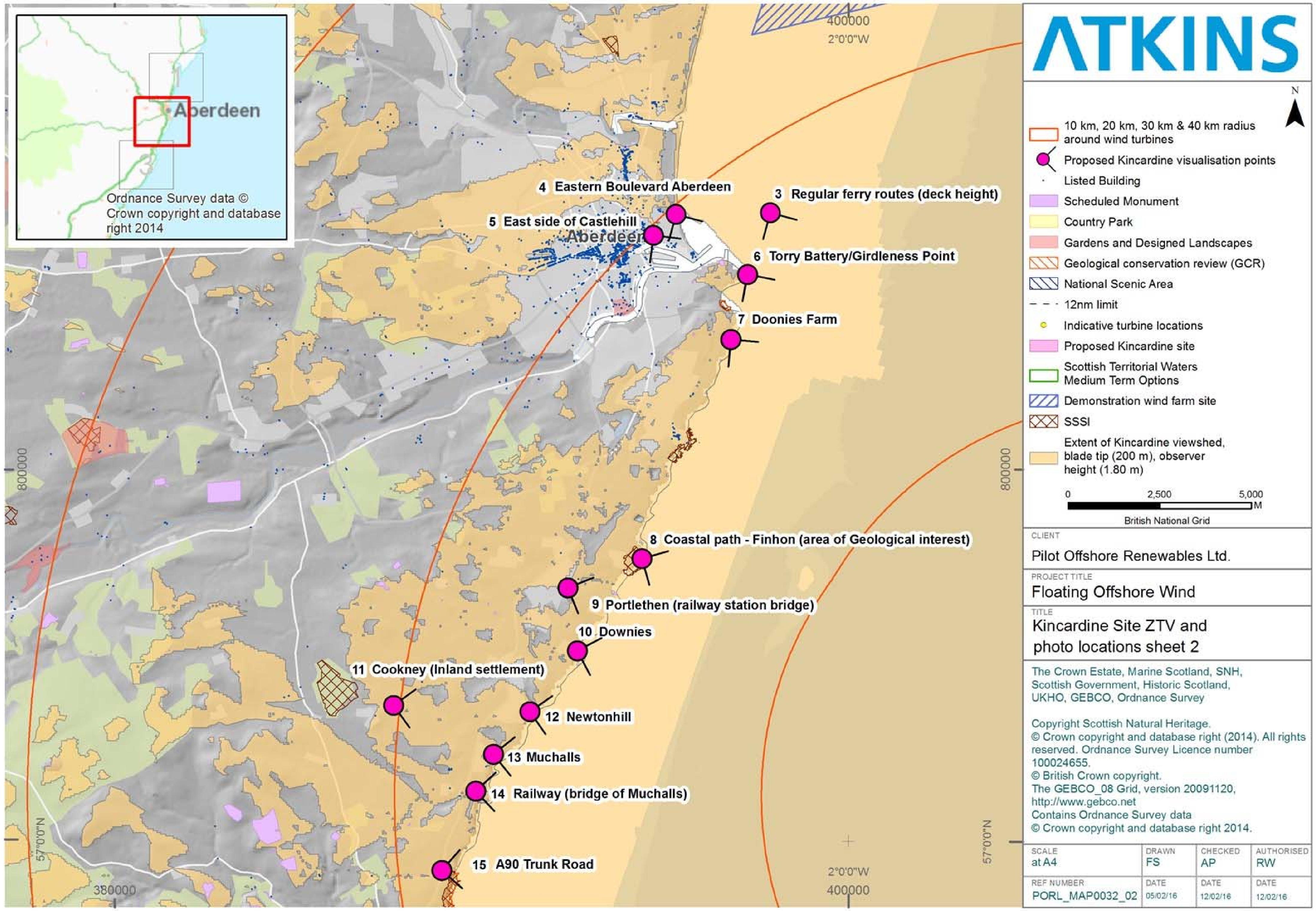

Figure 11-5 Smaller scale image of identified viewpoints 3-15 showing viewing angle to Project site

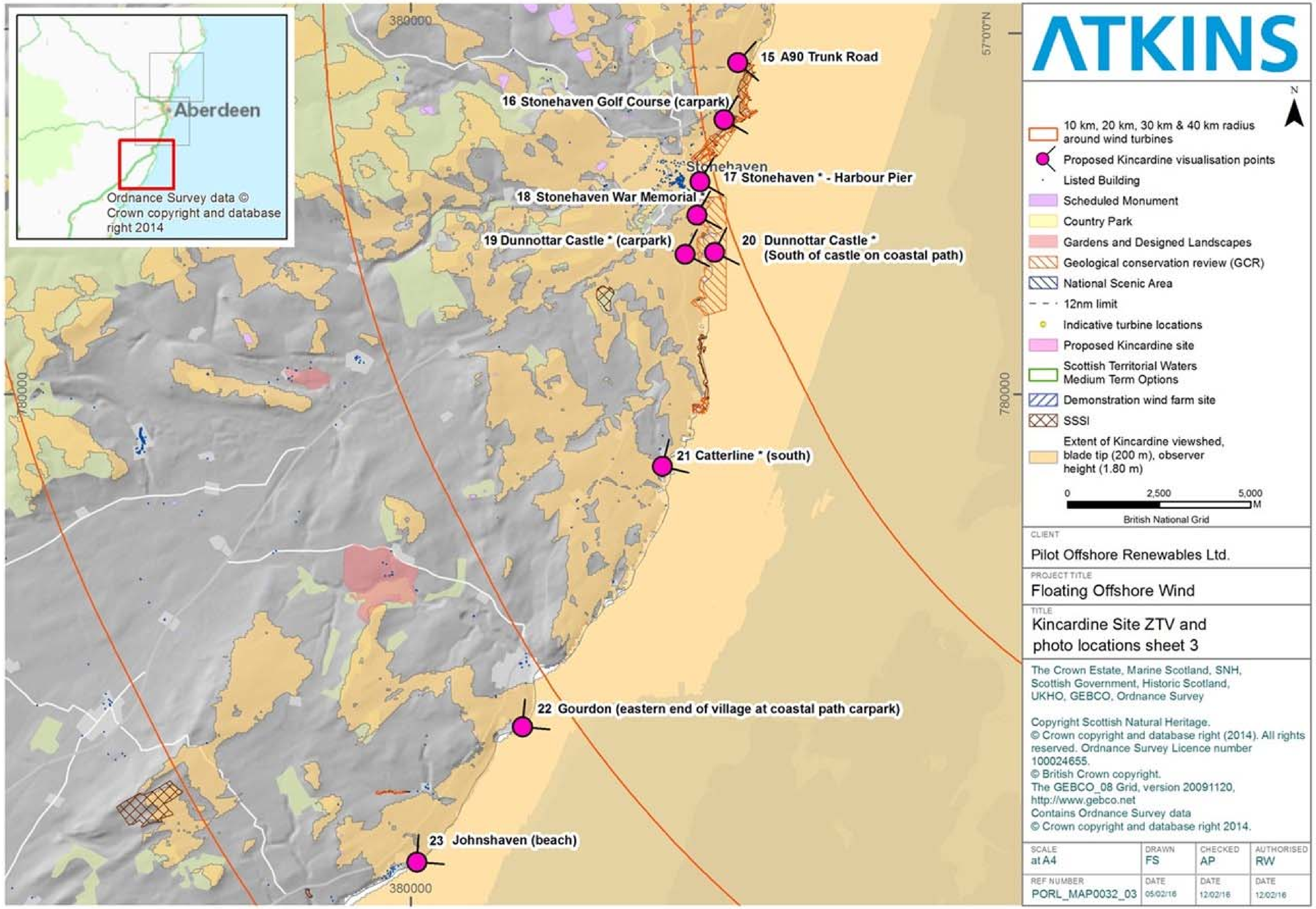

Figure 11-6 Smaller scale image of identified viewpoints 15 to 23 showing viewing angle to Project site

11.3. Assessment Methodology

11.3.1. Assessment Criteria

25. The SLVIA is based on the impact assessment methodology described in Chapter 1, however it does differ slightly due to the inclusion of guidance on SLVIA methodology. The process follows the steps below;

- Determination of baseline conditions through analysis of existing data (See Section 11.2 above);
- Prediction of the activities during the different stages of the Project development that may result in potential impacts;
- Characterisation of potential impacts during likelihood of occurrence;
- Assess whether impacts are significant (related back to baseline conditions) and the geographical scale at which they may occur;
- Assessment of cumulative effects due to the Project and other developments and activities;
- Propose mitigation if applicable; and
- Assess whether residual impacts (after mitigation) are significant.

26. The effects and impacts of the Project were assessed in line with the following definitions;

27. Magnitude of an effect is quantified where possible, and based on interpretation of the below parameters, and is defined as either negligible, low, moderate and high (Table 11-6);

- Distance of viewpoint from the windfarm;
- Duration of predicted impact;
- Extent of windfarm in view;
- Angle of view in relation to main receptor activity;
- Degree of contrast;
- Extent to which views will be blocked or retained with some interruption;
- Background to the windfarm; and
- Extent and nature of other built developments visible.

Table 11-6 Definition of magnitude of effects for the seascape and landscape impact assessment

Magnitude	Description
Negligible	Very slight change from baseline conditions; change may be barely distinguishable
Low	Slight minor alteration or limited loss to one or more key elements/features/characteristics of the existing seascape/landscape character view. Change is discernible, but underlying landscape character or view composition will be similar to the baseline
Moderate	Partial loss or changes to one or more of the key features of baseline conditions. Change perceived as a partial or localised change within a broader, unaltered context
High	Complete loss or very major changes to key features of baseline conditions. Change to baseline is very substantial

28. For the EIA the level of sensitivity of the resource or the receptor must be defined. The sensitivity may be defined in terms of quality, value, rarity or importance of the receptor which is being assessed. The scale of sensitivity is classed as high, moderate and low with specific scales of increasing sensitivity defined where this is appropriate. Guidance is also taken for the value of a receptor through protection under law or through specific designation.

29. The determination of each factor of sensitivity of each receptor will vary according to the specific receptor and will be defined on a receptor by receptor basis using industry best practice. Expert judgement is used in order to determine the overall sensitivity of the receptor. Sensitivity is attributed to receptors on a topic by topic basis within individual ES Chapters using best practice guidelines and industry standards.

30. The sensitivity of the landscape to changes is defined as high, moderate or low based on the interpretation of a combination of parameters including:

- The value attributed to a landscape through designation or identifiable form of recognition;
- The scale and pattern of the landscape;
- The simplicity or complexity of the landscape;
- The nature of the skylines;
- Landscape quality or condition, including the presence of any detracting features;
- Existing land use;
- Visual enclosure/openness of views and distribution of visual receptors; and
- The scope of mitigation, which would be in character with the existing landscape.

31. Seascape sensitivity is judged according to the criteria listed by SNH (Scott *et al.,* 2005 and SNH, 2008). The sensitivity of the seascape to changes is defined as high, moderate or low based on professional interpretation if the following parameters;

- Scale and openness of the seascape;
- Form;
- Settlement type;
- Pattern and Foci;
- Movement;
- Lighting;
- Aspect;
- Experiential qualities (e.g. busyness);
- Quality/Condition;
- Designations;
- Modification/Naturalness/Remoteness; and
- Exposure

32. Viewpoint sensitivity is defined as high, moderate or low based on an interpretation of a combination of parameters including;

- Location and context of the viewpoint;
- Land use or main activity at the viewpoint;
- Frequency and duration of use;
- Seascape or landscape character and quality of the intervening seascape or landscape; and
- Importance of the view

33. Considering the magnitude of the potential impact and the sensitivity of the receptor will determine an expression for the significance of the positive or negative impacts as described in Chapter 1.

34. For this EIA any positive or negative effects which are indicated as 'Major' and 'Moderate/Major' are considered as significant.

35. The SLVIA firstly considered the additional effect of the Project WTGs and floating substructures in conjunction with existing and consented windfarms as these are already, or will become part of the landscape/seascape. The cumulative assessment then also considered the WTGs and floating substructures and consented windfarms as well as application and scoping stage windfarm developments. Therefore, the Hywind Pilot Park is already considered as part of this assessment as it is not consented at the time of writing.

11.3.2. Design Envelope

36. The Project potential development parameters and scenarios are defined as a Rochdale Envelope and outlined in Chapter 1.

37. The assessment of potential impacts on landscape/seascape within this chapter is based on the Rochdale Envelope, with the development methodology and parameters being based upon the worst case scenario.

38. For the assessment, these scenarios include:

- Consideration of the maximum number of WTGSs (in this case this is 8 WTGs)
- Consideration of the maximum height of the WTGs ;
  N.B. a configuration of 8 x 8MW turbines will not occur as this would exceed the maximum 50 MW capacity of the Project. This has been assessed to cover both worst case scenarios in either confirguation 6 x 8MW (which would be the highest tip height) or 8 x 6MW (which would have the larger footprint)
- Positioning of WTGs in shallowest water depths in the Development Area which would be closer to the shore; and
- Installation of one cable corridor containing two export cables.

39. Key parameters for the worst case scenario for each potential impact are detailed in Table 11-7.

Table 11-7 Key parameters for potential impacts

Potential Impact	Worst Case Scenario Assessed in ES
Vessel movements during inter-array and export cable laying, and deployment of floating substructures and WTGs.	Longest installation period for both Offshore Export Cable Corridor installation and burial, and installation of WTGs.
Landscape/seascape disturbance	Conservatively 200 m was assessed in line with the ZTVNumber of WTGs and substructure: 8
Night time lighting of Development Area may affect seascape and/or landscape character and visual amenity.	Maritime and navigational lighting as described in Chapter 2.

11.3.3. Embedded Mitigation

40. A range of embedded mitigation measures to minimise environmental effects are captured within the Design Envelope. The assessment of the effects on the seascape and landscape has taken into account the following Embedded Mitigation measures:

- WTGs will be placed in a regular grid subject to requirements during installation of anchors;
- WTGs will all be of equal dimensions;
- The WTGs will all be pale grey in colour. This reduces the distance over which the WTGs are visible, especially in dull or overcast conditions. Offshore WTGs are viewed against the sky, consequently grey is the most appropriate colour as it is closest to that of the lower part of the sky under most frequent UK weather conditions.

11.4. Impact Assessment

41. An assessment of the predicted visibility of the WTGs the SLVIA Study Area has been determined by analysis of the landscapes and seascapes that fall within the 200m ZTV (worst case scenario as used at scoping stage) and field verification from key sensitive receptors using wireline images and photomontages. The visibility assessment has concentrated on publically accessible areas and key receptors including residential and outdoor recreational areas, as well as road and rail routes and public footpath networks.

11.4.1. Wirelines and Photomontages

42. Wirelines were produced for all viewpoints during consultation with MS, SNH and Aberdeen City Council. From these wirelines, six priority viewpoints were chosen for which photomontages were produced. These photomontages have been used as a guide from which all the identified landscape, seascape types and viewpoints have been assessed and can be found in Appendix D along with the original photograph and wirelines. The six viewpoints that were identified for the production of photomontages were:

- Viewpoint 6 Tory Battery/Girdleness Point
- Viewpoint 7 Doonies Farm
- Viewpoint 10 Downies
- Viewpoint 16 Stonehaven Golf Course (Garrrow Point)
- Viewpoint 18 Stonehaven War Memorial
- Viewpoint 20 Dunnotar Castle (south of castle on coastal path)

43. The photomontages were created using photographs taking using a digital camera with a 50mm lens (unless stated otherwise) which conforms with the recommendation of the Landscape Institute and IEMA (2013) and SNH (2014) guidance which considers this size lens to be the most appropriate to represent the view obtained by the human eye. The images should be viewed flat at a comfortable arms' length.

44. The existing and predicted views from each of the viewpoints have been analysed to identify the magnitude of change/effect to the identified seascape and landscape character areas and viewpoints.

45. An assessment of the significance of the residual effect was then able to be carried out to determine the predicted impact of the Project in relation to seascape and landscape character and visual amenity. The significance of an impact is a function of the sensitivity of the affected seascape, landscape or visual receptor, and the magnitude of change that will occur as defined by the methodology given in Section 11.3.1.

11.4.2. Impact Assessment: Development Area

46. The key risks and potential impacts within the Development Area are summarised Table 11-8.

Table 11-8 Summary of the potential risks and impacts to the Development Area during construction, operation and decommissioning

Activity	Risk	Potential Impact	Construction	Operation	Decommissioning
Installation and decommissioning of inter-array cables and anchors	Vessel movements during laying and decommissioning of inter-array cables	Short term impact to seascape and landscape resources due to presences of vessels	X		X
Installation and decommissioning of WTGs and floating substructures	Vessel movement during towing of WTGs and floating substructures to site	Short term impact to seascape and landscape resources as the WTGs and floating substructures are towed to site	X		X
Maintenance of WTGs and substructures (major component maintenance)	Vessel movements during maintenance of WTGs and substructures	Changes to seascape/landscape resources as WTGs and floating substructures are		X	

Activity	Risk	Potential Impact	Construction	Operation	Decommissioning
		towed back to port for maintenance			
Operational windfarm	Presence of WTGs	Changes to seascape/landscape resources due to the presence of the windfarm once installed and commissioned		X	

11.4.2.1. Installation and Decommissioning of Inter-array Cables and Anchors

<u>Overview of Impact</u>

47. During installation and decommissioning of anchors systems (maximum of 32) and then the inter-array cables (maximum of 30km of cable), there will be vessel movement from Port to the Development Area, where the anchors and cables are laid/recovered and vessel transits back to the Port. The time period for installation of the anchor systems is expected to be six hours per placement and the expected installation period is noted in Chapter 2. A decommissioning plan has not been prepared at this point in time, however, potential effects from decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed in the construction phase. It should be noted that all anchor vessels are likely to be sourced from Aberdeen, Peterhead or Montrose and therefore all vessels used for the Project will be local to the area and will have transited/worked within the area on a regular basis and therefore would not be considered to be abnormal vessels for this area of the coast.

<u>Characterisation of Impact</u>

48. It is anticipated that the construction and decommissioning phases will take place in staggered sequential stages (see Chapter 2). For installation, the deployment of the anchors and the inter-array cables will be undertaken in separate operations. This will limit the number of additional vessel movements in the area in comparison to normal vessel activity from Aberdeen Harbour. Furthermore, due to the small scale of this demonstrator Project, and the anticipated short time period for programmed for installation and decommissioning, in comparison to larger windfarm developments, changes to the landscape and seascape receptors will be very limited in both time and numbers and when compared to the baseline vessel movement within the area of Aberdeen Port (Chapter 9). Therefore, this will result in a negligible increase in vessel movements for the area. Vessels movements in and out of Aberdeen Harbour are frequent (See Chapter 9), and span a variety of activities, and wide range of vessel size, such as, large anchor handlers, rig supply vessels, pilot vessels, tugs, general cargo vessels, tankers, fishing vessels, ferries and marine based recreational activities. For the most part, apart from steaming to the site, the majority of the activity during the construction period will be within the Development Area itself, 15km offshore, some distance from the identified landscapes, seascapes, viewpoints and receptors. Therefore, the magnitude of effect in relation to the seascape, landscape and visual receptors is considered to be negligible.

49. As a result of the above considerations, it is concluded that there will be no significant impacts to the identified seascapes, landscapes, viewpoints or receptors during installation of the inter-array cables and anchors as shown in Tables 11-9 and 11-10.

11.4.2.2. Installation and Decommissioning for WTGs and Floating Substructures

Overview of Impact

50. As described in Chapter 2 construction of the WTGs and floating substructures will occur in dry docks, once complete, the docks will be flooded and the WTGs and substructures towed out to the Development Area where they will be attached to the pre-installed anchors. Installation is anticipated to occur over a number of weeks. During transport to site, the WTGs (maximum blade tip 192m) and floating substructures (12m) will be visible close to shore and along the Offshore Export Cable Corridor, reducing in visibility towards and within the Development Area as per the photomontages.

Characterisation of Impact

51. One of the major advantages of floating substructures is that there is a significant reduction of onsite installation activities compared to fixed structure offshore windfarms (no large offshore installation vessels). Moreover, as there is a maximum of eight turbines to be installed, the scale of the installation process/effort is also significantly smaller than other windfarms that are planned to be installed along the North-East coastline of Scotland. Secondly, the demonstrator scale of the Project means the physical time for installation is also limited, and finally since the majority of the construction activities are undertaken within a port, the onsite installation and commissioning activities are significantly shorter (weeks rather than months) when compared to normal fixed offshore installations. Therefore, the magnitude of effect in relation to the seascape, landscape and visual receptors is considered to be negligible.

52. As a result of the above considerations, it is concluded that there will be no significant impacts to the identified seascapes, landscapes, viewpoints or receptors during installation of the WTGs and floating substructures as shown in Tables 11-9 and 11-10.

11.4.2.3. Maintenance of WTGs and Floating Substructures

Overview of Impact

53. There are two separate phases in the O&M process, the first is the regular maintenance schedule that will take place using small local boats to undertake a weekly (estimated) maintenance programme on the WTGs within the Development Area. The second phase will be only undertaken during major component replacement and will require the structures to be towed back into a local port (such as Aberdeen, Nigg Bay). This is only likely to occur once per WTG during the full life time of the Project and therefore will be considered a one off event for each structure. Therefore, there will be only very limited weekly impacts from a small vessel (<20m) on a weekly basis, and negligible impacts from the midlife replacement of the major components.

Characterisation of Impact

54. The individual WTGs/substructures are not likely to need maintenance simultaneously, therefore the magnitude of change on the landscape/seascape is anticipated to be reduced during maintenance compared to the initial installation.

55. As described above in Section 11.4.2.2.during installation of the WTGs and floating substructures, the magnitude of effect during maintenance activities in relation to the seascapes, landscapes, viewpoints and receptors is considered to be negligible. It is therefore concluded that there will be no significant impacts to the identified seascapes, landscapes, viewpoints or receptors during maintenance activities of the WTGs and floating substructures as shown in Tables 11-9 and 11-10.

Table 11-9 Impact assessment to identified seascapes and landscapes during installation and decommissioning of the windfarm

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
Construction and decommissioning of inter-array cables, mooring, WTGS and substructures	National Seascape Unit 4 comprised of Type 2 and 3 Seascape Character Types	Low/Moderate • General absence of focal features • Expansive scale of the sea • Simple landform	Negligible • Limited increases to vessel movements • Distance offshore	Minor
	Coastal Character Types	Moderate • Formartine Links and Dunes • Kincardine Cliffs • Kincardine Links	Negligible • Limited increases to vessel movements • Distance offshore	Minor
		High • Aberdeen Links • Girdle Ness/ Nigg Bay • Doonies/Cove Coast		Minor/ Moderate
	Landscape Character Types	High • Garvock and Glenbervie • Formartine Lowlands • Kincardine Plateau	Negligible • Limited increases to vessel movements • Distance offshore	Minor/ Moderate
		Moderate • Tyrebaggar Hill/ Kirkhall • Brimmond Hill • Kincorth and Tullos Hills • Perwinnes • Potteron • Murcar • East Elrick • Kingshill/ Bogskeathy		Minor
		Low • Gairnhill • Dyce • Lower Don Valley • Upper Don Valley • Dee Valley • Den of Leggart • Loirston • Newhills • Maidencraig • Anguston/ Leuchar/ Easter Ord • Clinterty • Breas of Don • Craibstone		Negligible/ Minor

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance
		• Kingswells • Hazelhead • Countesswells/ Milltimber/ Kennerty		

Table 11-10 Impact assessment to identified viewpoints and visual receptors during installation and decommissioning of the windfarm

Impact	Viewpoint	Landscape/ Seascape Receptors	Sensitivity of Viewpoint Sensitivity of Receptors	Magnitude of Effect	Significance of Impact
Construction, decommissioning and maintenance of inter-array cables, anchors, WTGS and substructures, and export cables	1 Newburgh (carpark to links)	Seascape	Low	Negligible • Limited increases to vessel movements • Distance offshore	Negligible/Minor
		Visitors/ Walkers/ Residents	Low		Negligible/Minor
	2 Balmedie (access to beach)	Seascape	Low		Negligible/Minor
		Visitors/ Walkers/ Residents	Low		Negligible/Minor
	3 Regular Ferry Routes	Seascape	Low		Negligible/Minor
		Travellers	Moderate		Minor
	4 Eastern Boulevard Aberdeen	Seascape	Moderate		Minor
		Visitors/ Walkers	Moderate/High		Minor/Moderate
	5 East side of Castlehill	Landscape	Low		Negligible/Minor
		Residents	Moderate/High		Minor/ Moderate
	6 Torry Battery/Girdleness Point	Seascape	Low		Negligible/Minor
		Visitors/ Walkers	Moderate to High		Minor/ Moderate
	7 Doonies Farm	Seascape	Moderate		Minor
		Visitors/ Walkers	Moderate to High		Minor/ Moderate
	8 Coastal Path - Finhon (area of Geological interest)	Seascape	Moderate		Minor
		Visitors/ Walkers	High		Minor/Moderate
	9 Portlethen (railway station bridge)	Seascape	Moderate		Minor
		Residents	Moderate/Low		Minor
	10 Downies	Seascape	Moderate/High		Minor/Moderate
		Residents/ Walkers	High/Moderate		Minor/Moderate

Impact	Viewpoint	Landscape/ Seascape Receptors	Sensitivity of Viewpoint Sensitivity of Receptors	Magnitude of Effect	Significance of Impact
	11 Cookney (Inland settlement)	Landscape	Moderate		Minor
		Residents	Low		Negligible/Minor
	12 Newtonhill	Seascape	Moderate		Minor
		Residents	Moderate		Minor
	13 Muchalls	Seascape	Moderate		Minor
		Residents	Moderate/Low		Minor
	14 Railway (bridge of Muchalls)	Seascape	Moderate		Minor
		Travellers	Moderate/Low		Minor
	15 A90 Trunk Road	Seascape	Low		Negligible/Minor
		Travellers	Moderate/Low		Minor
	16 Stonehaven Golf Course (Garrow Point)	Seascape	Moderate		Minor
		Visitors/ Walkers	Moderate/High		Minor/Moderate
	17 Stonehaven Harbour Pier	Seascape	Moderate/High		Minor/Moderate
		Residents	High		Minor/Moderate
	18 Stonehaven War Memorial	Seascape	High		Minor/Moderate
		Visitors/ Walkers	High		Minor/Moderate
	19 Dunnottar Castle (carpark)	Seascape	Moderate		Minor
		Visitors/ Walkers	High		Minor/Moderate
	20 Dunnottar Castle (south of castle on coastal path)	Seascape	High		Minor/Moderate
		Visitors/ Walkers	High		Minor/Moderate
	21 Catterline (south)	Seascape	Moderate/High		Minor/Moderate
		Visitors/ Walkers/ Residents	High		Minor/Moderate

Impact	Viewpoint	Landscape/ Seascape Receptors	Sensitivity of Viewpoint Sensitivity of Receptors	Magnitude of Effect	Significance of Impact
	22 Gourdon (eastern end of village at coastal path carpark)	Seascape	Moderate		Minor
		Visitors/ Walkers/ Residents	Moderate/Low		Minor
	23 Johnshaven (beach)	Seascape	Moderate		Minor
		Visitors/ Walkers/ Residents	Moderate/Low		Minor

11.4.2.4. Operational Windfarm - WTGs

Overview of Impact

56. The previous sections have identified that the installation process of the WTGs and offshore infrastructure will not have any significant impact on the seascapes, landscapes and identified viewpoints or receptors of the Aberdeenshire coastline due to the predominantly temporary nature and scale of the installation and decommissioning activities. The operational windfarm, however, with an operational life span of 25 years will have a potential for impact on the landscapes and seascapes and must be considered for each identified landscape, seascape and viewpoints.

57. The Rochdale Envelope (see Chapter 1) or worst case scenario for the operational windfarm on landscape, seascape and the identified impacts is defined in Table 11-11, and is what was used for the impact assessment.

Table 11-11 Rochdale Envelope for operation windfarm assessment on identified landscapes, seascapes and viewpoints

Component	Dimensions
Maximum Number of WTGs	8
Maximum Blade Tip Height	192m
Maximum Floating Substructure Height	12m
Maximum size of the WTG substructure	Base approximately 70m wide
Shortest Distance of Closest Turbine to Shoreline	8nm /14km

11.4.2.4.1. Impacts of Landscapes Character Areas and Seascape Character Types

58. The following table outlines the identified landscapes and seascape character areas, the sensitivity of the areas and assessment of the potential impacts of the Project during operation and maintenance. The sensitivity and magnitude of the landscapes and seascapes has been identified based on the criteria described in Section 11.3 and information provided in SNH Landscape Character Assessment reports for Aberdeen and Coastal and Southern Aberdeenshire (SNH, 1996 and 1998).

Table 11-12 Results of the impact assessment for the identified landscapes and seascapes character areas through identification of sensitivity, magnitude of effect and the resultant significance of impact

Impact	Landscape/ Seascape Character Area	Landscape/ Seascape	Sensitivity of Landscape/Seascape Area	Magnitude of Effect	Significance of Impact
Visual impact of operational windfarm	National Seascape Unit 4 comprised of Type 2 and 3 Seascape Character Types	Seascape	Low/Moderate • General absence of focal features • Expansive scale of the sea • Simple landform	Low • Small scale of Project and distance offshore	Minor
	Formartine Links and Dunes	Seascape	Moderate • Expansive views out to sea provide vast sense of scale • The open and exposed character of the landscape (cliffs) is sensitive to changes in land use and scale of development	Moderate • Small scale of Project and distance offshore • Does not have a direct line of sight to project (bearing 160°) • EOWDC consented site will be in eye line between the area and the Project resulting in a cumulative effect	Moderate
	Kincardine Cliffs	Seascape	Moderate/ High • Farmland extends to edge of cliffs • A90 and east coast railway behind the cliff tops • Extensive developments at edge of coastal towns • Expansive views out to sea • Open and exposed character of the landscape (cliffs) is sensitive to changes	Moderate • Small scale of Project and distance offshore • Direct line sight to Development Area c. 70-90°	Moderate

Impact	Landscape/ Seascape Character Area	Landscape/ Seascape	Sensitivity of Landscape/Seascape Area	Magnitude of Effect	Significance of Impact
	Kincardine Links	Seascape	Moderate • Raised beach encompassing open farmland, marsh and reedbed with little woodland, as well as narrow sandy fringe • Expansive views are fundamental to character • Open landscape sensitive to changes	Low • Small scale of Project and distance offshore • Does not have a direct line of sight to project (bearing 50°)	Minor/ Moderate
	Garvock and Glenbervie	Landscape	Low • Large field of arable land • Radio masts prominent • Scattered settlements • Long, uninterrupted views are sensitive	Low • Small scale of Project and distance offshore • Distance from Project increases inland • Does not have a direct line of sight to project (bearing 50°)	Minor
	Formartine Lowlands	Landscape	Low • Extensive open farmland • Prominent lines of trees and estates • Large, compact settlements	Low • Small scale of Project and distance offshore • Distance from Project increases inland • Does not have a direct line of sight to Project (bearing 160°) • EOWDC consented site will be in eye line between the area and the Project resulting in a cumulative effect	Minor
	Kincardine Plateau	Landscape	Low • Pasture and marginal farmland	Moderate • Small scale of Project and distance offshore	Minor/ Moderate

Impact	Landscape/ Seascape Character Area	Landscape/ Seascape	Sensitivity of Landscape/Seascape Area	Magnitude of Effect	Significance of Impact
			• Exposed mounds and hills with trees • Ad hoc/ uncoordinated housing developments	• Distance from Project area increases inland • Direct line of sight to Project c. 70-90°	
	Aberdeen Links	Seascape	High • Shore, dune and links topography • Panoramic views • Recreational land use and nature reserve	Moderate • Small scale of Project and distance offshore • No direct line of sight c. 145° • Limited additional activity than currently from Nigg Bay/Aberdeen Harbour	Moderate/ Major
	Girdle Ness/ Nigg Bay	Seascape	High • Distinctive coastal landform • Open character • Occasional but distinctive buildings • Views of city and coast	Moderate • Small scale of Project and distance offshore • Limited additional activity than currently from Nigg Bay/Aberdeen Harbour	Moderate/ Major
	Doonies/Cove Coast	Seascape	Moderate • Coastal cliffs • Open, agricultural character • Presence of railway line • Views to sea • Views to adjacent industrial estate	Moderate • Small scale of Project and distance offshore • Existing industrial activity	Moderate
	Tyrebaggar Hill/ Kirkhall	Landscape	Moderate • Smoothly rounded hill ground height 233m	Low • Small scale of Project and distance offshore	Minor/ Moderate

Impact	Landscape/ Seascape Character Area	Landscape/ Seascape	Sensitivity of Landscape/Seascape Area	Magnitude of Effect	Significance of Impact
			• Mixture of woodland and agriculture • Prominent in views from many parts of the city	• Distance from Project increases inland • Woodland interrupted views	
	Brimmond Hill	Landscape	Moderate • Smooth rounded hills 266m that form 'ring of hills' • Presence of telecommunication masts	Low • Small scale of Project and distance offshore • Distance from Project increases inland • Elevated views	Minor/ Moderate
	Gairnhill	Landscape	Low • Hill landform • Dense forestry on upper slopes • Sparse settlements • Too low to be prominent in views from the city	Negligible • Small scale of Project and distance offshore • Distance from Project increases inland • Gairnhill is not visible from urban area of Aberdeen City, therefore, visibility of Development Area will be low	Negligible/ Minor
	Kincorth and Tullos Hills	Landscape	Moderate • Hill topography • Open character • Wide views of the city	Moderate • Small scale of Project and distance offshore • Limited additional activity than currently from Nigg Bay/Aberdeen Harbour	Moderate
	Dyce	Landscape	Low • Flat topography • Open character • Large busy airport and heliport	Negligible • Small scale of Project and distance offshore • Distance from Project increases inland	Negligible/ Minor

Impact	Landscape/ Seascape Character Area	Landscape/ Seascape	Sensitivity of Landscape/Seascape Area	Magnitude of Effect	Significance of Impact
			• Extensive industrial estates	• Industry/air traffic presence	
	Lower Don Valley	Landscape	Low • Large scale valley • Woodland • Transport and industrial uses associated with the valley	Negligible • Small scale of Project and distance offshore • Distance from Project increases inland • Industrial nature of area	Negligible/ Minor
	Upper Don Valley	Landscape	Low • Large scale valley • Tree cover • St Fergus' Church and Liddell's Monument	Negligible • Small scale of Project and distance offshore • Distance from Project increases inland • Upper Don Valley is not visible from urban area of Aberdeen City, therefore, visibility of the Project is not likely	Negligible/ Minor
	Dee Valley	Landscape	Low • Large scale valley stretched from countryside to city • Variety of woodland areas • Developed north bank and rural south bank	Negligible • Small scale of Project and distance offshore • Distance from Project increases inland • Woodland and existing developments	Negligible/ Minor
	Perwinnes	Landscape	Moderate • Corby Loch and Perwinnes Moss nature conservation areas • Few trees • Sparse settlements	Moderate • Small scale of Project and distance offshore • Open views • High ground • No direct line of sight c. 145°	Moderate

Impact	Landscape/ Seascape Character Area	Landscape/ Seascape	Sensitivity of Landscape/Seascape Area	Magnitude of Effect	Significance of Impact
			• 65 – 100m ground height with wide views available	• Limited additional activity than currently from Nigg Bay/Aberdeen Harbour	
	Potteron	Landscape	Moderate • Agriculture, little woodland • Sparse settlements • Views eastward to the sea	Moderate • Small scale of Project and distance offshore • Open views • High ground • No direct line of sight c. 145° • Limited additional activity than currently from Nigg Bay/Aberdeen Harbour	Moderate
	Murcar	Landscape	Moderate • Low-lying • Open character • Scattered housing • Trunk road • Views to sea/ along the coast	Moderate • Small scale of Project and distance offshore • Open views • High ground • No direct line of sight c. 145° • Limited additional activity than currently from Nigg Bay/Aberdeen Harbour	Moderate
	Den of Leggart	Landscape	Low • Shallow valley landform • Sparse traditional settlement • Views only to the north	Negligible • Small scale of Project and distance offshore • No coastal views other than the North Sea	Negligible/ Minor

Impact	Landscape/ Seascape Character Area	Landscape/ Seascape	Sensitivity of Landscape/Seascape Area	Magnitude of Effect	Significance of Impact
	Loirston	Landscape	Low • Nearby large scale industrial development • Views restricted by higher ground	Negligible • Small scale of Project and distance offshore • No coastal views	Negligible/ Minor
	East Elrick	Landscape	Moderate • Plateau landform • Open character very few trees • Extensive views	Low • Small scale of Project and distance offshore • Open views • Distance from Project increases inland	Minor/ Moderate
	Newhills	Landscape	Low • Open character of central area • Range of hedgerow trees and shelterbelts • Elevation/land height 100-200m	Low • Small scale of Project and distance offshore • Open views • Distance from Project increases inland	Minor
	Maidencraig	Landscape	Low • Small-scale valley landform • Beech trees line main road to city • Frequent scattered building • Existing development	Negligible • Small scale of Project and distance offshore • Distance from Project increases inland • Existing development	Negligible/ Minor
	Kingshill/ Bogskeathy	Landscape	Moderate • Plateau like landform • Open character • Extensive views to the city	Low • Small scale of Project and distance offshore • Distance from Project increases inland • Existing views	Minor/ Moderate
	Anguston/ Leuchar/ Easter Ord	Landscape	Low • Gentle, smooth rolling topography	Negligible • Small scale of Project and distance offshore	Negligible/ Minor

Impact	Landscape/ Seascape Character Area	Landscape/ Seascape	Sensitivity of Landscape/Seascape Area	Magnitude of Effect	Significance of Impact
			• General open appearance • Presence of blocks of coniferous trees • Scattered clumps of deciduous trees and settlements	• Distance from project increases inland. Most inland area.	
	Clinterty	Landscape	Low • Varied topography 70-150m • Tree clumps and shelterbelts • Scattered settlement patterns	Negligible • Small scale of Project and distance offshore • Distance from Project increases inland	Negligible/ Minor
	Breas of Don	Landscape	Low • Farmland and woodland • Residential developments	Negligible • Small scale of Project and distance offshore • Distance from Project increases inland • Area cannot be seen from viewpoints with the urban area of Aberdeen reducing potential that Development Area will be visible	Negligible/ Minor
	Craibstone	Landscape	Low • Undulating, hummocky landforms 80-150m • Woodland and agriculture • Views eastward to city and coast	Low • Small scale of Project and distance offshore • Distance from Project increases inland • None direct line of sight	Minor
	Kingswells	Landscape	Low • Varied topography	Negligible	Negligible/ Minor

Impact	Landscape/ Seascape Character Area	Landscape/ Seascape	Sensitivity of Landscape/Seascape Area	Magnitude of Effect	Significance of Impact
			• Variety of woodland forms • Visual enclosure	• Small scale of Project and distance offshore • Distance from Project increases inland • Visual enclosures	
	Hazelhead	Landscape	Low • Flat/low lying ground • Woodland, large and broad in scale	Negligible • Small scale of Project and distance offshore • Distance from Project increase inland • Woodland interrupting views	Negligible/ Minor
	Countesswells/ Milltimber/ Kennerty	Landscape	Low • Topographical variety • Mixed wooded and open areas	Low • Small scale of Project and distance offshore • Distance from Project increase inland	Minor

11.4.2.4.2. Impacts on Viewpoints and Receptors

59. The following table outlines the agreed viewpoints, the receptors from the viewpoints, the sensitivity of the viewpoint and receptors, and the assessment of the potential impacts of the Project at the viewpoints and to the receptors. The sensitivity and magnitude of the effect have been identified based on the criteria described in Section 11.3 and consideration of the sensitivity given to the landscape and seascape areas above in which the viewpoints lay. Consideration is also given to the sensitivity given to the viewpoints during previous impact assessments where mutual viewpoints haven used.

Table 11-13 Results of the impact assessment for the identified viewpoints and receptors through identification of sensitivity, magnitude of effect and the resultant significance of impact

Impact	Landscape/Seascape Character Area	Landscape/ Seascape Receptors	Sensitivity of Viewpoint Sensitivity of Receptors	Magnitude of Effect	Significance of Impact
Operational Windfarm	1 Newburgh (carpark to links)	Seascape	Low	Moderate • Small scale of Project and distance offshore • EOWDC will be in direct line of view closer to shore possible cumulative effects	Minor/ Moderate
		Visitors/ Walkers/ Residents	Low		Minor/ Moderate
	2 Balmedie (access to beach)	Seascape	Low	Moderate • Small scale of Project and distance offshore • EOWDC will be in direct line of view closer to shore possible cumulative effects	Minor/ Moderate
		Visitors/ Walkers/ Residents	Low		Minor/ Moderate
	3 Regular Ferry Routes	Seascape	Low	Low • Small scale of Project and distance offshore • Current marine activities at Aberdeen Harbour and Nigg Bay • Main route goes north east out of Aberdeen away from project site	Minor
		Travellers	Moderate		Minor/ Moderate
	4 Eastern Boulevard Aberdeen	Seascape	Moderate	Low • Small scale of Project and distance offshore • Current marine activities at Aberdeen Harbour and Nigg Bay	Minor/ Moderate
		Visitors/ Walkers	Moderate/High		Moderate
		Landscape	Low	Low	Minor

Impact	Landscape/Seascape Character Area	Landscape/ Seascape	Sensitivity of Viewpoint	Magnitude of Effect	Significance of Impact
		Receptors	Sensitivity of Receptors		
	5 East side of Castlehill	Residents	Moderate/High	• Small scale of Project and distance offshore • Current marine activities at Aberdeen Harbour and Nigg Bay	Minor/ Moderate
	6 Torry Battery/Girdleness Point	Seascape	Low	Low • Small scale of Project and distance offshore • Direct line of sight • Visible in Figure D-1 • Current marine activities at Aberdeen Harbour and Nigg Bay as shown in Figure D-1	Minor
		Visitors/ Walkers	Medium to High		Minor/ Moderate
	7 Doonies Farm	Seascape	Moderate	Moderate • Small scale of Project and distance offshore • Direct line of sight to project • Visible in Figure D-2 • Current marine activities at Aberdeen Harbour and Nigg Bay as shown in Figure D-2	Moderate
		Visitors/ Walkers	Moderate to High		Minor/ Moderate
	8 Coastal Path - Finhon (area of Geological interest)	Seascape	Moderate	Moderate • Direct line of sight to Project • Small scale of Project and distance offshore • Visible in Figure D-3 • Current marine activities at Aberdeen	Moderate
		Visitors/ Walkers	High		Moderate/ Major

Impact	Landscape/Seascape Character Area	Landscape/ Seascape Receptors	Sensitivity of Viewpoint Sensitivity of Receptors	Magnitude of Effect	Significance of Impact
				Harbour and Nigg Bay as shown in Figure D-3	
	9 Portlethen (railway station bridge)	Seascape	Moderate	Moderate • Direct line of sight to Project • Small scale of Project and distance offshore • Visible in Figure D-3 • Current marine activities at Aberdeen Harbour and Nigg Bay as shown in Figure D-3	Moderate
		Residents	Moderate/Low		Moderate
	10 Downies	Seascape	Moderate/High	Moderate Moderate • Direct line of sight to Project • Small scale of Project and distance offshore • Visible in Figure D-3 • Current marine activities at Aberdeen Harbour and Nigg Bay as shown in Figure D-3	Moderate/ Major
		Residents/ Walkers	High/Moderate		Moderate/ Major
	11 Cookney (Inland settlement)	Landscape	Moderate	Moderate • Direct line of sight to Project • Small scale of Project and distance offshore • Visible in Figure D-3 • Current marine activities at Aberdeen Harbour and Nigg Bay	Moderate
		Residents	Low		Minor/ Moderate

Impact	Landscape/Seascape Character Area	Landscape/ Seascape Receptors	Sensitivity of Viewpoint Sensitivity of Receptors	Magnitude of Effect	Significance of Impact
				as shown in Figure D-3	
	12 Newtonhill	Seascape	Moderate	Moderate • Direct line of sight to Project • Small scale of Project and distance offshore • Visible in Figure D-3 • Current marine activities at Aberdeen Harbour and Nigg Bay as shown in Figure D-3	Moderate
		Residents	Moderate		Moderate
	13 Muchalls	Seascape	Moderate	Moderate • Direct line of sight to Project • Small scale of Project and distance offshore • Slight view in Figure D-4	Moderate
		Residents	Moderate/Low		Moderate
	14 Railway (bridge of Muchalls)	Seascape	Moderate	Moderate • Direct line of sight to Project • Small scale of Project and distance offshore • Slight view in Figure D-4	Moderate
		Travellers	Moderate/Low		Moderate
	15 A90 Trunk Road	Seascape	Low	Moderate • Direct line of sight to Project • Small scale of Project and distance offshore • Slight view in Figure D-4	Minor/ Moderate
		Travellers	Moderate/Low		Moderate

Impact	Landscape/Seascape Character Area	Landscape/ Seascape Receptors	Sensitivity of Viewpoint Sensitivity of Receptors	Magnitude of Effect	Significance of Impact
	16 Stonehaven Golf Course (Garrow Point)	Seascape	Moderate	Moderate • Small scale of Project and distance offshore • Slight view in Figure D-4	Moderate
		Visitors/ Walkers	Moderate/High		Moderate /Major
	17 Stonehaven Harbour Pier	Seascape	Moderate/High	Low • Very slight view in Figure D-5 • Small scale of Project and distance offshore	Minor/ Moderate
		Residents	High		Minor/ Moderate
	18 Stonehaven War Memorial	Seascape	High	Low • Very slight view in Figure D-5 • Small scale of Project and distance offshore	Moderate
		Visitors/ Walkers	High		Moderate
	19 Dunnottar Castle (carpark)	Seascape	Moderate	Low • Very slight view in Figure D-6 • Small scale of Project and distance offshore	Minor/ Moderate
		Visitors/ Walkers	High		Moderate
	20 Dunnottar Castle (south of castle on coastal path)	Seascape	High	Low • Very slight view in Figure D-6 • Small scale of Project and distance offshore	Moderate
		Visitors/ Walkers	High		Moderate
	21 Catterline (south)	Seascape	Moderate/High	Low • Small scale of Project and distance offshore • Very slight view in Figure D-6	Moderate
		Visitors/ Walkers/ Residents	High		Moderate
		Seascape	Moderate	Low	Minor/ Moderate

Impact	Landscape/Seascape Character Area	Landscape/ Seascape Receptors	Sensitivity of Viewpoint Sensitivity of Receptors	Magnitude of Effect	Significance of Impact
	22 Gourdon (eastern end of village at coastal path carpark)	Visitors/ Walkers/ Residents	Moderate/Low	• Small scale of Project and distance offshore • Very slight view in Figure D-6	Minor/ Moderate
	23 Johnshaven (beach)	Seascape	Moderate	Low • Small scale of Project and distance offshore • Very slight view in Figure D-6	Minor/ Moderate
		Visitors/ Walkers/ Residents	Moderate/Low		Minor/ Moderate

11.4.3. Impact Assessment: Offshore Export Cable Corridor

60. The key risks and potential impacts within the Offshore Export Cable Corridor are summarised in Table 11-14.

Table 11-14 Summary of the potential risks and impacts to the Offshore Export Cable Corridor during construction, operation and decommissioning

Activity	Risk	Potential Impact	Construction	Operation	Decommissioning
Installation of export cables in the Offshore Export Cable Corridor	Vessel movements during laying and burying of export cables	Changes to seascape and landscape resources due to the presence of cable laying and burying vessels	X		

11.4.3.1. Installation of Export Cables in Offshore Export Cable Corridor

Overview of Impact

61. The export cable laying process will likely involve a combined process of dredging the trench, laying the cables and burial all occurring sequentially along the cable corridor using a cable laying vessel. Therefore, there will be vessel movement occurring along the length of the cable corridor (15km).

Characterisation of Impact

62. The export cable laying process is anticipated to be less than a week, and the size of the vessel will not be larger than other vessels entering/leaving Aberdeen Harbour (likely to source from the local area and therefore a regular presence with the regional environment). Therefore, the magnitude of changes relation to the seascape, landscape and visual receptors is considered to be negligible.

63. As a result of the above considerations, it is concluded that there will be no significant residual seascape, landscape or viewpoint impacts during installation of the Offshore Export Cable Corridor as shown in Tables 11-9 and 11-10.

11.5. Mitigation

64. As the photomontages show that there will be very limited impact on the viewpoints, and the impact assessment has shown that very few of the landscapes, seascapes and viewpoints are likely to experience any significant impacts from the development of the Project, no further mitigation is planned or required. The embedded mitigation described in Section 11.3.2 results in the WTGs and floating substructures to ‘blend in’ with the existing seascapes, but at the same time ensuring that they are visible to allow safe use of the coastal area by other marine users.

65. It should also be noted, that the photomontages were created from photographs taken during clear weather conditions providing a worst case scenario for this assessment. Poor weather conditions due to low cloud, fog, rain or snow will significantly reduce the visibility of the WTGs and floating substructures.

11.6. Cumulative Impacts

11.6.1. Development Area and Offshore Export Cable Corridor

66. To assess the cumulative effect of the Project on landscapes, seascapes and visual receptors, the combined impacts from within the Development Area and Offshore Export Cable Corridor have been considered.

67. Due to the temporary nature of the installation process for both export cables, inter-array cables, anchors and WTGs and floating substructures, and that there were no significant impacts identified during this process, there are no cumulative impacts between the Development Area and Offshore Export Cable Corridor to be considered. It should also be noted that all of these processes will take place sequentially so there will a limited number of vessels for each activity on site at any one time which also reduce the visual impacts to the landscapes, seascapes and identified viewpoints. Therefore, there will be no cumulative impact of the installation phase and operational phase of the Project.

11.6.2. Other Proposed Windfarms

68. The table below outlines the other windfarms in the vicinity of the Project. The EOWDC has been considered as part of the assessment due to its proximity to this project (17km), and therefore mutual viewpoints were assessed where necessary to the north of Aberdeen. As the additional windfarms in the table below are >35km, no further cumulative impact is deemed necessary as part of this assessment as they do not share any mutual viewpoints. Additionally, there are no known windfarms in planning phase to be considered.

Table 11-15 Details of consented windfarms within 50km of Kincardine Floating Offshore Windfarm

Project Name	Distance from KOWL	Project Developer	High Level Description	Project Status
European Offshore Wind Deployment Centre (EOWDC)	17km	Aberdeen Offshore Windfarm Ltd	Offshore wind turbine deployment centre for 11 turbines with up to 100MW capacity	Consented
Seagreen Alpha Offshore Windfarm and Seagreen Bravo Offshore Windfarm	34km	Seagreen Wind Energy Limited	Offshore windfarm and export cabling to be developed in three phases with a total target capacity of 3.5GW.	Phase 1 Consented Phase 2 and 3 EIA Scoping Opinion issued
Hywind Scotland Pilot Park	45km	Statoil	Pilot project for 5 6MW floating turbines	Consented
Inch Cape Offshore Windfarm	47km	Inch Cape Offshore Windfarm Ltd	Offshore windfarm up to 21 turbines covering an area of up to 150km^2 with a capacity of approximately 1,000MW	Consented

11.6.3. Aberdeen Harbour Port Expansion, Nigg Bay

69. The proposed expansion of the port of the Aberdeen in the Nigg Bay area will have a significant impact on the visualisations for the Torry Battery location (Viewpoint 6) as the port area is planned to encompass this location and have significant port infrastructure (quayside, break waters, rock armour, and lighting) placed adjacent/in front of this location. Section 17 of the Nigg Bay ES (Aberdeen Harbour, 2015) outlines the possible impact to the Viewpoint from Torry battery (Figure 4b, WIB14221-100-GR-SLVIA-04b-RevA). The installation of the southern breakwater (shown in the distance in this image) indicates the visual impact from the Project will be significantly masked by the construction of this port area and the visual impact from this site will be significantly reduced if this development is constructed.

11.7. Summary and Residual Impacts

70. As no further mitigation measures are available, the residual impacts are the same as those identified in the proceeding sections. Table 11-16 summarises the results of the SLVIA for the Project.

Table 11-16 Summary of identified impacts of the Project to seascapes, landscapes, viewpoints and visual receptors

Impact	Receptor	Residual Impact Significance		
Construction				
Installation and decommissioning of inter-array cables and anchors	Seascapes	4	3	0
	Landscapes	24	3	0
	Viewpoints	18	5	0
	Receptors	11	12	0
Installation and decommissioning of WTGs and floating substructures	Seascapes	4	3	0
	Landscapes	24	3	0
	Viewpoints	18	5	0
	Receptors	11	12	0
Installation of export cable(s)	Seascapes	4	3	0
	Landscapes	24	3	0
	Viewpoints	18	5	0
	Receptors	11	12	0
Maintenance of WTGs and substructures	Seascapes	4	3	0
	Landscapes	24	3	0
	Viewpoints	18	5	0
	Receptors	11	12	0
Operation and Maintenance				
Operational windfarm	Seascapes	1	4	2
	Landscapes	19	8	0
	Viewpoints	3	19	1
	Receptors	0	20	3

11.8. References

Aberdeen Harbour (2015) Aberdeen Harbour Expansion Project. http://www.aberdeen-harbour.co.uk/article/expansion-project-environmental-impact-assessment/

Atkins (2014) Kincardine Offshore Windfarm Environmental Scoping Assessment

Benson, J.F., Scott, K.E., Anderson, C., Macfarlane, R., Dunsford, H. and Turner K. (2004) Landscape capacity study for onshore wind energy development in the Western Isles. Scottish Natural Heritage Commissioned Report No. 042 (ROAME No. F02LC04)

Landscape Institute and Institute of Environmental Management and Assessment (2013) *Guidelines for Landscape and Visual Impact Assessment* Third Edition. Routledge.

The Landscape Institute and the Institute of Environmental Management and Assessment (IEMA) (2013) Guidelines for Landscape and Visual Impact Assessment;

Scott, K.E., Anderson, C., Dunsford, H., Benson, J.F. and MacFarlane, R. (2005). An assessment of the sensitivity and capacity of the Scottish seascape in relation to offshore windfarms. Scottish Natural Heritage Commissioned Report No.103 (ROAME No. F03AA06).

Scottish Natural Heritage (2014) Visual Representation of Windfarms Version 2.1

Scottish Natural Heritage (2012a) Offshore Renewables – guidance on assessing the impact on coastal landscape and seascape

Scottish Natural Heritage (2012b) Assessing the Cumulative Impacts of Onshore Wind Energy Developments

Scottish Natural Heritage (2008) Guidance for Landscape /Seascape Capacity for Aquaculture

Scottish Natural Heritage (1998) Report no 102 South and Coastal Aberdeenshire: Landscape Character Assessment (written by Environmental Resources Management)

Scottish Natural Heritage (1996) Report no 80 Landscape character assessment of Aberdeen

12. Marine Historic Environment

12.1. Introduction

1. This chapter of the ES is an assessment of the potential effects of construction, operation and decommissioning of the Project on the marine historic environment within the Development Area and Offshore Export Cable Corridor. The assessment includes a consideration of the potential for currently unknown receptors as well as previously identified aircraft and shipwrecks. This chapter also considers direct and indirect impacts as a result of the proposed offshore works.

2. As described in Chapter 1, the Project is made up of three components (Development Area, Offshore Export Cable Corridor and Onshore Area). This chapter only makes reference to the Development Area and the Offshore Export Cable Corridor as defined below. The Onshore Area is not considered in this assessment as the potential impacts to onshore cultural heritage receptors is discussed in Chapter 16.

   b. The Development Area – the windfarm area including the WTG, floating substructures and inter-array cables.
   - The Offshore Export Cable Corridor – the area within which the proposed export cables will be laid, from the perimeter of the Development Area to the Onshore Area at Mean High Water Spring (MHWS).
   - These areas combined are referred to as the Project.

3. This chapter shares linkages with the following chapters within the ES:

   - Chapter 3: Coastal Processes; and
   - Chapter 11: Landscape and Seascape.

12.1.1. Policy and Regulations

4. In relation to the historic marine environment, there are international legally binding conventions, EU Directives, UK and Scottish legislation, policy frameworks and guidance to consider, these are detailed below.

12.1.1.1. International and EU Legislation and Policy.

5. In 1997 the United Nations Convention of the Law of the Sea (UNCLOS) was ratified by the UK. Article 303 of this document, outlines that member states have an obligation to 'Protect objects of an archaeological and historical nature found at sea and shall co-operate for this purpose'.

6. The UK Government ratified the European convention on the Protection of the Archaeological Heritage also known as the Valletta Convention in 2000. This required archaeological heritage both underwater and on land to be protected. It outlined a preference for sites to be protected in situ, however, if disturbance is unavoidable, provisions for appropriate recording and recovery are in place.

12.1.1.2. UK Legislation and Policy

7. Section 1 of The Protection of Wrecks Act 1973, provides protection for designated wrecks deemed to have important archaeological, historical, or artistic value. Around the coasts of the UK, there are 56 wrecks which are classified under this section of the Act. Each wreck is designated an exclusion zone and it is an offence to carry out any diving or salvage operations, tamper with, damage or remove any parts of the vessel. In Scotland, the responsibility of the administration of this act lies with Historic Scotland.

8. The Protection of Military Remains Act 1986 was drafted to protect the sanctity of vessels and aircraft which act as military marine graves. Under this act, all military aircraft lost during service are automatically protected, which may be of concern if discovered during the proposed works.

9. Under the Merchant Shipping Act 1995, all recovered wrecks that are landed in the UK must be reported to the Receiver of Wreck, whether recovered from within or outside UK waters and even if the finder is the legal owner.

10. The Marine (Scotland) Act 2010 states that an area of the sea may be designated as a Historic MPA in order to preserve a marine historic asset of national importance. Marine historic assets include whole, part or remains of vessels, vehicles or aircrafts, an object contained in or formerly contained in a vessel, vehicle or aircraft, a building or other structure, a cave or excavation or a deposit or artefact or any other thing which evidences, or group of things which evidence, previous human activity.

11. The UK Marine Policy Statement 2011 states heritage assets should be conserved through marine planning in a manner appropriate and proportionate to their significance. There are a number of heritage assets not currently designated as scheduled monuments or protected wrecks, which hold archaeological interest. Undesignated assets do not necessarily indicate a lower significance and the marine planning authority should consider them subject to the same policy principles as designated heritage assets. Any new assets identified during the onsite survey works or during construction and installation will require a separate assessment and will follow the appropriate guidelines to ensure the correct protections are applied further details on the appropriate procedures can be found in Section 12.3.2.

12.1.1.3. Scottish Legislation and Policy

12. The following Scottish policies have also been taken into consideration within this chapter.

- Scottish Historic Environmental Policy (SHEP) 2011;
- Scottish Planning Policy (SPP) 2014;
- The Scottish Government's Planning Advice Note (PAN 2/2011);
- Historic Scotland's operational Policy Paper HP6 (1999); and
- Planning Scotland's Seas.

12.1.1.4. Other Relevant Codes of Practice, Professional Guidance and Standards

13. Additionally, the following sources were also considered during the assessment of impacts on the marine historic environment:

- Joint Nautical Archaeology Policy committee and Crown Estate's (2006) Maritime Cultural Heritage & Seabed Development: JNAPC Code of Practice;
- Wessex Archaeology Ltd (2007) Historic Environment Guidance for the Offshore Renewable Energy Sector, commissioned by COWRIE Ltd;
- Oxford Archaeology & George Lambrick Archaeology and Heritage (2008) Guidance for the assessment of Cumulative Impacts in the Historic Environment Offshore Renewable Energy, commissioned by COWRIE Ltd;
- Gribble, J and Leather, S for EMU Ltd. (2011) Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector, commissioned by COWRIE Ltd;
- The Crown Estate (2014) Protocol for Archaeological Discoveries: Offshore Renewables Projects, Wessex Archaeology Ltd for The Crown Estate;
- The Crown Estate (2010) Model clauses for Archaeological Written Schemes of Investigation: Offshore Renewables Projects, Wessex Archaeology Ltd; and
- The Institute for Archaeologists (IfA) Codes, Standards and Guidance.

12.1.2. Stakeholder Consultation

14. The consultation process is outlined below:

- The Scoping Report for the Project was developed by Atkins and submitted for review in April 2014 (Atkins, 2014).
- The Scoping Opinion was produced by Marine Scotland (2015) in response to the Scoping Report. This collated responses from Marine Scotland, Statutory consultees and non-statutory consultees.

15. In addition to the formal Scoping Opinion, further informal consultation has been undertaken in relation to the assessment of the impacts of the windfarm with relevant stakeholders (Marine Scotland and SNH). The information received through this consultation and the formal Scoping Opinion has informed the methodology and scope for the assessment of the impacts on the marine historic environment presented in this chapter.

16. A summary of the comments to the Environmental Scoping Opinion in relation to the marine historic environment is presented in Table 12-1. Also included is the response which outlines the action to be taken/not taken in reply to the comments.

Table 12-1 Consultation summary responses related to the marine historic environment

Consultee	Comment	Project Response
Scottish Natural Heritage	The applicant should liaise with Marine Scotland (MS) regarding updates / progress on the selection of Marine Protected Areas (MPA) as part of the Scottish Marine Protected Areas Project (SMPA).	Marine Scotland have been regularly consulted throughout the EIA process, as part of this, no additional information has been provided to KOWL regarding selection of new MPAs and no Historical MPAs are present in the Project site either.
Historic Scotland	On the basis of the information supplied, we are content with the general principle of the proposal. In our view, it is considered unlikely that there shall be significant adverse impacts on marine or terrestrial assets within our statutory remit with the exception of one key asset - SM Dunnottar Castle.	The potential impact to Dunnottar Castle has been considered in Chapter 11 as part of the Seascape and Landscape Visual Impact Assessment as there are no potential physical impacts that could occur do Dunnottar Castle as part of the proposed development.
Historic Scotland	There are no HMPAs (Historic Marine Protected Areas) in the vicinity of the site or the wider area. However, we welcome that the assessment will consider direct disturbance and loss to known and unknown assets of historic importance and indirect impacts and indirect potential for impacts relating to disturbance and changes to the physical environment and coastal sediment dynamics of the area. The relevant Council Archaeology Services may also wish to comment.	The identified impacts in Chapter 3 have been referenced whilst conducting the impact assessment for identified known and unknown receptors.

12.2. Baseline Environment

12.2.1. Introduction

17. In order to describe the baseline environment to inform this assessment, the following activities were undertaken:

- A brief background to UK policy and statutory protection given to wrecks in UK waters (See Section 12.1.1);
- A desktop study identifying any recorded wrecks and other features of marine interest within the Development Area and Offshore Export Cable Corridor;
- An estimate of the historical importance of each recorded feature; and
- Definition of a suggested exclusion zone around each recorded feature.

12.2.2. Shipwrecks

18. Within the wider study area (Aberdeen to Stonehaven) 30 wreck sites were identified during the desktop study. These were identified using CANMORE (an online mapping service), a database run by the Royal Commission on the Ancient and Historic Monuments of Scotland (RCAHMS). Available information on historic MPAs from Historic Scotland was also considered as part of this assessment.

19. None of the registered wrecks are protected under the following;

- The Protection of Wrecks Act 1973; or
- The Protection of Military Remains Act 1986.

20. The following sections outline the identified receptors within the Development Area and Offshore Export Cable Corridor that are considered in this impact assessment. Receptors within the wider area have not been considered due to the limited impact expected due to suspended sediment concentrations (SSC) during construction as discussed in Chapter 3. In total 11 identified ship and aviation wreck sites, and unknown wrecks sites have been considered as part of this assessment.

12.2.2.1. Shipwrecks located in or in or within a 500m buffer of the Development Area

21. There are four identified wreck sites within the Development Area. Their locations are shown on Figure 12-1, and known details of the wreck sites are presented in Table 12-2.

Table 12-2 Identified shipwrecks and unknown possible obstructions within the Development Area

Name	Details if Known	Grid Reference
SS Creemuir	• British Cargo ship • Built 1924 • Steam Propulsion • Lost, 11/11/1924 (Air Raid)	NGR NP 1021 9188
Unknown/ Creemuir	• Obstruction possible	NGR NP 08036 91378
Our Merit (possibly)	• Fishing Vessel	NGR NP 10300 89869
U 40 (1915)	• German Submarine	NGR NP10123 89684

12.2.2.2. Shipwrecks located in or within a 500m buffer of the Offshore Export Cable Corridor

22. There are five identified wreck sites within the Offshore Export Cable Corridor. Their locations are shown on Figure 12-1 and summary details of the wreck sites are presented in Table 12-3.

Table 12-3 Identified shipwrecks and unknown possible obstructions within the Offshore Export Cable Corridor (including a 500m buffer)

Name	Details if Known	Provided Grid Reference
SS Prince Consort	• British Steam propulsion • Lost 11/05/1867 (ran aground)	NGR NJ 966 024
MFV Luffness	• British Fishing Trawler • Built 1935 • Diesel Propulsion • Lost 21/01/1958 (ran aground)	NGR NO 990 997
Unknown	• None available	NGR NO 99002 99569
Unknown	• None available	NGR NP 00220 98123
Silverburn	• Coal transporter • Built 1914 • Lost 13/06/1917 (Gunfire/Shelled)	NGR NP 002211 96504

12.2.3. Aviation Wrecks

23. During the desktop study two aviation wreck sites were also identified within the Project site.

12.2.3.1. Aviation Wrecks within the Development Area

24. The following aviation wreck was identified to be within the Development Area (Figure12-1).

Table 12-4 Identified aviation wrecks within the Development Area

Name	Details if Known	Provided Grid Reference
A/C Supermarine	• WW2 Aircraft • Lost 1945	NGR NP 10 89

12.2.3.2. Aviation Wrecks located in or within a 500m buffer of the Offshore Export Cable Corridor

25. The following aviation wreck was identified to be within the Offshore Export Cable Corridor including a 500m buffer (Figure 12-1).

Table 12-5 Identified aviation wrecks and unknown possible obstructions within the Offshore Export Cable Corridor (including a 500m buffer)

Name	Details if Known	Provided Grid Reference
Fairey Barracuda	• WW2 Aircraft	NGR NO 98 99

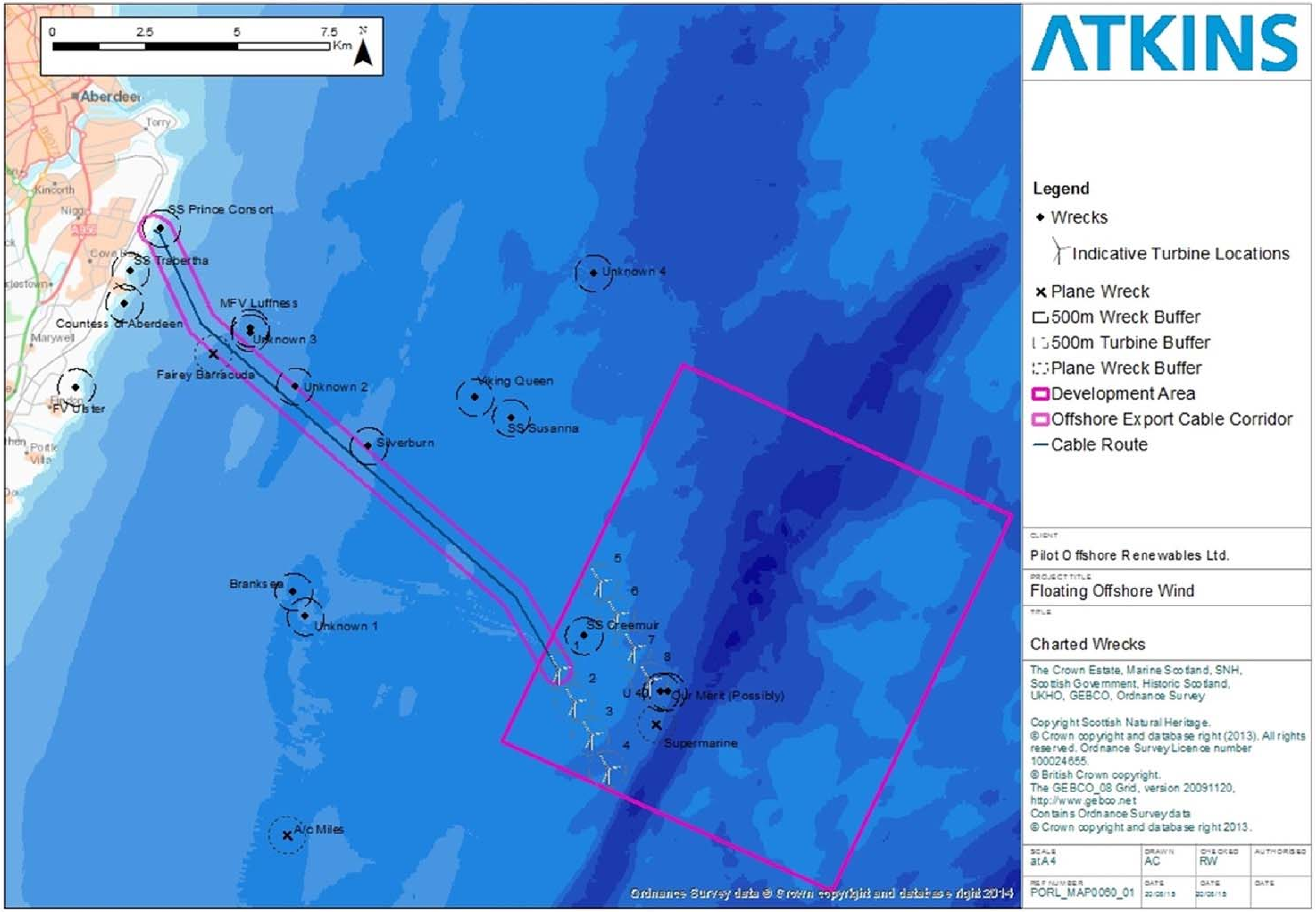

Figure 12-1 Locations of identified ship and aviation wrecks with the Project site

12.3. Assessment Methodology

26. The assessment for the impacts to the marine historic environment is based on the methodology described in Chapter 1. The process includes the following steps:

- Determination of baseline conditions through analysis of existing data (See Section 12.2);
- Prediction of the activities during the different stages of the project development that may results in potential impacts;
- Characterisation of potential impacts during likelihood of occurrence;
- Assess whether impacts are significant (related back to baseline conditions) and the geographical scale at which they may occur;
- Assessment of cumulative effects of the Project and other developments and activities;
- Propose mitigation if applicable; and
- Assess whether residual impacts (after mitigation) are significant.

27. As also outlined in Chapter 1, the effects and impacts of the development were assessed in line with the following definitions.

28. The magnitude of an effect is based on four key considerations, and has been quantified where possible. Effects are defined as either positive, negligible, low, moderate and high (Table 12-6). The four key considerations for determining the magnitude of effects are:

- Spatial extent (the geographical range of the effect);
- Duration (how long the effect lasts);
- Frequency (how often the effect occurs); and
- Severity (the degree of change).

Table 12-6 Definitions of the magnitude of effect for the impact assessment on the marine historic environment

Magnitude	Description
Positive	Positive change from baseline conditions
Negligible	Very slight change from baseline conditions
Low	Slight or minor change from features of the baseline conditions
Moderate	Partial loss or changes to one or more of the key features of baseline conditions
High	Complete loss or very major changes to key features of baseline conditions

29. The determination of each factor of sensitivity of each receptor will vary according to the specific receptor and is defined on a receptor by receptor basis using expert judgement and industry best practice.

30. The sensitivity of the identified receptors are defined as high, moderate, low or uncertain based on the following definitions (Table 12-7).

Table 12-7 Definitions of receptor sensitivity for the impact assessment on the marine historic environment

Sensitivity	Definition
High	Archaeological and historical sites, wrecks and their cargos (of international importance), World Heritage Sites, Nationally and Internationally Historic Marine Protected Areas, Designated Wrecks. Wrecks dating back to Prehistoric, Norse and Medieval periods (due to their rarity). Vessels lost during international conflict, and aviation losses resulting in large losses in life. National and International shipping vessels wrecked before the onset of WW1 (1914).
Moderate	Archaeological and historical sites, wrecks and their cargos of regional importance including Pre WW1; wrecks, cargos and anchorages. Examples of wrecks and cargos that are representative of advances in naval architecture or which support the identification and preservation of the variety of vessels from this period.
Low	Locally significant wrecks, cargos, or areas. Post WW1 vessels utilised for; fishing, ferrying or local coastwise trade. Wreck cargos of limited intrinsic, contextual or associative characteristics, or that are commonly recovered. Features that have been recorded, however have no significant archaeological or historic importance e.g. recent fishing wrecks, or wrecks that have been damaged to such a degree that they are no longer considered significant.
Uncertain	Features that potentially are of interest, but are unidentifiable without further investigation. Examples include vessels whose date of construction and rarity is not known, but could be of interest.

12.3.1. Design Envelope

31. The Project potential development parameters and scenarios are defined as a Rochdale Envelope and outlined in Chapter 1.

32. The assessment of potential impacts on identifying wrecks within this chapter is based on the Rochdale Envelope, with the development methodology and parameters being based upon the worst case scenario.

33. For the assessment, these scenarios include:

- Consideration of the maximum number of WTGs with the largest footprint, therefore the maximum loss of seabed disturbance due to anchors (in this case this is 8 x 6 MW WTGs each with four anchors i.e. 32 anchors) – approximately 10x10m area per anchor;
- Inter-array cables within the Development area; and
- One Offshore Export Cable Corridor containing two export cables (cable trench 3m wide, with two trenches in the corridor).

34. Key parameters for the worst case scenario for each potential impact are detailed in Table 12-8.

Table 12-8 Key parameters for potential impacts on the marine historic environment

Potential Impact	Worst Case Scenario Assessed in ES
Disturbance of sediments during anchor deployment which could smother/bury wrecks	8 x 6MW WTGs each with four anchor lines
Sediment disturbance and suspended sediment plume generation during installation of inter-array cables which could smother/bury wrecks	Maximum 12 cables Cable length 2.5km each Cable overall diameter 180mm It is not anticipated that the cables will be buried. If it is necessary, up to 10% of cable length may be buried as a worst case scenario.
Seabed/sediment disturbance and suspended sediment plume generation during dredging and burial of export cables which would displace during dredging or smother/bury wrecks	Maximum 2 cables Cable length 15km each Cable overall diameter 180mm Cable to be buried to target depth of 1.5m Trench expected to be 3m wide Where the target burial depth is not reached, remedial cable protection, e.g. concrete mattressing or rock dumping, may be required (up to 10% cable length).
Suspended sediments created due to scour erosion around anchor structures during operational phase which could smother/bury wrecks	Maximum 32 anchors (10x10m per anchor maximum area of disturbance)

12.3.2. Embedded Mitigation

35. A range of embedded mitigation measures to minimise environmental effects are captured within the outline Design Envelope (Section 12.3). The assessment of the effects on the marine historic environment has taken into account the following Embedded Mitigation measures:

- A geophysical survey will be carried out to verify the locations of existing known (named) and unknown wreck sites identified during the desktop survey. This survey will also identify any new wrecks, areas of interest or anomalies located in the Development Area and along the Offshore Export Cable Corridor. This will form the principal embedded mitigation and will utilise side scan sonar, sub-bottom profiling and magnetrometry surveys (where required) to assess the seabed and sub-seabed environment.
- A reporting protocol will be implemented in the event that there is an unexpected or incidental find relating to the historic environment during pre-construction surveys or during construction and installation activities. This protocol will be in line with The Crown Estate (2014) Protocol for Archaeological Discoveries: Offshore Renewables Projects. A Protocol for Archaeological Discoveries (PAD) provides a system for reporting and investigating unexpected archaeological discoveries encountered during construction and installation works. All finds are reported through the PAD Implementation Service (IS), and are researched by members of the IS team. Identified information is disseminated to everyone involved in the reporting of the find (roles are defined within the PAD) and recorded in relevant national databases.
- To reduce sediment disturbance and suspended sediment plume generation during all phases, construction, operational and maintenance and decommissioning, activities should be limited to ‘normal’/calm tidal current and wave conditions. Increases in wave energy and tidal currents have the potential to transported suspended sediments further than under normal conditions. Limiting activities to calm conditions will reduce the footprint over which plumes can have a potential impact, as well as reduce other risks during the process.
- Similarly, it is anticipated that construction will take place during summer months when wave energy is lower than during winter months. See Chapter 3 for further details on wave heights and occurrence.

- Works vessel co-ordination to ensure that disturbances to the seabed for as limited a period as possible.

12.4. Impact Assessment

12.4.1. Impact Assessment: Development Area

36. The key risks and potential impacts within the Development Area are summarised in Table 12-9. For the impact assessment within the Development Area, only SS Creemuir, U 40, Our Merit and Supermarine have been considered. For each impact the wrecks which have been assessed are detailed.

Table 12-9 Summary of the potential risks and impacts to identified wrecks in close proximity to the Development Area during construction, operation and decommissioning

Activity	Risk	Potential Impact	Construction	Operation	Decommissioning
(1) Deployment/removal of inter-array cables	Temporary disturbance of seabed and interaction with wreck(s)	• Increased suspended sediment concentration (SSC) • Damage to wrecks • Smothering/burial of wrecks	X		X
(2) Presence of inter-array cables on seabed	Possible localised scour of sea bed	• Increased SSC • Smothering/burial of wrecks		X	
(3) Deployment/removal of anchors/ mooring lines	Temporary disturbance of seabed and interaction with wreck(s)	• Increased SSC • Damage to wrecks • Smothering/burial of wrecks	X		X
(4) Presence of four anchors per substructure (32 in total) plus mooring lines.	Possible localised scour of sea bed	• Increased SSC • Smothering/burial of wrecks		X	

12.4.1.1. (1) Deployment and Removal of Inter-array Cables

Overview of Impact

37. During the laying and decommissioning of the inter-array cables in the Development Area there is the potential for increased SSC in the water column as the seabed is disturbed by the installation of the inter-array cables and during the removal of the cables from the seabed during the decommissioning process. There is potential for the suspended sediment to settle out and smother/bury identified wreck sites.

38. During the installation process, there is also the potential for there to be disturbance/interaction between the identified wrecks and vessels, equipment and inter-array cables as they are deployed.

39. The worst case scenario for the deployment and removal of the inter-array cables is defined in Table 12-10.

Table 12-10 Rochdale Envelope for impact assessment on the marine historic environment due to the inter-array cables

Component	Dimensions
Number of Inter-array Cables	Max 12
Inter-array Cable Length	2.5km each/ 30km total
Inter-array Cable Diameter	180mm
Total Area of Inter-array Cables	5,400m^2
Total Volume of Potential Sediment Displacement if laid on seabed	972m^3
Total Volume of Potential Sediment Displacement if 10% is buried to 1m and 90% laid on seabed	3,785m^3
Cable burial up to 10% of cable length	3km

Characterisation of Impact

40. The potential for seabed disturbance is very likely during both the construction and decommissioning phases (cables and anchors). However, considering the nature of the sediment (fine to medium sand), the volume that would potentially be displaced, and depths of water (>70 m) in the Development Area, any increases in SSC will only impact a very limited area (<80 m as discussed in Chapter 3) compared to the total footprint of the Project. Possible impacts are also significantly reduced due to the settling velocity of the particles and the temporary nature of the disturbance as also discussed in Chapter 3.

41. Initial onsite investigations (Marine Scotland video tows) have indicated a significant level of suspended particles in suspension across the development site and the Offshore Export Cable Corridor (Chapter 4). Therefore any suspended sediment generated as a result of the onsite activities will only have a small proportional impact on the nominal suspended sediment concentrations at the site.

42. The impact associated with sediment deposition and interaction with identified wrecks will ultimately depend on the chosen route of the cables between the WTGs which will be determined after further geophysical surveys. However, the four identified wrecks will be taken into account when this route is being determined as outlined below as part of impact assessment.

43. A summary of the impact assessment for the deployment/removal of the inter-array cables in the Development Area is presented in Table 12-11 below.

Table 12-11 Results of the impact assessment of deployment/ removal of inter-array cables in the Development Area on the identified wrecks through identification of sensitivity, magnitude of effect and the resultant significance of impact

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Impact
Damage to wreck sites during installation/ decommissioning of inter-array cables due to direct damage or Increased SSC	SS Creemuir	Low • Post WW1 cargo vessel • No significant archaeological or historic importance • No recorded loss of life	Low • Location between the rows of turbines so cables may run between and over the site • Small cable diameter (180mm) so unlikely to cause significant damage to wreck if it is in this location	Minor
	U 40 (1915)	High • Sunk during wartime • 29 sailors were reported to be killed • Proximity to WTGs (within 500m buffer)	Moderate • Wreck site is within the 500m buffer zone of the nearest turbine (location to be confirmed with geophysical survey of site) • Could be some damage through deployment of inter-array cables either due to physical placement or sediment disturbance • Depth of water (70m)	Moderate/ Major
	Our Merit	Low • Post WW1 cargo vessel • No significant archaeological or historic importance • No recorded loss of life	Low • Wreck site just beyond the 500m buffer zone of the nearest turbine • Could be some damage through deployment of inter-array cables either due to physical placement or sediment disturbance • Depth of water (70m)	Minor
	Supermarine	Moderate • Post WW1 cargo vessel • No recorded loss of life	Negligible • Wreck site beyond the 500m buffer zone of the nearest turbine • Depth of water (70m)	Minor

12.4.1.2. (2) Presence of Inter-array Cables (During Operational Phase)

Overview of Impact

44. The presence of the inter-array cables on the sea bed around the structures (if laid on the surface) could induce localised scour. This scour would occur during the operational phase of the windfarm.

Characterisation of Impact

45. Due the small diameter of the inter-array cables (180mm) this impact is likely to be minimal. Any scour around the inter-array cables is likely to only impact the seabed in close proximity to the cables (within five metres, see Chapter 3).

46. A summary of the impact assessment of the potential impact of scour erosion during the operational phase of the windfarm is presented in Table 12-12 below.

Table 12-12 Results of the impact assessment for scour erosion around the inter-array cables on the identified wrecks through identification of sensitivity, magnitude of effect and the resultant significance of impact

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Impact
Damage to wreck sites due to scour erosion around inter-array cables due Increased SSC	SS Creemuir	Low • Post WW1 cargo vessel • No significant archaeological or historic importance • No recorded loss of life	Negligible • Minimal amount of sediment will be re-suspended as a result of scour erosion around the inter-array cables • Seabed is considered active, so any additional suspended sediment is likely to be negligible above baseline conditions	Negligible/ Minor
	U 40 (1915)	High • Sunk during wartime • 29 sailors were reported to be killed • Proximity to WTGs (within 500m buffer)	Negligible • Wreck site is within the 500m buffer zone of the nearest turbine • Minimal amount of sediment will be re-suspended as a result of scour erosion around the inter-array cables • Seabed is considered active, so any additional suspended sediment is likely to be negligible above baseline conditions	Minor/ Moderate
	Our Merit	Low • Post WW1 cargo vessel • No significant archaeological or historic importance • No recorded loss of life	Negligible • Wreck site just beyond the 500m buffer zone of the nearest turbine • Minimal amount of sediment will be re-suspended as a result of scour erosion around the inter-array cables • Seabed is considered active, so any additional suspended sediment is likely to be negligible above baseline conditions	Negligible/ Minor
	Supermarine	Moderate • Post WW1 cargo vessel • No recorded loss of life	Negligible • Wreck site beyond the 500m buffer zone of the nearest turbine • Minimal amount of sediment will be re-suspended as a result of scour erosion around the inter-array cables • Seabed is considered active, so any additional suspended sediment is likely to be negligible above baseline conditions	Minor

12.4.1.3. (3) Deployment and Removal of Anchors

Overview of Impact

47. During the deployment and removal of the anchors (worst case scenario 32 anchors), there is potential for temporary disturbance of the seabed and sediments to be re-suspended as the anchors are lowered and dragged into position. There is also the potential for the anchors to interact/damage known and unknown wrecks during this process.

48. The footprint for the anchors is not known at this stage, but it is expected the maximum spatial impact from the placement and tensioning of the each anchor point will not exceed $10m^2$, with the likely 'stick up' (protrusion of the anchor above the sea bed) not exceeding one metre above the sea bed. During the decommissioning phase the anchors will be removed and there will be a second limited phase of SSC being created, but this will rapidly disperse and settle following removal.

Characterisation of Impact

49. As with the inter-array cable laying, the potential for seabed disturbance is very likely during both the construction and decommissioning phases. However, considering the nature of the sediment (fine to medium sand) and depths of water (>70m) in the Development Area, any increases in SSC will only impact a very limited area, will be temporary in nature, will only occur once and will not be considered significant against baseline conditions. Therefore, in general, the magnitude of the impact is considered to be negligible and the significance of the impact is also considered low.

50. The maximum length of the mooring cable is to be nine times the water depth at the turbine location, (9 x 80m). There are two wrecks which should be considered when the anchor locations are being determined as they are located within this 720m radius, U 40 and Our Merit in relation to Turbine 8 (Figure 12-1).

51. A summary of the impact assessment of the potential impact of the deployment of the anchors on wrecks within the Development Area is presented in Table 12-13 below.

Table 12-13 Results of the impact assessment for deployment of anchors In the Development Area on wreck sites through identification of sensitivity, magnitude of effect and the resultant significance of impact

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Impact
Damage to wreck sites during installation/ decommissioning of anchors due to direct damage or Increased SSC	U 40 (1915)	High • Sunk during wartime • 29 sailors were reported to be killed • Proximity to WTGs (within 500m buffer)	Moderate • Footprint of individual anchor is 10x10m, therefore, there is potential for significant destruction of a wreck if an anchor was to be deployed on it • 435m from nearest turbine • Position of anchors is very precise, so wreck sites can be avoided	Moderate/ Major
	Our Merit	Low • Post WW1 cargo vessel • No significant archaeological or historic importance • No recorded loss of life	Moderate • Footprint of individual anchor is 10x10m, therefore, there is potential for significant destruction of a wreck during deployment of anchors • 580m from nearest turbine • Position of anchors is very precise, so wreck sites can be avoided	Minor/ Moderate

12.4.1.4. (4) Presence of four anchors per substructure (32 in total) plus mooring lines

Overview of Impact

52. During the operational phase of the Project there is the potential for limited scour erosion to occur at the base of the anchors as discussed in Chapter 3. It was concluded as part of the coastal processes assessment that the impact of scour is considered to be very localised and categorised as low/negligible magnitude of effect for the project.

Characterisation of Impact

53. As with (3) above only U 40 and Our Merit were assessed for this impact as they are within the 720m radius to Turbine 8. The maximum length of the mooring cable is to be 9x the water depth at the turbine location, (9 x 80m) 720m.

54. A summary of the impact assessment of the potential impact of scour erosion during the operational phase of the windfarm is presented in Table 12-14 below.

Table 12-14 Results of the impact assessment for scour erosion around the anchors in the Development Area on wreck sites through identification of sensitivity, magnitude of effect and the resultant significance of impact

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Impact
Damage to wreck sites due to scour erosion around anchors due Increased SSC	U 40 (1915)	High • Sunk during wartime • 29 sailors were reported to be killed • Proximity to WTGs (within 500m buffer)	Negligible/Low • Limited amount of sediment will be resuspended due to scour erosion • Current/existing active nature of seabed	Minor / Moderate
	Our Merit	Low • Post WW1 cargo vessel • No significant archaeological or historic importance • No recorded loss of life	Negligible/Low • Limited amount of sediment will be resuspended due to scour erosions • Current/existing active nature of seabed	Negligible/ Minor

12.4.2. Impact Assessment: Offshore Export Cable Corridor

55. The key risks and potential impacts within the Development Area are summarised in Table 12-15. For the impact assessment within the Offshore Export Cable Corridor the identified wrecks that were considered were SS Prince Consort, Fairey Barracuda, MFV Luffness, Unknown 2, Unknown 3 and Silverburn as the 500m buffer for each of these falls with the Offshore Export Cable Corridor (Table 12-15). The remaining identified wrecks are beyond 500m, and thus have not been considered for this assessment.

Table 12-15 Summary of the potential risks and impacts to identified wrecks within close proximity to the Offshore Export Cable Corridor during construction, operation and decommissioning

Activity	Risk	Potential Impact	Construction	Operation	Decommissioning
(5) Ploughing of trench, cable laying and burial	Temporary disturbance of seabed and interaction with wreck(s)	• Increased SSC • Damage to wrecks • Smothering/burial of wrecks	X		X
(6) Scour erosion around areas of the export cable(s) that are buried by rock dumping (up to 10%)	Possible localised scour of sea bed	• Increased SSC • Damage to wrecks • Smothering/burial of wrecks		X	

12.4.2.1. (5) Deployment of export cable in the Offshore Export Cable Corridor

Overview of Impact

56. The cable laying process will likely involve a combined process of opening a trench to a depth of 1.5m, laying the cable and burial of the cable all occurring sequentially along the cable corridor (likely to be undertaken at the same time). Therefore the majority of the sediment that is displaced during trenching will be replaced immediately during the burial process (i.e. cable plough). Currently there are no plans to decommission the export cable but leave it in place indefinitely, depending on the market conditions during the decommissioning phase and the consenting conditions.

57. The table below gives the worst case Rochdale envelope for the Offshore Export Cable Corridor which was used for this assessment.

Table 12-16 Rochdale Envelope for Offshore Export Cable Corridor assessment

Component	Dimensions
Number of Export Cables	Max 2
Export Cable Length	15km
Export Cable Diameter	180mm
Target Burial Depth	1.5m
Total Area per Export Cable to be excavated (and replaced) during cable laying (assuming a 3m wide trench is ploughed)	45,000m^2 per cable
Total Volume of Potential Sediment Displacement (assuming a 3m wide trench is ploughed and to a depth of 1.5m)	67,500m^3 per cable

Characterisation of Impact

58. During the installation of the Offshore Export Cable Corridor (15km x 1.5m deep x 3m wide) a maximum of 67,500m^3 of sediment is expected to be displaced (via ploughing and potential jetting), which will also temporarily increase SSC. Therefore, during the cable laying processes, there is the potential for damage to occur to the wrecks by the cable laying vessels as the cables are installed and the plough/jetted sediment returned to the trench to bury the cables (cut and cover approach likely by using an automated cut and cover plough type machine). Resuspended sediment has the potential to smother/bury wrecks in the surrounding area. However, due to active nature of the seabed, the amount of material and that the installation of the export cable is expected to be gradual (1km per day) sediment that will be re-suspended will have time to settle between stages (settling velocity of medium sand is rapid and will only travel limited (80m) from the site on mobilisation). Therefore, the only potential impact that has been assessed below is the potential for direct damage to the unknown wrecks during cable installation. It should be noted that the below impact assessment is based on the cable route as shown in Figure 12-1. However, post geophysical survey, there is scope for the route to be amended to avoid any direct collisions with identified wreck sites within the selected Offshore Export Cable Corridor.

Table 12-17 Results of the impact assessment for the Offshore Export Cable Corridor installation process on wreck sites through identification of sensitivity, magnitude of effect and the resultant significance of impact

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Impact
Damage to wreck sites during installation/ decommissioning of export cables due to direct damage or Increased SSC	SS Prince Consort	Moderate • Sunk before WW1 • Transport vessel	High • Wreck site is within the Offshore Export Cable Corridor • Site is in shallow water close to the coast • It could be expected that this site will be significantly degraded due its location near to the coast.	Moderate/ Major
	Fairey Barracuda	Moderate • WW2 aircraft • No recorded loss of life	Moderate • Wreck site is on the edge of the Offshore Export Cable Corridor • Close to shoreline	Moderate
	MFV Luffness	Low • Post WW1 fishing vessel • Sunk post WW2 • Ran aground • No recorded loss of life	Low • Wreck site is not within the Offshore Export Cable Corridor • 500m buffer is within the export cable corridor • Active nature of seabed	Minor
	Unknown 3	Unknown	Low • Location is not within the Offshore Export Cable Corridor • 500m buffer is within the Offshore Export Cable Corridor • Active nature of seabed	Minor
	Unknown 2	Unknown	Moderate • Wreck site is on the edge of the Offshore Export Cable Corridor	Moderate
	Silverburn	High • Built c.WW1 • Sunk during WW1 during conflict • Transport vessel	Low • Wreck site is on the edge of the Offshore Export Cable Corridor. • Micro siting of cable possible to avoid wreck following detailed geophysical surveys (sidescan and magnetic anomaly)	Moderate

12.4.2.2. (6) Scour erosion around areas of the export cable(s) that are buried by rock dumping

Overview of Impact

59. The presence of rocks on the seabed to bury the export cable(s) could induce localised scour. This scour would occur during the operational phase of the windfarm.

Characterisation of Impact

60. Due the small area of the total cable length (10%) that may need to be buried this impact is likely to be minimal. Any scour around the rocks used to bury the cables is likely to only impact the seabed in close proximity to the cables (within five metres, see Chapter 3).

61. A summary of the impact assessment of the potential impact of scour erosion during the operational phase of the windfarm is presented in Figure 12-18 below.

Table 12-18 Results of the impact assessment for scour erosion around rock dumping on wreck sites through identification of sensitivity, magnitude of effect and the resultant significance of impact

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Impact
Damage to wreck sites due to increased SSC from scour erosion around the areas of the export cables that are buried by rock dumping	SS Prince Consort	Moderate • Sunk before WW1 • Transport vessel	Low • Wreck site is within the Offshore Export Cable Corridor • Site is in shallow water close to the coast • Closest to areas that are likely to be buried by rock dumping • Limited amount of sediment would be resuspended • Active nature of seabed	Minor/ Moderate
	Fairey Barracuda	Moderate • WW2 aircraft • No recorded loss of life	Low • Wreck site is on the edge of the Offshore Export Cable Corridor • Close to shoreline • Close to areas that are likely to be buried by rock dumping • Limited amount of sediment would be resuspended • Active nature of seabed	Minor/ Moderate
	MFV Luffness	Low • Post WW1 fishing vessel • Sunk post WW2 • Ran aground • No recorded loss of life	Low • Wreck site is on the edge of the Offshore Export Cable Corridor • Close to shoreline • Close to areas that are likely to be buried by rock dumping • Limited amount of sediment would be resuspended • Active nature of seabed	Minor

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Impact
	Unknown 3	Unknown	Low • Wreck site is on the edge of the Offshore Export Cable Corridor • Close to shoreline • Close to areas that are likely to be buried by rock dumping • Limited amount of sediment would be resuspended • Active nature of seabed	Minor
	Unknown 2	Unknown	Negligible • Wreck site is on the edge of the Offshore Export Cable Corridor • Further away from part of cable that is likely to be buried via rock dumping • Active nature of seabed	Negligible/ Minor
	Silverburn	High • Built c.WW1 • Sunk during WW1 during conflict • Transport vessel	Negligible • Wreck site is on the edge of the Offshore Export Cable Corridor • Further away from part of cable that is likely to be buried via rock dumping • Active nature of seabed	Minor/ Moderate

12.5. Mitigation

62. This impact assessment has been based on a desktop study only at this stage. A geophysical survey of the Development Area and Offshore Export Cable Corridor is planned to aid the detailed design stage. During this survey, the identified wreck sites should also be surveyed to determine exact locations of wrecks. Once these have been determined, the locations can be taken into consideration when final routes for the export cables, and the location of the turbine anchors and inter-array cables are determined.

63. If an unknown wreck/archaeology is identified during these detailed geophysical survey, then the Crown Estate protocol for new discoveries (2014) will be implemented to ensure correct recording and reporting procedures are maintained.

64. The cable route will also be assessed by magnetic anomaly survey (once the cable route has been defined by sidescan and sub-bottom profiling) to ensure the area is clear of unexploded ordinance. This will also identify any buried metallic objects which will significantly reduce the risk of damage to unknown sites.

65. The Offshore Export Cable Corridor shown in Figure 12-1 depicts the full corridor width including a buffer zone between the cables. The actual trenches that will be dredged will only be 3m wide, therefore it will be able to avoid wrecks where it is deemed necessary.

66. Due to the active nature of the seabed, it is not deemed necessary to mitigate further for any suspended sediment plumes that may be created during the installation process through the use of for example, silt curtains. The wrecks sites in the area will be periodically buried and exposed, and due to the temporary nature and small scale of this project, the changes to SSC will not be significant over baseline conditions.

67. As a result of the mitigation measures that can be put in place, the residual magnitude of effect for all the impacts discussed above can be considered low unless already stated as negligible.

12.6. Cumulative Impacts

12.6.1. Development Area and Offshore Export Cable Corridor

68. To assess the cumulative effect of the Project on the marine historic environment the combined impacts from within the Development Area and Offshore Export Cable Corridor have been considered.

69. Due to the limited spatial extent over which suspended sediments will be mobile (See Chapter 3), it is not anticipated that the impacts which will occur in the Development Area will have any effect on the wrecks sites in the Offshore Export Cable Corridor or vice versa. Therefore, there will be no cumulative impact of the installation phase and operational phase of the Project.

70. The Aberdeen Harbour Nigg Bay port extension is located approximately 2km to the north of the proposed cable landing location and the Offshore Export Cable Corridor. Due to the distances between the Project and the Nigg Bay development there is no cumulative impact for marine historic environment to consider.

12.6.2. Other Proposed Windfarms

71. The table below outlines the other windfarms in the vicinity of this Project. Due to the distances between the windfarms, there is no potential for cumulative impacts on the marine historic environment between windfarms.

Table 12-19 Details of consented windfarms within 50km of Kincardine Floating Offshore Windfarm

Project Name	Distance from KOWL	Project Developer	High Level Description	Project Status
European Offshore Wind Deployment Centre (EOWDC)	17km	Aberdeen Offshore Windfarm Ltd	Offshore wind turbine deployment centre for 11 turbines with up to 100 MW capacity	Consented
Seagreen Alpha Offshore Windfarm and Seagreen Bravo Offshore Windfarm	34km	Seagreen Wind Energy Limited	Offshore windfarm and export cabling to be developed in three phases with a total target capacity of 3.5 GW.	Phase 1 Consented Phase 2 and 3 EIA Scoping Opinion issued
Hywind Scotland Pilot Park	45km	Statoil	Pilot project for 5 6MW floating turbines	Consented
Inch Cape Offshore Windfarm	47km	Inch Cape Offshore Windfarm Ltd	Offshore windfarm up to 21 turbines covering an area of up to 150 km^2 with a capacity of approximately 1,000 MW	Consented

12.7. Summary and Residual Impacts

72. The following tables summarises the residual results of the EIA on the marine historic environment considering the proposed mitigation options outlined above.

Table 12-20 Summary of the residual significance of the identified impacts to the marine historic environment with the Development Area

Impact	Receptors	Impact Significance	Mitigation	Residual Impact Significance
Construction and Decommissioning				
Deployment/removal of inter-array cables	SS Creemuir	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	U40	Moderate/Major	Geophysical Survey to assist in planning where inter-array cables will be laid	Minor
	Our Merit	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Supermarine	Minor	Embedded Mitigation with no Additional Mitigation	Minor
Deployment/removal of anchors/ mooring lines	U40	Moderate/Major	Geophysical Survey to assist in planning where anchors will be laid	Minor
	Our Merit	Minor/Moderate	Geophysical Survey to assist in planning where anchors will be laid	Minor
Operation				
Scour erosions around inter-array cables	SS Creemuir	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
	U40	Minor/Moderate	Geophysical Survey to assist in planning where inter-array cables will be laid	Negligible/Minor
	Our Merit	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor

Impact	Receptors	Impact Significance	Mitigation	Residual Impact Significance
	Supermarine	Minor	Embedded Mitigation with no Additional Mitigation	Minor
Scour erosion around anchors	U40	Minor/Moderate	Geophysical Survey to assist in planning where anchors will be laid	Minor
	Our Merit	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/ Minor

Table 12-21Summary of the residual significance of the identified impacts to the marine historic environment within the Offshore Export Cable Corridor

Impact	Receptors	Impact Significance	Mitigation	Residual Impact Significance
Construction and Decommissioning				
Ploughing of trench, cable laying and burial	SS Prince Consort	Moderate/Major	Geophysical Survey to assist in planning final cable routes within corridor Magnetic Anomaly survey	Minor
	Fairey Barracuda	Moderate	Geophysical Survey to assist in planning final cable routes within corridor Magnetic Anomaly survey	Minor
	MFV Luffness	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Unknown 3	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Unknown 2	Moderate	Geophysical Survey to assist in planning final cable routes within corridor Magnetic Anomaly survey	Minor
	Silverburn	Moderate	Geophysical Survey to assist in planning final cable routes within corridor Magnetic Anomaly survey	Minor
Operation				
Scour erosion around areas where export cable is protected with rock dumping	SS Prince Consort	Minor/Moderate	Geophysical Survey to assist in planning final cable routes within corridor Magnetic Anomaly survey	Minor
	Fairey Barracuda	Minor/Moderate	Geophysical Survey to assist in planning final cable routes within corridor Magnetic Anomaly survey	Minor

Impact	Receptors	Impact Significance	Mitigation	Residual Impact Significance
	MFV Luffness	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Unknown 3	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Unknown 2	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
	Silverburn	Minor/Moderate	Geophysical Survey to assist in planning final cable routes within corridor Magnetic Anomaly survey	Minor

Table 12-22Summary of the residual significance of the identified cumulative impacts to the marine historic environment from the Project

Impact	Receptors	Impact Significance	Mitigation	Residual Impact Significance
Construction and Decommissioning				
Combined impact of deployment/removal of inter-array cables and anchors in Development Area and ploughing of trench, cable laying and burial of export cables in the Offshore Export Cable Corridor	SS Creemuir	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	U40	Moderate/Major	Geophysical Survey to assist in planning where inter-array cables will be laid	Minor
	Our Merit	Minor/Moderate	Geophysical Survey to assist in planning where anchors will be laid	Minor
	Supermarine	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	SS Prince Consort	Moderate/Major	Geophysical Survey to assist in planning final cable routes within corridor Magnetic Anomaly survey	Minor
	Fairey Barracuda	Moderate	Geophysical Survey to assist in planning final cable routes within corridor Magnetic Anomaly survey	Minor
	MFV Luffness	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Unknown 3	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Unknown 2	Moderate	Geophysical Survey to assist in planning final cable routes within corridor Magnetic Anomaly survey	Minor
	Silverburn	Moderate	Geophysical Survey to assist in planning final cable routes within corridor Magnetic Anomaly survey	Minor

Impact	Receptors	Impact Significance	Mitigation	Residual Impact Significance
Operation				
Cumulative impact of increased SSC due to scour erosion around the inter-array cable, anchors and around rock dumping areas on all receptors	SS Creemuir	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	U40	Minor/Moderate	Geophysical Survey to assist in planning where inter-array cables will be laid	Minor
	Our Merit	Negligible/Minor	Geophysical Survey to assist in planning where anchors will be laid	Negligible/Minor
	Supermarine	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	SS Prince Consort	Negligible/Minor	Geophysical Survey to assist in planning final cable routes within corridor Magnetic Anomaly survey	Minor
	Fairey Barracuda	Negligible/Minor	Geophysical Survey to assist in planning final cable routes within corridor Magnetic Anomaly survey	Minor
	MFV Luffness	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Unknown 3	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Unknown 2	Negligible/Minor	Geophysical Survey to assist in planning final cable routes within corridor Magnetic Anomaly survey	Negligible/Minor
	Silverburn	Negligible/Minor	Geophysical Survey to assist in planning final cable routes within corridor Magnetic Anomaly survey	Negligible/Minor

12.8. References

CANMORE (2015) http://canmore.org.uk/index.php?action=do_advanced&maritimeevidencecode=Wreck&sitediscipline=3 (Last Accessed 27/07/2015)

Council of Europe (1992) European Convention on the Protection of Archaeological Heritage (Revised) Available Online: http://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/143 [Last Accessed: August 2015]

Gribble, J and Leather, S for EMU Ltd. (2011) Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector, commissioned by COWRIE Ltd. Available online http://www.thecrownestate.co.uk/media/5901/km-ex-pc-historic-012011-offshore-geotechnical-investigations-and-historic-environment-analysis-guidance-for-the-renewable-energy-sector.pdf [Last Accessed August 2015]

Her Majesty's Government (1973) Protection of Wrecks Act Available Online: http://www.legislation.gov.uk/ukpga/1973/33/contents [Last Accessed: August]

Her Majesty Government (1986) The Protection of Military Remains Act 1986 Available Online: http://www.legislation.gov.uk/ukpga/1986/35/contents [Last Accessed: August 2015]

Her Majesty's Government (2011) UK Marine Policy Statement Available Online: https://www.gov.uk/government/publications/uk-marine-policy-statement [Last Accessed: August 2015]

Historic Scotland (2011) Sottish Historic Environmental Policy Available Online http://www.historic-scotland.gov.uk/shep-dec2011.pdf [Last Accessed August 2015]

Historic Scotland (1999) Operational Policy Paper Conserving Underwater Heritage Available Online http://www.historic-scotland.gov.uk/conserving-underwater-heritage.pdf [Last Accessed August 2015]

Historic Scotland GIS Downloads (2015) http://data.historic-scotland.gov.uk/pls/htmldb/f?p=2100:10:0::NO::: Last Accessed 20/07/2015

JNAPC (2006) Maritime Cultural Heritage & Seabed Development Code of Practice Available Online http://www.jnapc.org.uk/jnapc_brochure_may_2006.pdf [Last Accessed August 2015]

Oxford Archaeology & George Lambrick Archaeology and Heritage (2008) Guidance for the assessment of Cumulative Impacts in the Historic Environment Offshore Renewable Energy, commissioned by COWRIE Ltd;

Scottish Government (2010). Marine (Scotland) Act. Available Online: http://www.legislation.gov.uk/asp/2010/5/contents [Accessed: March 2015]

Scottish Government (2013) Planning Scotland's Seas Website http://www.gov.scot/Topics/marine/seamanagement/national/marine-consultation [Last Accessed August 2015]

Scottish Government (2011) Scottish Planning Policy Available Online: http://www.gov.scot/Resource/0045/00453827.pdf [Last Accessed August 2015]

Scottish Government (2011) Planning Advice Note PAN 2/2011 Planning and Archaeology Available Online http://www.gov.scot/Resource/Doc/355385/0120020.pdf [Last Accessed August 2015]

The Crown Estate (2014) Protocol for Archaeological Discoveries: Offshore Renewables Projects. Published by Wessex Archaeology Ltd on behalf of The Crown Estate Available Online http://www.thecrownestate.co.uk/media/148964/ei-protocol-for-archaeological-discoveries-offshore-renewables-projects.pdf [Last Accessed August 2015]

The Crown Estate (2010) Model clauses for Archaeological Written Schemes of Investigation: Offshore Renewables Projects. Published by Wessex Archaeology Ltd. Available online http://www.wessexarch.co.uk/system/files/WSI%20Renewables_low%20res.pdf [Last Accessed August 2015]

Royal Commission on the Ancient and Historical Monuments of Scotland (2015) http://www.rcahms.gov.uk/news/shipwreck-map-of-scotland-published-as-maritime-record-enhanced [Last Accessed 27/07/2015]

United Nation (1982) Convention on the Law of the Sea Available Online http://www.un.org/depts/los/convention_agreements/convention_overview_convention.htm [Accessed: August 2015]

Wessex Archaeology Ltd (January 2007) Historic Environment Guidance for the Offshore Renewable Energy Sector, commissioned by COWRIE Ltd. Available online http://www.thecrownestate.co.uk/media/5876/km-ex-pc-historic-012007-historic-environment-guidance-for-the-offshore-renewable-energy-sector.pdf [Last Accessed August 2015]

13. Socio-Economics

13.1. Introduction

1. This chapter presents an assessment of the potential socio-economic impacts arising as a result of the Project. The impact assessment is undertaken with consideration to the socio-economic context of the local area in terms of its baseline conditions and the relevant local and national policy documents. The section outlines the approach to the assessment and sets out the anticipated socio-economic effects of the proposed development.

13.1.1. Policy and Regulations

2. The following provides a summary of the policies and initiatives that have relevance to the socio-economic considerations of the development as part of this assessment.

Scottish Government Economic Strategy (2011)

3. The Strategy is an update on the document produced in 2007. It sets out six strategic priorities that aim to tackle unemployment and promote employment that drives sustainable economic growth. The Strategic Priorities include:

- Supportive business environment and promotion of jobs;
- Learning, skills and well-being;
- Effective government;
- Transition to a low carbon economy;
- Infrastructure, development and place; and,
- Equity.

4. Of particular relevance is the emphasis on skills development in order to provide employment opportunities. In addition the Strategy outlines seven growth sectors, one of which is energy (including renewables). The energy sector is highlighted as it provides a comparative advantage in Scotland as a whole.

National Planning Framework 3 (2014)

5. The Framework sets out an approach to ensure a more 'successful county' achieved through sustainable economic growth. Economic growth is built around the development of 'place' which includes the facets of sustainability, low carbon, natural environment, resilience and connectivity.

6. The Framework includes the expansion of Aberdeen Harbour as one of fourteen nationally significant infrastructure projects. The project outlines the need for new harbour facilities and associated infrastructure to expand current capacity and ensure business opportunities are not limited going forward. Aberdeen is identified as a leading location for energy in Europe and the economic performance of the area associated with this is noted. The expansion of the Harbour is noted as providing the opportunity to strengthen the supporting role to energy in the area. In addition Peterhead is outlined as a key port location to support connectivity in Scotland.

National Renewables Infrastructure Plan

7. The Plan highlights the economic growth potential that development of offshore renewables provide to Scotland. The Plan outlines the economic growth aims associated with renewables. Aberdeen is identified as a first phase site for infrastructure in regard to manufacturing and operation/ maintenance. Noted in the Plan is the need to take action to support the growth of the renewables sector in order to maximise economic growth. The need to support the workforce and supply chain to enable developments is clearly noted. The broad requirements for port and manufacturing facilities to support construction and operation of new offshore wind sites are set out.

Economic Action Plan for Aberdeen City and Shire (2013-18)

8. The second five year economic action plan continues the joined-up approach to economic development in Aberdeen City and Shire. The Plan provides support to the area as a global energy sector hub. It outlines seven strategic priorities in order to support economic growth and improved quality of life.

9. There is priority given to infrastructure investment, development of skills (including proposed International Energy Centre of Excellence) and investment in business. In particular there are actions to support supply chain businesses associated with offshore energy requirements as well as efforts to attract inward investment.

Aberdeen City and Shire Structure Plan (2009)

10. Economic growth is one of the objectives of the Plan, this includes new employment opportunities. The need to ensure the right quantity, type and location of land for differing uses is outlined. Areas to the north, including Peterhead and to the south including Stonehaven are identified as strategic growth areas.

Aberdeen City and Shire Strategic Development Plan (2014)

11. The Plan's vision focuses on ensuring a sustainable, attractive and prosperous place to live. A number of strategic growth areas are identified to facilitate growth in housing and employment land. These areas included the City as well as areas to the north, including Peterhead and to the south including Stonehaven.

12. Aberdeen Harbour is identified as a key economic gateway and expansion as a nationally significant project to support Scotland's infrastructure.

13.1.2. Stakeholder Consultation

13. No socio-economic specific consultation was identified as being required for this assessment. Consultation has been undertaken with Marine Scotland, Aberdeen City Council and Aberdeenshire Council regarding the project in general and in relation to infrastructure improvements. This information, where appropriate, has informed the assessment process and supported identification of potential impacts and effects of the proposed development.

13.2. Baseline Environment

14. A range of socio-economic indicators have been identified to inform the assessment of socio-economic effects of the development. The indicators include population, economic activity, unemployment, qualifications and occupational profile. The geographical areas of Aberdeen City, Aberdeenshire and Scotland have been identified in order to consider the socio-economic effects of the proposed development. The socio-economic indicators covering these geographical areas provide a snap-shot of the socio-economic character of the Aberdeen City and Shire impact area and comparison to the national picture across Scotland.

15. Table 13-1 shows the population of Aberdeen City was 227,100 and Aberdeenshire 257,700 in 2013. These areas experienced high population growth over the period 2004 to 2013. The population of both Aberdeen City and Aberdeenshire grew by 9.3% and 9.8% respectively, both substantially above the average for Scotland at 4.8%.

Table 13-1 Population (ONS, Mid-Year population Estimates 2013)

Area	Population		
	2004	2013	% change 2004-2013
Aberdeen City	207,800	227,100	9.3
Aberdeenshire	234,700	257,700	9.8
Scotland	5,084,300	5,327,700	4.8

16. In 2013 Aberdeen City had a higher proportion of working age population, those aged 16-64 years (70.6%), compared to Aberdeenshire at 64.1% and Scotland at 65.1%.

17. The economic activity rate[15] was higher in both Aberdeen City (73.3%) and Aberdeenshire (74.9%) compared to Scotland at 69% (Source: Census 2011). Similarly in 2014 the employment rate[16] for Aberdeen and Aberdeenshire (at 76.0% and 80.9% respectively) were above the average for Scotland at 72.6% (Source: Annual Population Survey, 2014).

18. Figure 13-1 shows changing rates of claimants for the Job Seeker's Allowance (used as a proxy measure for unemployment) over the period 2006-15. The Job Seeker's Allowance claim rate in the first quarter of 2015 was lower in Aberdeenshire (0.8%) and Aberdeen City (1.2%), compared to 2.4% across Scotland as a whole. Both Aberdeenshire and Aberdeen City had a consistently lower claimant rates compared to Scotland over the period. All followed a similar trend with a peak of claimants across all three areas in 2012, with the rates subsequently falling.

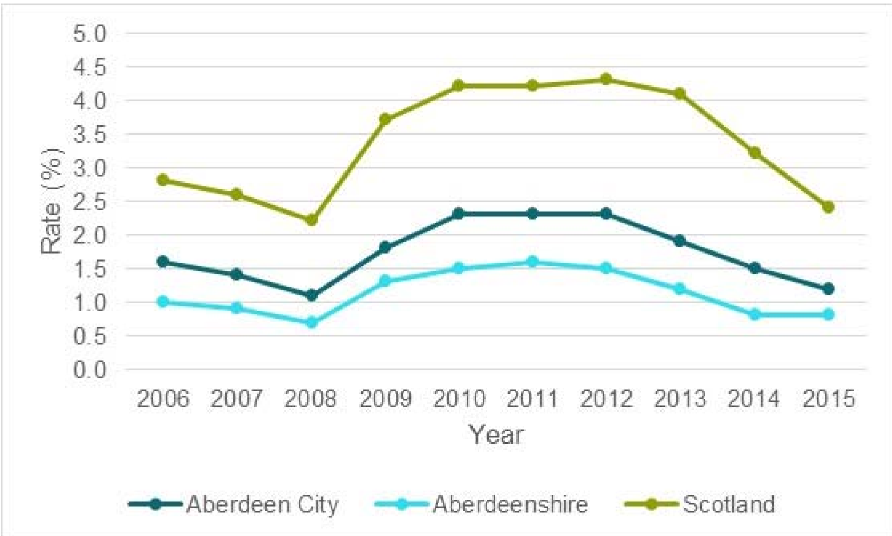

Figure 13-1: Claimant Count 2006-2015 (ONS)

19. Analysis of employment data by sector, Table 13-2, shows the proportion of working age population employed by industrial sector in 2011. Aberdeenshire had a higher proportion of working age employed in *manufacturing* at 10.2% compared to 6.9% in Aberdeen City and 8% nationally. At 10.4% Aberdeen City had a higher proportion employed in *professional, scientific and technical services* than Aberdeenshire and Scotland, at 8.3% and 5.2% respectively.

[15] the proportion of the labour market employed and unemployed

[16] the number of people in employment as a proportion of the working age population

Table 13-2 Employment by Industrial Sector (Census 2011)

Industrial Sector	Area - % of employment		
	Aberdeen City	Aberdeenshire	Scotland
A. Agriculture, forestry & fishing	0.2	4.4	1.7
B. Mining & quarrying	8.8	7.4	1.4
C. Manufacturing	6.9	10.2	8.0
D. Electricity, gas, steam & air conditioning supply	0.3	0.5	0.8
E. Water, sewerage, waste management	0.5	0.6	0.8
F. Construction	6.0	8.8	8.0
G. Wholesale and retail trade	15.1	14.4	15.0
H. Transport & storage	5.5	5.1	5.0
I. Accommodation & food services	7.4	4.8	6.3
J. Information & communications	2.4	1.6	2.7
K. Financial & insurance	1.4	1.3	4.5
L. Real estate	0.8	1.0	1.2
M. Professional, scientific & technical services	10.4	8.3	5.2
N. Administration & support services	5.1	3.7	4.3
O. Public administration, defence & social care	4.0	4.3	7.0
P. Education	8.2	8.1	8.4
Q. Human health & social work	12.8	11.8	15.0
R, S, T, U. Other	3.9	3.8	4.9

20. The occupational profile of residents located within Aberdeen City and Shire are set out in Table 13-3. Aberdeen City has a higher proportion (27.5%) in occupational categories 1 and 2, compared to 25.2% in both Aberdeenshire and Scotland as a whole. Aberdeenshire has a high proportion of category 5 occupations (skilled trades) at 17.3% compared to the City and Scotland at 11.1% and 12.5% respectively. Aberdeen City also has a higher proportion of category 9 occupations compared to both Aberdeenshire and Scotland.

Table 13-3 Occupational Profile (Census 2011)

Occupation Category	Area - % of employment		
	Aberdeen City	Aberdeenshire	Scotland
1. Manager, director & senior officials	7.5	9.0	8.4
2. Professionals	20.0	16.2	16.8
3. Associate professional & technical	13.0	12.5	12.6
4. Administrative & secretarial	11.8	10.7	11.4
5. Skilled trades	11.1	17.3	12.5
6. Caring, leisure & other services	8.3	8.5	9.7
7. Sales & customer services	8.4	6.7	9.3
8. Process, plant & machine operatives	7.3	8.7	11.6
9. Elementary	12.7	10.3	11.6

10. Visit Scotland identifies top attractions within the Aberdeen and Grampian area. Within Aberdeen City the Art Gallery and Maritime Museum are within the top five attractions in terms of visitor numbers. Visitor statistics for Aberdeen City and Shire are shown in Table 13-4.

Table 13-4 Tourism Statistics (Visit Scotland 2011)

	Aberdeen City	Aberdeenshire	Scotland
Employment	10,100	6,400	171,500
GVA (£m)	339.3	217.7	3090.7

Source: Visit Scotland[17]

11. Tourist trips to Aberdeen and Grampian region (GB trips) amounted to 1.44m in 2013 and spend of £289m, accounting for 11.8% of total GB trips to Scotland and 10% of tourist spend across Scotland. Dunnottar Castle at Stonehaven is the only tourist attraction in any proximity to the proposed development, visitor statistics for this historic attraction were not available.

[17]Tourism in Scotland’s Regions 2013
http://www.visitscotland.org/pdf/Tourism%20in%20Scotland's%20Regions%202013.pdf

13.3. Assessment Methodology

12. The methodology for the evaluation of the socio-economic impacts of the Development is based on previous experience of similar developments, professional judgement, statutory requirements and Government advice. The assessment considers how the Development will affect the socio-economic baseline conditions, during both construction and operational phases. Given the nature of the development, quantitative and qualitative impacts have been considered where possible, including employment, possible disruption during the construction phase and other impacts.

13. While there is no high-level guidance as to preferred criteria for socio-economic assessment the significance of the socio-economic effects of the project will be based on defined assessment criteria, as set out in Table 13-5. The methodology in this chapter is slightly different to that outlined in Chapter 1, as the table below is more suitable for assessing socio-economic impacts.

Table 13-5 Socio-Economic Significance Criteria

Significance	Description
Beneficial	Positive effect on the economic/ social activity in Aberdeen City and Shire.
Minor beneficial	Slight positive effect on the economic/ social activity in Aberdeen City and Shire.
Negligible	Little or no effect on the economic/ social activity in Aberdeen City and Shire.
Minor adverse	Slightly negative effect on the economic/ social activity in Aberdeen City and Shire.
Adverse	Negative effect on the economic/ social activity in Aberdeen City and Shire.

13.4. Impact Assessment

14. This section outlines the likely significant effects of the Development in both the construction and operational phases.

13.4.1. Employment and Economic

Construction

15. Construction of the substructures is expected to be undertaken within a Scottish port facility and this is likely to include a significant level of fabrication support for the substructure assembly at a regional/UK wide level. The Project and enhancement of skill sets associated with the construction of the KOWL floating units will form a positive, short term (up to two years) employment opportunity for the selected port site. It is expected that over 50 people could be required to support the construction and installation of the turbines within the construction port over a two year period and therefore this represents a net economic benefit to the regional/national economy.

16. It is expected that all of the WTG unit (tower, blade and nacelles) will be fabricated outside of Scotland and transported to the construction base for assembly. This is likely to provide additional local development and skill enhancement to the local port construction work force which could enable further windfarm development opportunities for the local workforce.

17. The construction of the Project is expected to create a small number of short-term employment opportunities in the area. There will be demand for skilled onshore and offshore construction workers, vessel operators and engineers during the construction phase. Given the nature of the development and the type of skills available in the local labour market it is anticipated these jobs will be fulfilled using existing employment from the Aberdeen City and Shire labour market.

18. The equivalent of approximately 40 jobs are anticipated to be required in order to assemble the turbines and install. The construction period for the onshore and offshore section of the connecting cable to the sub-station is anticipated to be between three to six months. It is estimated the installation of the cable will employ a maximum of 20 people. The offshore section will also require the charter of a suitable vessel and associated crew. It is expected that an existing vessel from either Aberdeen or Peterhead harbours would be used to support the offshore cable element.

19. In addition, further indirect jobs would be supported locally and regionally through supply linkage and income multiplier effects. This includes firms supplying construction materials and equipment.

20. Employment and economic impacts are considered to be a temporary, beneficial effect, of minor significance for the economy of Aberdeen City and Shire.

Operation

21. In order to ensure the turbines operate efficiently a regular checks and maintenance schedule will be followed. For approximately one week every month during the 25 year operational life of the windfarm the turbines will undergo checks and maintenance. This will require approximately 4 engineers and a supporting vessel, plus around 4 onshore support staff. As with the construction phase it is anticipated that the required skills, for the maintenance and support work, will be supplied by the existing Aberdeen and Shire labour market. The skilled labour required and potentially the vessel used is anticipated to be shared with another offshore windfarm. Use of vessels to support operation and undertake the maintained of the turbines will be drawn from existing fleet at either Aberdeen or Peterhead harbours.

22. These employment and economic impacts are considered to be negligible due to the very small number of existing jobs supported when considered in the context of the existing economy of Aberdeen and Shire.

23. For further details on the impact of the proposed development on the employment and commercial returns of the fisheries sector refer to Chapter 14.

13.4.2. Local Disruption

24. The impact of any disruption associated with the construction and/or operation of the development is anticipated to be negligible. As the development is predominantly based offshore, approximately 8 miles south east of the coast from Aberdeen, the impacts on either local residents or businesses is unlikely to be noticeable. The onshore section of the cable connection to the sub-station is also expected to be of negligible impact in terms of disruption. The route the cable will follow is on the edge of an existing industrial estate and will not impact business operations in any significant way.

13.4.3. Tourism and Recreation

25. The development is expected to have a negligible impact on tourism and recreation in the local area. The distance of the development from the shore and very limited onshore development element means there is no impact on existing tourism and recreation uses and users in the local area. Dunnottar Castle at Stonehaven is the only tourist attraction in any proximity to the proposed development and its operation and use will be unaffected by the development.

26. For full details of the visual impacts of the development in terms of visual amenity for tourism and recreation refer to Chapter 11 and Chapter 15 for impacts on any other related marine uses.

13.5. Mitigation

27. Mitigation is not a requirement for beneficial impacts or for those assessed to be of negligible or minor beneficial significance. Thus, no specific mitigation measures are proposed for the construction phase in relation to impacts associated with key socio-economic factors of this development.

13.6. Cumulative Impacts

28. No cumulative impacts in socio-economic terms have been identified. There are two other offshore windfarm developments, one approximately 25 miles north and one 40 miles to the south. Given

the distances and size of this proposed development cumulative impacts in socio-economic terms are not identified. There are no major or significant developments identified onshore that would provide any cumulative impacts of development in socio-economic terms.

13.7. Summary and Residual Impacts

29. The following table (Table 13-6) summarises the results of the EIA for social economic assessment. Overall, there is no negative impacts, whilst a number of positive impacts have been identified.

Table 13-6 Socio-economic assessment summary

Impact	Significance of Impact
Construction – Scottish Port	Positive (local and national)
Installation (Site)	Positive (local and national)
Operation and Maintenance	Positive (local and national)
Decommissioning	Positive (local and national)
Tourism	Negligible
Local Disruption	Negligible

14. Commercial Fisheries

14.1. Introduction

1. This chapter of the Environmental Statement (ES) is an assessment of the potential effects of construction, operation and decommissioning of the Kincardine Offshore Windfarm and Offshore Export Cable Corridor on commercial fishing activities. It provides a summary of the existing commercial fisheries activities in the vicinity of the Kincardine Offshore Windfarm.

2. In order to quantify spatial and temporal variation, commercial fisheries are described both at a local level and at a wider regional and national level in order to provide context to the baseline. For the purpose of this study, commercial fishing is defined as any legal fishing activity undertaken for declared taxable profit.

3. In addition, aspects relating to the safety of fishing vessels and their crews are covered in Chapter 10-Maritime Navigation.

4. This chapter is supported by the following appendix:

- Appendix E: Commercial Fisheries Baseline

5. This chapter shares linkages with the following chapters:

- Chapter 5: Fish and Shellfish
- Chapter 9: Navigation

14.1.1. Legislation and Guidance

6. There is no specific legislation which covers the scope of an impact assessment on commercial fisheries, although there is guidance which provides information on how to assess impacts to fisheries from offshore windfarms.

7. In order to provide a detailed and robust baseline description of fisheries operating within the site and the wider region surrounding the area, the compilation of the available data for the assessment takes into consideration the requirements laid out in the following:

- Guidance note for Environmental Impact Assessment In respect of FEPA and CPA requirements (Cefas, 2004);
- Recommendations for Fisheries Liaison: FLOWW (Fishing Liaison with Offshore Wind and Wet Renewables Group) (BERR, 2008);
- Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Liaison (FLOWW, 2014);
- Guidance on Environmental Considerations for Offshore Windfarm Development. Reference Number: 2008-3 (OSPAR, 2008); and
- Scoping responses (Section 15.1.2).

14.1.2. Stakeholder Consultation

8. Consultation with the Scottish Fishermen's Federation (SFF) was undertaken by Atkins, The Crown Estate and MacAskill Associates on the 16th January 2014 in Aberdeen. Following this meeting UK Fisherman's Information Mapping Project (UKFIM) data was released exclusively to Kincardine Offshore Wind Limited (KOWL) for background information on the site. Due to extreme sensitivities surrounding the data KOWL has signed a license agreement stating that data will only be used internally, and that data will not enter public domain through GIS maps or other visual representation or statement of data. Data has been shared in order to promote dialogue and understanding. KOWL are thankful to SFF for allowing access to this data to provide valuable knowledge in our site selection and to allow KOWL to reduce the impacts on the fishing effort within the area.

9. Issues raised in the Scoping Opinion which were relevant to the commercial fisheries impact assessment are summarised below in Table 14-1.

Table 14-1 Commercial Fisheries Scoping Responses

Kincardine Offshore Windfarm Environmental Scoping Assessment		
Consultee	**Scoping Response**	**Project Response**
MS LOT	As much use as possible should be made of published reports, rather than carry out unnecessary independent assessment of the state of diadromous fish stocks, for example.	Noted, fisheries targeting diadromous fish is covered within this chapter, biological aspects such as life cycle and populations is covered within Chapter 5.
	There will also be a need to check that that there is no possibility of interference with any salmon net fisheries close to the coast during installation of the cables	Noted, fisheries targeting diadromous fish is covered within this chapter.
	Scottish fishing vessels <15m do not carry VMS, and their activity was recently mapped using an interview based approach with fishery stakeholders (the ScotMap project). Data were collected during face-to-face interviews with over 1000 fishermen across Scotland covering a 72% vessel coverage overall. This source of information should be used as primary source of information on the potential overlap of the spatial distribution of smaller vessels with the proposed site. Please visit for more information and access to spatial layers: http://www.scotland.gov.uk/Topics/marine/science/MSInteractive/Themes/ScotMap	Considered and illustrated in Section 14.2.1.4.6.
	It is very positive that the developers have already initiated consultation with the SFF, However, consultation with other local fishermen's associations and fish producers' organisations is advised. Contacts could be sought through the Fishery Office in Aberdeen and East Coast Inshore Fisheries Group. You might find it useful to prepare and maintain a project specific register of local fishermen's groups and associations. Providing information on the offshore surface and subsea structures and activities to Kingfisher Division of Seafish will be also useful. Please consider appointing a Company Fishing Liaison Officer to act as the primary point of contact for the fishing industry.	A dedicated Fisheries Liaison Officer (FLO) has been appointed as a link with the fishing community.
	In addition, it is advised to establish Fishing Industry representative(s) to act as a single onshore trusted contact point within the fishing community. You may consider a dedicated International Maritime Mobile VHF working channel for the exchange of relevant information between contractors afloat and other vessels in the area during construction and maintenance.	A dedicated Fisheries Liaison Officer has been appointed as a link with the fishing community.
	You may consider developing a Fisheries Liaison Plan which will include mitigation and coexistence plan. Please see more at the guidance produced by COWRIE on options for the mitigation of impacts of offshore windfarms on fishing activities. MSS would expect to see a specific chapter in the stakeholder section where potential concerns of the fishing community raised during consultation have been addressed.	Mitigation measures are detailed in Section 14.3.1.7 and will be detailed in the Draft Construction Management Plan (CMP).
	You may consider co-existence options with the fishing sector e.g. fishing vessels could provide guard vessel services, or service boats for periodic overhauls (visual	Mitigation measures are detailed in Section 14.3.1.7 and will be detailed in the

Kincardine Offshore Windfarm Environmental Scoping Assessment		
Consultee	**Scoping Response**	**Project Response**
	inspection and surveillance purposes) as briefly mentioned.	Draft Construction Management Plan (CMP).
	Source column identifies “Marine Scotland; CEFAS, literature; SFF, *local fishing federations*”. Please replace with “Local Fishing Associations” or more explicitly with the names of the local fishing associations.	Changed within the ES document
	SNH and COWRIE reviews suggest that EMFs may interact with migrating eels and potentially salmonids if migration routes take them over cables particularly in shallow waters (<20m), hence there will be no impact on their movements. It is unclear how no interaction with their movements has been derived.	Considered within the assessment and within Chapter 5.
	Layers shown include vessels above 15m only (fitted with VMS equipment). MS has undertaken an interview based project to map the activity from smaller vessels (<15m) called ScotMap (additional comments above). Please scope overlap with these layers as well.	Noted and included within the baseline (Section 14.2.1.4.6 and Appendix E).
	It has been mentioned that additional high level, commercially sensitive fishing data have been provided by the SFF. Please provide additional information on the type of data, period covered, vessels represented etc. It might be possible to agree on a protocol for the use and presentation of activity data, acknowledging the need to maintain commercial confidentiality.	This is detailed in Section 14.1.2.
	MSS welcomes the proposal for a radar study to establish use of the site by smaller vessels. ScotMap data will be useful for this exercise. Please provide additional information on radar type (e.g. terrestrial radar, SAR), detection range, similar case studies etc.	A radar study has been undertaken for Chapter 9
	Overview of *current* commercial fishing activity was based on preliminary assessment of fisheries landings data for 2000-2008. It is advised to use the last 5 years of available data instead. MSS can provide guidance with this.	Years 2009-2013 have been used in the assessment.
	The vessels engaging with the fishing activity within rectangle 42E7 have identified to be mainly less than 15m in length (59.4% under 15m), hence it is expected that the satellite densities given underestimate the actual levels of fishing. MSS has recently prepared landings value distribution layers where VMS and ScotMap data have been combined together. It is advised to use these layers which will be uploaded on Marine Scotland Interactive website or by directly engaging with MSS	Noted, ScotMap data is included in Appendix E and Section 14.2.3.1.4.6.
	It is stated that identification of the levels and locations of fishing activities *within this rectangle* will be will be undertaken as part of assessing potential cumulative impacts during the EIA process. However, it is advised that the potential cumulative impacts assessment should take account of interactions out with this rectangle for cumulative loss of grounds should activity of individual fishers is found to be overlapping with other major offshore projects in the vicinity. Ideally, this assessment will be undertaken on an individual vessel level which can be assisted by MSS.	Noted and assessed within Section 14.7.

Kincardine Offshore Windfarm Environmental Scoping Assessment		
Consultee	**Scoping Response**	**Project Response**
	It is stated that "*No data gaps* have been currently identified, with the onsite survey fulfilling the remaining data requirements for the site". This is statement is contradicting with sentence in page 118 for underestimation of inshore fishing activity in rectangle 42E7. Please also note that SFF will not necessarily represent all smaller vessels in the area. Identification of overlapping vessels with ScotMap layers and consultation with North East IFG is advised.	Noted, ScotMap data is included in Section 14.2.1.4.6.
	Please scope in barrier effects in accessing fishing grounds (especially important for smaller vessels) in the table of potential impacts on commercial fishing.	Noted and scoped in.
	Comments on loss of fishing grounds. Please replace "moveable fishing gears" with the term "mobile fishing gears".	Correct within text in the ES.
	Comments on fishing gear and anchoring system. You may find useful information in FLOWW guidance for fishing gear entanglement.	Noted and used as guidance within the production of the chapter.
	Please note that apart from SFF, IFGs, and other fisheries organisations, non-affiliated individuals should be consulted.	Noted, a public stakeholder event was undertaken giving the opportunity for interested stakeholders to participate.
SNH	As part of the EIA, the applicant should consider the environmental effects of displacing (and potentially concentrating) fishing effort to other areas, although we acknowledge that this assessment may be best made at a cumulative or strategic level.	Noted, included within the Section 14.7.
SFF	It is worrying that on page 29 it is stated that fishing activity at the site is limited despite scallop dredging value in the area (represented by the 2 ICES rectangles) amounts to almost £1.5 million and other species combine to over £1million.	This is portrayed in more detail in Section 14.2.1.4 and Appendix E.
	When it becomes clear in 3.8 that the development is quite likely to become a fishing exclusion zone due to constraints of the moorings and inter-array cables, it is obvious that the development will need to define the mitigation which will be provided for this potential clash, both in terms of the turbine areas and the export cables.	Noted and discussed within Section 14.3.1.7
	Whilst the very nature of the development, mooring and inter-array cables may preclude fishing, the SFF would maintain that the export cable must be buried to avoid negative interaction with the inshore fisheries which it will impact on.	Export cable will be buried to a depth of 1.5 meters in accordance with DECC Guidelines (2011).
	The SFF would expect the EIA to include detailed baselines of nursery areas, spawning grounds and commercial species. Further to that baseline, the SFF would expect to see some substantiation of the simplistic statements in the table 10-11 on page 75, inferring that fishing is a negative and destructive activity in the marine environment which is further reiterated in tables 10-12 and 10-13.	Baselines are described in detail in Chapter 5.

Kincardine Offshore Windfarm Environmental Scoping Assessment		
Consultee	**Scoping Response**	**Project Response**
	The SFF would agree with the list given in 10.6.1.3 on page 73 of potential impacts all of which must be addressed and mitigation defined.	Noted
	Finally referring to the table 11-15, the SFF agrees with the list of items seeped in and would expect to see mitigation defined for any/all negative impacts on the fishing fleet.	Noted, mitigation measures identified in Section 14.3.1.7 and 14.5.

14.2. Baseline Environment

14.2.1. Commercial Fisheries

10. The focus of the impact assessment is potential impacts on any commercial fisheries receptors affected by the development. This requires an understanding of the fishing activities which take place within the waters adjacent to and in the project area. Study areas considered for commercial fishing activity are not identical to study areas in Chapter 5 as the assessment for this chapter is focused on commercial not ecological interests, however they do overlap as one is dependent on the other to a large extend.

11. The establishment of the baseline environment was compiled from a mix of both desk-based research and consultation. Baseline data has been collected and collated from a variety of sources as fisheries data cannot be accurately depicted from a single data set. Data has included fisheries statistical datasets, grey and peer reviewed literature and consultation with fishermen and their representatives.

12. A detailed baseline study of the commercial fisheries in the Development Area and Offshore Export Cable Corridor is presented in Appendix E. This section of the ES summarises the main findings of that more detailed report with regards to commercial fisheries. The local study is based on data from three International Council for the Exploration of the Sea (ICES) statistical rectangles. The study area for this assessment is depicted in Figure 14-1.

13. The area of assessment for commercial fishing in relation to the Kincardine Offshore Windfarm is illustrated in Figure 14-1. Defined further, the area sits within ICES rectangles 43E7, 43E8 and 42E8 (to a small extent). ICES rectangles align to 1° of longitude and 30' of latitude, an individual ICES rectangle for the most part covers an area of 900nm^2.

14. Three study areas have been defined for the assessment of commercial fisheries:

   a. **National Study Area (NSA)** in order to provide a Scottish national overview allowing fishing grounds in the general area of the site to be described within a national context.
   b. **Regional Study Area (RSA)** – a wider study area which incorporates the Kincardine Development Area and the Offshore Export Cable Corridor as well as the wider region.

c. **Local Study Area (LSA)** - study area specifically accounting for the Kincardine Development Area and the Offshore Export Cable Corridor and comprises of ICES Rectangles 43E7, 43E8 and 42E8. The local study area can be defined as the smallest spatial unit available for the collection and collation of relevant fisheries data to the site.

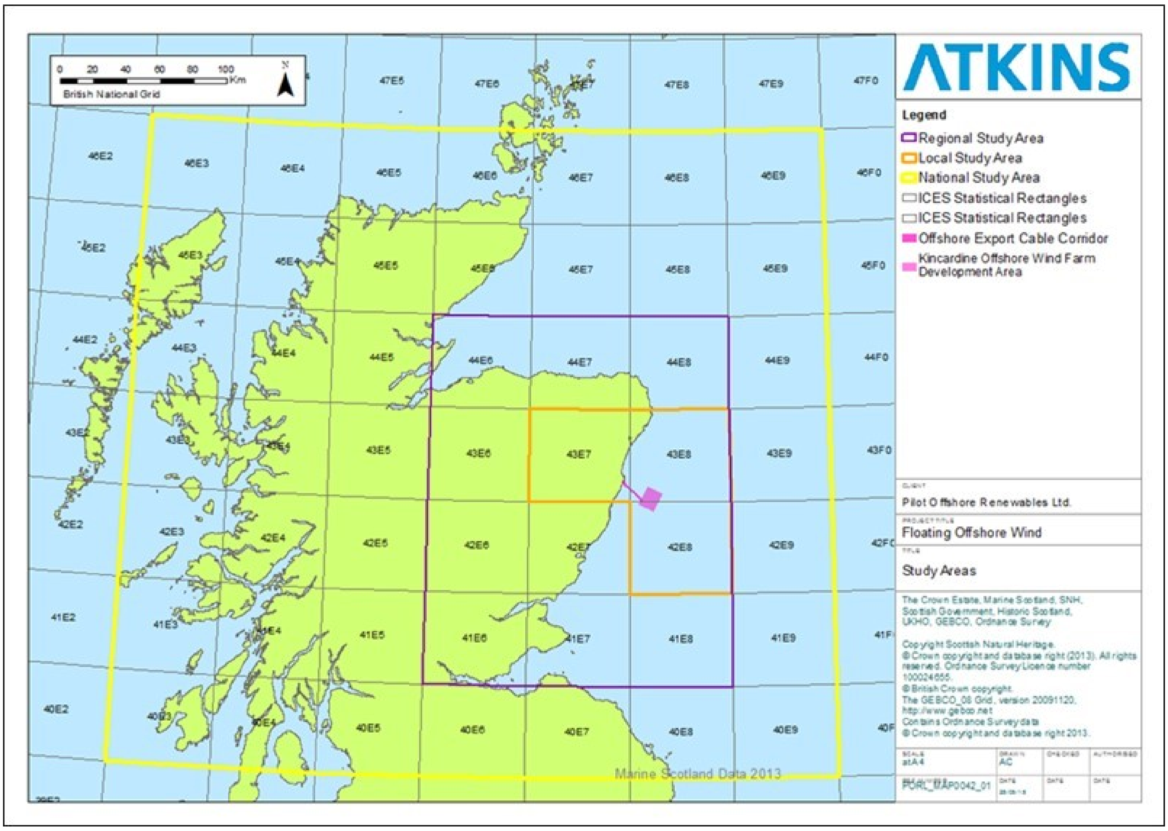

Figure 14-1 Commercial Fisheries Study Area

14.2.1.1. Data Sources

15. Analysis of the data and information used for the commercial fisheries assessment are subject to a range of qualifications, limitations, sensitivities and gaps which are fully discussed in Appendix: E. Despite these minor limitations the published data is considered to be a robust baseline against which impacts can be assessed.

16. The principle sources of data and information for the baseline were:

- Marine Scotland;
- Marine Management Organisation (MMO);
- International Council for the Exploration of the Sea;
- Scottish Fishermen's Federation;
- Fishermen and their representatives;
- International Council for the Exploration of the Seas (ICES);
- Marine Management Organisation (MMO);
- Marine Scotland;
- Marine Scotland Science (MSS);
- ScotMap Data;
- Centre for Environment, Fisheries and Aquaculture Science (CEFAS);
- Scottish Fishermen's Federations (SFF) made up of nine constituent members (Anglo-Scottish Fishermen's Association, Clyde Fishermen's Association, Fishing Vessel Agents & Owners Association (Scotland) Limited, Mallaig and North-West Fishermen's Association Limited, Orkney Fisheries Association, Scallop Association, Scottish Pelagic Fishermen's Association Limited, Scottish White Fish Producers' Association Limited and Shetland Fishermen's Association);

- District Fishery Officers (DFO);
- Fishermen and their representatives;
- Grey & peer reviewed literature; and
- Official fisheries statistics.

14.2.1.2. Fisheries Controls and Legislation

17. Relevant fisheries controls and legislation include:

- The Common Fisheries Policy;
- Quota and Total Allowable Catch (TAC);
- Fishing Licenses;
- Effort;
- Shellfish Entitlements; and
- Local fishing restrictions.

14.2.1.3. Fishing Methods

18. Fishing methods used in the study area are:

- Dredging for scallops;
- Demersal trawling for *Nephrops* and squid; and
- Creeling for lobster, edible crabs and velvet crabs.

19. The majority of vessels using dredging, demersal trawl and creeling gear are over 10m vessels in all three ICES rectangles with the exception of creeling in ICES area 43E7 where the majority of vessels creeling are under 10m. It is therefore of note that the activities of these vessels will not be included within the vessel monitoring systems (VMS) datasets. Landings of vessels over 10m are highest in the offshore rectangles (42E8, 43E8).

14.2.1.4. Overview of Landings Data

20. The Development Area is located within ICES rectangles 42E8 and 43E8 where the majority of landings are from scallops.

21. Scallops represent the highest landings values (2009-2013) in ICES rectangle in 43E8 with a value of £943,846 (49%). A breakdown of landings values for ICES rectangle 43E8 is detailed in Table 14-2 and for ICES rectangle 42E8 in Table 14.3 below.

Table 14-2 Landings Values on average (2009-2013) in ICES Rectangle 43E8

Species	Value (£)	Percentage of total landings
Scallop	£943,846	49%
Other	£240,710	12%
Edible Crab	£194,861	10%
Haddock	£192,014	10%
Mackerel	£128,334	6.6%
Lobster	£110,598	5.7%
Nephrops	£38,669	2%
Velvet Swimming Crab	£38,025	2%
Squid	£36,447	2%
Whiting	£11,340	0.6%
Cod	£5,744	0.3%

Table 14-3 Landings Values on Average (2009-2013) in ICES Rectangle 42E8

Species	Value (£)	Percentage of total landings
Scallop	£676,290	79%
Squid	£72,267	8.4%
Haddock	£47,514	5.5%
Mackerel	£17,782	2%
Nephrops	£15,118	1.8%
Lobster	£14,488	1.7%
Edible Crab	£6,632	0.8%
Whiting	£4,554	0.5%
Other	£2,761	0.3%
Cod	£762	0.1%
Velvet Swimming Crab	£542	0.1%

22. The Offshore Export Cable Corridor is located within ICES rectangle 43E7. Crustaceans represent the highest landings values in ICES rectangle 43E7 on average between 2009 and 2013. A breakdown of landings values for ICES rectangle 43E7 is detailed in Table 14-4 below.

Table 14-4 Landings Values on Average (2009-2013) in ICES Rectangle 43E7

Species	Value (£)	Percentage of total landings
Edible crab	£62,589	35%
Lobster	£45,899	26%
Squid	£28,620	16%
Scallop	£22,589	13%
Mackerel	£4,504	3%
Other	£3,845	2.6%
Haddock	£3,269	2%
Nephrops	£2,337	1%
Velvet Swimming Crab	£2,300	1%
Cod	£899	0.5%
Whiting	£336	0.2%

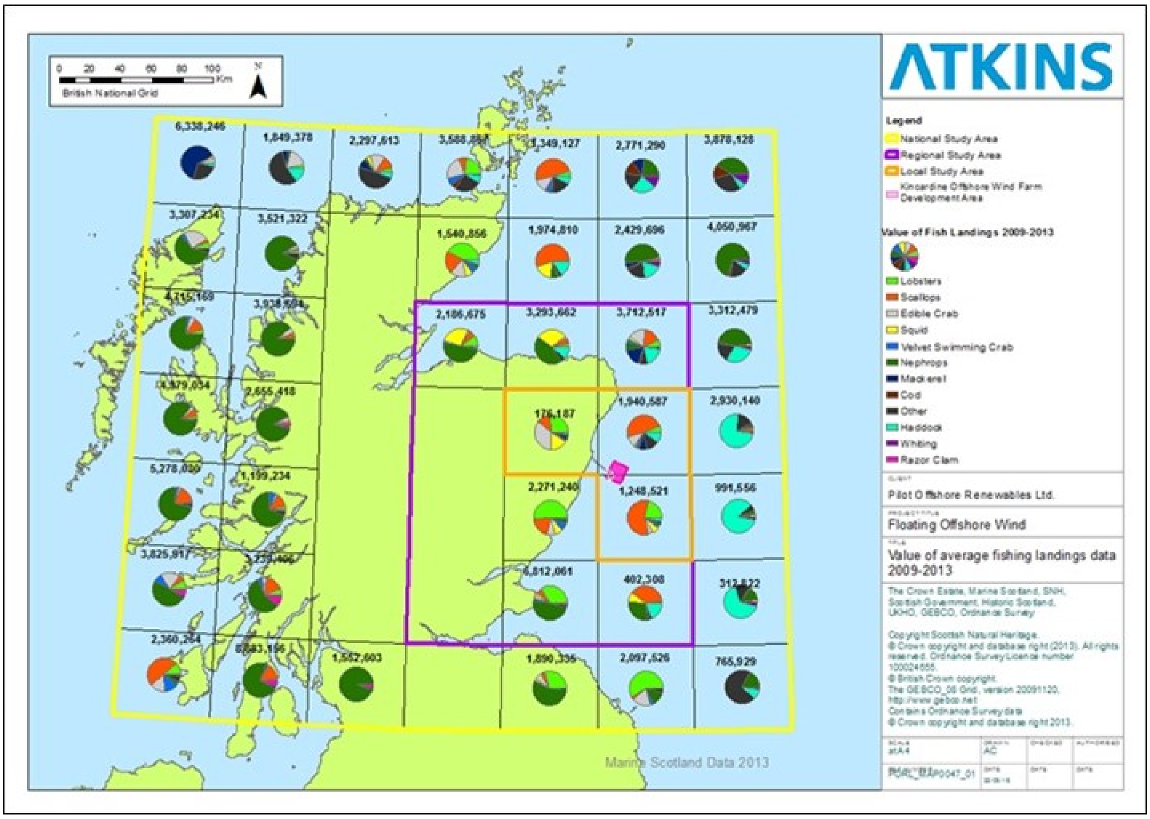

Figure 14-2 Landings values (£) by Species in the National Study Area (Source: MMO, 2014)

23. Aberdeen is the principle port where the majority of landings from ICES rectangles 42E8 (49.3%) and 43E7 (77.7%) are landed. Landings from 42E8 represents 20% of the port's total annual income for fisheries, while landings from 43E8 represents only 6% of the ports total annual fisheries income.

24. Peterhead is the principle port where the majority of landings from ICES rectangle 43E8 (69%) with landings from this rectangle representing only 1% of the port total annual income.

25. Figure 14-3 indicates the relative value of the inshore fishery based on ScotMap data and demonstrates the importance of the inshore areas of the Offshore Export Cable Corridor, relative to the north east coast of Scotland. It can be seen that relative to other areas on the north east coast there is a lower value in the vicinity of the Development Area and for most of the length of the Offshore Export Cable Corridor.

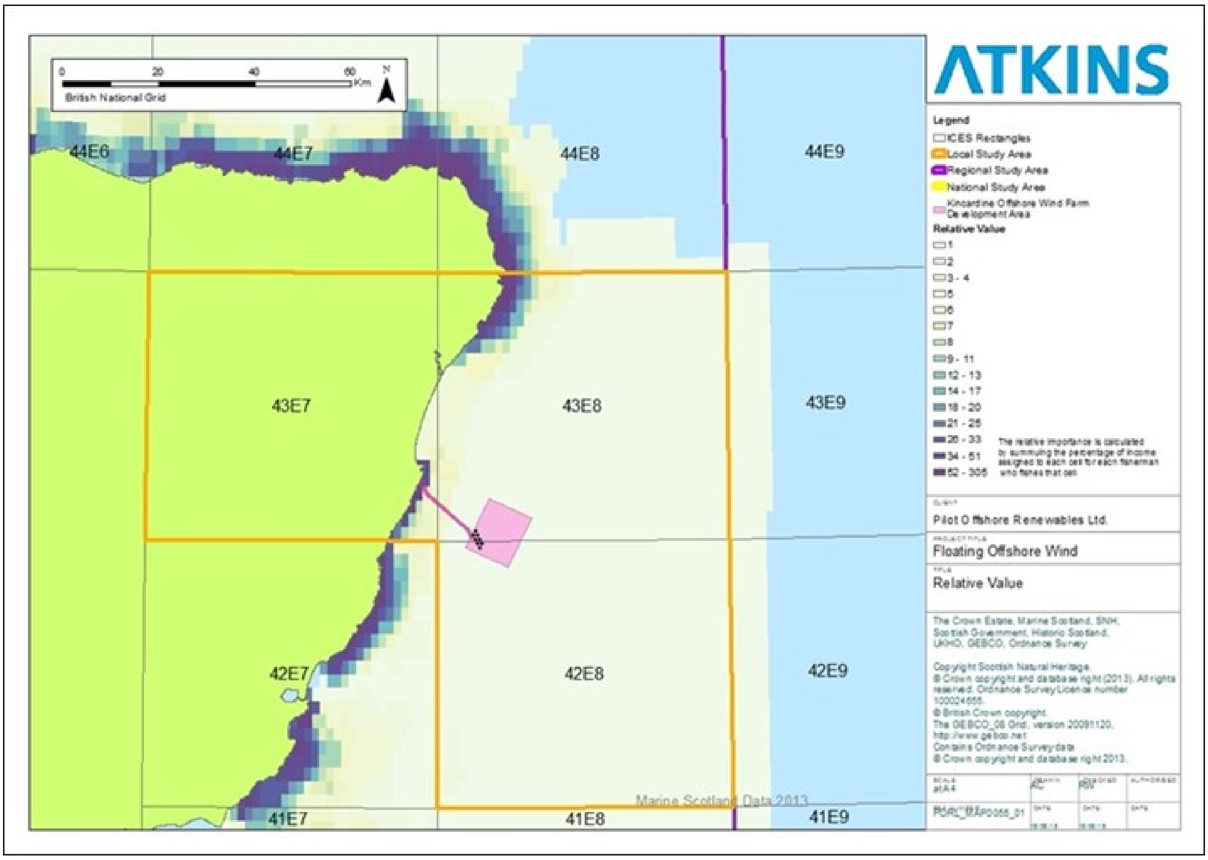

Figure 14-3 Relative Value of Inshore Fisheries (ScotMap, 2014)

14.2.1.4.1. Seasonality

26. The majority of landings values for species targeted from vessels in 43E7, 43E8 and 42E8 are broadly highest in late summer between July and August with moderate values for some species recorded over the remainder of the year. The main exception for this is scallop landings which peak in the spring months April and May.

14.2.1.4.2. Scallop Fishery

27. King scallop is the most important exploited mollusc and second most valuable shellfish species landed in Scotland. It is one of the top five most valuable species in the UK. The most common method to catch the species in Scottish waters is by mechanical dredging, with the main fisheries off the east coast of Scotland, Orkney and Shetland Isles. There is a small commercial hand-diving sector which fluctuates at around 5% of the total landings of scallop in Scotland.

28. Generally vessels undertaking scallop dredging are >15m in length and fish in inshore (<12nm) and offshore waters (>12nm).

29. Rectangles 43E8 and 42E8 record the two highest scallop landings within the Regional Study Area respectively (£943,846 and £713,830, averaged 2009-2013). Vessels targeting scallops are mainly over 10m vessels operating boat dredges and are therefore included in the VMS data.

30. Figure 14-4 illustrates that the Development Area is located in an area of low to moderate intensity fishing grounds with the Offshore Export Cable Corridor passing through an area of high intensity fishing grounds. In addition there are high intensity fishing grounds close to both the Development Area and Offshore Export Cable Corridor.

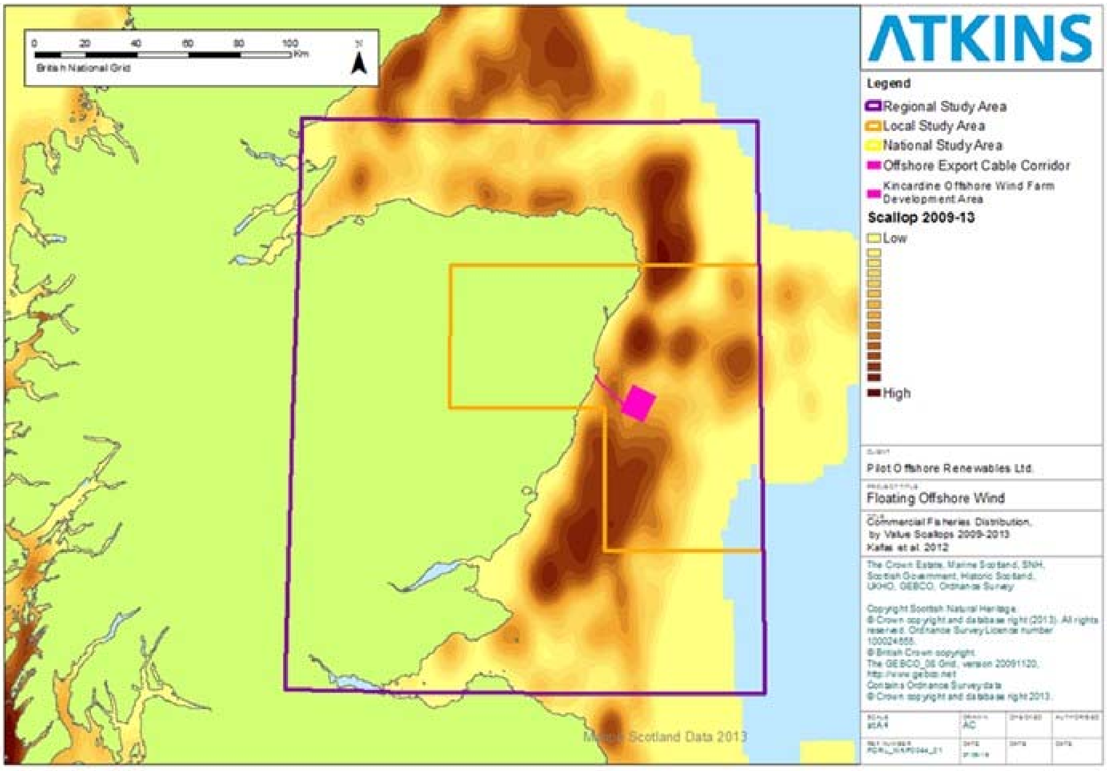

Figure 14-4 Commercial Fisheries Distribution by Value, Scallops 2009-2013 (Source: Marine Scotland)

14.2.1.4.3. Squid Fishery

31. Squid is an increasingly important fishery on the east coast of Scotland. Annual landings of squid vary significantly as the squid fishery is dependent on the seasonal arrival of the species to the area. Fishing grounds for squid are often located in inshore areas, however as the season progresses fishermen move into areas further offshore to target species in deeper waters. Peak landings for squid occur between July and September (see Appendix E for more details). Figure 14-5 shows that there are low intensity fishing grounds for squid along the majority of the east coast of Scotland.

32. The squid fishery is targeted by vessels operating bottom otter trawls and, for the most part, by vessels from home ports in the Regional Study Area (ICOL, 2012). The fishery is currently unrestricted which enables some demersal trawl vessels which have restrictions on other stocks (e.g. whitefish such as cod and haddock or *Nephrops*) to reconfigure gear to in order to target squid.

33. In the local Study Area the highest landings values for squid were recorded in ICES rectangle 42E8 with an average value (2009-2013) of £72,267, followed by £28,620 in 43E7.

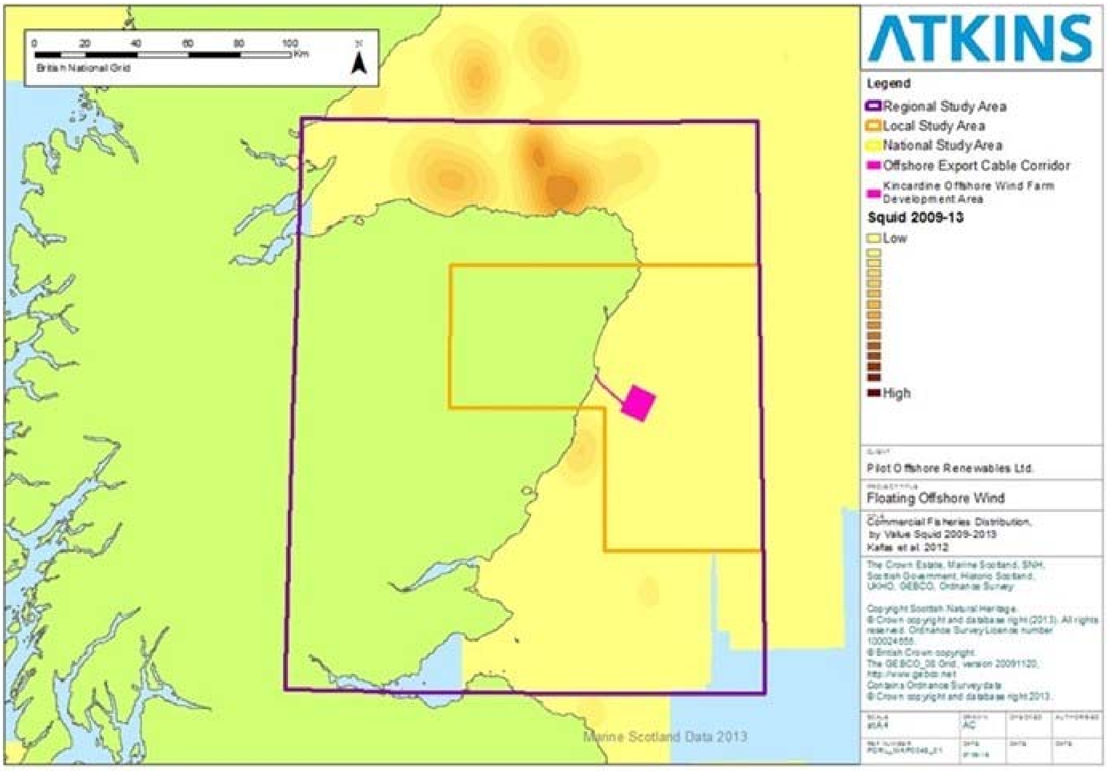

Figure 14-5 Commercial Fisheries Distribution by Value, Squid (2009-2013) (MSS, 2014)

14.2.1.4.4. Creel Fishery

34. ICES rectangles 43E7 records the highest landings values for crab and lobster within the Regional Study Area (£2,731,377 averaged 2009-2013). The highest proportion of these landings are of edible crab (£61,589) followed by lobsters (£45,899). Figure 14-6 illustrates the monetary value averaged (2007-2011) of creels (pots) of the <15m fleet from ScotMap data. As indicated by landings data the highest value areas are inshore of the Development Area, covering approximately half of the Offshore Export Cable Corridor. The areas represented are of relatively small value to other locations along the north east coast.

35. Crab and lobster are targeted by static gear normally using creels in inshore areas although an increasing number of vessels are able to target grounds further offshore. Landings for edible crab are recorded as being fairly stable all year round, with the highest landings values recorded in November. Landings for lobsters are highest within the summer months from June to September, with the highest values recorded in August.

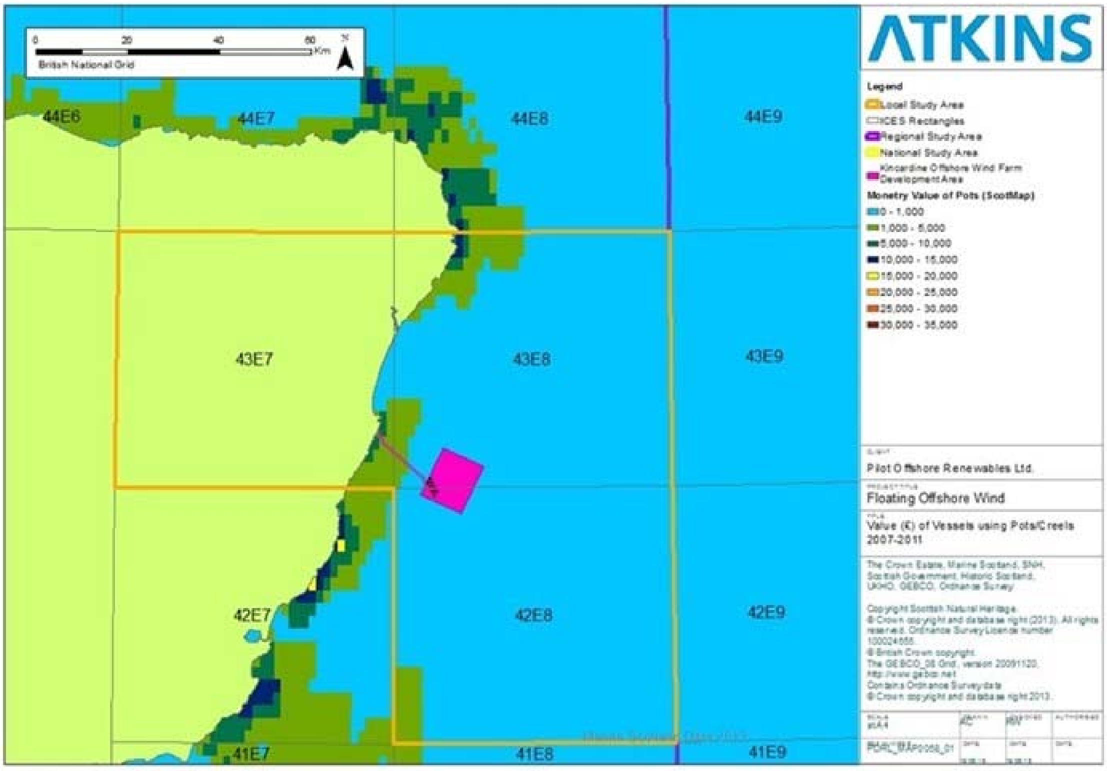

Figure 14-6 Monetary value of Creels (pots) in the vicinity of the Project

14.2.1.4.5. Demersal Fishery

36. The Demersal fishery has the highest values of landings recorded for haddock, cod and whiting within the local Study Area. The highest values are recorded in offshore areas ICES rectangles 43E8 and 42E8. Haddock record the highest value of landings in both ICES rectangle 43E8 and 42E8 (£192,014 and £47,514 respectively. Values for whiting and cod are considerably lower (Chapter 14 provides a more detailed assessment). Haddock, cod and whiting are targeted by demersal trawling gear, predominantly from May to November.

37. Demersal trawling is carried out predominantly by the >15m length vessels. This is supported by Figure 14-7 below illustrating the monetary value (£) for trawls in the vicinity of the Development Area and the Offshore Export Cable Corridor.

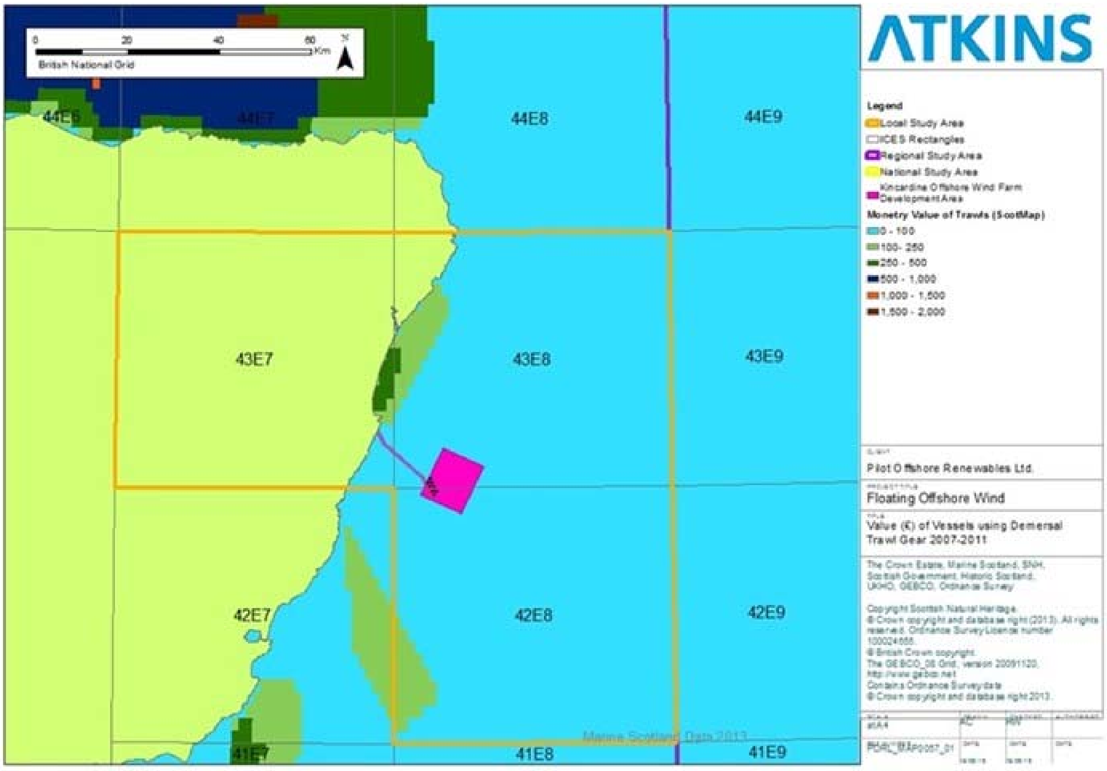

Figure 14-7 Monetary value (£) of vessels using Demersal Gear (2007-2011)

14.2.1.4.6. ScotMap and VMS

38. Figure 14-8 illustrates the combined data VMS and ScotMap data averaged from 2007-2011. It illustrates the relatively low value of fishing activity (on average) (£0-10,000) within the Development Area and the slightly higher value of the Offshore Export Cable Corridor (£10,000-£50,000). This data takes into account over 15m and under 15m in length vessels (limitations of this data are described in Appendix E).

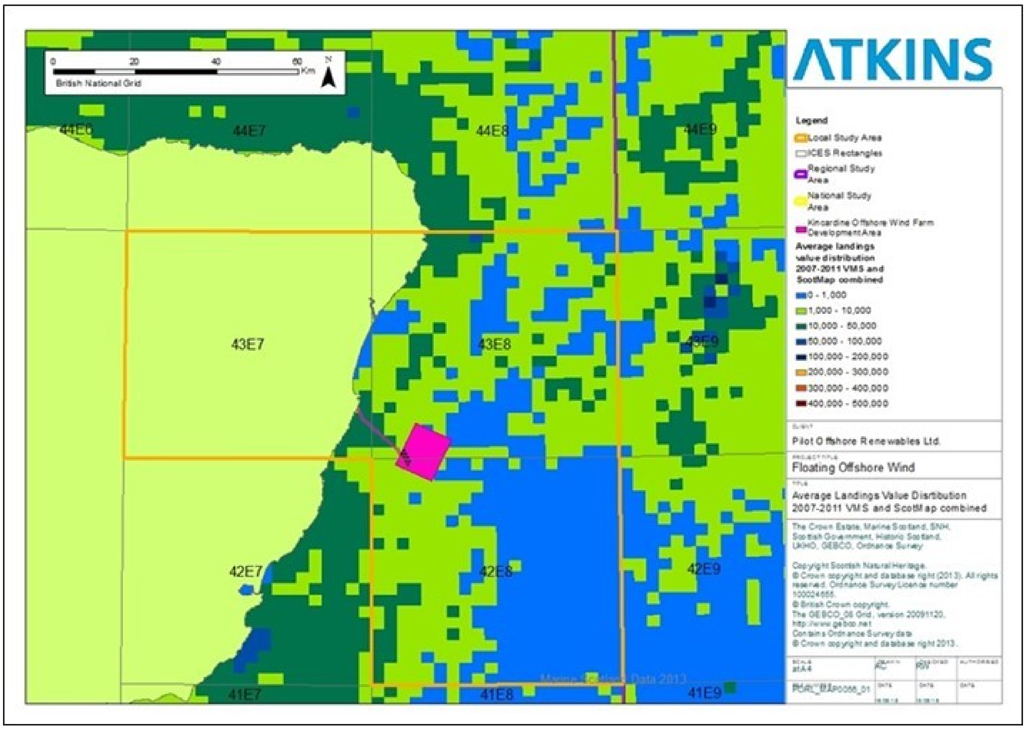

Figure 14-8 Average landings value distribution 2007-2011 from VMS and ScotMap data combined

14.2.2. Salmon and Sea Trout Fisheries

39. Atlantic salmon (*Salmo salar*) and sea trout (*Salmo trutta*) have nationally and internationally important populations within the rivers on the northeast coast. Both species are diadromous, meaning they are migratory species. Their life cycle includes a period spent in a freshwater riverine environment, after which they migrate to offshore marine feeding grounds and return after one or more years to spawn (see Chapter 5 for more detail on their biology). It is probable that they pass through the Offshore Export Cable Corridor during migration and thus catch levels have the potential to be disrupted.

40. The right to fish for salmon in Scotland is classed as a heritable right, however the taking of salmon without the right or written permission to do so is prohibited under the Salmon and Freshwater Fisheries (Protection) (Scotland) Act 1951. Originally these rights belonged to the Crown Estate. The Crown has granted the right of salmon fishing to others and ownership is now widely distributed among private individuals, companies and local authorities. Rights can be bought and sold or leased independently of land, except in Orkney and the Shetlands.

41. The salmon and sea trout fishery is managed through fishery districts each of which has a District Salmon Fisheries Board (DSFB). Salmon and sea trout are recorded under the following categories:

- Salmon (multi-sea-winter);
- Grilse (salmon which have only spent one year at sea);
- Sea trout; and
- Finnock (small sea trout in their first year after smolt migration).

42. In Scotland each fishery is required to provide the number and the total weight of salmon, grilse and sea trout caught and retained during each month of the fishing season.

43. They are also required to provide the same information for fish that are caught and released back into the river. As a result catch data from MSS is divided into two categories of ‘rod-and-line’ and ‘catch and release’.

44. Areas of study have been defined at a local, regional and national level for the purposes of assessments relating to salmon and sea trout. The Local Study Areas focuses on the salmon fishery districts in closest proximity to the Development Area and the Offshore Export Cable Corridor. These are mainly the Esk, Don, Dee and Ythan. The Regional Study Area takes account of salmon fisheries regions located in the vicinity of the Development Area and the Offshore Export Cable Corridor in the North East region see Figure 14-9 below.

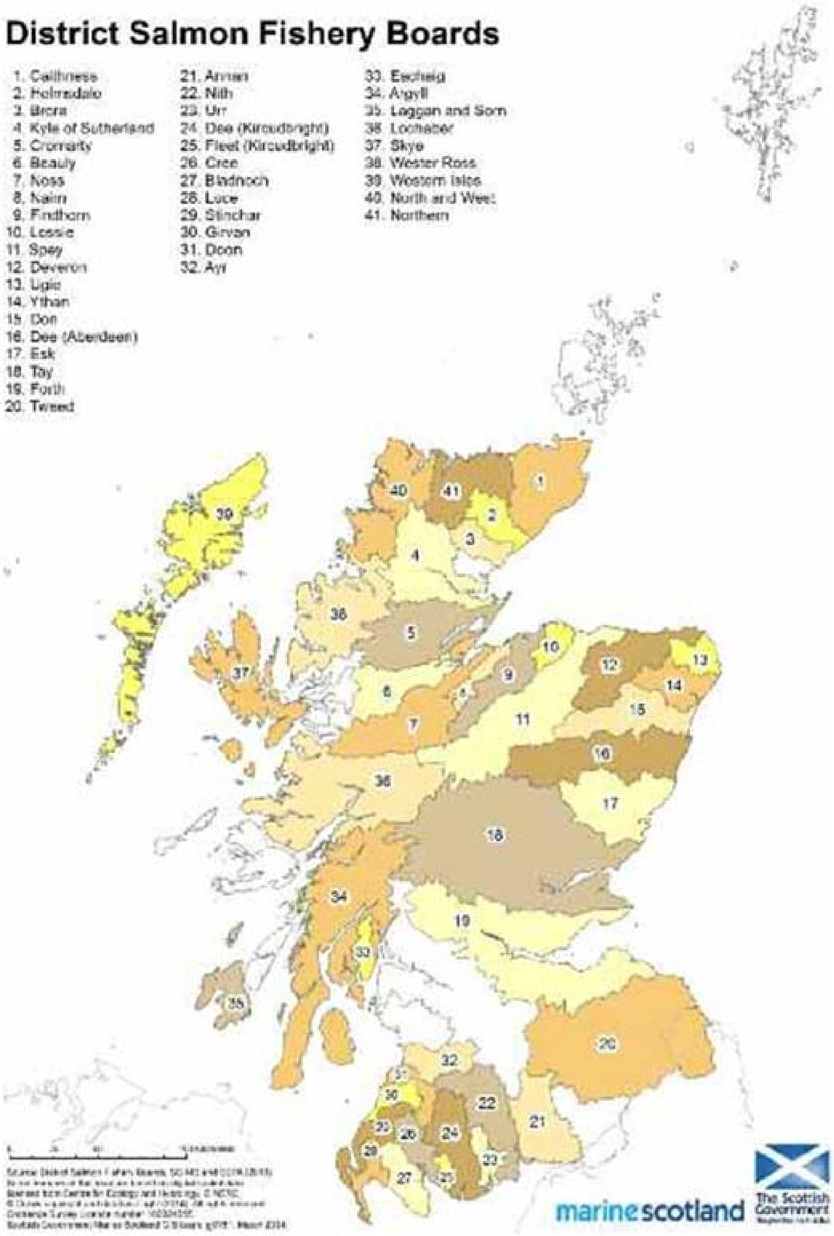

Figure 14-9 District Salmon Fisheries Boards Source: Marine Scotland)

14.2.2.1. Data Sources

45. The principle sources of information and the data used for the salmon and sea trout fisheries baseline were:

- Marine Scotland Science;
- DSFB; and
- Stakeholder Consultation.

46. It should be noted that the analysis of fisheries statistics is not intended as an assessment of stock abundance but rather as an indication of the underlying population trends and relative importance of the fisheries of salmon and sea trout by region and fishery district in Scotland. In addition critical times of the fisheries do not necessarily represent critical times for salmon and sea trout movements and therefore catch data are limited in terms of presenting an accurate baseline of fish populations and fish migration outside of the time of fisheries.

14.2.2.2. Salmon and Sea Trout Statistics

47. Salmon and sea trout statistics are described in more detail in Appendix E. In general rod-and-line (catch and release) accounts for the majority of the reported catch in most salmon fishery regions. Netting by both fixed engines and net-and-cobble occurs at varying degrees in the Esk and Ythan.

The Rod-and Line Fishery

48. Data from Marine Scotland Science for 2014 show that within the North East region the highest number of Atlantic salmon and grilse (combined retained and released) were caught within the Dee District followed by the North Esk. The total number of individuals caught in the Districts are described in Table 14-5.

Table 14-5 Number of salmon and grilse caught in the relevant districts (Source: MSS, 2014)

District	Number of Individuals
Dee	3492
North Esk	1667
Don	723
South Esk	607
Ythan	209

49. Data from Marine Scotland Science for 2014 show that within the North East region the highest number of sea trout (combined retained and released) were caught within the Ythan followed by the Dee. The total number of individuals caught in the Districts are described in Table 14-6.

Table 14-6 Number of sea trout caught in the relevant Districts (Source: MSS, 2014)

District	Number of Individuals
Ythan	1820
Dee	1521
North Esk	1110
South Esk	644
Don	254

14.2.3. Baseline without the Project

50. It should be noted that commercial fishing is subject to numerous factors which may cause it to change in the future from the baseline provided. This may be due to changes in policies and legislation, alteration in species distribution and abundance, introduction of additional marine conservation areas and increases in running costs (e.g. fuel costs). At the time of writing, there are no anticipated changes to the legislation or policy and current trends are likely to continue.

14.3. Assessment Methodology

51. Following establishment of the baseline conditions of commercial fisheries in relation to the Project, the surrounding area and an understanding of the project activities, it is possible to assess the potential impacts from the project. The range of impacts which have been considered in the assessment are based on impacts identified during the Scoping phase of the project (see separate Scoping Report) and any other further potential impacts which have been identified as the project has progressed. It should be noted that not all impacts are relevant to all phases of the project.

52. Impacts considered include:

- Adverse impacts on commercial and recreational fish and shellfish populations (covered fully in Chapter 5) and any knock-on effects to commercial fisheries;
- Loss of or restricted access to fishing grounds during construction and operation;

- Safety issues for fishing vessels from navigation and entanglement of gear (detailed fully in Chapter 9); and
- Increased steaming time to/from fishing grounds.

53. The assessment of impacts listed above has been separately described for the Development Area and the Offshore Export Cable Corridor. For each of the assessments the potential impacts from construction, operation and decommissioning are considered.

54. As a result of salmon and sea trout fisheries being either in-river or coastal, it is considered that there will not be direct impacts to these fishing activities arising from the construction/decommissioning and operation of the windfarm. Assessment of the potential impacts on the ecology of these species is provided in Chapter 5 where only a minor impact to diadromous species ecology was determined across all identified impacts.

55. Potential impacts of decommissioning are considered to be equal to or lower than the worst case effects assessed for the construction phase as the export cable will be left in-situ. A decommissioning plan has been prepared in accordance with requirements of the Energy Act 2004 and will be subject to approval from the Department of Energy and Climate Change (DECC) prior to implementation.

14.3.1.1. Assessment Limitations

56. The predominant limitation of the impact assessment is the probable change in the commercial fisheries baseline over time due to a variety of reasons including:

- Fluctuations in landings;
- Changes in relevant legislation and/or management;
- Introduction of conservation areas e.g. Marine Protected Areas (MPAs);
- Changes to economic constraints (*e.g.* fuel costs, crew availability); and
- Environmental Constraints (*e.g.* weather).

57. For the purpose of this study the scope of the assessment is limited to the baseline that has been described. This assessment has assessed impacts which are project specific and cumulative relative to the commercial fishing grounds in the Regional Study Area.

58. ICES rectangles provide a useful baseline for data such as value on commercial fisheries in the area, however ICES rectangles have a much larger resolution than the project area. As a result of this ICES quantities and values are not specific to the Project and therefore values for the project will likely be lower than the total landings in the ICES rectangle.

59. Impacts on the ecology of commercially and recreationally important fish and shellfish species may indirectly affect commercial fishing activities during construction, operation and decommissioning. The assessment covering effects on fish and shellfish populations is given in Chapter 5. It should be noted that the methodology used to assess commercial fisheries largely differs from that used to assess impacts in the biological environment.

14.3.1.2. Significance Criteria

60. Significance criteria used for this commercial fisheries assessment can be seen below in Table 14-7, Table 14-8 and Table 14-9). There is currently no specific recognised methodology for the quantification of impacts on offshore windfarms on commercial fisheries, and therefore a level of professional judgement has been applied, taking account of the guidance listed in Section 14.1.1.

14.3.1.3. Sensitivity of Receptor

61. For this assessment receptors have been defined by fishery and identified as the following:

- The scallop fishery;
- The squid fishery;
- The creel fishery (targeting crabs and lobsters); and
- Demersal trawl fishery.

62. The sensitivity of the fishery may vary for different phases of the project (construction, operation and decommissioning). Sensitivities may also differ with each potential impact.

Table 14-7 Significance Criteria

Receptor Sensitivity	Example
Positive Impact	Change is likely to benefit the value of the receptor
No Impact	No impact on the receptor
Low	• Fishing vessels have a high amount of spatial adaptability due to operational range and/or ability to deploy a number of gear types. • Spatial tolerance of fishers due to their ability to fish a moderate number of fishing grounds. • High level of recoverability due to the ability to mitigate loss of fishing area by operating in a range of alternative areas.
Medium	• Fishing vessels have some spatial adaptability due to operational range and/or ability to deploy a number of gear types. • Moderate spatial tolerance of fishers due to their ability to fish a limited number of fishing grounds. • Limited recoverability due to the ability to mitigate loss of fishing area by operating in a range of alternative areas.
High	• Fishing vessels have low adaptability due to operational range and/or ability to deploy only one gear type. • Low spatial tolerance of fishers due to their ability to fish only one fishing ground. • Limited recoverability due to the ability to mitigate loss of fishing area by operating in a range of alternative areas.
Unknown	• Unknown effect requiring further data.

14.3.1.4. Magnitude of impacts

Table 14-8 Magnitude of Impacts

Magnitude	Definition
High	• In the proximity of high intensity fishing grounds which severely compromises the majority of the receptors fishing grounds. • Permanent duration (i.e. operational phase). • Severe impact as fishing activities cannot be undertaken in the Development Area.
Moderate	• In the proximity of fishing grounds which are frequently targeted which compromises a portion of receptor fishing grounds. • Temporary duration (i.e. during construction/decommissioning or during peak fishing season). • Fishing activities have a limited opportunity to adapt and there is a discernible reduction in the Development Area and Offshore Export Cable Corridor.
Low	• In the proximity of low intensity fishing grounds. • Short term or lying outside of peak fishing season. • Some amendment to fishing activities but no significant change.
Negligible	• Not in the proximity of fishing grounds or very low intensity fishing grounds. • Very short duration or in periods of very low fishing intensity. • No discernible or very minimal changes to fishing practices.

14.3.1.5. Significance of Impacts Matrix

63. The matrix used in the assessment in order to evaluate the significance of the impact, taking into consideration the sensitivity of the receptor and the magnitude of effect is detailed in Chapter 1. Those effects identified and assessed as being of moderate/major or major are considered to be significant.

64. The significance criteria in Table 14-7is not used in relation to health and safety of fishing vessels and crew, these are addressed separately in Chapter 9.

14.3.1.6. Design Envelope

65. The worst case development scenario design parameters which will have the greatest impact on commercial fisheries have been identified and are summarised in Table 14-9. A total of eight 6MW wind turbine generators (WTGs) have been considered throughout the worst case layout. WTGs are spaced a minimum of 1,000m (NNW / SSE orientation) and 2,200m (north / south orientation) apart.

66. There is the potential for the windfarm to cause indirect impacts to commercially important fish and shellfish from indirect effects to fish and shellfish ecology which are fully discussed in Chapter 5.

67. In addition there is the potential for the windfarm to constitute a physical obstacle and/or safety risk to the continuation of normal fishing activities as described in the baseline (Section 14.2 and Chapter 9).

68. It is not expected that commercial fishing activity will be completely excluded from the Offshore Export Cable Corridor during construction. However, safety zones/exclusion zones are considered to be in place around construction/tow vessels.

69. During the operational phase it is expected that the majority of fishing activities will be able to resume to some degree within the Development Area with the likelihood of safety/exclusion zones to be implemented around the WTGs. It is noted that due to certain gear types, configuration and mode of deployment that fishing methods including trawling and dredging may be restricted in their ability to operate as normal.

Table 14-9 Design Envelope

Potential Impact	Design Envelope Assessed
Construction and Decommissioning	
Adverse impacts on commercially exploited fish and shellfish populations	See Chapter 5.
Temporary loss of or restricted access to fishing grounds	Total Development Area: 110km^2, area of habitat likely to be lost: 0.129km^2. Maximum inter-array cables: 12 Inter-array Cable Length: 2.5km 500m safety/exclusion zone around construction works Export Cables: Max 2 with a maximum length of 15km Export Cable Burial and Protection: Target depth 1.5m. Localised burial, rock dump or mattressing. Mooring line radius: Max 9 x Water Depth and touchdown within 250 metres Mooring points: Up to 4 Mooring lines/points. Catenary Anchor - drag embedment anchors Anchor Chain, mooring cables and polyester mooring lines. Anchors and mooring system present on the seabed for up to 18 months prior to turbine installation

	Permanent submersible buoys at seabed for ROV recovery
Safety issues for fishing vessels	Fishing activities cannot be undertaken safely or resumed (see Chapter 9)
Increased steaming times	The maximum amount of infrastructure and associated exclusion zones in the Development Area thus resulting in the maximum amount of disruption to established steaming routes.
Operation	
Adverse impacts on commercially exploited fish and shellfish populations	See Chapter 5.
Complete loss of or restricted access to fishing grounds	Infrastructure resulting in the maximum loss of fishing ground: Export Cable Length: 15km Cables will be suitably buried to a depth of 1.5m (DECC, 2011) or protected by other means when burial is not practicable.
Safety issues for fishing vessels	Fishing activities cannot be undertaken in a safe manner (see Chapter 9)
Increased steaming times	The maximum amount of infrastructure and associated exclusion zones (500m) in the Development Area thus resulting in the maximum amount of disruption to established steaming routes.

14.3.1.7. Embedded Mitigation

70. For the purposes of the commercial fisheries assessment, the following embedded mitigation measures have been taken into consideration:

- A Regional working group will be established in order to provide a forum for collaborative discussion and action in relation to the Project.
- A construction management plan will be developed in consultation with the fishing industry representatives which establishes a protocol for engagement between KOWL and the fishing industry.
- 500m safety zones around working areas during construction, decommissioning and any major maintenance activities. Consultation with relevant stakeholders will ensure efficient and effective implementation and management of safety/exclusion zones.
- Structures within the Development Area will be marked and lit in accordance with International Association of Lighthouse Authorities (IALA) best practice and recommendations for the marking of offshore structures (IALA, 2008).
- Cables will be suitably buried as directed in the DECC (2011) guidance or will be protected by other means when burial is not practicable, this will help to reduce the risk of snagging fishing gear.
- Continued consultation and dissemination of information will be carried out to ensure information about the works are circulated through agreed procedures such as Notices to Mariners and Kingfisher to allow vessels to effectively and safely navigate around proposed sites.

14.4. Impact Assessment

71. Following the establishment of the baseline conditions, it is possible to assess the potential impacts from the project. The impacts which have been considered are based on impacts identified during the EIA scoping stage (see separate Scoping Report) and any further potential impacts which have been identified as the EIA has progressed.

14.4.1. Development Area Impact Assessment

72. Table 14-10 describes the considerations in describing the sensitivity of receptors undertaken within the Development Area Impact Assessment. The sensitivity is determined to be the same for each impact within the Development Area.

73. The *Nephrops* fishery has not been assessed due to the negligible nature of the recorded activity within the Development Area.

74. Chapter 5 concludes that there are no significant effects on populations of commercially important salmon and sea trout, with the highest significance identified as minor. Therefore no knock on effects from fish ecology are expected on salmon and sea trout fisheries. In addition fishing activities for salmon and sea trout have not been identified in the Development Area. As such salmon and sea trout fisheries have not been assessed for the Development Area.

Table 14-10 Receptor Sensitivity for Development Area Impact Assessment

Receptor	Consideration	Sensitivity
Scallop Fishery	The sensitivity of the scallop fishery recognises that there are scallop grounds which are fished within the Development Area. However it also takes into account the wider availability of grounds which are fished more intensively and the often nomadic nature of the fleet which may target grounds in other areas.	Low
Squid Fishery	The sensitivity of the squid fishery takes into consideration the limited activity recorded directly in the Development Area but there is also high levels of natural fluctuation in squid populations annually.	Low
Creel Fishery	The sensitivity of the creel fishery takes into account the limited activity of creeling vessels in the Development Area and recognises that the majority of creeling activity occurs in inshore waters.	Low
Demersal Fishery	The sensitivity of the demersal trawl fishery the limited activity recorded directly in the Development Area. However it also takes into account the wider availability of grounds which are fished more intensively and the often nomadic nature of the fleet which may target grounds in other areas	Low

75. In addition magnitude of effect has been determined to be low for all receptors and impacts identified within the Development Area (unless stated within the associated impact table). The magnitude of effect takes into consideration the temporary duration of the construction activities and temporary safety/exclusion areas during construction and prior to the WTG unit installation and fact that construction is confined to a very small area of locally available fishing grounds.

14.4.1.1. Effects of Construction

76. An assessment of the potential effects of the Development Area during construction is provided below. Note should be taken that only those fisheries sensitive to an effect are assessed in each instance.

Adverse Impacts on Commercial and Recreational Fish and Shellfish Populations

77. Construction activities which take place within the Development Area have the potential to result in adverse impacts on commercial fish and shellfish populations (see Chapter 5) and therefore affect the fisheries which target those species. As described in Section 14.4 the principle commercial species targeted within the Development Area, which fall within ICES rectangles 42E8 and 43E8, are scallops, crab and lobster.

Temporary Loss or Restricted Access to Traditional Fishing Grounds

78. The monetary value of landings from within the proposed turbine deployment area is relatively low when taken into context the values of grounds around Scotland. The principle commercial species targeted by gear type are scallop dredging for scallop and demersal trawling for haddock and squid.

79. Safety/exclusion zones of 500m around areas of offshore works are likely to be present during the construction and installation phase, this will exclude all vessels (with the exception of construction vessels), including fishing vessels. Exclusion zones will be in place for the duration of the

construction phase at locations within the Development Area. Due to the seasonality of fishing activity in the area (broadly speaking, summer months record the highest levels of fishing activity), the impact of these safety zones will vary depending on the time of year. However, relative to the Development Area and the area of available fishing grounds in the area and the temporary construction time, the Project Area will constitute a very small area.

80. Following the installation of the anchors and the mooring system, there will likely be a lag time of up to 12 months before the WTG units hook-up (see Chapter 2). Therefore the seabed infrastructure may pose a risk to fishing vessels through entanglement of gear and navigational issues (navigation risk is covered in full in Chapter 9). Information on the location of the infrastructure will be provided to fishermen via FishSafe.

81. Fisheries most affected by the temporary loss or the restricted access to fishing grounds within the Development Area are predominantly the scallop fishery and to a lesser extent the squid fishery. Discussions with SFF noted that the Development Area is popular for squid and scallop fishing. This is supported by the landings data.

82. The significance of the effect of temporary loss or restricted access to fishing grounds during the construction phase is given in Table 14-11.

Table 14-11 Temporary Loss or Restriction of Access to Fishing Grounds in the Development Area

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Temporary Loss or Restriction of Access to Fishing Grounds in the Development Area	Scallop Fishery	Low There are scallop grounds which are fished within the Development Area. However there is wider availability of grounds which are fished more intensively. In addition, the often nomadic nature of the fleet enable the fleet to target grounds in other areas.	Low Due to the small scale of the project and temporary nature of construction works.	Minor
	Squid Fishery	Low There is limited activity recorded directly in the Development Area but there is also high levels of natural fluctuation in squid populations annually.		Minor
	Creel Fishery	Low There is limited activity of creeling vessels in the Development Area and recognises that the majority of creeling activity occurs in inshore waters.		Minor
	Demersal Fishery	Low There is limited activity recorded directly in the Development Area. However it also takes into account the wider availability of grounds which are fished more intensively and the often nomadic nature of the fleet which may target grounds in other areas		Minor

Safety Issues for Fishing Vessels from Navigation and Entanglement of Gear

83. An assessment of safety issues relating to commercial fishing vessels as a result of construction activities within the Development Area is fully described in Chapter 9. An assessment of safety issues relating to commercial fishing vessels as a result of construction activities within the Development Area is fully described in Chapter 9. This concludes that there will be a negligible/minor significance of effect with regards to safety issues for fishing vessels from navigation and entanglement of gear.

Increased Steaming Time to Fishing Grounds

84. Implementation of safety/exclusion zones within the Development Area could result in diversions for fishing vessels which may result in increases in steaming times for fishing vessels leading to increased operating costs (e.g. fuel).

85. Surveys undertaken for Chapter 9 indicate that low numbers of vessels were recorded in the area, with the majority of vessels recorded as passing through the area. In the areas which identified fishing activity, the majority were recorded within shallower (less than 50m) waters in closer proximity to the shore.

86. Due to the size of the construction work exclusion area (500m) within the Development Area, fishing vessels will not have to transit any considerable distance from normal routes. In addition during construction this will be short term.

Table 14-12 Increased Steaming Time to Fishing Grounds in the Development Area

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Increased Steaming Time to Fishing Grounds in the Development Area	Scallop Fishery	Low There are scallop grounds which are fished within the Development Area. However there is wider availability of grounds which are fished more intensively. In addition, the often nomadic nature of the fleet enable the fleet to target grounds in other areas.	Low The size of construction work exclusion area is only 500m and therefore fishing vessels will not have to transit considerable distances from normal routes. In addition the construction works are small scale and temporary	Minor
	Squid Fishery	Low There is limited activity recorded directly in the Development Area but there is also high levels of natural fluctuation in squid populations annually.		Minor
	Creel Fishery	Low There is limited activity of creeling vessels in the Development Area and recognises that the majority of creeling activity occurs in inshore waters.		Minor
	Demersal Fishery	Low There is limited activity recorded directly in the Development Area. However it also takes into account the wider availability of grounds which are fished more intensively and the often nomadic nature of the fleet which may target grounds in other areas		Minor

14.4.1.2. Effects of Operation and Maintenance (O&M)

87. An assessment of the potential effects of the floating windfarm and associated structures within the Development Area during operation and maintenance is provided in the sections below. Note should be taken that only those fisheries sensitive to an effect are assessed in each instance.

88. In the instance of the salmon and the sea trout fishery, only the adverse effects identified on commercial and recreational fish and shellfish populations are relevant to the assessment. Chapter 5 identifies that there are no significant effects on populations of commercially important salmon and sea trout, with the highest significance identified as minor. Therefore no knock on effects from fish ecology are expected on salmon and sea trout fisheries

89. The impacts which are described are considered within the context of the operational life of the Windfarm and associated structures (20 years).

Adverse Impacts on Commercial and Recreational Fish and Shellfish Populations

90. O&M activities which take place within the Development Area have the potential to result in adverse impacts on commercial fish and shellfish populations through disruption of spawning and nursery habitats (see Chapter 5) and therefore affect the fisheries which target those species. As described in Section 14.3.1 the principle commercial species targeted within the Development Area, which falls within ICES rectangles 42E8 and 43E8, are scallops, crab and lobster.

Complete Loss or Restricted Access to Traditional Fishing Grounds

91. The Project will be operational for 20 years and during this time fishing within the turbine deployment area will be restricted around each WTG to a distance of 500m (worst case). The plans for safety/exclusion zones, either as compulsory or advisory, will need to be agreed with DECC, the MCA and Marine Scotland pre construction. The primary risk for fishing vessels is identified as the presence of mid water mooring lines and inter-array cables which may pose a snagging risk for gear.

92. It is considered that fishing activities, particularly towing gear such as demersal trawls and scallop dredgers, cannot safely occur in the area of the windfarm site due to safety risks posed by the increase in infrastructure to the seabed. However the size and scale of Development will only exclude a small area in relation to the available fishing areas in the region.

93. Prior to commercial fishing activity taking place within the site, it is recommended that post-construction surveys are undertaken to ensure that the seabed is at a reasonable and acceptable standard for fishing activities to be safely resumed.

Table 14-13 Complete Loss or Restricted Access to Fishing Grounds in the Development Area

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Complete Loss or Restricted Access to Fishing Grounds in the Development Area	Scallop Fishery	Low There are scallop grounds which are fished within the Development Area. However there is wider availability of grounds which are fished more intensively. In addition, the often nomadic nature of the fleet enable the fleet to target grounds in other areas.	Low The size and scale of Development will only exclude a small area in relation to the available fishing areas in the region.	Minor
	Squid Fishery	Low There is limited activity recorded directly in the Development Area but there is also high levels of natural fluctuation in squid populations annually.		Minor

	Creel Fishery	Low There is limited activity of creeling vessels in the Development Area and recognises that the majority of creeling activity occurs in inshore waters.		Minor
	Demersal Fishery	Low There is limited activity recorded directly in the Development Area. However it also takes into account the wider availability of grounds which are fished more intensively and the often nomadic nature of the fleet which may target grounds in other areas		Minor

Safety Issues for Fishing Vessels from Navigation and Entanglement of Gear

94. An assessment of safety issues relating to commercial fishing vessels as a result of construction activities within the Development Area is fully described in Chapter 9. This concludes that there will be a negligible/minor significance of effect with regards to safety issues for fishing vessels from navigation and entanglement of gear.

Increased Steaming Time to Fishing Grounds

95. 500m safety/exclusion zones will be established around structures in the Development Area (or an appropriate size in order to safely encompass the footprint), from which fishing vessels will be excluded. Relative to the Development Area, the exclusion zones are small, which will require minimal deviation to steaming routes.

96. In addition, Chapter 9 indicates that low numbers of vessels were recorded in the area, with the majority of vessels recorded as passing through the area. In the areas which identified fishing activity, the majority were recorded within shallower (less than 50m) waters in closer proximity to the shore.

Table 14-14 Increased Steaming Time to Fishing Ground During O&M of the Development Area

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Increased Steaming Time to Fishing Ground During O&M of the Development Area	Scallop Fishery	Low There are scallop grounds which are fished within the Development Area. However there is wider availability of grounds which are fished more intensively. In addition, the often nomadic nature of the fleet enable the fleet to target grounds in other areas.	Low Relative to the Development Area, the exclusion zones are small, which will require minimal deviation to steaming routes.	Minor
	Squid Fishery	Low There is limited activity recorded directly in the Development Area but there is also high levels of natural fluctuation in squid populations annually.		Minor
	Creel Fishery	Low There is limited activity of creeling vessels in the		Minor

		Development Area and recognises that the majority of creeling activity occurs in inshore waters.		
	Demersal Fishery	Low There is limited activity recorded directly in the Development Area. However it also takes into account the wider availability of grounds which are fished more intensively and the often nomadic nature of the fleet which may target grounds in other areas		Minor

14.4.1.3. Effects of Decommissioning

97. The potential effects of decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed for the construction phase as the export cable will be left in-situ. The approach to decommissioning is described in Chapter 2. A decommissioning plan will be prepared in accordance with requirements of the Energy Act 2004 and will be subject to approval from DECC prior to implementation.

14.4.2. Offshore Export Cable Corridor Impact Assessment

98. An assessment of the potential effects of the Offshore Export Cable Corridor during construction is provided below. Note should be taken that only those fisheries sensitive to an effect are assessed in each instance.

99. Table 14-15 describes the considerations in describing the sensitivity of receptors undertaken within the Development Area Impact Assessment. The sensitivity is determined to be the same for each impact within the Development Area.

100. The *Nephrops* fishery has not been assessed due to the negligible nature of the recorded activity within the Development Area.

101. Chapter 5 concludes that there are no significant effects on populations of commercially important salmon and sea trout, with the highest significance identified as minor. Therefore no knock on effects from fish ecology are expected on salmon and sea trout fisheries. As such salmon and sea trout fisheries have not been assessed for the Offshore Export Cable Corridor.

Table 14-15 Receptor Sensitivity for Development Area Impact Assessment

Receptor	Consideration	Sensitivity
Scallop Fishery	The sensitivity of the scallop fishery recognises that there are scallop grounds which are fished within the Offshore Export Cable Corridor, however it also takes into account the wider availability of grounds which are fished more intensively, the often nomadic nature of the fleet which may target grounds around Scotland and the limited activity in the ICES rectangle.	Low
Squid Fishery	The sensitivity of the squid fishery takes into consideration the limited activity recorded directly in the Offshore Export Cable Corridor but there is also high levels of natural fluctuation annually.	Low
Creel Fishery	The sensitivity of the creel fishery takes into account the higher proportion of smaller vessel activity in the Offshore Export Cable Corridor, their limited range and the discrete location of fishing grounds and recognises that the majority of creeling activity occurs in inshore waters.	Low
Demersal Fishery	The sensitivity of the demersal fishery recognises that there are trawling grounds which are fished within the Offshore Export Cable Corridor, however it also takes into account the wider availability of grounds which are fished more intensively, the often nomadic nature of the fleet which may target grounds around Scotland and the limited activity in the ICES rectangle.	Low

102. In addition magnitude of effect has been determined to be low for all receptors and impacts identified within the Offshore Export Cable Corridor (unless stated within the associated impact table). The magnitude of effect takes into consideration the temporary duration of the construction activities and temporary safety/exclusion areas during construction and prior to the WTG unit installation and fact that construction is confined to a very small area of locally available fishing grounds.

14.4.2.1. Effects of Construction

103. The Offshore Export Cable Corridor assessment includes all Export Cables and all associated cable protection. The assessment considers a maximum of two Alternating Current (AC) cables installed in a trench with a maximum width of 3m. Installation of the Export Cables is expected to last for less than. The approximate length of the Offshore Export Cable Corridor is 15km, from the Development Area to landfall.

Adverse Impacts on Commercial and Recreational Fish and Shellfish Populations

104. Construction activities which take place within the Offshore Export Cable Corridor have the potential to result in adverse impacts on commercial fish and shellfish populations and therefore affect the fisheries which target those species (see Chapter 5). As described in Section 14.4 the principle commercial species targeted within the Offshore Export Cable Corridor, which falls within ICES rectangle 43E7, are crab, scallops and lobster.

Temporary Loss or restricted Access to Fishing Grounds

105. The principle effects of the construction/installation of the Offshore Export Cables are as follows:

- Safety/exclusion zones of 500m around construction activities; and
- Additional temporary loss of fishing grounds in the Offshore Export Cable Corridor until the area is confirmed to be safe for fishing activities to be resumed.

106. The Offshore Export Cables will be suitably buried to a depth of 1.5m in accordance with DECC Guidelines (2011) or will be protected by other means such as rock placement or mattresses, when burial is not practicable.

107. It is considered that there will be a temporary loss of access to fishing grounds as installation activities proceed due to the safety risks associated with fishing in the vicinity of the installed Export Cable (such as snagging on cables or as a result to changes in the seabed). Fishing vessels will be excluded from specific areas until post-installation surveys confirm the status of the seabed, and if necessary any correction measures have been undertaken for the area.

108. Commercial fisheries which are identified as being affected by the temporary loss of access to fishing grounds are:

- Boat dredging for scallops;
- Trawling for squid which vary on an annual basis; and
- Creeling for crab and lobster in the inshore section of the Offshore Export Cable Corridor, and in proximity to the Development Area to a lesser extent.

109. For this assessment it has also been assumed that the installation period and associated temporary loss of fishing grounds will encompass some peak seasonal periods for all the affected fisheries. Seasonality of fisheries should be considered for the installation schedule of the Export Cables. Generally fishing in rectangle 43E7 is highest in the summer months (July to September) for lobster and crab.

110. Within ICES 43E7 there is a higher proportion of smaller, locally based vessels which are likely to be restricted to fishing grounds closer to their home ports. This therefore increases their sensitivity to impact. The Project area is not as important for the inshore fleet as the surrounding area (Figure 14-3). Creeling is the predominate fishing activity within the inshore areas, ScotMap data (Figure 15-6) indicate that only low values for creeling were recorded from under 15m vessels on average between 2007-2011.

111. Larger vessels are generally less sensitive to loss in grounds due to their higher operational ranges and the nomadic nature of a large proportion of vessels targeting the fishery in the area.

Table 14-16 Temporary Loss or Restricted Access to Fishing Grounds in the Offshore Export Cable Corridor

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Temporary Loss or Restricted Access to Fishing Grounds in the Offshore Export Cable Corridor	Scallop Fishery	Low The sensitivity of the scallop fishery recognises that there are scallop grounds which are fished within the Offshore Export Cable Corridor, however it also takes into account the wider availability of grounds which are fished more intensively, the often nomadic nature of the fleet which may target grounds around Scotland and the limited activity in the ICES rectangle.	Low Construction of the Offshore Export Cable Corridor will be of short duration and temporary. In addition construction exclusion zones will only 500m.	Minor
	Squid Fishery	Low The sensitivity of the squid fishery takes into consideration the limited activity recorded directly in the Offshore Export Cable Corridor but there is also high levels of natural fluctuation annually.		Minor
	Creel Fishery	Low The sensitivity of the creel fishery takes into account the higher proportion of smaller vessel activity in the Offshore Export Cable Corridor, their limited range and the discrete location of fishing grounds and recognises that the majority of creeling activity occurs in inshore waters.		Minor
	Demersal Fishery	Low The sensitivity of the demersal fishery recognises that there are trawling grounds which are fished within the Offshore Export Cable Corridor, however it also takes into account the wider availability of grounds which are fished more intensively, the often nomadic nature of the fleet which may target grounds around Scotland and the limited activity in the ICES rectangle.		Minor

Safety Issues for Fishing Vessels from Navigation and Entanglement of Gear

112. An assessment of safety issues relating to commercial fishing vessels as a result of construction activities within the Development Area is fully described in Chapter 9. An assessment of safety issues relating to commercial fishing vessels as a result of construction activities within the Development Area is fully described in Chapter 9. This concludes that there will be a negligible/minor significance of effect with regards to safety issues for fishing vessels from navigation and entanglement of gear.

Increased Steaming Time to Fishing Grounds

113. The introduction of 500m safety/exclusion zones during in the Export Cable installation may result in short term increases in steaming distances and times and therefore result in higher operation costs for vessels through increased fuel use.

114. In terms of increases to steaming times during construction, local fishing vessels will be made aware of installation and cable laying activities though notices to mariners and fisheries liaison (embedded mitigation measures).

115. Those vessels which are not local to the area will be made aware of installation activities through day marks and lights used by cable laying vessels to warn passing vessels of restrictions in manoeuvrability. Therefore fishing vessels should be able to re-route around installation vessels temporarily on lower use routes to fishing grounds.

116. The safety/exclusion zones implemented during installation will be small and in transitory locations along the Offshore Export Cable Corridor. This will result in a limited spatial extent and duration of effect in relation to all available fishing grounds in the regional and local study areas.

Table 14-17 Increased Steaming Time to Fishing Grounds during O&M in the Offshore Export Cable Corridor

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Increased Steaming Time to Fishing Grounds during O&M in the Offshore Export Cable Corridor	Scallop Fishery	Low The sensitivity of the scallop fishery recognises that there are scallop grounds which are fished within the Offshore Export Cable Corridor, however it also takes into account the wider availability of grounds which are fished more intensively, the often nomadic nature of the fleet which may target grounds around Scotland and the limited activity in the ICES rectangle.	Low	Minor
	Squid Fishery	Low The sensitivity of the squid fishery takes into consideration the limited activity recorded directly in the Offshore Export Cable Corridor but there is also high levels of natural fluctuation annually.		Minor
	Creel Fishery	Low The sensitivity of the creel fishery takes into account the higher proportion of smaller vessel activity in the Offshore Export Cable Corridor, their limited range and the discrete location of fishing grounds and recognises that the majority of creeling activity occurs in inshore waters.		Minor
	Demersal Fishery	Low The sensitivity of the demersal fishery recognises that there are trawling grounds which are fished within the Offshore Export Cable Corridor, however it also takes into account the wider availability of grounds which are fished more intensively, the often nomadic nature of the fleet which		Minor

		may target grounds around Scotland and the limited activity in the ICES rectangle.		

14.4.2.2. Effects of Operation and Maintenance

117. An assessment of the potential effects of the Offshore Export Cables during operation is provided in the section below. It should be noted that only fisheries sensitive to an effect are assessed. Impacts described are considered in the context of the operational life of the project (25 years). As mentioned previously, trends in fishing activities are difficult to establish over long time periods and therefore the impacts are assessed based on the current baseline conditions, of which the limitations are recognised.

Adverse impacts on Commercial and Recreational Fish and Shellfish Populations

118. Construction activities which take place within the Offshore Export Cable Corridor have the potential to result in adverse impacts on commercial fish and shellfish populations and therefore affect the fisheries which target those species (see Chapter 5). As described in Section 14.4 the principle commercial species targeted within the Offshore Export Cable Corridor, which falls within ICES rectangle 43E7, are crab, scallops and lobster.

Complete Loss or Restricted Access to Fishing Grounds

119. Where possible the Offshore Export Cables will be buried to a depth of 1.5m (DECC, 2011) or protected where burial is not practicable e.g. by rock placement or mattresses. Fishing vessels should be able to resume normal activities once the protocol for the removal of temporary construction/installation works and any post construction works, including appropriate verification has been implemented. This will all be completed during the construction phase.

120. Fishing activities should be able to continue safely in the area. As such, the Operational Offshore Export Cables are not considered to have a discernible effect on fishing activities. In addition there will be no change to the access of grounds associated with the identified fisheries.

Table 14-18 Complete Loss or Restricted Access to Fishing grounds during O&M in the Offshore Export Cable Corridor

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Complete Loss or Restricted Access to Fishing grounds during O&M in the Offshore Export Cable Corridor	Scallop Fishery	Low The sensitivity of the scallop fishery recognises that there are scallop grounds which are fished within the Offshore Export Cable Corridor, however it also takes into account the wider availability of grounds which are fished more intensively, the often nomadic nature of the fleet which may target grounds around Scotland and the limited activity in the ICES rectangle.	Negligible Fishing vessels should be able to resume normal activities once the protocol for the removal of temporary construction/installation works and any post construction works, including appropriate verification has been implemented.	Negligible/Minor
	Squid Fishery	Low The sensitivity of the squid fishery takes into consideration the limited activity recorded directly in the Offshore Export Cable Corridor but there is also high levels of natural fluctuation annually.		Negligible/Minor
	Creel Fishery	Low The sensitivity of the creel fishery takes into account the higher proportion of smaller vessel		Negligible/Minor

		activity in the Offshore Export Cable Corridor, their limited range and the discrete location of fishing grounds and recognises that the majority of creeling activity occurs in inshore waters.		
	Demersal Fishery	Low The sensitivity of the demersal fishery recognises that there are trawling grounds which are fished within the Offshore Export Cable Corridor, however it also takes into account the wider availability of grounds which are fished more intensively, the often nomadic nature of the fleet which may target grounds around Scotland and the limited activity in the ICES rectangle.		Negligible/Minor

Safety Issues for Fishing Vessels from Navigation and Entanglement of Gear

121. An assessment of safety issues relating to commercial fishing vessels as a result of construction activities within the Development Area is fully described in Chapter 9. This concludes that there will be a negligible/minor significance of effect with regards to safety issues for fishing vessels from navigation and entanglement of gear.

122. Provided that cable protection measures are satisfactorily completed and protocol for removal of temporary works post construction including appropriate verification has been implemented to confirm that fishing activities can resume safely, there are no unacceptable safety risks to fishing vessels during the operation of the Offshore Export Cable.

Increased Steaming Times to Fishing Grounds

123. The operational aspect of the Offshore Export Cables are not considered to have any distinct effect on the steaming times of vessels to fishing grounds, therefore the sensitivity of fishing vessels from the identified fisheries is considered to be low and the magnitude of effect is therefore negligible.

Table 14-19 Increased Steaming Times to Fishing Grounds during Operations for the Offshore Export Cable

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Increased Steaming Times to Fishing Grounds during Operations for the Offshore Export Cable	Scallop Fishery	Low The sensitivity of the scallop fishery recognises that there are scallop grounds which are fished within the Offshore Export Cable Corridor, however it also takes into account the wider availability of grounds which are fished more intensively, the often nomadic nature of the fleet which may target grounds around Scotland and the limited activity in the ICES rectangle.	Negligible The operational aspect of the Offshore Export Cables are not considered to have any distinct effect on the steaming times of vessels to fishing grounds	Negligible/Minor
	Squid Fishery	Low The sensitivity of the squid fishery takes into consideration the limited activity recorded directly in the Offshore Export Cable Corridor but there is also high levels of natural fluctuation annually.		Negligible/Minor

	Creel Fishery	Low The sensitivity of the creel fishery takes into account the higher proportion of smaller vessel activity in the Offshore Export Cable Corridor, their limited range and the discrete location of fishing grounds and recognises that the majority of creeling activity occurs in inshore waters.			Negligible/Minor
	Demersal Fishery	Low The sensitivity of the demersal fishery recognises that there are trawling grounds which are fished within the Offshore Export Cable Corridor, however it also takes into account the wider availability of grounds which are fished more intensively, the often nomadic nature of the fleet which may target grounds around Scotland and the limited activity in the ICES rectangle.			Negligible/Minor

14.4.2.3. Effects of Decommissioning

124. The potential effects of decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed for the construction phase as the export cable will be left in-situ. The approach to decommissioning is described in Chapter 2. A decommissioning plan will be prepared in accordance with requirements of the Energy Act 2004 and will be subject to approval from DECC prior to implementation.

14.5. Mitigation

125. Although significant impacts are all classed as low the following mitigation measures based on FLOWW guidelines will be implemented:

- A Fisheries Liaison Officer (FLO) will be appointed for the Project in order to ensure that fishermen are informed in advance of installation plans and to answer queries raised by fishermen;
- Details of the project will be included in updated Kingfisher fishermen's awareness charts and FishSAFE; and
- Additional mitigation measures for all shipping and navigation have been identified in Chapter 9.

14.6. Commercial Fisheries Monitoring

126. No additional monitoring is currently suggested for commercial fishing activities. A monitoring plan and the need/type of monitoring activities will be discussed further with Marine Scotland and the Fisheries Liaison Officer (FLO) as the project develops.

14.7. Cumulative Impacts

127. The potential cumulative impacts for the Development Area and the Offshore Export Cable Corridor during construction/decommissioning and operation phases are assessed below.

128. Cumulative impacts from the effects of the Project in conjunction with other projects and activities are described in Section 14.7.1 below. KOWL recognises that some of these projects could potentially contribute to cumulative impacts on commercial fish receptors. For the commercial fish receptors and projects, the scale, nature and the distance of the Project suggests that they will not interact with a significant proportion of any of the receptors which could result in a cumulative impact occurring.

14.7.1. The Project

129. For the purposes of this assessment, a fishery is considered to have the potential to sustain a cumulative impact only if it is affected by the Project components.

130. As described in the individual assessments, the main fisheries affected are the scallop (particularly in the Development Area), squid, and lobster and crab fisheries.

131. The potential for the Development Area and the Offshore Export Cable to have a cumulative effect on commercial fish and shellfish populations is discussed in Chapter 5.

14.7.1.1. Potential Cumulative Impacts during Construction/Installation

132. Cumulative and in-combination impacts on commercial fisheries during construction/installation include:

- Temporary loss/restriction of access to fishing grounds;
- Safety issues for fishing vessels (assessed in detail in Chapter 10); and
- Increased steaming time to fishing grounds.

Temporary loss/restriction of access to fishing grounds

133. There may be a small cumulative increase of effect as a result of temporary loss/restriction of access to fishing grounds for all fisheries. This is not likely to increase in significance (see Table 4-20 taking into account the following:

- Spatial aspects of the fisheries,
- Size and scale of the Project,
- Phased construction approach.

134. The inter-array cables are due to be installed first, followed by the anchors, and then export cables, before the floating structures and WTGs are towed to site. In addition there is a limited amount of fishing activity in the Development Area and particularly within the Offshore Export Cable Corridor.

Table 14-20 Potential Cumulative Impacts relating to Temporary Loss/Restriction to Fishing Grounds

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Potential Cumulative Impacts relating to Temporary Loss/Restriction to Fishing Grounds	Scallop Fishery	Low The sensitivity of the scallop fishery recognises that there are scallop grounds which are fished within the Offshore Export Cable Corridor, however it also takes into account the wider availability of grounds which are fished more intensively, the often nomadic nature of the fleet which may target grounds around Scotland and the limited activity in the ICES rectangle.	Low Due to the spatial aspects of the fisheries, size and scale of the Project and phased construction approach	Minor
	Squid Fishery	Low The sensitivity of the squid fishery takes into consideration the limited activity recorded directly in the Development Area but there is also high levels of natural fluctuation annually.		Minor

	Creel Fishery	Low The sensitivity of the creel fishery takes into account the higher proportion of smaller vessel activity in the Offshore Export Cable Corridor, their limited range and the discrete location of fishing grounds and recognises that the majority of creeling activity occurs in inshore waters.		Minor
	Demersal Fishery	Low The sensitivity of the demersal fishery recognises that there are trawling grounds which are fished within the Offshore Export Cable Corridor, however it also takes into account the wider availability of grounds which are fished more intensively, the often nomadic nature of the fleet which may target grounds around Scotland and the limited activity in the ICES rectangle.		Minor

Safety issues for fishing vessels

135. For all fishing activities there are no unacceptable safety risks, from a cumulative perspective, where there are designated safety/exclusion zones. Cumulative safety issues are discussed in more detail in Chapter 9.

Increased Steaming Time to Fishing Grounds

136. For all fishing activities identified in the region (scallop, lobster and crab) the significance of the impact is considered to be minor resulting. This is due to the low sensitivity of the fisheries and low magnitude of effect from the safety/exclusion zones during the construction/installation phase.

Table 14-21 Potential Cumulative Impacts Relating to Increased Steaming time to Fishing Grounds

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Cumulative Impacts Relating to Increased Steaming time to Fishing Grounds	Scallop Fishery	Low The sensitivity of the scallop fishery recognises that there are scallop grounds which are fished within the Offshore Export Cable Corridor, however it also takes into account the wider availability of grounds which are fished more intensively, the often nomadic nature of the fleet which may target grounds around Scotland and the limited activity in the ICES rectangle.	Low Safety/exclusion zones will be present during construction but these will be only 500m. In addition the construction period is temporary and phased.	Minor
	Squid Fishery	Low The sensitivity of the squid fishery takes into consideration the limited activity recorded		Minor

		directly in the Development Area but there is also high levels of natural fluctuation annually.		
	Creel Fishery	Low The sensitivity of the creel fishery takes into account the higher proportion of smaller vessel activity in the Offshore Export Cable Corridor, their limited range and the discrete location of fishing grounds and recognises that the majority of creeling activity occurs in inshore waters.		Minor
	Demersal Fishery	Low The sensitivity of the demersal fishery recognises that there are trawling grounds which are fished within the Offshore Export Cable Corridor, however it also takes into account the wider availability of grounds which are fished more intensively, the often nomadic nature of the fleet which may target grounds around Scotland and the limited activity in the ICES rectangle.		Minor

14.7.1.2. Potential Cumulative Impacts during Operation

137. Cumulative impacts on commercial fisheries during operation include:

- Complete loss/restriction of access to fishing grounds;
- Safety issues for fishing vessels (assessed in detail in Chapter 9); and
- Increased steaming time to fishing grounds.

Complete Loss or Restricted Access to Fishing Grounds

138. During the 25 year operational phase of the Project there may be safety/exclusion zones which will restrict fishing vessels from around the WTG units and mooring systems. However this is still is discussion with the MCA at this stage. For the purposes of this assessment, the safety/exclusion zones have been assessed. The size, scale and distance of the development it is considered that there will be a minor significance during operation in the Development Area and the Offshore Export Cable Corridor.

Table 14-22 Potential Cumulative Impacts relation to Complete Loss or Restricted Access to Fishing Grounds during Operation

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Cumulative Impacts relation to Complete Loss or Restricted Access to Fishing Grounds during Operation	Scallop Fishery	Low The sensitivity of the scallop fishery recognises that there are scallop grounds which are fished within the Offshore Export Cable Corridor, however it also takes into account the wider availability of grounds which are fished more intensively, the often nomadic nature of the fleet which may target grounds around Scotland and the limited activity in the ICES rectangle.	Low Due to the small size and scale of the Project.	Minor

	Squid Fishery	Low The sensitivity of the squid fishery takes into consideration the limited activity recorded directly in the Development Area but there is also high levels of natural fluctuation annually.		Minor
	Creel Fishery	Low The sensitivity of the creel fishery takes into account the higher proportion of smaller vessel activity in the Offshore Export Cable Corridor, their limited range and the discrete location of fishing grounds and recognises that the majority of creeling activity occurs in inshore waters.		Minor
	Demersal Fishery	Low The sensitivity of the demersal fishery recognises that there are trawling grounds which are fished within the Offshore Export Cable Corridor, however it also takes into account the wider availability of grounds which are fished more intensively, the often nomadic nature of the fleet which may target grounds around Scotland and the limited activity in the ICES rectangle.		Minor

Safety issues for fishing vessels

139. For all fishing activities there are no safety risks for all operational infrastructure within the designated safety/exclusion zones. A full discussion of cumulative impacts regarding safety of vessels is detailed in Chapter 9.

Increased Steaming Time to Fishing Grounds

140. For all fishing activities identified in the region (scallop, lobster and crab) the significance of the impact is considered to be minor resulting from low sensitivity of the fisheries and low magnitude of effect from the negligible impact from the Offshore Export Cables, the size and scale of the project and discrete nature of any safety/exclusion zones.

Table 14-23 Potential Cumulative Impacts relation to Increased Steaming Time to Fishing Grounds during Operation

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Cumulative Impacts relation to Increased Steaming Time to Fishing Grounds during Operation	Scallop Fishery	Low The sensitivity of the scallop fishery recognises that there are scallop grounds which are fished within the Development Area and Offshore Export Cable Corridor, however it also takes into account the wider availability of grounds which are fished more intensively, the often nomadic nature of the fleet which may target grounds around Scotland and the limited activity in the ICES rectangles.	Low Due to the negligible impact from the Offshore Export Cables, the size and scale of the project and discrete nature of any safety/exclusion zones.	Minor

	Squid Fishery	Low The sensitivity of the squid fishery takes into consideration the limited activity recorded directly in the Development Area and Offshore Export Cable Corridor but there is also high levels of natural fluctuation annually.		Minor
	Creel Fishery	Low The sensitivity of the creel fishery takes into account the higher proportion of smaller vessel activity in the Offshore Export Cable Corridor, their limited range and the discrete location of fishing grounds and recognises that the majority of creeling activity occurs in inshore waters and the limited activity in the Development Area		Minor
	Demersal Fishery	Low The sensitivity of the demersal fishery recognises that there are trawling grounds which are fished within the Offshore Export Cable Corridor, however it also takes into account the wider availability of grounds which are fished more intensively, the often nomadic nature of the fleet which may target grounds around Scotland and the limited activity in the ICES rectangle.		Minor

14.7.2. Other Projects

141. The following section describes the in-combination impacts arising from the impacts of the Project in conjunction with other relevant marine and coastal developments which have the potential to interact with the Project and the identified fisheries in the area.

142. The consideration of which projects may result in potential cumulative or in-combination impacts is based on the results of the project-specific impact assessment and expert judgement. Having considered the information which is publicly available at the time of writing, projects for which there may be a potential cumulative or in-combination impact in relation to commercial fisheries are:

- NorthConnect;
- Eastern HVDC Link;
- Hywind Scotland Pilot Park Project (also known as the Buchan Deep Demonstration Site;
- European Offshore Wind Deployment Centre (EOWDC);
- Inch Cape Offshore Windfarm;
- Seagreen;
- Neart ne Gaoithe;
- Beatrice Offshore Windfarm; and
- Moray Firth Offshore Windfarm R3 Zone.

143. Table 14-24 below provides details of the offshore wind projects identified.

Table 14-24 Projects Considered for Cumulative Impacts

	Project name	Distance from Pilot Park	Project developer	High level description	Project status
Offshore windfarm projects					
1	European Offshore Wind Deployment Centre (EOWFL)	17km	Aberdeen Offshore Windfarm Ltd	Offshore wind turbine deployment centre for 11 turbines with up to 100 MW capacity.	Consented.
2	Seagreen Alpha Offshore Windfarm and Seagreen Bravo Offshore Windfarm	34km	Seagreen Wind Energy Limited	Offshore windfarm and export cabling to be developed in three Phases with a total target capacity of 3.5 GW. Phase 1: Alpha and Bravo. 1,050 MW, export cable to Carnoustie in Angus. Phase 2: Charlie, Delta and Echo. Phase 3: Foxtrot and Golf.	Phase 1 – consented. Phase 2 & 3 – EIA Scoping Opinion issued.
3	Hywind Scotland Pilot Park	45km	Statoil	Pilot project for five 6MW floating wind turbines	Consented
4	Inch Cape Offshore Windfarm	47km	Inch Cape Offshore Windfarm Ltd	Offshore windfarm up to 213 turbines, covering an area of up to 150 km^2 with capacity of approximately 1,000 MW.	Consented.
5	Neart na Gaoithe Offshore Windfarm	74km	Mainstream Renewable Power	Offshore windfarm, 75 - 125 turbines, 450 MW with 33 km export cable to shore.	Consented. Offshore construction due to begin in 2015 subject to consent.
6	Moray Offshore Renewables Windfarm (eastern Development Area)	125km	Moray Offshore Renewables Ltd (MORL)	A 1,500 MW windfarm over an area of 125 km2 in the outer Moray Firth. Includes an export cable approximately 105 km in length offshore to Fraserburgh and 30 km onshore to substation.	1.116 MW consented. Construction planned to begin Q3 2015 to full generation in Q3 2020.
7	Beatrice Offshore Windfarm Ltd (BOWL)	150km	SSE	An offshore windfarm with a maximum of 227 offshore turbines, generating up to 1,000 MW in the outer Moray Firth. Includes an electrical transmission cable along a 65 km corridor to the shore at Portgordon and 20 km of onshore cable to a new substation at Blackhill hock.	Consented.

144. The following sites were not considered necessary to assess in-combination with Kincardine, either due to their distance from Kincardine, the magnitude and scope of their impacts or the stage in their consenting process.

- Fife Energy Park Offshore Demonstration Wind Turbine;
- 2B Energy Demonstrator;
- Dounreay Floating Offshore Wind Development Centre; and
- All land based windfarm development.

14.7.2.1. Potential Cumulative Impacts during Construction

Temporary loss/restriction of access to fishing grounds

145. Based on information currently available, it is not likely that the construction schedule of the Development will overlap temporally or geographically with other identified projects. As such it is not likely that there will be any concurrent construction activities. In addition, the Project is of a small scale and will be phased. No cumulative impacts are anticipated for loss of fishing grounds during construction.

Safety issues for fishing vessels

146. For all fishing activities there are no unacceptable safety risks where there are designated safety/exclusion zones from a cumulative perspective. Cumulative safety issues regarding vessels are discussed in more detail in Chapter 9, Section 9.7.

Increased Steaming Time to Fishing Grounds

147. Due to the distance to other projects from the Project, the discrete nature of the safety/exclusion zones relative to the available fishing grounds during construction, and the construction schedule being phased, it is concluded that there will be no cumulative impacts associated with increased steaming time to fishing grounds.

14.7.2.2. Potential Cumulative Impacts during Operation

Complete loss/restriction of access to fishing grounds

148. Following the satisfactory completion of post-construction surveys it is considered that fishing vessels will regain some degree of access to fishing grounds within the operational Development Area and that all fishing should be able to resume within the Offshore Export Cable Corridor. Once the NorthConnect and the Eastern HVDC Link have been installed there will be no fishing restrictions along these cable routes. Therefore, it is considered that fishing activities in the vicinity of the Offshore Export Cable Corridor will not be affected from a cumulative perspective during the operational life of the windfarm (25 years).

149. Within the Development Area it is likely that safety/exclusion zones will be in place during the operational life of the windfarm. Safety/exclusion zones will also be in place for the Hywind Demonstrator Site (45km) and the European Offshore Wind Deployment Centre (EOWFL) (17km) to the North of the KOWL Project and the Seagreen Development (34km) and Inch Cape Offshore Windfarm (47km) to the South which are the closest identified projects to the Project. It is anticipated there will be a minor significance of effect cumulatively for the identified fisheries through the combined aspect of safety/exclusion areas during the operation of the various projects.

Table 14-25 Cumulative Impact of Complete Loss/Restriction to Fishing Grounds with Other Projects

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Cumulative Impact of Complete Loss/Restriction to Fishing Grounds with Other Projects	Scallop Fishery	Low The sensitivity of the scallop fishery recognises that there are scallop grounds which are fished within the Development Area and Offshore Export Cable Corridor, and the surrounding ICES rectangles however it also takes into account the wider availability of grounds which are fished more intensively out with other Projects, the often nomadic nature of the fleet which may target grounds around Scotland and the limited activity in the ICES rectangles.	Low Due to the distance between Projects and exclusion zones	Minor
	Squid Fishery	Low The sensitivity of the squid fishery takes into consideration the limited activity recorded directly in the Development Area and Offshore Export Cable Corridor and surrounding ICES rectangles but there is also high levels of natural fluctuation annually.		Minor
	Creel Fishery	Low The sensitivity of the creel fishery takes into account the higher proportion of smaller vessel activity in the Offshore Export Cable Corridor, their limited range and the discrete location of fishing grounds and recognises that the majority of creeling activity occurs in inshore waters and the limited activity in the Development Area. The majority of the other Projects are located offshore and in most cases it is likely that fishing activity will resume in the Export Cable Corridors.		Minor
	Demersal Fishery	Low The sensitivity of the demersal fishery recognises that there are trawling grounds which are fished within the Offshore Export Cable Corridor and Development Area, however it also takes into account the wider availability of grounds which are fished more intensively outwith other Projects, the often nomadic nature of the fleet which may target grounds around Scotland and the limited activity in the ICES rectangle.		Minor

Safety issues for fishing vessels

150. All infrastructure associated with the Project will be appropriately marked, in line with industry best practice standards and as stated in Chapter 2.

151. Fishing vessels will be able to resume normal fishing activities when the development is in operation. Full discussions on the cumulative impacts to maritime navigation are discussed in Chapter 9.

Increased Steaming Time to Fishing Grounds

152. There will be no discernible effects from operational Offshore Export Cables on steaming time to fishing grounds.

153. Sensitivity of all fisheries is classed as low. Due to the nature, size and scale of the Development and the distance to other projects, the magnitude of effect is classed as low. The significance of the impact is concluded to be minor.

Table 14-26 Cumulative Impact of Increased Steaming Time to Fishing Grounds with Other Projects

Impact	Receptor	Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Cumulative Impact of Increased Steaming Time to Fishing Grounds with Other Projects	Scallop Fishery	Low The sensitivity of the scallop fishery recognises that there are scallop grounds which are fished within the Development Area and Offshore Export Cable Corridor, and the surrounding ICES rectangles however it also takes into account the wider availability of grounds which are fished more intensively outwith other Projects, the often nomadic nature of the fleet which may target grounds around Scotland and the limited activity in the ICES rectangles.	Low Due to the nature, size and scale of the Development and the distance to other projects	Minor
	Squid Fishery	Low The sensitivity of the squid fishery takes into consideration the limited activity recorded directly in the Development Area and Offshore Export Cable Corridor and surrounding ICES rectangles but there is also high levels of natural fluctuation annually.		Minor
	Creel Fishery	Low The sensitivity of the creel fishery takes into account the higher proportion of smaller vessel activity in the Offshore Export Cable Corridor, their limited range and the discrete location of fishing grounds and recognises that the majority of creeling activity occurs in inshore waters and the limited activity in the Development Area. The majority of the other Projects are located offshore and in most cases it is likely that fishing activity will		Minor

		resume in the Export Cable Corridors.		
	Demersal Fishery	Low The sensitivity of the demersal fishery recognises that there are trawling grounds which are fished within the Offshore Export Cable Corridor and Development Area, however it also takes into account the wider availability of grounds which are fished more intensively outwith other Projects, the often nomadic nature of the fleet which may target grounds around Scotland and the limited activity in the ICES rectangle.		Minor

14.8. Summary and Residual Impacts

14.8.1. Development Area

154. The table below provides a summary of the impacts identified, including mitigation and residual impacts for the Development Area. No additional mitigation measures are required as no significant impacts are predicted.

Table 14-27 Summary of Effects and Mitigation - Development Area

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Construction				
Temporary loss/Restriction to Fishing Grounds	Scallop Fishery	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Squid Fishery		Embedded Mitigation with no Additional Mitigation	
	Creel Fishery		Embedded Mitigation with no Additional Mitigation	
Increased Steaming Times to Fishing Grounds	Scallop Fishery	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Squid Fishery		Embedded Mitigation with no Additional Mitigation	
	Creel Fishery		Embedded Mitigation with no Additional Mitigation	
Operation				
Complete Loss/Restriction to Fishing Grounds	Scallop Fishery	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Squid Fishery		Embedded Mitigation with no Additional Mitigation	
	Creel Fishery		Embedded Mitigation with no Additional Mitigation	
Increased Steaming Times to Fishing Grounds	Scallop Fishery	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Squid Fishery		Embedded Mitigation with no Additional Mitigation	
	Creel Fishery		Embedded Mitigation with no Additional Mitigation	

14.8.2. Offshore Export Cable

155. Table 14-28 Table 14-29below provides a summary of the impacts identified, including mitigation and residual impacts for the Offshore Export Cable. No additional mitigation measures are required as no significant impacts are predicted.

Table 14-28: Summary of Effects and Mitigation - Offshore Export Cable

Effect	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Construction				
	Scallop Fishery	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Squid Fishery		Embedded Mitigation with no Additional Mitigation	
	Creel Fishery		Embedded Mitigation with no Additional Mitigation	
	Scallop Fishery	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Squid Fishery		Embedded Mitigation with no Additional Mitigation	
	Creel Fishery		Embedded Mitigation with no Additional Mitigation	
Operation				
Complete Loss/Restriction to Fishing Grounds	Scallop Fishery	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
	Squid Fishery		Embedded Mitigation with no Additional Mitigation	
	Creel Fishery		Embedded Mitigation with no Additional Mitigation	
Increased Steaming Times to Fishing Grounds	Scallop Fishery	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
	Squid Fishery		Embedded Mitigation with no Additional Mitigation	
	Creel Fishery		Embedded Mitigation with no Additional Mitigation	

14.8.3. Cumulative Impacts of the Project

156. Table 14-29 below provides a summary of the impacts identified, including mitigation and residual impacts for the cumulative impacts of the Development Area and the Offshore Export Cable Corridor.

Table 14-29 Summary of Effects and Mitigation - Cumulative Impacts from the Project

Effect	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Construction				
Temporary loss/Restriction to Fishing Grounds	Scallop Fishery	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Squid Fishery		Embedded Mitigation with no Additional Mitigation	
	Creel Fishery		Embedded Mitigation with no Additional Mitigation	
Increased Steaming Times to Fishing Grounds	Scallop Fishery	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Squid Fishery		Embedded Mitigation with no Additional Mitigation	
	Creel Fishery		Embedded Mitigation with no Additional Mitigation	
Operation				
Complete Loss/Restriction to Fishing Grounds	Scallop Fishery	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Squid Fishery		Embedded Mitigation with no Additional Mitigation	
	Creel Fishery		Embedded Mitigation with no Additional Mitigation	
Increased Steaming Times to Fishing Grounds	Scallop Fishery	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Squid Fishery		Embedded Mitigation with no Additional Mitigation	
	Creel Fishery		Embedded Mitigation with no Additional Mitigation	

14.8.4. Cumulative Impacts from interaction with Other Projects

157. Table 14-30 below provides a summary of the impacts identified, including mitigation and residual impacts for the cumulative impacts of the Development Area and the Offshore Export Cable.

Table 14-30 Summary of Effects and Mitigation - Cumulative Impacts from Other Projects

Effect	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Construction				
Temporary loss/Restriction to Fishing Grounds	Scallop Fishery	No Impact	Embedded Mitigation with no Additional Mitigation	No Impact
	Squid Fishery		Embedded Mitigation with no Additional Mitigation	
	Creel Fishery		Embedded Mitigation with no Additional Mitigation	
Increased Steaming Times to Fishing Grounds	Scallop Fishery	No Impact	Embedded Mitigation with no Additional Mitigation	No Impact
	Squid Fishery		Embedded Mitigation with no Additional Mitigation	
	Creel Fishery		Embedded Mitigation with no Additional Mitigation	
Operation				
Complete Loss/Restriction to Fishing Grounds	Scallop Fishery	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Squid Fishery		Embedded Mitigation with no Additional Mitigation	
	Creel Fishery		Embedded Mitigation with no Additional Mitigation	
Increased Steaming Times to Fishing Grounds	Scallop Fishery	Minor	Embedded Mitigation with no Additional Mitigation	Minor
	Squid Fishery		Embedded Mitigation with no Additional Mitigation	
	Creel Fishery		Embedded Mitigation with no Additional Mitigation	

14.9. References

ASFB. (2015). Association of Salmon Fishery Boards. Members. Available Online: http://www.asfb.org.uk/members/ [Accessed: July 2015]

BERR (Department for Business Enterprise and Regulatory Reform). (2008). Fishing Liaison with Offshore Wind and Wet Renewables Group (FLOWW) Recommendations for Fisheries Liaison. Available Online: http://webarchive.nationalarchives.gov.uk/+/http:/www.berr.gov.uk/files/file46366.pdf [Accessed: July 2015]

Beukers-Stewart, B.D. and Beukers-Stewart, J.S. (2009) Principles for the Management of Inshore Scallop Fisheries around the United Kingdom, Environmental Department, University of York report to CCW/SNH/N.Cappell, R., Robinson,M., Gascoigne, J. and Nimmo, F. (2013). A review of the Scottish Scallop Fishery. Poseidon report to Marine Scotland.

Cefas/MCEU (2004) Guidance Note for Environmental Impact Assessment in Respect of FEPA and CPA Requirements. Available Online: http://www.cefas.co.uk/publications/files/windfarm-guidance.pdf [Accessed: July 2015]

DECC (2011). National Policy Statement for renewable Energy Infrastructure (EN-3). Presented to Parliament pursuant to section 5(9) of the Planning Act 2008.

Dee District Salmon Fishery Board and River Dee Trust. (2015). Aberdeenshire Dee & District Fisheries Management Plan 2015-2018. Available Online: http://www.riverdee.org.uk/FileLibrary/publications/Draft%20Aberdeenshire%20Dee%20Fisheries%20Management%20Plan%20for%20consultation%20June%202015.pdf [Accessed: July 2015].

FLOWW. (2014). Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Liaison. Available Online: http://www.thecrownestate.co.uk/media/5693/floww-best-practice-guidance-for-offshore-renewables-developments-recommendations-for-fisheries-liaison.pdf [Accessed: June 2015]

Galbraith, R.D. and Rice, A. (2004). An introduction to commercial fishing gear and methods used in Scotland. Scottish Fisheries information Pamphlet. No.25. Aberdeen. FRS Marine Laboratory.

ICOL. (2012). Inch Cape Environmental Statement. Available Online: http://www.inchcapewind.com/publications/environmental-statement/introduction [Accessed: July 2015]

IEEM (2010) *Guidelines for ecological impact assessment in Britain and Ireland: Marine and coastal*, Final Document. IEEM, 2010.

IMO. (1996). Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972. Available Online: http://www.imo.org/en/OurWork/environment/pollutionprevention/pages/1996-protocol-to-the-convention-on-the-prevention-of-marine-pollution-by-dumping-of-wastes-and-other-matter,-1972.aspx [Accessed: July 2015].

International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) (2008) Recommendation O-139 – The Marking of Man-made Offshore Structures, December 2008.

NMPI. (2015). Available Online: https://marinescotland.atkinsgeospatial.com/nmpi/ [Accessed: July 2015]

Salmon Net Fishing Association of Scotland. (2010). Fixed Engines and Net and Coble. Available Online: http://scottishsalmonassoc.net/ [Accessed: April 2015)

The Scottish Government. (2013a). Scottish Sea Fisheries Statistics. Available Online: http://www.scotland.gov.uk/Publications/2014/09/7931/downloads#res459540 [Accessed: 25/05/15]

The Scottish Government. (2013b) *Nephrops* stocks – Biology and Assessment. Available Online: http://www.scotland.gov.uk/Publications/2013/09/6505/20 [Accessed: 25/05/2015]

The Scottish Government. (2014). Land Reform Review Group Final Report – The Land of Scotland and the Common Good. Available Online: http://www.gov.scot/Publications/2014/05/2852/298188 [Accessed: July 2015]

15. Other Marine Users

15.1. Introduction

1. This chapter focuses on the assessment of the predicted impacts of the Project on other marine users and activities not covered by the chapters that focus on the main marine user groups including shipping and navigation (Chapter 9) and Commercial Fishing (Chapter 14). Due to the Project's location and associated water depth there are a limited number of potential other marine users that could be affected. This chapter will focus on these other marine activities which include cables and pipelines, unexploded ordnance, surfers, kayakers, and scuba diving.

15.1.1. Stakeholder Consultation

2. Consultation was undertaken with the representatives of other marine activities as part of the EIA scoping exercise for the Project (Table 15-1). In addition to the formal scoping opinion, further consultation has been undertaken with the Royal Yachting Association and this consultation has been considered within Chapter 9 as part of the marine navigation assessment and is therefore not covered as part of this chapter assessment.

Table 15-1 Stakeholder consultation – MS LOT Scoping Opinion 2014

Consultee	Comment	Project Response
Sports Scotland	Consultation with Scottish Sub Aqua	A review of the wrecks in the project area has been undertaken and it has been noted that due to the water depths (over 60m) there is limited diving activity within the area. Diving has been noted on the wreck (SS Cremuir) which is located near to the development (1.5km from the nearest turbine). This is covered as part of this assessment.
RYA	RYA want direct involvement in the Navigational Risk Assessment	The RYA have been included in the marine Navigation Risk Assessment work and this is incorporated within Chapter 9.
RYA	Limited impact on recreation or tourism sector.	This has been assessed in Chapter 13, but note that there is expected to be limited impact from the development on recreation or tourism in this area due to its offshore location.
RYA	Review Offshore renewable energy installations - wind RYA document 2014	This has been reviewed and incorporated within Marine Navigation chapter (9).

15.1.2. Design Envelope

3. The design envelope for the project is discussed in detail in Chapter 2 and this assessment for the possible impact on other marine activities is based on the worst case scenario identified in this section. For consideration within this assessment two main areas are reviewed:

- Development area (location of the WTGs); and
- Offshore Export Cable Corridor from Development Area to onshore directional drill out location (15km).

4. Three main phases of works are considered for this assessment and these consist of:

- Installation and construction phase;
- Operation and maintenance phase; and
- Decommissioning phase.

5. Five other marine activities have been identified for this assessment:

- Cables and pipelines
- Unexploded ordnance;
- Scuba diving;
- Other water sports (surfing, canoeing/sea kayaking, jet skiing, open water swimming); and
- Golf course located on the coastline.

15.2. Baseline Environment

6. The baseline description of other human activities in the Project area has been compiled from available published data.

15.2.1. Subsea Cables and Pipelines

7. There are currently no identified cables or pipelines within the Development Area or the Offshore Export Cable Corridor. It is noted that there is a potential for an east coast HVDC cable route (cable corridor C Figure 15-1) for which a scoping report was submitted to MS LOT in 2012. However, no additional information or data is currently available on this project to confirm the potential route. All other corridor routes would be pass to the east of the Development Area.

Figure 15-1 Kingfisher Map of North Sea cable and pipelines (Project marked by red circle)

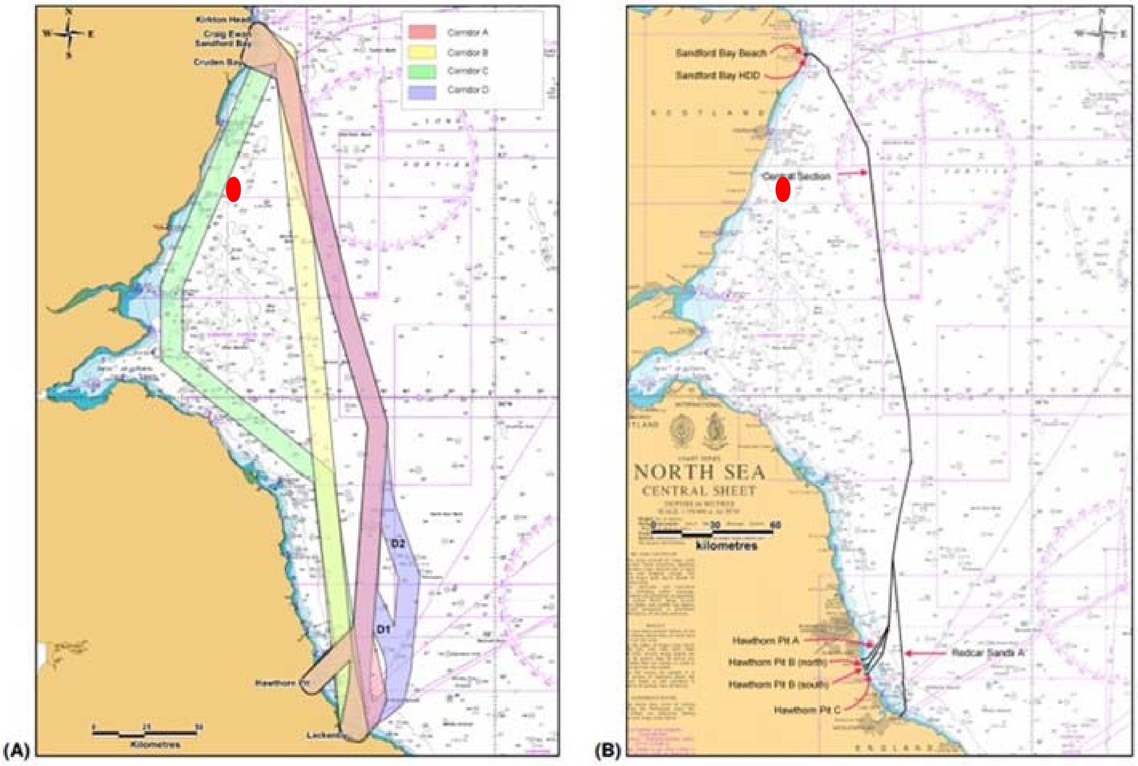

Figure 15-2 East Coast HVDC connector (possible routes) (National Grid 2012) (KOWL site marked by red ovals)

15.2.2. Unexploded Ordnance

8. Table 15-2 identifies the possible UXO risks that are potentially within the area of the Project. Key data on the regional UXO risks are identified in the Inch Cape Chapter 21 (2013) and the Hywind UXO desk based assessment (2014). Figure 15-3 and Figure 15-4 show the location of the disposal zone impacting on the project and also the WWII mined areas and these will required further assessment.

Table 15-2 Potential UXO sources within the Development Area and Offshore Export Cable Corridor

Potential sources of UXO Contamination	Potential Items	Potential presence To Development Area	Potential presence To Offshore Export Cable Corridor
Naval Warfare (WWI and WWII)	Torpedoes and artillery projectiles	Possible; U-Boats were active within the North Sea in both World Wars. Allied vessels (both merchant and warships) were armed in order to combat the U-Boats.	Possible to likely; U-Boats were active within the North Sea in both World Wars. Allied vessels (both merchant and warships) were armed in order to combat the U-Boats.
Sea Minefields (Axis)	German sea mines	Possible to likely; the Axis forces used U-Boat deployed mines in WWI and aerial delivered mines in WWII in the vicinity of the Development Area.	Possible to likely; the Axis forces used U-Boat deployed mines in WWI and aerial delivered mines in WWII in the vicinity of the Offshore Export Cable Corridor.
(Allied)	British sea mines (Mk. XVII)	Possible; Allied minefields that formed	Possible to likely; An Allied declared mine

Potential sources of UXO Contamination	Potential Items	Potential presence To Development Area	Potential presence To Offshore Export Cable Corridor
		parts of the east coast mine barrier were located within 20 km of the Development Area.	area is located to the east of the site.
Aerial Bombing	German 50kg-1,000kg High Explosive (HE) bombs	Possible to likely; convoys that passed through the Development Area were bombed by the Luftwaffe.	Possible to likely; convoys that passed through the site were bombed by the Luftwaffe and the Offshore Export Cable Corridor is within proximity to land based targets.
Munitions Related Shipwrecks	Unspecified general munitions	Almost Certain; naval warfare sank one wreck which could contain munitions within the Development Area (submarine).	Almost certain; naval and Submarine warfare sunk three wrecks within the Offshore Export Cable Corridor.
Munitions Disposal Areas	Unspecified general munitions	Remote: there are munitions disposal areas located 10km from the Development Area (Aberdeen disposal site). However post WWII munitions dumping was often poorly monitored and thus illegal dumping in the vicinity of specified munitions dumps often occurred.	Likely: there are munitions disposal areas located 4km from the Offshore Export Cable Corridor (Aberdeen disposal site). Post WWII, munitions dumping was often poorly monitored and thus illegal dumping in the vicinity of specified munitions dumps often occurred.

* Extracted from Inch Cape Environmental statement Chapter 21 (2012) and HyWind UXO desk based assessment (2014).

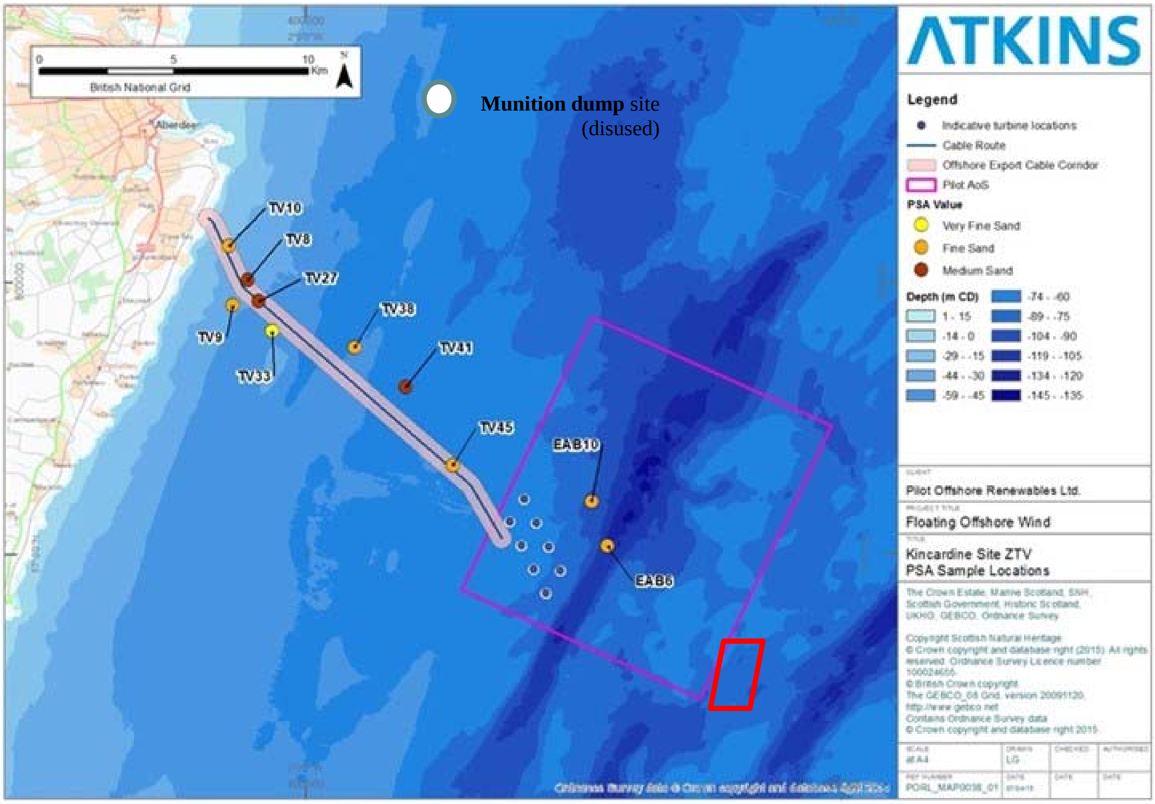

Figure 15-3 Munition dump site (disused)

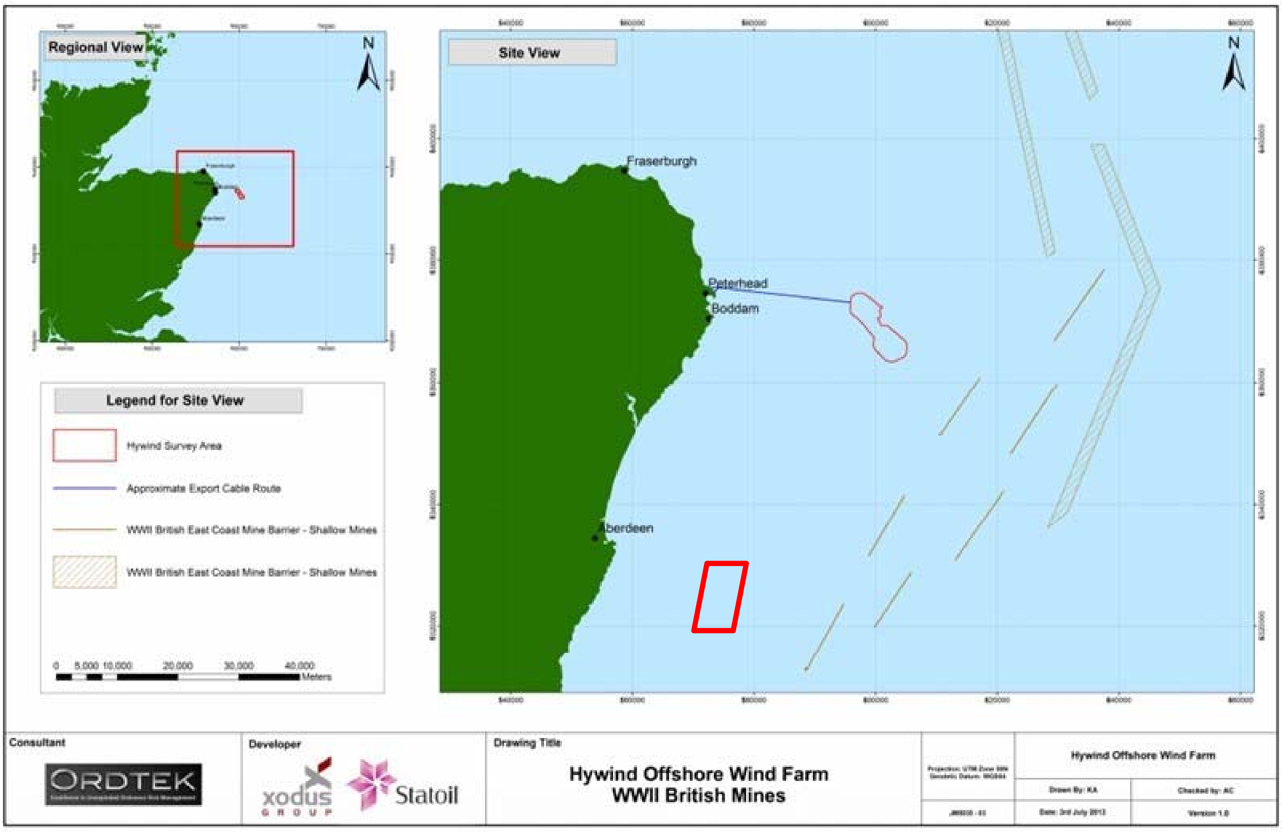

Figure 15-4 Modified from Hywind UXO (2014) - WWII British Mine locations. Development Area noted on map

15.2.3. Disposal Site

9. There is an open sea disposal site (CR110) to the north of the Offshore Export Cable Corridor (Figure 15-5). This site has been used by the Port of Aberdeen to deposit dredged harbour material. As the export cables will not pass close to or through this site no additional information has been gathered as part of this assessment. As there is no direct impact on this site this has been scoped out of this assessment. As noted in the above UXO desk assessment, it is likely that this site could contain UXO material dating back to WWI and WWII disposal activities (HyWind UXO desk based assessment (2014)).

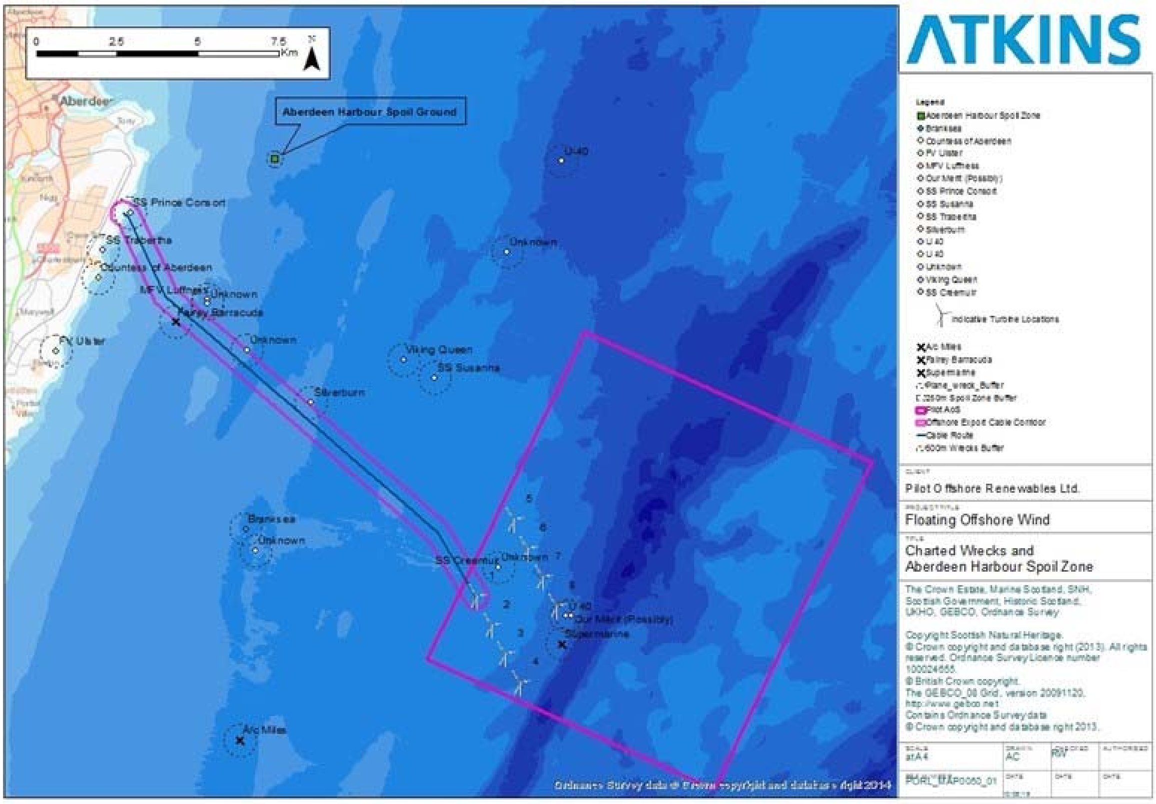

Figure 15-5 Cable route, dredge disposal site and location of ship wrecks within the area of the Project

15.2.4. Scuba Diving (non-commercial)

10. The only identified diving site within the Development Area is the SS Creemuir (Figure 15-5) and it is noted that this wreck was dived on by non-commercial divers in 2009 to raise the ships bell (CCRExplorers, 2009). The depth of the site and distance from shore indicates that the vessel is not regularly visited by divers (the above is the only recorded visit identified to date).

11. There are a number of wrecks situated in proximity to the Offshore Export Cable Corridor. However, the Offshore Export Cable Corridor has been designed to avoid direct interaction with charted wrecks where possible.

15.2.5. Other Water Sports

12. The east coast of Scotland has a number of established offshore water sport activities that occur along the entire coastline as a result of the constant swells. Activities such as sea/surf kayaking and wind surfing are located around a number of popular surfing locations around the east coast of Scotland. These areas are predominantly located in East Lothian (Belhaven Bay, Coldingham Bay and Pease Bay) and to the North of Aberdeen. All of these locations are a significant distance from the Project site. There are no surfing areas in the area of the cable landing area due to the presence of sea cliffs and deep water (approximately 20 m) at this location.

13. Sea kayaking on the east coast of Scotland is mainly confined to the Lothian coastline and East Neuk of Fife. The Aberdeen kayak club currently undertake summer kayaking trips to the south of Stonehaven, utilising Stonehaven as the start/end point. Currently there are no identified

significant sea kayaking within the area of the cable landing. This is predominantly due to the exposed nature of the cable landing location and also the limited number of safe havens on this section of coastline.

14. Jet skies are not covered by the same regulations as small boats taking passengers and therefore currently the responsibility for regulating such personal watercraft lies with local authorities and harbour authorities (HofC 2010). Jet skis have a nominal operating limit of 1000 m from the coast and/or safe haven (MCA MGN 280) and therefore it is highly unlikely they will occur in the project area.

15. Open water swimming is currently not undertaken with the area of the cable landing location or the development site and is therefore not further covered by this assessment.

15.2.6. Coastal Golf Courses Users

16. There are a significant number of golf courses located along the Aberdeenshire/Aberdeen City coastline and form one of the major land owners in this area of the coastline. The following golf clubs have been contacted (via e-mail and letter) as part of the stakeholder engagement process, but no formal comments have been received:

- Stonehaven Golf Club;
- Porthlethen Golf Club;
- Nigg Bay (Balnagask) Golf Club;
- Murcar Links Golf Club;
- Trump International Golf Club;
- Newburgh-on-Ythan Golf Club;
- Royal Aberdeen Golf Club; and
- King’s Links Golf Club.

17. The closest coastal golf course to the cable landing location is Nigg Bay Golf Club (approximately 2.5 km away) and this is not visible from the cable landing area.

18. This will be considered in further detail within the SLVIA chapter (11) and not below as this is considered to be a visual impact, rather than a direct marine impact on the golf course users. The key location being the Stonehaven Golf Course, which is considered as part of the Garrow Point visualisation point.

15.2.7. Walkers and Horse Riders

19. The 165 mile Aberdeenshire Coastal Trail follows the length of the coastline (from Buckie to Montrose) and is considered one of Scotland’s long distance footpaths. The routes main walking areas are located around the main coastal features, such as Dunnottar Castle and Stonehaven on the section of coast concerning the Project. North of Stonehaven to Aberdeen receives limited visitors due to access and key viewpoints (note cycling is not allowed along the Aberdeen Coastal Train and therefore not assessed here). This will be considered in further detail within the SLVIA chapter (11) and not below as this is considered to be a visual impact, rather than a direct marine impact on the walkers and horse riders.

20. There are no currently identified coastal horse-riding areas along the coastline in relation to the project, due to the steep cliffs and limited access horse riding is not permitted in any locations along the coastal section of the coastal trail.

21. As both of these receptors are land based and are not marine based activities, these receptors will be considered in further detail within the SLVIA chapter and not below as this is considered to be a visual impact, rather than a direct marine impact on the coastal users. The key location being the coastal path viewing point.

15.2.8. Embedded Mitigation

22. The assessment for the above uses has identified a number of embedded mitigation measures that will be put in place by the project to reduce possible impact.

15.2.8.1. Subsea cables

23. During the detailed design and construction phases the Project will maintain consultation with SSE in regard to the possible East Coast HVDC connector cable that could cross the Offshore Export Cable Corridor. Currently no new information is available to determine the maturity of this concept cable, other than the scoping assessment report currently noted on the MS LOT website.

15.2.8.2. Unexploded Ordnance (UXO)

24. A UXO threat assessment (as per DNV-RP-J301) will be undertaken prior to construction and risk mitigation measures will be implemented with regard to all hazards on site. All practicable mitigation measures to minimise the risk of health and safety incidents associated with UXO will be fully developed prior to construction, as per standard industry practice and included in the Project health and safety plan. Specific measures include the following:

- Survey will be undertaken prior to any intrusive works to confirm the presence and form of any known or potential UXO;
- Survey anomalies which indicate the presence of UXO will be avoided through micro-siting of all infrastructure works which could disturb UXO. Establishment of a formal quality assurance process with sign-off certification of the design process from a UXO specialist to reduce risks to As Low As Reasonably Practicable (ALARP);
- The scope and extent of further surveys to detect the presence of UXO in advance of major maintenance work will be considered in advance of scheduling and undertaking maintenance which has the potential to affect UXO;
- A UXO coordinator will be part of the vessel crew on relevant construction and maintenance vessels involved in activities where there is a risk of encountering previously unidentified UXO to ensure that all safety procedures and responses are adhered to during operations and in the event of UXO being encountered; and
- Crew on board all vessels involved in Project construction, maintenance and support during operations will be regularly briefed on munitions safety procedures and awareness.

25. A UXO management procedure will be put in place to manage any unanticipated finds of suspected UXO. These measures will be delivered as part of the Project Environmental Management Plan (PEMP).

15.2.8.3. Marine Recreational Activities (including Scuba Diving)

26. The following measures will be undertaken for marine recreation activities:

- Provision of safety/exclusion zones around construction activities including the installation of the export cable, major O&M activities (such as anchor replacement or detachment for return to port) and decommissioning activities (500m);
- The Project including individual WTGs will be marked on relevant United Kingdom Hydrographic Office (UKHO) admiralty charts. The Offshore Export Cable Corridor will also be charted, although whether the inter-array cables are shown will depend on the scale of the chart.
- Distribution of information and appropriate liaison with marine recreational users will be carried out to ensure information on the works are circulated through agreed procedure (MCA and NLB) e.g. Notices to Mariners, Kingfisher, local water sports clubs, local harbour masters and other appropriate media to allow marine users to effectively and safely navigate around the proposed sites.

15.3. Assessment Methodology

27. The assessment methodology applied within the chapter follows that described in Chapter 1. The magnitude of the effect is assigned using the criteria presented in Table 15-3 Sensitivity criteria specific to marine activities have been applied and these are shown in Table 15-4.

Table 15-3 Criteria for assessing the magnitude of effect

Magnitude of effect	Definition		
Severe	Permanent or long lasting disruption that threatens the future viability of an approved or marine activities	Scale of Effect	Development stops future activities during the life time of the project
		Receptor	High impact on receptor stopping their activities.
Major	Temporary disruption that affects an approved or licenced activity or service, but does not threaten future viability	Scale of Effect	Development has major impact on other site activities
		Receptor	Has major impact on other marine activities, but does not stop them.
Moderate	Temporary and low level disruption of approved or licenced activity or service	Scale of Effect	Development has impact on future development but does not major modifications to their activities
		Receptor	Requires some adaption by the receptor due to the presence of the site
Minor	Little disruption to other sea users	Scale of Effect	Minor impact other marine users
		Receptor	Requires limited adaption of current practices to continue their marine activities
Negligible	No detectable disruption	Scale of Effect	No impact on other marine users activities
		Receptor	No change to how the marine users uses the marine area.

Table 15-4 Criteria for assessing the sensitivity of other marine users and activities as receptors

Sensitivity	Receptor Characteristics and Examples
High	Nationally and/or Strategically important areas or locations including: • Marine Recreational Areas and their users such as high quality and very regularly used recreational diving sites • Subsea Cables and Pipelines of strategic infrastructure importance and/or where protection is paramount • Unexploded Ordnance whose presence is classed as likely to almost certain to be present
Moderate	Regionally important areas or locations including: • Marine Recreational Areas and their users such as moderate quality or regularly used recreational diving sites • Subsea Cables and Pipelines of strategic infrastructure importance • Unexploded Ordnance whose presence is classed as remote to possible
Low	Locally important areas or locations including: • Marine Recreational Areas and their users such as occasionally used recreational diving sites • Subsea Cables and Pipelines of some infrastructure importance • Unexploded Ordnance unlikely to be present
Negligible	Areas of limited importance including: • Marine Recreational Areas with very limited appeal and use for recreation • Subsea Cables and Pipelines with limited infrastructure importance • No unexploded ordnance present

15.3.1. Embedded Mitigation

28. For the purposes of this assessment, the following embedded mitigation measures have been taken into consideration:

- Provision of safety/exclusion zones around construction activities (500m);
- Regular amendments to relevant UKHO admiralty charts to mark the location of the WTGs and subsea cable routes;
- Regular Notice to Mariners will be incorporated into the design of the construction, major maintenance and decommissioning programmes to avoid disruption to RYA cruising routes and to minimise any navigational disruption along these routes; and
- A consultation strategy will be agreed with all relevant recreation groups, clubs and authorities to inform all key recreational users of the sea and coastline of the implications of construction, operation and maintenance of the development and to facilitate feedback in order to minimise disruption where possible.
- Prior to construction a review of the current status of the East Coast HVDC route will be undertaken with National Grid/SSE to ensure that the Offshore Export Cables is considered in their development plans and what impact this cable could have on the Project.

15.4. Impact Assessment

29. Following establishment of the baseline activities relevant to the Project area, and an understanding of the Project activities it is possible to assess the potential impacts from the Project. The range of impacts that have been considered is based on impacts identified during EIA Scoping and any further potential impacts that have been highlighted as the EIA has progressed. The impacts assessed are summarised below.

- Impacts on cables and pipelines;
- Inadvertent detonation of unidentified unexploded ordnance;
- Impact on Scuba diving;
- Impact on other water sports; and
- Impact on coastal golf

30. Summary of which receptors may be impacted during each stage of the development programme is identified in Table below.

Table 15-5 Receptors in the Development Area and Offshore Export Cable Corridor during development lifetime

Receptor	Construction	Operation and Maintenance	Decommissioning	Impact
Cables	X	X	X	No impact identified
UXO	X	X	X	Possible UXO risk at site and development area
Scuba diving	X	X	X	Possible impact on diving on wrecks within the development area
Other water sport users	X	X	X	Displacement of other water sport users by project activities

31. The following impacts were scoped out of the assessment during EIA scoping:

- Restriction on the expansion potential of at sea disposal sites located adjacent to the export cable corridor; and
- Interference with military practice and exercise areas.

15.4.1. Development Area

15.4.1.1. Impacts during construction and installation

Impacts of Cables

32. There are no known cables or pipelines within the Development Area and therefore there will be no impact during the construction phase.

Impacts from UXO

33. There is a potential health and safety risk for UXO associated with historic and current military activity to be encountered on the seabed in the Development. During construction, activities which will have contact with the seabed, either directly (e.g. cable laying) or via the placement of material (e.g. anchors or cable protection), are at risk of disturbing UXO with potentially damaging and dangerous effects to operatives, equipment and Project infrastructure.

34. As human life is at risk, receptor sensitivity is considered to be High. Magnitude of effect would be Major and the significance of the impact therefore Major (Table 15-3). The possibility of finding UXO in the Development Area is considered to be likely (see Table 15-2). The Embedded Mitigation and Additional Mitigation measures set out in Sections 15.5 will ensure that all risk is reduced as far as is reasonably practicable and the residual impact is predicted to be Minor (Table 15-8).

Impacts on scuba diving

35. Scuba diving is normally confined to the coastal areas of rocky shorelines, with most activity focused further to the south of the Development Area (Firth of Forth). Recreational diving is extremely limited in the Development Area due to the water depth (over 60m) which requires specialist dive equipment to reach the seabed. This is coupled with the lack of seabed features within the Development Area to severely restrict diving activities on site. The one exception to this is the very limited diving on the SS Creemuir within the Development Area, but due to the water depth, currents, distance from shore the level of activity on this site is very minimal. Therefore, the sensitivity of diving to site construction activities is considered to be Negligible, magnitude of effect is considered to be Minor and the resulting significance of impact Negligible/Minor (Table 15-6).

Impacts on other water sports

36. All other water sports users are located in close proximity to the coast and will not intentionally travel greater than one kilometre offshore due to safety issues. As the Project is located 15km offshore there is a very low impact on these marine activities during the installation of the cables at site. Therefore the sensitivity of water sports activities to site construction activities is considered to be Negligible, while the magnitude of effect is considered to be Minimal and the resulting significant of impact is Negligible/Minor (Table 15-6).

15.4.1.2. Impacts during operation and maintenance

Impacts of Cables/Pipes

37. There are no known cables or pipelines within the development area and therefore there will be no impacts on other cables. Therefore there will be no impact during the O&M phase.

Impacts from UXO

38. There is a potential health and safety risk for UXO associated with historic and current military activity to be encountered on the seabed in the Development Area. During O&M, activities which will have contact with the seabed, either directly (e.g. possible repair of cable) or via the placement of material (e.g. anchors or cable protection), are at risk of disturbing UXO with potentially damaging and dangerous effects to operatives, equipment and Windfarm infrastructure.

39. As human life is at risk, receptor sensitivity is considered to be High. Magnitude of effect would be Major and the significance of the impact therefore Major (Table 15-6). The possibility of finding UXO in the Development Area is considered to be likely (see Table 15-2). The Embedded Mitigation and Additional Mitigation measures set out in Sections 15.5 will ensure that all risk is reduced as far as is reasonably practicable and the residual impact is predicted to be Minor (Table 15-8).

Impacts on scuba diving

40. Scuba diving is normally confined to the coastal areas of rocky shorelines, with most activity focused further to the south of the development area (Firth of Forth). Recreational diving is extremely limited in the area of the development due to the water depth (over 60m) which requires specialist dive equipment to reach the sea bed. This is coupled with the lack of sea bed features within the Development Area to severely restrict diving activities on site. The one exception to this is the very limited diving on the SS Creemuir within the Development Area, but due to the water depth, currents, distance from shore the level of activity on this site is very minimal. Therefore the sensitivity of the diving activities to site O&M activities is considered to be Negligible, magnitude of impact is considered to be Minimal and the resulting impact Negligible.

Impacts on other water sports

41. All other water sports users are located in close proximity to the coast and will not intentionally travel greater than one kilometre offshore due to safety issues. As the Project is located 15km

offshore there is a very low impact on this marine user group during the O&M phase of the project. Therefore the sensitivity of other water sport activities to site O&M activities is considered to be Negligible, while the magnitude of impact is considered to be Minimal and the resulting impact Negligible.

15.4.1.3. Impacts during Decommissioning

Impacts of Cables/Pipes

42. There are no know cables or pipelines within the development area and therefore there will be no impacts on other cables. Therefore there will be no impact during the decommissioning phase.

Impacts from UXO

43. There is a potential health and safety risk for UXO associated with historic and current military activity to be encountered on the seabed in the Development Area. During decommissioning, activities which will have contact with the seabed, either directly (e.g. cable removal (inter-array) or via the placement of material (e.g. cable protection) to allow the export cable to be left in-situ for future repowering of the site are at risk of disturbing UXO with potentially damaging and dangerous effects to operatives, equipment and Windfarm infrastructure.

44. As human life is at risk, receptor sensitivity is considered to be High. Magnitude of effect would be Major and the significance of the impact therefore Major (Table 15-6). The possibility of finding UXO in the Development Area is considered to be likely (see Table 15-2). The Additional Mitigation measures set out in Sections 15.5 will ensure that all risk is reduced as far as is reasonably practicable and the residual impact is predicted to be Minor (Table 15-8).

Impacts on scuba diving

45. Scuba diving is normally confined to the coastal areas of rocky shorelines, with most activity focused further to the south of the Development Area (Firth of Forth). Recreational diving is extremely limited in the Development Area due to the water depth (over 60m) which requires specialist dive equipment to reach the seabed. This is coupled with the lack of seabed features within the Development Area to severely restrict diving activities on site. The one exception to this is the very limited diving on the SS Creemuir within the Development Area, but due to the water depth, currents, distance from shore the level of activity on this site is very minimal. Therefore, the sensitivity of diving to site construction activities is considered to be Negligible, magnitude of effect is considered to be Minor and the resulting significance of impact Negligible/Minor (Table 15-6).

Impacts on other water sports

46. All other water sports users are located in close proximity to the coast and will not intentionally travel greater than one kilometre offshore due to safety issues. As the Project is located 15km offshore there is a very low impact on this marine user group during the O&M phase of the project. Therefore the sensitivity of other water sport activities to site O&M activities is considered to be Negligible, while the magnitude of impact is considered to be Minimal and the resulting impact Negligible.

Table 15-6 Impact assessment summary on other marine users within the Development Area

Impact	Receptor	Sensitivity of receptor	Magnitude of effect	Significance
Collison with other cables	Cables	Negligible No cables present	Negligible No cables present	Negligible
Collison with UXO	UXO	High UXO presence is classed as likely	Major Temporary disruption	Major
Reduced areas for Scuba Diving	Scuba Divers	Negligible Limited diving activity in Development Area	Minor Little disruption due to limited activity that currently occurs	Negligible/Minor
Restrictions to other water sports	Water sports enthusiasts	Negligible Limited use of this offshore area	Minor Little disruption due to limited activity that currently occurs	Negligible/Minor

15.4.2. Offshore Export Cable Corridor

15.4.2.1. Impacts during construction and installation

Impacts of Cables

47. Installation of the export cables, which will be installed by jet trenchers and mechanical trenchers will be undertaken on a continuous basis and will be undertaken install two export cables from the development area to the directional drill location located approximately 250m from the shore at the cable landing location.

Impacts from UXO

48. There is a potential health and safety risk for UXO associated with historic and current military activity to be encountered on the seabed in the Offshore Export Cable Corridor. During construction, activities which will have contact with the seabed, either directly (e.g. cable laying) or via the placement of material (e.g. anchors or cable protection), are at risk of disturbing UXO with potentially damaging and dangerous effects to operatives, equipment and Windfarm infrastructure.

49. As human life is at risk, receptor sensitivity is considered to be High. Magnitude of effect would be Major and the significance of the impact therefore Major (Table 15-7). The possibility of finding UXO in the Development Area is considered to be likely (see Table 15-2). The Embedded Mitigation and Additional Mitigation measures set out in Sections 15.5 will ensure that all risk is reduced as far as is reasonably practicable and the residual impact is predicted to be Minor (15-9).

Impacts on scuba diving

50. Scuba diving is normally confined to the coastal areas of rocky shorelines, with most activity focused further to the south of the development area (Firth of Forth). There are a number of wrecks situated in proximity to the Offshore Export Cable Corridor. However, the Offshore Export Cable Corridor has been planned to avoid direct interaction with these charted wrecks and therefore mitigate any dive risk during the construction phase. Therefore receptor sensitivity is considered to be Negligible, magnitude of effect is considered to be Minor and the resulting impact Negligible/Minor.

Impacts on other water sports

51. All other water sports users are located in close proximity to the coast and will not intentionally travel greater than one kilometre offshore due to safety issues. This means that only during the

installation of the export cable near to the coastline (approximately one kilometre) is there a possibility of impact on this user group. As noted above the occurrence of other water sports users in this area is very minimal and the embedded mitigation measures of local signage and notification via notice to mariners will minimise any potential impact. Therefore the sensitivity of other water sport users to the export cable installation is considered to be Negligible, and the magnitude of effect is considered to be Minor and therefore the significance of impact is Negligible/Minor.

15.4.2.2. Impacts during operation and maintenance

Impacts of Cables

52. Undertaking O&M activities on the export cable (break or remedial protection), will have no impact at present as there are no cables or pipelines in the current cable corridor. As no current pipes or cables are currently within the export cable route there are no impacts associated with other cable/pipelines.

Impacts from UXO

53. There is a potential health and safety risk for UXO associated with historic and current military activity to be encountered on the seabed in the Offshore Export Cable Corridor. During O&M, activities which will have contact with the seabed, either directly (e.g. cable laying) or via the placement of material (e.g. anchors or cable protection), are at risk of disturbing UXO with potentially damaging and dangerous effects to operatives, equipment and Windfarm infrastructure.

54. As human life is at risk, receptor sensitivity is considered to be High. Magnitude of effect would be Major and the significance of the impact therefore Major (Table 15-7). The possibility of finding UXO in the Development Area is considered to be likely (see Table 15-2). The Embedded Mitigation and Additional Mitigation measures set out in Sections 15.5 will ensure that all risk is reduced as far as is reasonably practicable and the residual impact is predicted to be Minor (Table 15-9).

Impacts on scuba diving

55. Scuba diving is normally confined to the coastal areas of rocky shorelines, with most activity focused further to the south of the development area (Firth of Forth). There are a number of wrecks situated in proximity to the Offshore Export Cable Corridor. However, the Offshore Export Cable Corridor has sought to avoid direct interaction with these charted wrecks and therefore mitigate any dive risk during the construction phase. Therefore the sensitivity of diving activities to the site O&M activities is considered to be Negligible, magnitude of effect is considered to be Minor and the resulting impact Negligible/Minor.

Impacts on other water sports

56. All other water sports users are located in close proximity to the coast and will not intentionally travel greater than one kilometre offshore due to safety issues. There are expected to be limited activities associated with the O&M phase of the export cable section of the project. This will consist of periodic ROV cable burial inspections from a surface support vessel. Such operations will only be undertaken after the appropriate notifications have been raised locally (as above) which will be the primary mitigation approach for this receptor and all other marine traffic. As noted above there is a very low level of use from other water sport users in this area and therefore very limited impacts are predicted. Therefore the sensitivity other water sport activities to the export cable O&M activities is considered to be Negligible, while the magnitude of effect is considered to be Minor and the resulting impact Negligible/Minor.

15.4.2.3. Impacts during Decommissioning

Impacts of Cables/Pipes

57. Undertaking decommissioning activities on the export cable (removal or capping), will have no impact at present as there are no cables or pipelines in the current cable corridor. As no current pipes or cables are currently within the Offshore Export Cable Corridor there are no impacts associated with other cable/pipelines.

Impacts from UXO

58. There is a potential health and safety risk for UXO associated with historic and current military activity to be encountered on the seabed in the Development Area and the Offshore Export Cable Corridor. During decommissioning, activities which will have contact with the seabed, either directly (e.g. cable laying) or via the placement of material (e.g. anchors or cable protection), are at risk of

disturbing UXO with potentially damaging and dangerous effects to operatives, equipment and Project infrastructure.

59. As human life is at risk, receptor sensitivity is considered to be High. Magnitude of effect would be Major and the significance of the impact therefore Major (Table 15-7). The possibility of finding UXO in the Development Area is considered to be likely (see Table 15-2). The Embedded Mitigation and Additional Mitigation measures set out in Sections 15.5 will ensure that all risk is reduced as far as is reasonably practicable and the residual impact is predicted to be Minor (Table 15-9).

Impacts on scuba diving

60. Scuba diving is normally confined to the coastal areas of rocky shorelines, with most activity focused further to the south of the development area (Firth of Forth). There are a number of wrecks situated in proximity to the Offshore Export Cable Corridor. However, the Offshore Export Cable Corridor has sought to avoid direct interaction with these charted wrecks and therefore mitigate any dive risk during the construction phase. Therefore the sensitivity diving activities to the Project decommissioning activities is considered to be Negligible, magnitude of effect is considered to be Minor and the resulting impact Negligible/Minor.

Impacts on other water sports

61. All other water sports users are located in close proximity to the coast and will not intentionally travel greater than one kilometre offshore due to safety issues. This means that only during the possible decommissioning of the export cable near to the coastline (approximately one kilometre) there is a possibility of impact on this user group. As noted above the occurrence of other water sports users in this area is very minimal and the imbedded mitigation measures of local signage and notification via notice to mariners will minimise any potential impact. Therefore the sensitivity of the other water sport activities to the export cable decommissioning is considered to be Negligible, while the magnitude of effect is considered to be Minor and the resulting impact Negligible/Minor.

Table 15-7 Impact assessment summary on other marine users within the Offshore Export Cable Corridor

Impact	Receptor	Sensitivity of receptor	Magnitude of effect	Significance
Collison with other cables	Cables	Negligible No cables present	Negligible No cables present	Negligible
Collison with UXO	UXO	High UXO presence is classed as likely	Major Temporary disruption	Major
Reduced areas for Scuba Diving	Scuba Divers	Negligible Limited diving activity in Development Area	Minor Some disruption close to shore Limited activity that currently occurs	Negligible/Minor
Restrictions to other water sports	Water sports enthusiasts	Negligible Limited use of this offshore area	Minor Some disruption close to shore Limited activity that currently occurs	Negligible/Minor

15.5. Mitigation

62. This section sets out additional mitigation measures for the Project identified following the assessment process.

63. The additional mitigation measures are a direct response to the specific predicted effects of the Project on other marine activities and are therefore different from, and supplementary to, those assumed to be embedded. Measures are set out below for each of the topic addressed in this chapter and apply to the windfarm unless stated otherwise.

64. The following mitigation measures have been identified and will be undertaken:

- A UXO survey will be undertaken to provide accurate information when planning cable routes and where anchors will be placed.
- To reduce potential risk and impact to canoeing, sea kayaking and jet skiing during the cable landing installation phase, all operating vessels must use appropriate signage. The Project will coordinate with the UKHO, MCA, Aberdeen County Council, and Aberdeen Harbour Master, to agree the programme of works and the issue of temporary Notices to Mariners.
- The Project will make canoeing, sea kayaking and jet skiing users aware of the installation activities (and in time: decommissioning), providing information on the duration, location and temporary access restriction, by sending information to local recreational clubs, canoeing/kayaking associations, and moorings/harbours, through key contacts, but not limited to the following groups:

    - Aberdeen Kayak Club
    - Aberdeen Harbour
    - SRYA
    - Aberdeen & Stonehaven Yacht Club
    - Aberdeen Lifeboat Station
    - MCA
    - Adventure Aberdeen
    - Integrate Paddling

- Personnel undertaking installation, maintenance or decommissioning works must remain vigilant for unaware marine users, particularly for open water swimmers and divers.
- Measures to mitigate impact to navigation of recreational boat users, fishing and shipping vessels, are set out in Section 9.5 and mitigation measures proposed for impacts on commercial fishing are set out in Section 14.5.

15.6. Cumulative Impacts

65. There are no significant in combination impacts during the construction, O&M and decommissioning phases with other offshore developments due to the site specific nature of the above receptors noted.

66. As no pipes or cables are currently within the Offshore Export Cable Corridor the possible impact on sensitive receptors is negligible and the magnitude of impact would be not be significant. This has been included at present (rather than being scoped out) due to possible cable route for the Eastern High Voltage Direct Current Subsea Link that has a potential cable corridor (Corridor C - Figure 15-1) that could cross the Offshore Export Cable Corridor of this Project. As this would be a subsequent event to the laying of the export cables this would have the largest impact in the decommissioning and O&M phase due the cable crossing and possible repairs to the export cables. If this HVDC was installed then the possible sensitivity could be Low, magnitude of effect Negligible and the possible overall significance of impact Negligible/Minor.

67. The only residual impact that still exists for this section is the possible installation of the East Coast HVDC connector cable noted above. Currently the progress on this possible scheme is unknown (Pers. Comms with MS LOT) and therefore it remains a possible in combination impact on the project.

15.7. Summary and Residual Impacts

158. The following tables summarise the residual impacts to other marine users, and the mitigation measures identified.

Table 15-8 Summary of the residual significance of the identified impacts to other marine users within the Development Area

Potential Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Construction				
Collison with other cables	Cables/Pipelines	Negligible	Embedded Mitigation with no Additional Mitigation	Negligible
Collison with UXO	UXO	Major	UXO survey	Minor
Reduced areas for Scuba Diving	Scuba Diving	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Restrictions to other water sports	Other water sports	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Operation and Maintenance				
Collison with other cables	Cables/Pipelines	Negligible	Embedded Mitigation with no Additional Mitigation	Negligible
Collison with UXO	UXO	Major	Yes – UXO survey	Minor
Reduced areas for Scuba Diving	Scuba Diving	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Restrictions to other water sports	Other water sports	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Decommissioning				
Collison with other cables	Cables/Pipelines	Negligible	Embedded Mitigation with no Additional Mitigation	Negligible
Collison with UXO	UXO	Major	Yes – UXO survey	Minor
Reduced areas for Scuba Diving	Scuba Diving	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Restrictions to other water sports	Other water sports	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor

Table 15-9 Summary of the residual significance of the identified impacts to other marine users within the Export Cable Corridor

Potential Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Construction				
Collison with other cables	Cables/Pipelines	Negligible	Embedded Mitigation with no Additional Mitigation	Negligible
Collison with UXO	UXO	Major	UXO survey	Minor
Reduced areas for Scuba Diving	Scuba Diving	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Restrictions to other water sports	Other water sports	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Operation and Maintenance				
Collison with other cables	Cables/Pipelines	Negligible	Embedded Mitigation with no Additional Mitigation	Negligible
Collison with UXO	UXO	Major	Yes – UXO survey	Minor
Reduced areas for Scuba Diving	Scuba Diving	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Restrictions to other water sports	Other water sports	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Decommissioning				
Collison with other cables	Cables/Pipelines	Negligible	Embedded Mitigation with no Additional Mitigation	Negligible
Collison with UXO	UXO	Major	Yes – UXO survey	Minor
Reduced areas for Scuba Diving	Scuba Diving	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Restrictions to other water sports	Other water sports	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor

Table 15-10 Summary of the residual significance of the identified cumulative impacts to other marine users from the Development Area and Offshore Export Cable Corridor

Potential Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Construction				
Collison with other cables	Cables/Pipelines	Negligible	Embedded Mitigation with no Additional Mitigation	Negligible
Collison with UXO	UXO	Major	UXO survey	Minor
Reduced areas for Scuba Diving	Scuba Diving	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Restrictions to other water sports	Other water sports	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Operation and Maintenance				
Collison with other cables	Cables/Pipelines	Negligible	Embedded Mitigation with no Additional Mitigation	Negligible
Collison with UXO	UXO	Major	Yes – UXO survey	Minor
Reduced areas for Scuba Diving	Scuba Diving	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Restrictions to other water sports	Other water sports	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Decommissioning				
Collison with other cables	Cables/Pipelines	Negligible	Embedded Mitigation with no Additional Mitigation	Negligible
Collison with UXO	UXO	Major	Yes – UXO survey	Minor
Reduced areas for Scuba Diving	Scuba Diving	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Restrictions to other water sports	Other water sports	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor

Table 15-11 Summary of the residual significance of the identified cumulative impacts to other marine users from the Project and other developments

Potential Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Construction				
Collison with other cables	Cables/Pipelines	Negligible	Embedded Mitigation with no Additional Mitigation	Negligible
Collison with UXO	UXO	Major	UXO survey	Minor
Reduced areas for Scuba Diving	Scuba Diving	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Restrictions to other water sports	Other water sports	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Operation and Maintenance				
Collison with other cables	Cables/Pipelines	Negligible	Embedded Mitigation with no Additional Mitigation	Negligible
Collison with UXO	UXO	Major	Yes – UXO survey	Minor
Reduced areas for Scuba Diving	Scuba Diving	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Restrictions to other water sports	Other water sports	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Decommissioning				
Collison with other cables	Cables/Pipelines (Eastern HDVD)	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Collison with UXO	UXO	Major	Yes – UXO survey	Minor
Reduced areas for Scuba Diving	Scuba Diving	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor
Restrictions to other water sports	Other water sports	Negligible/Minor	Embedded Mitigation with no Additional Mitigation	Negligible/Minor

15.8. References

CCRExplorers 2009 http://www.ccrexplorers.com/showthread.php?t=15916

DNV-RP-J301 Subsea power cables in shallow water: Renewable Energy Applications February 2014

Eastern HVDC Link Project - Scoping Report National Grid Electricity Transmission & Scottish Hydro Electric Transmission Ltd August 2012 http://www.gov.scot/Resource/0039/00398450.pdf

House of Commons shipping: jet skis. http://researchbriefings.files.parliament.uk/documents/SN00268/SN00268.pdf

Hywind UXO desk based assessment (2014). http://www.statoil.com/no/EnvironmentSociety/Environment/impactassessments/NewEnergy/IntWind/Downloads/supporting%20studies/Unexploded%20Ordnance%20Desk%20Based%20Study%20with%20Risk%20Assessment.pdf

Inch Cape Environmental Statement Chapter 21 – Other Human (2014) http://www.inchcapewind.com/publications/environmental-statement/HumanEnvironment/Chapter21/Chapter21

MCA MGN 280 (M) - Small Vessels in Commercial Use for Sport or Pleasure, Workboats and Pilot Boats – Alternative. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/282245/mgn280.pd

16. Onshore

16.1. Introduction and Context

1. This chapter is an overview of the onshore works of the KOWL, and the associated potential impacts. However, this chapter of the ES is for information only, and therefore does not follow the same approach as the other chapters. This is based on the advice from Marine Scotland that the onshore works will be subject to a separate application submitted to Aberdeen City Council under the Town and Country Planning (Scotland) Act 1997. That application will be supported by appropriate environmental information to enable the City Council to assess the acceptability of the development.

2. The 'Onshore Works' comprise the following components:

- Landfall;
- Cable Corridor; and
- Substation Site.

3. The 'Landfall' will be located between the subsea cable termination and the jointing pits, in the vicinity of Souter Head. The onshore cables will connect to the offshore cables within the jointing pit which will comprise a sunken concrete pit.

4. The 'Cable Corridor' relates to the area within the Application Boundary from the transition pits to the substation site and includes the main 'working corridor'. A connection to the electricity transmission network ('the grid') for the Kincardine Offshore Windfarm has been secured at the Redmoss Substation, off Wellington Road, Aberdeen. From landfall, three alternative cable routes to the substation have been considered as shown on the plan below.

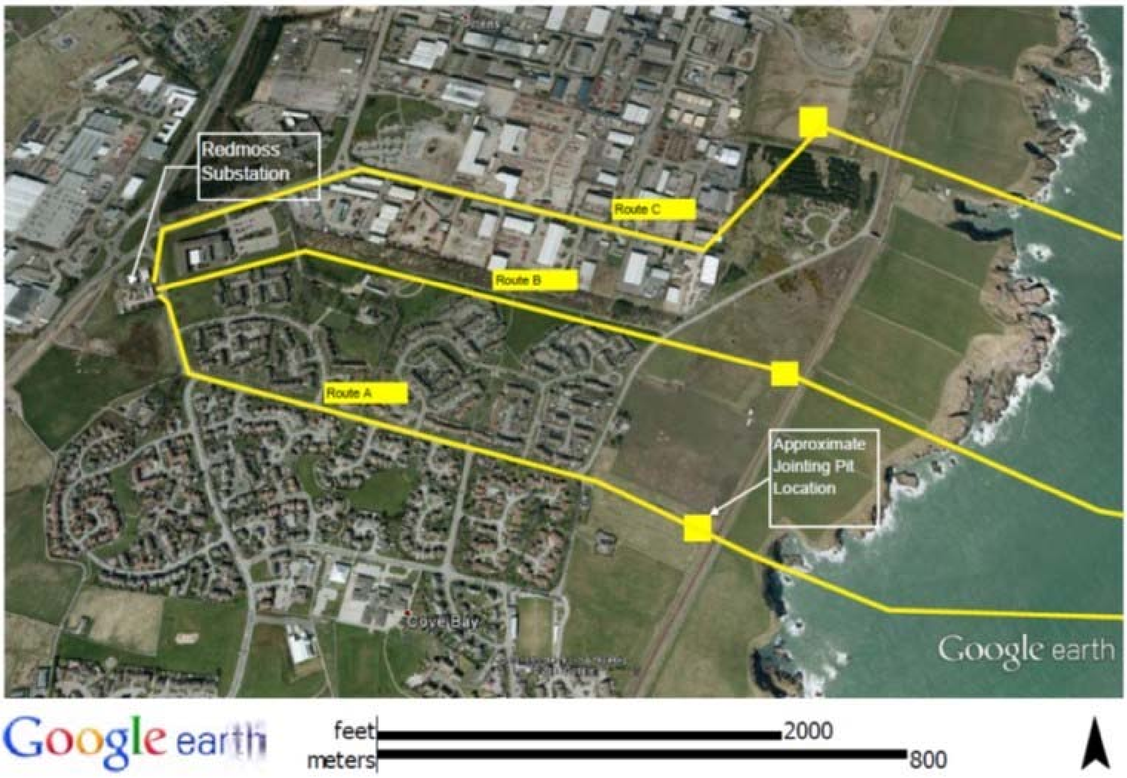

Figure 16-1 Alternative Cable Routes

5. Route A: The landfall would be located south of Burbanks Haven. The jointing pit would be located in an area of rough grazing to the west of the railway line. From the jointing pit the cable route would run west along Langdykes Road, with the cable being located in the carriageway.

6. Route B: The landfall would be located south of Burbanks Haven. The jointing pit would be located in an area of rough grazing to the west of the railway line. From the jointing pit the cable route would run west along a landscape buffer corridor between Altens employment area and housing located off Langdykes Road.

7. Route C: The landfall would be located north of Burbanks Haven. The jointing pit would be located in an area of rough grazing to the west of the railway line. From the jointing pit the cable route would run south through land in the ownership of the Aberdeen Harbour Board before turning west through the Altens employment area with the cable being located within the carriageway of Souter Head Road.

8. The distances between the landfall and the grid is approximately 2km. Temporary works taking place within the 'Cable Corridor' include:

- Establishing jointing pits;
- Excavating the trench (or undertaking trenchless techniques where trenching is not possible/appropriate);
- Laying down the cables;
- Heavy vehicle access;
- Small vehicle/pedestrian access;
- Establishment of temporary fences;
- Establishment of temporary construction access points;
- Car parking;
- Temporary storage of materials/spoil as sections of cable are laid;
- Reinstatement of land once sections of cables have been laid; and
- Establishment and maintenance of temporary construction compounds for the duration of construction.

16.2. Description of Development

16.2.1. Introduction

9. This section provides a more detailed description of the proposed Onshore Works required to enable the grid connection for the Project. The information provided forms the basis of the assessments presented in the following chapters. The section includes details about construction, operation and decommissioning of the Onshore Works, including measures incorporated within the construction methodology and project design which have been included to avoid or reduce potential effects on environmental receptors.

16.2.2. Project Elements

10. The Onshore Works comprise three principal elements:

- Landfall: export cables from the landfall to the jointing pit where the connections with the onshore cables are made. The connection with the onshore cables will be within a small substation;
- Cable corridor: onshore cables from the substation to a grid connection at the Alterns substation; and
- Substation site: connection to new transformers within the existing substation.

Onshore Cable – Landfall

11. The offshore export cable will be brought from the offshore cable laying vessel, across the intertidal zone, to a jointing pit located on land above Souter Head. The onshore and offshore cables will be connected at the jointing pit.

12. The precise cable route within the landfall area will be dependent on the results of detailed geotechnical investigations of the landfall area, but in any event will be within the Section 36 application red line boundary.

13. The method of installation for the intertidal works will be Horizontal Directional Drilling (HDD). HDD is a well-established method of underground intertidal cable installation. The principle of HDD is to install a high density polyethylene (HDPE) duct by drilling underground between two points. An electrical cable is installed within the duct and the installation is completed without the need to excavate between the two points. To achieve this, an onshore drill rig commences drilling a pilot hole at the onshore end of the works toward the end point of the works.

14. The HDD process is unlikely to give rise to significant amounts of waste such as drilling mud but any waste resulting will be disposed of by a licenced waste operator to a licenced facility. The management of waste arising across the whole Project will be articulated in a waste management plan.

15. A potential profile of the directional drilling is shown on the figure below (Figure 16-2:

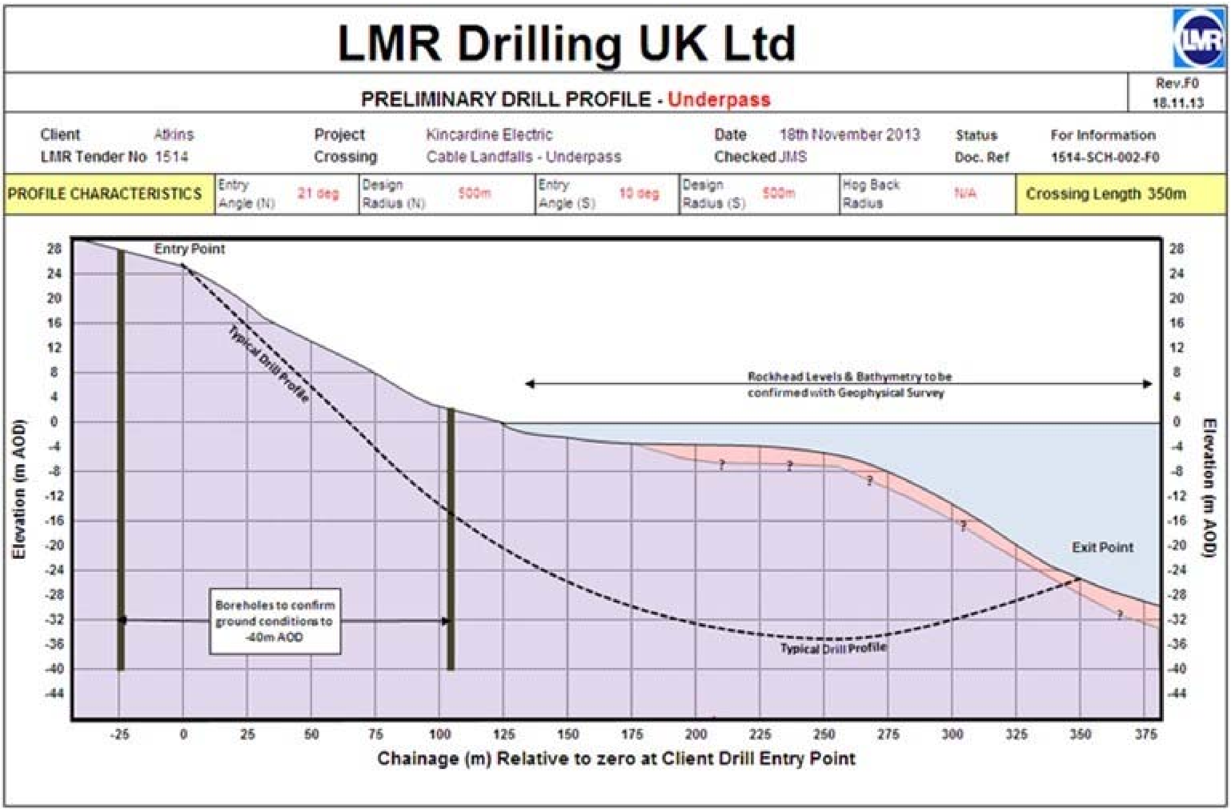

Figure 16-2 Potential Directional Drilling Profile

Jointing Pit

16. The jointing pit will be excavated by a mechanical excavator following which a concrete chamber will be installed. Once the transition pit has been established, the offshore cables will be winched into place. The offshore export cables will then be joined to the onshore cables. On completion of the joint at the transition pits, the ground surrounding and above the pits will be reinstated.

Substation

17. From the jointing pit the cables will be taken to a small onshore substation. This could comprise a small building and transformer but the exact specification will be described in the planning application.

Onshore Cable – Jointing Pit to Altens Substation

18. Underground cable installation is well-established and aside from the engineering challenges it incorporates environmental management and mitigation measures as standard practice. Precise construction methods will differ according to the nature of the environment through which the cable route is being constructed. Of particular importance are the underlying soils and strata, existing hydrological regimes, the terrain, the existence of physical constraints such as other underground services, infrastructure and environmental constraints such as development or environmentally sensitive areas. Special construction techniques will be necessary where the cable route crosses railways and roads.

19. Open cut trenching will be used for cable installation along the majority of the route. Works at each section will consist of excavation of the cable trench, cable laying, cable jointing and reinstatement. Before works begin at each section, the topsoil across the construction area will be removed using mechanical excavators and stored carefully alongside to enable reinstatement. Mechanical excavators will then be used to dig the cable trench. Once complete each section of cable will be placed into position at the end of the trench. The cables will then be winched through the open trench. Once the cables are installed, the trench will be backfilled with sand and native material, protective covers (where appropriate) and warning tapes, to avoid damage during any future excavations, then topsoil replaced. Previously excavated material will be used to backfill the cable trench wherever possible. This will minimise the amount of material to be disposed of off-site.

16.3. Legislation and Planning Policy

16.3.1. Introduction

20. This section sets out the legislation and planning policy considerations for the Onshore Works, which are of relevance in considering the acceptability of the proposal in policy terms. This chapter includes references, where appropriate, to national, regional and local planning policy and guidance frameworks and identifies other relevant material considerations.

16.3.2. Development Plan Framework

21. The Development lies wholly within the Aberdeen City administrative area. The adopted Development Plan comprises:

- The Aberdeen Local Development Plan 2012 which was adopted in February 2012.

Green Belt NE2

22. No development will be permitted in the green belt for purposes other than those essential for agriculture, woodland and forestry, recreational uses compatible with an agricultural or natural setting, mineral extraction or restoration or landscape renewal.

23. The following exceptions apply to this policy:

- Proposals for development associated with existing activities in the green belt will be permitted but only if all of the following criteria are met: a) the development is within the boundary of the existing activity; b) the development is small-scale; c) the intensity of activity is not significantly increased; d) any proposed built construction is ancillary to what exists.
- Essential infrastructure, such as electronic communications infrastructure and **electricity grid connections**, transport proposals identified in the Local Development Plan, such as the Aberdeen Western Peripheral Route, as well as roads planned through the master planning of new housing and employment

Green Space Network NE1

24. The City Council will protect, promote and enhance the wildlife, recreational, landscape and access value of the Green Space Network. Proposals for development that are likely to destroy or erode the character or function of the Green Space Network will not be permitted. Where major infrastructure projects or other developments necessitate crossing the Green Space Network, such developments shall take into account the coherence of the network. In doing so measures shall be taken to allow access across roads for wildlife and for access and outdoor recreation purposes.

Urban Green Space NE3

25. Permission will not be granted to use or redevelop any parks, playing fields, sports pitches, woods, allotments or all other areas of urban green space (including smaller spaces not identified on the Proposals Map) for any use other than recreation or sport, unless an equivalent and equally convenient and accessible area for public access is laid out and made available in the locality by the applicant for urban green space purposes. In all cases, development will only be acceptable provided that:

1. There is no significant loss to the landscape character and amenity of the site and adjoining areas;
2. Public access is either maintained or enhanced;
3. The site is of no significant wildlife or heritage value;
4. There is no loss of established or mature trees;
5. Replacement green space of similar or better quality is located in or immediately adjacent to the same community, providing similar or improved benefits to the replaced area and is as accessible to that community, taking into account public transport, walking and cycling networks and barriers such as major roads;
6. They do not impact detrimentally on lochs, ponds, watercourses or wetlands in the vicinity of the development; and
7. Proposals to develop playing fields or sports pitches should also be consistent with the terms of Scottish Planning Policy.

Renewable and Low Carbon Energy Developments - Policy R8

26. The development of renewable and low carbon energy schemes is supported and applications will be supported in principle if proposals:

- Do not cause significant harm to the local environment, including landscape character and the character and appearance of listed buildings and conservation areas;
- Do not negatively impact on air quality;
- Do not negatively impact on tourism; and
- Do not have a significant adverse impact on the amenity of dwelling houses.

Natural Heritage - Policy NE8

27. Development that, taking into account any proposed mitigation measures, has an adverse effect on a protected species or an area designated because of its natural heritage value will only be permitted where it satisfies the relevant criteria in Scottish Planning Policy. These are International Designations, National Designations, Local Designations and European Protected Species and Species protected under the Wildlife and Countryside Act 1981.

28. In all cases of development at any location: -

- Applicants should submit supporting evidence for any development that may have an adverse effect on a protected species demonstrating both the need for the development and that a full range of possible alternative courses of action has been properly examined and none found to acceptably meet the need identified'
- An ecological assessment will be required for a development proposal on or likely to affect a nearby designated site or where there is evidence to suggest that a habitat or species of importance (including those identified in the UK and Local Biodiversity Action Plans) exists on the site;

- No development will be permitted unless steps are taken to mitigate negative development impacts. All proposals that are likely to have a significant effect on the River Dee SAC will require an appropriate assessment which will include the assessment of a detailed construction method statement addressing possible impacts on Atlantic Salmon, Freshwater Pearl Mussel and Otter. Development proposals will only be approved where the appropriate assessment demonstrates that there will be no adverse effect on site integrity, except in situations of overriding public interest;
- Natural heritage beyond the confines of designated sites should be protected and enhanced.
- Where feasible, steps to prevent further fragmentation or isolation of habitats must be sought and opportunities to restore links which have been broken will be taken;
- Measures will be taken, in proportion to the opportunities available, to enhance biodiversity through the creation and restoration of habitats and, where possible, incorporating existing habitats; and
- There will be a presumption against excessive engineering and culverting; natural treatments of floodplains and other water storage features will be preferred wherever possible; there will be a requirement to restore existing culverted or canalised water bodies where this is possible; and the inclusion of SUDS. Natural buffer strips will be created for the protection and enhancement of water bodies, including lochs, ponds, wetlands, rivers, tributaries, estuaries and the sea. Supplementary Guidance will be developed on buffer strips.

Built Heritage - Policy D5

29. Proposals affecting Conservation Areas or Listed Buildings will only be permitted if they comply with Scottish Planning Policy. In relation to development affecting archaeological resources further details are set out in Supplementary Guidance on Archaeology and Planning.

30. Planning permission for development that would have an adverse effect on the character or setting of a site listed in the inventory of gardens and design landscapes in Scotland or in any addition to the inventory will be refused unless:

- The objectives of designation and the overall integrity and character of the designated area will not be compromised; or
- Any significant adverse effects on the qualities for which the area has been designated are clearly outweighed by social, economic and strategic benefit of national importance. In both cases mitigation and appropriate measures shall be taken to conserve and enhance the essential characteristics, aesthetics, archaeological and historical value and setting of the site.

Landscape - Policy D6

31. Development will not be acceptable unless it avoids:

- Significantly adversely affecting landscape character and elements which contribute to, or provide, a distinct ‘sense of place’ which point to being either in or around Aberdeen or a particular part of it;
- Obstructing important views of the City’s townscape, landmarks and features when seen from busy and important publicly accessible vantage points such as roads, railways, recreation areas and pathways and particularly from the main city approaches;
- Disturbance, loss or damage to important recreation, wildlife or woodland resources or to the physical links between them; and
- Sprawling onto important or necessary green spaces or buffers between places or communities with individual identities, and those which can provide opportunities for countryside activities.

32. Development should avoid significant adverse impacts upon existing landscape elements, including linear and boundary features or other components, which contribute to local amenity, and provide opportunities for conserving, restoring or enhancing them.

Access and Informal Recreation - Policy NE9

33. New development should not compromise the integrity of existing or potential recreational opportunities including access rights, core paths, other paths and rights of way. Core Paths are shown on the Proposals Map. Wherever appropriate, developments should include new or improved provision for public access, permeability and/or links to green space for recreation and active travel.

Coastal Planning - Policy NE7

34. Development will only be permitted in the developed coastal areas only where it has been demonstrated that a coastal location is necessary.

16.4. Ecology

16.4.1. Methodology

35. This section sets out a high level desk based assessment of the route options in order to highlight the key ecological constraints to the work.

36. The following methodology has been followed:

- The Multi Agency Geographic Information for the Countryside (MAGIC) website was used to identify the presence of statutory designated sites of nature conservation importance within 5km of each of the three options;
- Ordnance Survey maps were reviewed to identify water bodies within 500m of each of the three options. Great crested newts can use terrestrial habitat up to 500m from their breeding ponds, using hedgerows and woodland to commute and forage outwith the breeding season; and
- Aberdeen City Council were also consulted to obtain information relating to non-statutory sites of nature conservation importance within 1km of each of the three options.

16.4.2. Results

37. Statutory Sites of Nature Conservation

38. A search was made for all statutory sites of nature conservation within 5km of the three options. Figure 16-3 and Table 16-1 below show the results of this search.

Table 16-1 Detail of statutory sites of nature conservation importance within 5km if each option

Site Number (Map Ref)	Reason for designation	Distance from project site boundary	Direction from project site boundary
River Dee Special Area of Conservation (SAC)	Primary reason for selection – fresh water pearl mussel, Atlantic salmon and otter.	Option A: 2.26km	North West
		Option B: 2.23km	
		Option C: 2.20km	
Cove SSSI	Notified features include vascular plants and coastlands.	Option A: 285m	South East
		Option B: 560m	
		Option C: 780m	
Nigg Bay SSSI		Option A: 2.6km	North East
		Option B: 2.8km	
		Option C: 3.0km	
Findon Moor SSSI	Notified features include lowland heathland.	Option A: 3.8km	South
		Option B: 4.17km	
		Option C: 4.33km	

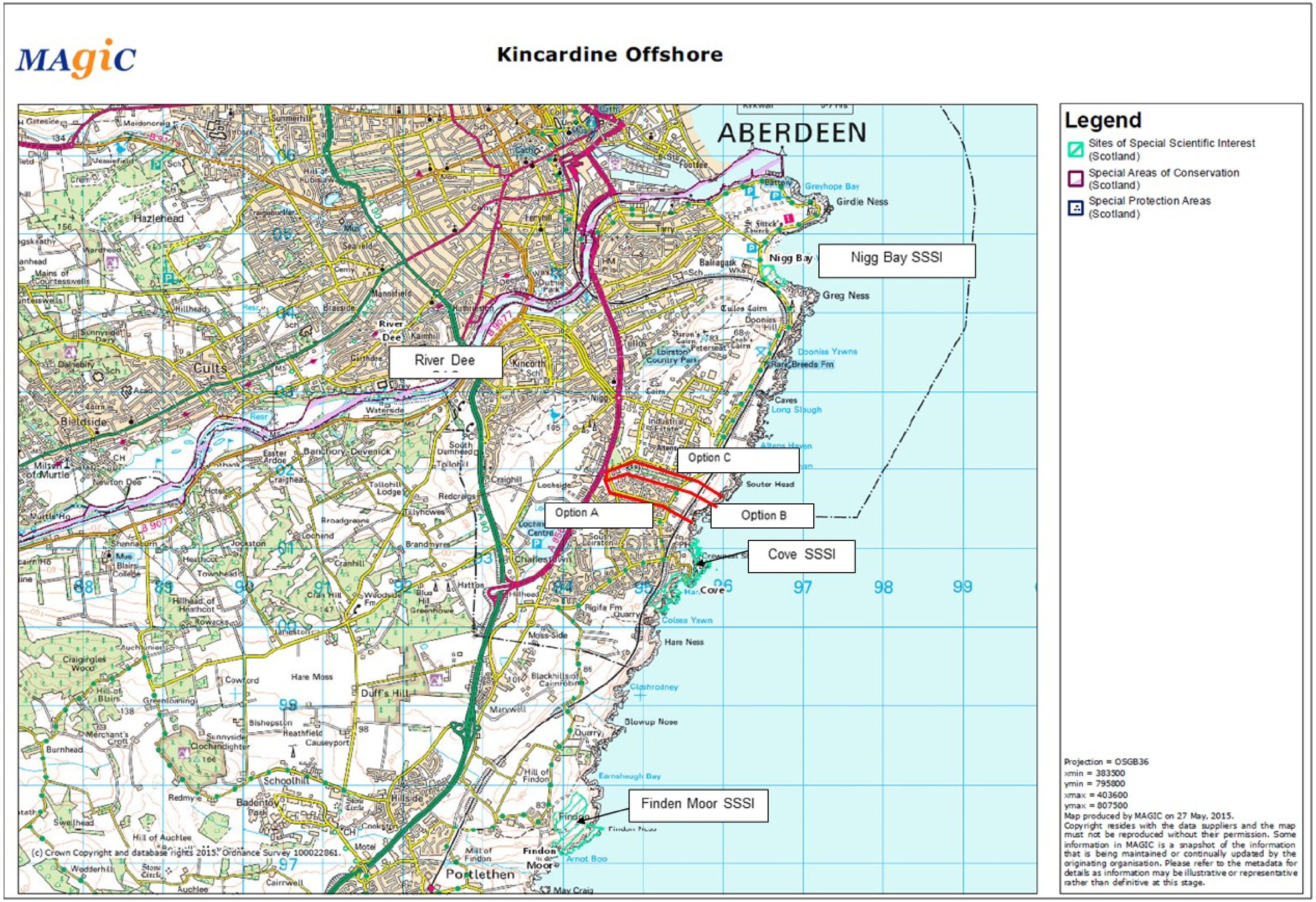

Figure 16-3 Designated Sites

Non-Statutory Sites of Nature Conservation

39. A search was made for all non-statutory sites of nature conservation within 1km of the three options. Figure 16-5 and Table 16-2 below show the results of this search.

Table 16-2 Detail of non-statutory sites of nature conservation importance within 1 km of each option

Site Number (Map Ref)	Distance from project site boundary	Direction from project site boundary
1 Coastline - Local Nature Conservation Site	Option A: Within	East
	Option B: Within	
	Option C: Within	
2 Kincorth Hill Local Nature Reserve	Option A: 885m	North West
	Option B: 870m	
	Option C: 785m	
3 Loriston Loch Local Nature Conservation Site	Option A: 660m	South West
	Option B: Over 1km	
	Option C: Over 1km	

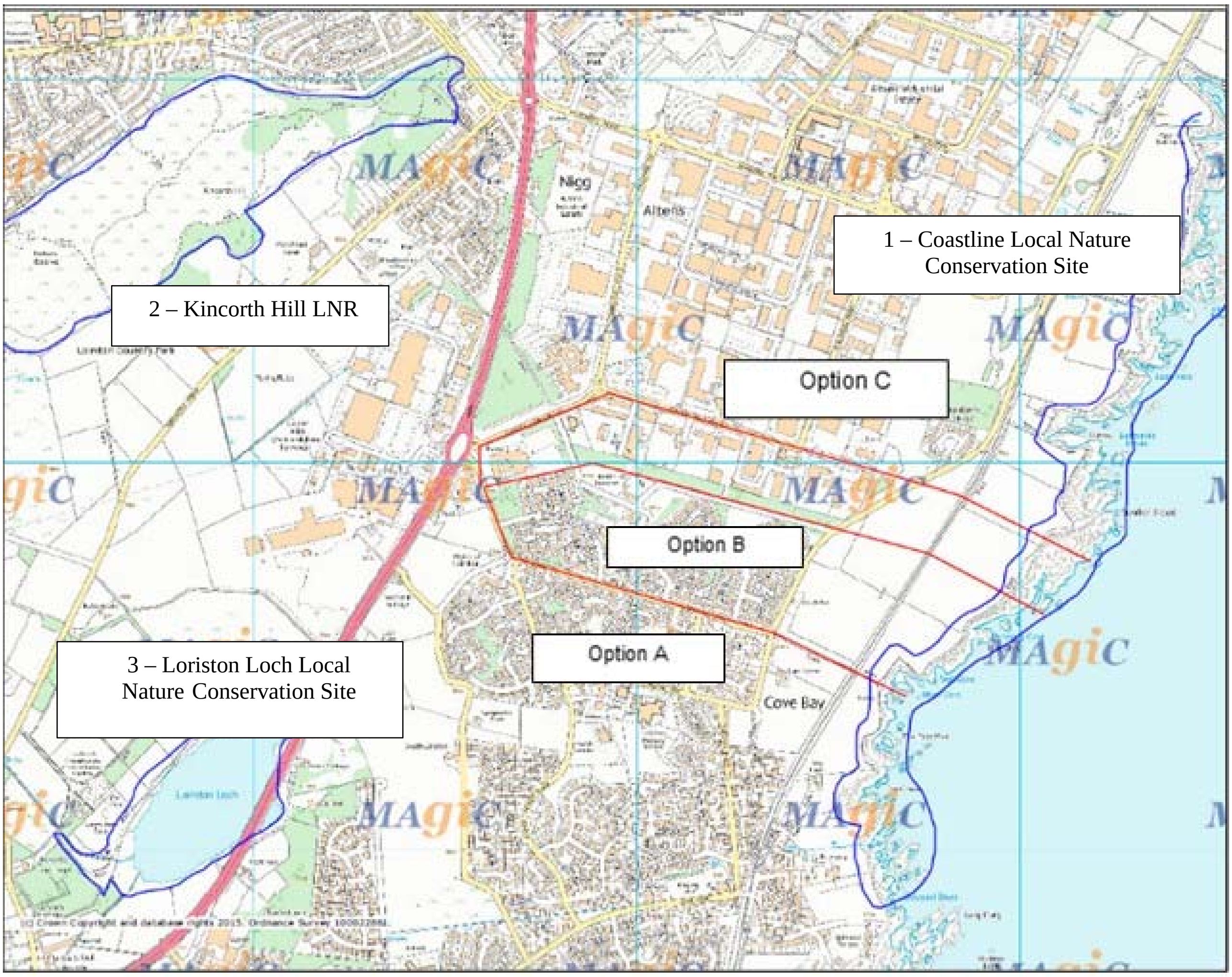

Figure 16-4 Map showing Non- Statutory Sites of Nature Conservation within 2km

Table 16-3 Table showing detail of waterbodies within 500m of each option

Waterbody Number (Map Ref)	Distance from project site boundary	Direction from project site boundary	Connecting habitat / barriers to amphibian movement
1 (ditch)	Option A: 474m	North West	Business park/A956 – a physical barrier to amphibian movement.
	Option B: 474m		
	Option C: 397m		
2 (Pond)	Option A: over 500m	North North East	Industrial land/estate, amenity land, housing, minor roads – no physical barrier to amphibian movement.
	Option B: 261m		
	Option C: 67m		
3 (Sea inlet/ditch)	Option A: 429m	South	Fields/cove – no physical barrier to amphibian movement.
	Option B: over 500m		
	Option C: over 500m		

Figure 16-5 Map showing water bodies within 500m of each option

16.4.3. Conclusions

40. The closest European designated site lies over 2.2km from each of the three options and is not aquatically linked to any of the proposed sites. The River Dee SAC is designated for presence of fresh water pearl mussel, Atlantic salmon and otter. Given the lack of aquatic connections to the site any impact on these species as a result of the works is considered highly unlikely and no further assessment is recommended.

41. The closest international designated site; Cove SSSI lies approximately 285m to the south east from Option A, 560m from Option B and 780m from Option C. This site is designated for its vascular plant and coastland habitat. The onshore work is considered to be far enough away from this SSSI to avoid direct impact on the designating features. However, due to the proximity of the shore line to the works and the connectivity along the coastline protection measures are recommended. These should include notifying any statutory bodies (including Scottish Natural Heritage and SEPA) of the works and agreeing specific protection measures. SEPA Pollution Prevention Guidance should be followed at all times during construction. It is also recommended that a survey of the

area between the SSSI and the works be undertaken prior to the works to check for specific ecological constraints. The second SSSI lies over 3km away from each option and it is considered even with the aquatic connection at the coastline that the on shore works will not impact on this site and therefore no further mitigation is considered necessary.

42. The site enters the Coastline Local Nature Conservation Site which has a non-statutory designation. The local council biodiversity office should be contacted to discuss the works and agree protection measures prior to works going ahead. It is also recommended that a survey be undertaken prior to the works to check for specific ecological constraints at this location. Given the distance from the other non-statutory sites identified it is not considered that the works will impact on these sites and no further recommendations are made.

43. A small number of waterbodies were found within 500m of the three options. The closest is a pond (Pond 2 on Table 16-3) which lies within 100m of Option C and just over 250m from Option B. If these options are taken forward it is recommended that this waterbody and any other waterbodies within 500m are surveys to assess their suitability to support great crested newts. Habitat suitability surveys can be undertaken at any time of the year. However, if further survey is recommended then these must be undertaken between March and June. The other two waterbodies, 1 and 3 on Figure 16-3, lie over 400m from the options and given the sites limited suitability (open grassland and hardstanding) it is considered unlikely that newts would travel this distance to reach the site for terrestrial purposes.

44. In the event that the route which is the subject of a planning application passes through habitat such as open grassland and near to coastal / marine habitats a pre-application ecological survey will be undertaken to check for signs of or suitability for protected and notable species such as bats, otter and badger. The outcome of the survey will be submitted with the planning application.

16.5. Cultural Heritage

16.5.1. Introduction

45. This section addresses the cultural heritage constrains associated with the proposed onshore grid connection for the deployment of floating offshore wind turbines at Cove Bay, Aberdeen.

46. The grid connection will be achieved by connecting the end of the aquatic element of the cable to a small substation by way of directional drilling through the cliff. The exit point for the cable is approximately -24 AOD. From the small substation, the cable would be placed in a cut and cover trench. The trench is assumed to be 300mm wide and 900mm.

47. Three alternative routes have been suggested for the cable. These are shown in Figure 16-1.

48. The purpose of this section is to establish an understanding of the historic environment in this area and to assess any initial potential impacts the works may have on heritage assets and as yet unknown archaeological remains.

16.5.2. Method

49. Known designated cultural heritage assets for an area of 1.5km around the site were determined in order to establish a broad enough background to the potential cultural heritage resource for the area which may be affected by the scheme. Where possible, records of undesignated assets were also sought, though a full search of the Cheshire HER was not undertaken. The following sources were used:

- The Defra and partners supported MAGIC map database, for natural statutory designations;
- Pastmap: the map based repository for the historic environment in Scotland (Canmore, the RCAHMS database of Scotland's Places; Scheduled Monuments and Listed Buildings; Conservation Areas; wreck sites, etc.);
- The Woodland Trust's inventory of ancient and veteran trees;
- Historic Ordnance Survey maps on Old-Maps.co.uk, the Ordnance Survey online map repository;
- British Geological Society online mapping; and
- Landscape Character Assessment

16.5.3. Baseline Conditions

50. Cove Bay is a coastal suburban settlement on the southern edge of Aberdeen City. The three proposed cable route options extend from the Redmoss substation to the west of Cove Bay, adjacent to Wellington Road, and follow road routes eastwards, crossing the Coast Road, the railway line, and open fields on the cliff. Jointing pits are proposed at the junction of the routes with the railway line.

51. Route A passes along Landykes Road. Modern residential housing of the Radburn system flank both sides of the road.

52. Route B passes along a tarmacked trackway with residential housing and open grassland to the south, and a strip of uncultivated scrubland to the north.

53. Route C passes along Souter Head Road through the Altans Industrial Estate.

54. In the eastern sections, all three routes cut across open grassland and fields to the cliff edge.

16.5.4. Geology

55. The study area is underlain by the Aberdeen Formation metamorphic bedrock, with an intrusion at the eastern end of igneous North Britain Siluro-devonian Calc-alkaline Dyke Suite. Overlying these at the western edge of the study area are the Lochton Sand and Gravel Formation, and the Mill Of Forest Till Formation.

16.5.5. Landscape Character

56. The coastal character of the study area is typified by low rocky cliffs, sloping seaward. To the east of the railway line, a narrow strip of agricultural land runs along the cliff. To the west, uncultivated grassland and agricultural land forms a buffer between suburban and light industrial development and the railway line. The open aspect of the agricultural and grassland areas allows strong sea views. Development is characterised by low-rise housing and low-rise industrial building and open plots.

Assessment of Cultural Heritage

16.5.6. Designated Heritage Assets

57. A search of a 1.6km radius from a central point within the study area was taken in order to identify all designated assets within proximity to the three proposed routes. Within this area, two scheduled monuments, twenty-three listed buildings, and one Conservation Area were identified.

- The Cove Bay Conservation Area boundary takes in the older part of Cove Bay around the harbour, east of the railway line. It lies to the south of the proposed routes, but abuts the path of Route A between the railway line and the cliff.
- The majority of the listed buildings comprise Grade C single storey 19th century cottages. In addition there are two Grade B churches. None of the listed buildings are directly in the path of any of the proposed alignments. However, the listed buildings of Burnbanks (15620, 15635, 15635) lie close to the north of Route C in the section between the industrial park and the railway.
- Both Scheduled Monuments lie well to the north of the northernmost proposed alignment (Route C).

Table 16-4 Designated Assets within 1.6km of the route options

Heritage Asset	Type / Grade	Location	Unique ID
Loirston Country Park, cairn and dyke 220m NE of Cat Cairn	Scheduled Monument	NJ 95357 03314	976
Cat Cairn, cairn	Scheduled Monument	NJ 95190 03173	4990
8 Loirston Road	Cat C Listed Building	NJ 9536 937	15637
2, 4, 4a Spark Terrace	Cat C Listed Building	NJ 9537 886	15629
7 and 9 Hasman Terrace	Cat C Listed Building	NJ 9536 870	15632
Upper Kirhill - lodge	Cat C Listed Building	NJ 9476 2843	15636
Nos 1-9 Colsea Road (odd numbers)	Cat C Listed Building	NJ 9536 937	15637
3 Spark Terrace	Cat C Listed Building	NJ 9533 898	19751
No 5 Burnbanks	Cat C Listed Building	NJ 95763 02039	15620
16 Loirston Road	Cat C Listed Building	NJ 9525 1111	15624
Cove Bay Hotel, Colsea Road	Cat C Listed Building	NJ 95395 00818	15633
Loirston Road, St Mary the Virgin Scottish Episcopal Church	Cat B Listed Building	NJ 9522 1017	19057
Nigg Kirk Road, Nigg Parish Church (C. of S.) including graveyard, gatepiers and boundary walls	Cat B Listed Building	NJ 94644 03147	19945
9 Loirston Road	Cat C Listed Building	NJ 95249 00914	15621
2 Hasman Terrace	Cat C Listed Building	NJ 95380 00853	15630
2, 4 Springhill Terrace	Cat C Listed Building	NJ 95383 00816	15631
7 and 8 Burnbanks	Cat C Listed Building	NJ 9577 2067	15634
Nos 4, 6, 8 Colsea Road	Cat C Listed Building	NJ 95351 00918	15638
1, 6, 9, 10, 12, 13, 18, 19 and 22 Burnbanks Village, former Aberdeen Agricultural Museum	Cat C Listed Building	NJ 95700 02000	15635
31 Loirston Road	Cat C Listed Building	NJ 95217 01253	15622
7, 8 Balmoral Place	Cat C Listed Building	NJ 95597 00717	17432
2 Loirston Road	Cat C Listed Building	NJ 95276 00905	15623
1 Loirston Road, Seaview House	Cat C Listed Building	NJ 95191 00832	15625
25 Loirston Road	Cat C Listed Building	NJ 95223 01151	15627
1 Spark Terrace	Cat C Listed Building	NJ 95318 00893	15628
Cove Bay Conservation Area	Conservation Area	NJ 95502 00857	597

16.5.7. Undesignated Cultural Heritage

58. The Pastmap database details a number of undesignated heritage assets including find spots, historic map sites, and wreck sites within the study area.

59. Within the immediate proximity of the three proposed routes, only historic map sites are listed in the Canmore database. These relate to the historic landscape character of the area – essentially rural, with croft cottages, farmsteads, and higher status houses. The areas past association with granite and gravel working is also well represented in the database.

Table 16-5 Undesignated Assets within 1.6km of the route options

Heritage Asset	Type	Location	Unique ID
Barbed arrow head, Cove Bay	Findspot	NJ 95000 01100	20236
Structure, iron spear head, Doonies Hill	Findspot	NJ 96000 03000	20243
Cove Harbour	Harbour	NJ 95540 00590	20245
Worked object, Loirston	Findspot	NJ 94500 01000	20250
Anti-tank blocks, Balmoral Terrace	WWII defences	NJ 95610 00720	81285
Cove Bay Station	Railway Station	NJ 95330 01040	112540
Cairn field, Tullos Hill	Cairn field	NJ 95300 03400	132977
Tullos Estate (site of)	Farmstead	NJ 95410 03340	173630
Nigg Radio Station	Pillbox	NJ 94290 02480	174759
Kincorth Hill	Possible Cairn	NJ 94010 02610	180629
Ice house, Colsea Road	Ice House	NJ 95470 00730	207507
Loirston House	Country House	NJ 95200 01440	207511
Altens Quarry	Quarry	NJ 95240 02240	207512
Altens	Site of Farmstead	NJ 95720 02450	207513
Mains	Site of Farmstead	NJ 96070 03050	207515
Newton	Site of Farmstead	NJ 95630 03080	207516
Burnbanks Haven Pit	Site of Gravel Workings	NJ 96010 02150	207518
Altens Haven	Site of Cottage	NJ 96130 02460	207519
Wester Croft	Site of Croft	NJ 95500 02720	207522
Upper Kirkhill	Site of Croft	NJ 95250 02800	207523
Heathvale Gravel Pit (Site of)	Sand and Gravel Workings	NJ 94060 01020	207792
Whitehills Gravel Pit (Site of)	Sand and Gravel Workings	NJ 94330 00980	207794
Lochlea Boundary Stone (Site of)	Boundary Stone	NJ 94210 01150	207795
Heatherly (Site of)	Sand and Gravel Workings	NJ 94100 01090	207799
Westerton	Site of Cottage	NJ 94540 01390	207801
Sergeant's Croft	Site of Cottage	NJ 94540 01390	207800

Heritage Asset	Type	Location	Unique ID
Cove Quarries	Site of Quarry(s)	NJ 94880 00420	207802
Mains of Loirston	Site of Sand and Gravel Workings	NJ 94570 01510	207803
Mains of Loirston	Site of Farmstead	NJ 94610 01670	207804
Redmoss	Cottage	NJ 94730 02300	207806
Redmoss farmstead	Farmhouse, farmstead	NJ 94480 02230	207807
Parkhead Farm Quarries	Quarry(s)	NJ 94000 02500	207812
Parkhead Farm	Farmhouse, Farmstead	NJ 94160 02540	207813
Stoneyhill Quarries	Quarry(s)	NJ 94070 02860	207815
Cove Farm	Farmhouse, Farmstead	NJ 95140 00810	207551
Altens Haven, Ice-house	Anti-tank blocks (second world war), building(s), icehouse	NJ 96320 02450	207553
Altens Cottage, Quarry	Quarry	NJ 95940 02180	207554
Tollohill Drive	Cottage	NJ 94270 03020	207737
Lochside, Boundary Stone	Boundary Stone	NJ 93880 02220	221031
Cove Harbour, Hand Crane	Crane	NJ 95540 00590	217904
Flint found at Peterseat Farm	Findspot	NJ 95100 03100	281370
Tullos Hill	Cremation, Lithic Scatter, Ring Cairn, Roundhouse (Possible)	NJ 95210 03230	311002
Trebartha: Cove Bay, North Sea	Wreck site Steamship	NJ 95759 01231	101781
Kenilworth: Altens, North Sea	Wreck site Steamship	NJ 96000 02000	200685
Brig: Cove Bay, North Sea	Wreck site Trawler	NJ 95700 01300	202001
Lady Louisa Stewart: Cove Bay, North Sea	Wreck site Schooner	NJ 95700 01300	206464
Karen Nickelstein: North Sea	Wreck site Craft	NJ 96000 03000	266889
Unknown: Burnbanks Haven, Cove, North Sea	Wreck site Craft	NJ 96190 02080	312548
Unknown: Cove, North Sea	Wreck site Craft	NJ 95000 01000	312632
Star of Peace: Mutton Rock, Cove, North Sea	Wreck site Auxiliary Yawl	NJ 95900 00700	312633
Raith: North Sea	Wreck site Steamship	NJ 96000 01000	312634
Newcastle: Cove, North Sea	Wreck site Schooner	NJ 95000 01000	312642
Goodenough: Cove, North Sea	Wreck site Schooner	NJ 95000 01000	312643
Unknown: Cove, North Sea	Wreck site Craft	NJ 95000 01000	312660

16.5.8. Historic Maps

60. The 1867 Kincardineshire Ordnance Survey map shows the study area largely comprising of fields. The farmstead of North Loirston is shown amid the fields, close to the proposed path of Route B where the trackway that Route B kinks at its western end. A number of cottages and crofts feature at Burnbanks. This area is currently grass and scrub and the site of the present-day Burnbanks Village. The proposed jointing pit of Route C is close to these crofts (in the 1904 map, a well is also shown here). The proposed course of Route A follows the boundary of Loirston House, an extensive house in gardens shown on the 1867 map.

61. There is little change in the 1904 map. The settlement of North Loirston has grown.

16.5.9. Woodland and Wetland

62. There are no areas of designated Ancient Woodland within the study area and no wetland sites.

16.5.10. Archaeology

63. No known archaeological sites or findspots exist along the proposed routes. Some findspots exist close by and are limited to isolated flint finds, except for the Scheduled Monument of Cat Cairn and the prehistoric remains found at Tullos Hill. Both sites lie considerably north of the proposed routes, on elevated ground.

64. Glacial deposits likely rules out the existence of prehistoric archaeological remains within the cliff. The area around Aberdeen has experienced human habitation since the Mesolithic period, following the melting of the last ice sheet. This archaeology features on the gravel terraces, but is unlikely on the cliff formations.

16.5.11. Assessment of Effects

65. Potential effects of the works would be limited to direct disturbance of unknown archaeological remains across the three proposed routes.

66. None of the routes will directly impact known archaeological sites, listed buildings, or other designated heritage assets. Route A has the potential to cause temporary visual disturbance to the setting of the Cove Bay Conservation Area.

67. The western section of all routes (trenched) could potentially impact post-medieval buried archaeology associated with the historic settlements of the area. However, as they follow existing tarmacked routes, it is likely that any archaeological remains have been disturbed or truncated. The eastern section of the routes, where directional drilling is proposed to provide a pathway for the cabling within the cliffs, has a very low potential to impact older unknown archaeological remains.

68. Route A: Route A follows the route of Langdykes Road, shown on the first edition Ordnance Survey map. There is potential for postmediaeval archaeological remains to be disturbed by the cut and cover trenching. However, any such remains are likely to be of low significance. This route also goes closest to the Cove Bay Conservation Area, however directional drilling would mean that section of the route would be unlikely to have anything other than a short-term minor adverse visual impact during works on the setting of the Conservation Area.

69. Route B: Route B follows a trackway shown on the first edition Ordnance Survey map. There is potential for postmediaeval archaeological remains to be disturbed by the cut and cover trenching. However, any such remains are likely to be of low significance.

70. Route C: Route C does not follow a historic track alignment. However, it passes directly through an area with high potential for the survival of post-medieval remains associated with Burnbank Village. The site of the proposed jointing pit in particular, has the highest potential of all routes to encounter unknown archaeological remains.

16.5.12. Conclusion

71. Based on current understanding of the area through available data, there is potential for post-medieval archaeology to exist in the cut and cover sections of all three proposed routes, but this is

likely to have been truncated and / or disturbed. The cliff section of the route – due to glaciation processes – would not contain archaeological evidence.

72. Route B has least impact on existing known heritage constraints (Conservation Area, listed buildings, historic settlement), and based on these determinants is considered the preferred route.

73. It is unlikely that archaeological mitigation would be necessary for Route B. Route C may require mitigation (such as watching brief) in relation to Burnbank Village.

16.6. Landscape

16.6.1. Introduction

74. The Aberdeen City Landscape Strategy was adopted in 2002. The Strategy establishes the criteria by which landscape setting may be defined, and highlights the areas, landmarks and features which are most important to the landscape setting of the City and which should be safeguarded from general development.

75. The landfall and cable corridor comprise works which once operational will be underground. The landfall marker is a large feature, but there are unlikely to be any significant landscape and visual effects arising from the other elements.

16.6.2. Landscape Resources

76. Landscape resources relate to local variations in landscape characteristics and are specifically linked to the key areas likely to be directly affected by the proposed works. Landscape resources are described in terms of variations of characteristics within the local landscape of the cable route. Each localised area comprises a number of elements, features of components which together constitute the landscape resource.

77. The landscape elements comprise open rough grazing and a mixed urban typology comprising employment, residential and open space.

78. There are no landscape designations within or adjacent to any of the cable corridor options.

16.6.3. Potential Impacts

79. With the exception of the permanent landfall marker potential effects arising from the cable corridor and landfall will be from construction and decommissioning only. Landscape and visual effects arising during the construction and decommissioning period are likely to of limited scale and duration. Once installed and the land reinstated there will be no visual impact from the presence of the cable within the cable corridor.

16.7. Construction Effects

16.7.1. Introduction

80. This section considers the potential effects of the proposed Onshore Works during the construction phase. This includes potential effects in respect of noise, air quality and traffic. The activities which could give rise to potential noise, air quality and traffic impacts include HDD, open trenching, the movement of materials to and from the working site and the movement of the workforce to and from the working site.

81. Dust emissions from construction activities are variable and will depend upon type and extent of the activity, soil conditions (soil type and moisture), road surface condition and weather conditions. Soils are inevitably drier during the summer period and periods of dry weather combined with higher than average winds have the potential to generate the most dust.

82. It is anticipated that the onshore works will have a duration of approximately three months.

16.7.2. Policy and Regulations

83. The Control of Pollution Act 1974 (as amended) provides local authorities with the power to control noise from construction sites. The powers include prosecution for failure to comply with the requirements of a notice served under section (s) 60 of the Act, and a system of providing prior consents for works to be carried out in a specified manner so as to reduce the likelihood of causing disturbance ('s.61 consents'). If a notice under s.60 is contravened, it shall be a defence to proceedings if prior consent has been granted under s.61 and the works are carried out in accordance with that consent. In addition, noise generators can use the defence that best practicable means have been employed to control noise emissions.

84. The Environmental Protection Act 1990 (as amended) provides local authorities with powers to serve abatement notices against noise (including vibration) considered to be a nuisance. Noise generators can use the defence that best practicable means have been used to control noise emissions or, in relation to construction noise, that the alleged nuisance arose from activities that were compliant with an extant consent under s.61 of the Control of Pollution Act 1974.Dust nuisance is the result of the perception of the soiling of surfaces by excessive rates of dust deposition. Dust nuisance is defined as a statutory nuisance in Part III of the Environmental Protection Act 1990. Within the UK there are currently neither standards nor guidelines for the nuisance of dust, nor specified formal dust deposition standards. This situation reflects the uncertainties in dust monitoring technology and the subjective relationship between events where dust is deposited, surface soiling and the perception of such events as a nuisance.

16.7.3. Existing Conditions

85. Route Option A – The exact locations of the landfall and jointing pit area are still to be defined. However the closest residential property (East Lynn) is between 160m and 200m from potential location. There is a further residential property (Greenarbor) where the cable route meets the public highway at Langdykes Road. Langdykes Road is a local distributor road with residential development located on either side of it. The residential properties are set well back from the edge of the carriageway.

86. Route Option B - The exact locations of the landfall and jointing pit area are still to be defined. However there are no residential properties in close proximity to the landfall and jointing pit. The landscape buffer which the cable route would pass through is not open to vehicular traffic and the residential properties which are adjacent to it will not currently experience noise from road traffic. However the properties are closer to the industrial units in Altens Business Park many of which have open yards and they may be subject to noise from those uses.

87. Route Option C - The exact locations of the landfall and jointing pit area are still to be defined. The closest dwellings (at Burnbanks Village) are over 200m from the indicative jointing pit location. The indicative jointing pit location is sited within an employment area. The cable route from the jointing pit passes though and area of scrubland before joining the alignment of Option B through the landscape buffer.

16.7.4. Mitigation

88. The proposed standard hours of work for construction are 08:00 to 18:00 Monday to Friday and 08:00 to 13:00 Saturday.

89. General principles of construction site noise control would be followed according to the guidance given in BS 5228: Part 1, 2009. This requires that noise control measures would be adopted according to 'Best Practicable Means' (BPM) to prevent and reduce significant adverse effects that may arise during the proposed works. BPM is defined as those measures which are reasonably practicable having regard amongst other things to local conditions and circumstances, to the current state of technical knowledge and to programme implications.

90. To minimise the level of noise to which sensitive receptors will be exposed, BS 5228 recommends the following measures as guidance on best available techniques to be implemented on site. Construction will be undertaken in accordance with this guidance.

91. General measures:

- Provide an induction to site personnel addressing their responsibilities with regard to noise and vibration management;
- Plan hours of working, taking into account the nature of land use in the areas concerned and duration of the work;
- Provide an out-of-hours works procedure to minimise the effect of any necessary works outside daytime working hours; and
- Notify potentially affected residents of construction activities likely to affect amenity due to noise or vibration in advance.

92. The effect of dust emitting activities outlined above can be greatly reduced or eliminated by applying the site specific mitigation measures from PAN 50: Controlling the Environmental Effects of Surface Mineral Workings. Mitigation appropriate for application to the construction works are listed below for inclusion in a Construction Environmental Management Plan (CEMP).

93. Site Planning

- Machinery and dust causing activities will be located away from sensitive receptors where possible;
- Tips and stockpiles will be located away and down-wind from neighbours where possible;
- All personnel will be to be fully trained;
- A trained and responsible manager will be on site during working times to maintain the required logbook and carry out site inspections; and
- Hard surface/compact site haul routes will be used, where practical.

94. Construction Traffic

- All vehicles will switch off engines when not required and no idling vehicles will be permitted;
- Effective vehicle cleaning will be implemented in addition to specific fixed wheel washing on leaving site and the damping down of haul routes;
- All loads entering and leaving site will be covered;
- No site runoff of water or mud will be permitted;
- Dusty surfaces will be swept regularly;
- On-road vehicles will comply with set emission standards;
- Low speed limits will be observed on site; and
- The movement of construction traffic around site will be minimised.

95. Site Activities

- Dust generating activities will be minimised;
- A dust removal system will be provided for plant;
- The drop height of falling material will be limited;
- Water will be used as a dust suppressant where applicable;
- Stockpiles will be covered, seeded or fenced to prevent wind whipping; and
- Activities/operations will be temporarily suspended if the creation of dust cannot be avoided.

16.7.5. Potential Impacts

96. It is considered that once the Onshore Works are operational, there is very limited potential for the works to affect local air quality or noise environment. If appropriate mitigation measures are adopted the construction phase is unlikely to give rise to significant impacts. All of the options would need appropriate traffic management to be in place during the installation phase.

16.8. Conclusions

97. The onshore work required to connect the proposed offshore windfarm to the grid is very limited. The 2km cable route will be underground and does not pass through a sensitive environment in terms of landscape, ecology and cultural heritage. Impacts will result from the installation of the cable but these will be limited in duration and can be mitigated by appropriate construction management.

98. As a consequence it is submitted that the works will be in accordance with the adopted development plan for the area and should therefore be approved by Aberdeen City and Aberdeenshire County Councils.