SeaEnergy RENEWABLES

Inch Cape Offshore Wind Farm

Offshore wind turbines, inter-array cabling & associated offshore infrastructure

Environmental Impact Assessment

Scoping Report

August 2010

Inch Cape Offshore Wind Farm – Scoping Report							
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This scoping report aims to seek the opinion of statutory and non-statutory consultees on the scope of the Environmental Impact Assessment which will be submitted to support the application for the consents required for the development of the Inch Cape offshore wind farm, inter-array cabling and associated offshore infrastructure.

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RPS
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Executive Summary

SeaEnergy Renewables Limited proposes to develop the Inch Cape offshore wind farm in the outer Firth of Tay region in Scottish Territorial Waters. The site is proposed to be located approximately 15-22 km to the east of the Angus coastline in Scotland (see Figure 1-1). It is anticipated to consist of approximately 180 wind turbines covering an area of about 150 km^2 with an estimated installed capacity of 1,000 MW and a potential yield of over 3,000 GWh per year.

This scoping report aims to seek the opinion of statutory and non-statutory consultees on the scope of the Environmental Impact Assessment which will be submitted to support the application for the consents required for the development of the wind farm. **It should be noted that this scoping report covers the wind turbines, inter-array cables and associated offshore infrastructure.** Although Seaenergy Renewables expects to consent the Offshore Transmission Operator (OFTO) infrastructure (i.e. OFTO offshore substations, offshore export cables, onshore export cables and onshore substation), these are not discussed in detail within this scoping report. A separate scoping report will be prepared for these offshore and onshore works at a later date when more details of the cable routes and grid connection opportunities are known. It should however be noted that the offshore wind farm EIA will take into account through in-combination effects, any potential impacts resulting from the combination of the activities.

The construction of the Inch Cape offshore wind farm aims to contribute to the Scottish Government's target of generating 50% of Scottish electricity demand from renewable sources by 2020. The project will offset the emission of greenhouse gases, in line with the UK's commitments under the Kyoto Protocol.

The Inch Cape offshore wind farm site was selected following a study of wind resource and water depth data to identify a suitable region for offshore wind farm development in Scottish Territorial Waters. This study identified the east coast of Scotland as having a suitable physical characteristics. Within the study area, analysis of other marine users and environmental parameters were then assessed to identify the site. Increased distance from shore was considered particularly important as initial discussions with local stakeholders (e.g. fisheries, nature conservation) highlighted conflicts in inshore coastal locations and potential increased impacts on other human environmental receptors (e.g. visual/seascape issues, tourism and recreation).

This scoping report presents detail regarding the baseline environment in and around the proposed Inch Cape development site. This report also identifies potential impacts that may arise as a result of this development, directly, cumulatively with other offshore wind farms and in combination with other developments. Studies and surveys are proposed in order to inform the EIA process and preliminary discussion on potential mitigation and monitoring measures is included.

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GLOSSARY

ADCP	Acoustic Doppler Current Profiler
ASSI	Areas of Scientific Interest
BGS	British Geological Society
BTO	British Trust for Ornithology
COWRIE	Collaboration for Offshore Wind Research in the Environment
dGPS	Differential Geographic Positioning System
DDV	Drop Down Video
DEFRA	Department for Environment, Food and Rural Affairs
DTI	Department of Trade and Industry
EGNOS	European Geostationary Navigation Overlay Service
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPS	European Protected Species
ES	Environmental Statement
FLO	Fisheries Liaison Officer
FTOWDG	Forth and Tay Offshore Wind Developers Group
GIS	Geographical Information System
GPS	Geographical Positioning System
ICES	International Council for Exploration of the Sea
ICOWL	Inch Cape Offshore Wind Limited
IHO	International Hydrographic Organisation
IUCN	International Union for Conservation of Nature
JNAPC	Joint Nautical Archaeology Policy Committee
JNCC	Joint Nature Conservation Committee
LAT	Lowest astronomical tide
LNR	Local Nature Reserve
MCA	Maritime and Coastguard Agency
MESH	Marine European Seabed Habitats
MHWS	Mean high water springs
mMSL	meters from Mean Sea Level
MNR	Marine Nature Reserves
MWDC	Mine Warfare Data Centre
NERL	NATS En Route Plc
NMBAQC	National Marine Biological Analytical Quality Control scheme
NNR	National Nature Reserve
OFTO	Offshore Transmission Operator
OWF	Offshore Wind Farm
OREI	Offshore Renewable Energy Installation
PSA	Particle Size Analysis
SAC	Special Areas of Conservation
SCADA	Supervisory Control and Data Acquisition
SEA	Strategic Environmental Assessment
SEERAD	Scottish Executive Environment and Rural Affairs Department

SERL	SeaEnergy Renewables Limited
SFF	Scottish Fishermen's Federation
SNH	Scottish Natural Heritage
SPA	Special Protection Areas
SPV	Special Purpose Vehicle
SSC	Suspended Sediment Concentration
SSSI	Sites of Special Scientific Interest
STW	Scottish Territorial Waters
SUT	Society for Underwater Technology
UKBAP	UK Biodiversity Action Plan
UKHO	United Kingdom Hydrographic Office

1. Introduction

SeaEnergy Renewables Limited (SERL) proposes to develop the Inch Cape offshore wind farm in the outer Firth of Tay region in Scottish Territorial Waters (STW). The site is proposed to be located approximately 15-22 km to the east of the Angus coastline in Scotland (see Figure 1-1). It is anticipated to consist of approximately 180 wind turbines covering an area of about 150 km^2 with an estimated installed capacity of 1,000 MW and a potential yield of over 3,000 GWh per year.

The purpose of this scoping report is to seek the opinion of the statutory and non-statutory consultees on the scope of the Environmental Impact Assessment (EIA), which will be submitted to support the application for the consents required for the development of the proposed Inch Cape offshore wind farm. **It should be noted that this scoping report covers the wind turbines, inter-array cables and associated offshore infrastructure.** Although SERL expects to consent the Offshore Transmission Operator (OFTO) infrastructure (i.e. OFTO offshore substations, offshore export cables, onshore export cables and onshore substation), these are not discussed in detail within this scoping report. A separate scoping report will be prepared for these offshore and onshore works at a later date when more details of the cable routes and grid connection opportunities are known. It should however be noted that the offshore wind farm EIA will take into account through in-combination effects, any potential impacts resulting from the combination of the activities.

Scoping is the process by which the content and extent of the matters which should be covered in the EIA are identified at an early stage. The final results of the EIA will be published in an Environmental Statement (ES), which will then be submitted together with the planning application to the competent authority for determination.

This scoping report provides details of the proposed offshore wind farm along with a summary of the baseline environmental information currently available for the project area. The potential impacts of the development have been identified, along with cumulative and in-combination impacts. Further proposed assessments and methodologies for the EIA are presented and an outline scope of works is provided.

The Inch Cape offshore wind Scoping Report is structured as follows:

Section 1 – Intoduction

Section 2 – Project Description

Section 3 – Cumulative and In-Combination Impacts

Section 4 – Stakeholder Consultation

Section 5 – Preminimary Environmental Considerations

Section 6 – Scoping Consultation

Section 7 – References

The fundamental purpose of the ES for the proposed Inch Cape offshore wind farm will be to demonstrate that:

- The proposed development site has been selected to minimise environmental impacts and conflicts of interest, where possible; and
- The proposed layout has been designed to mitigate any potential adverse impacts as far as reasonably possible.

The final ES will clearly inform stakeholders of the residual impacts and facilitate an informed consents decision.

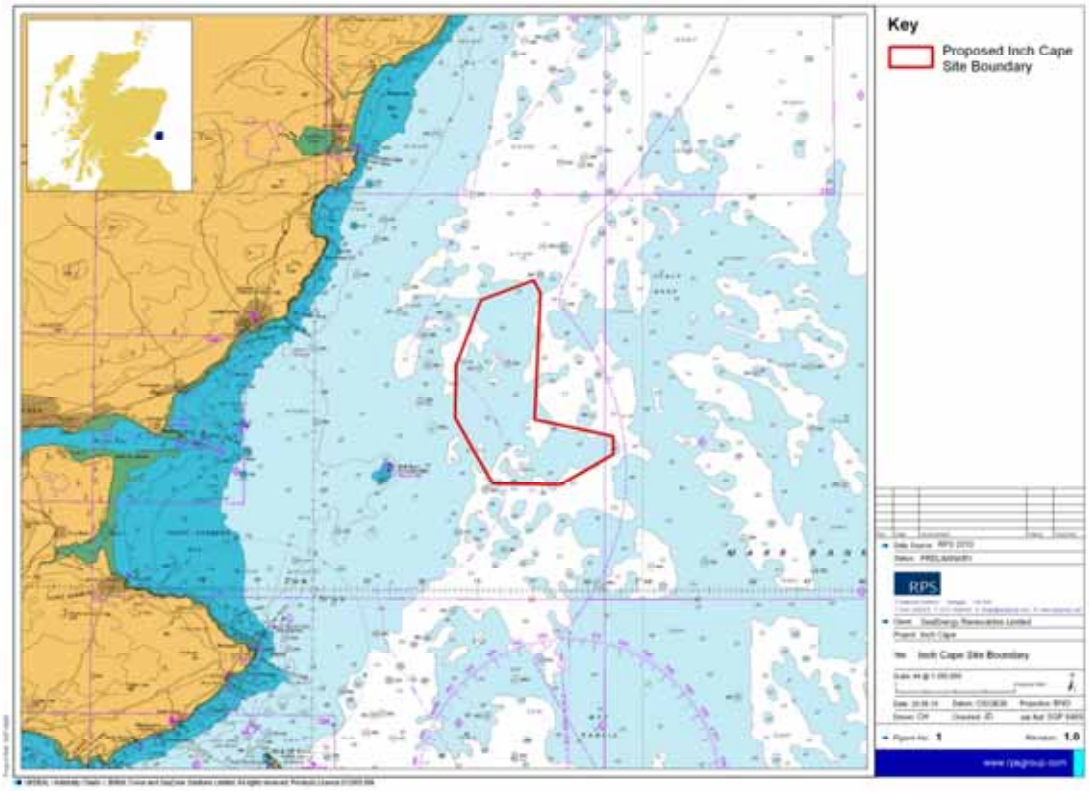


Figure 1-1: Location of the proposed Inch Cape offshore wind farm

1.1 The Developer

1.1.1 Inch Cape Offshore Wind Farm Limited

SERL will establish a special purpose vehicle (SPV) in the name of Inch Cape Offshore Wind Farm Limited (ICOWL), to develop, consent, finance, construct, operate and maintain the proposed wind farm over its lifetime.

1.1.2 SeaEnergy Renewables Limited

SERL is an offshore wind developer based in Scotland and was established to take a leading position in the global market developing for offshore wind energy. The Company was formed around the key personnel involved in the Beatrice Demonstrator project, a pioneering development situated 25 km from shore, involving the first installation of 5 MW turbines offshore and the first use of a jacket

substructure in the offshore wind industry, installed in water depths of 45 m. The Beatrice team brought together a unique combination of skills from the Oil and Gas and Utility Sectors.

SERL's technical expertise has been recognised worldwide and the company has been involved in a number of research and development programmes. SERL is also partners in the Beatrice Offshore Wind Farm Limited, together with SSE Renewables and in Moray Offshore Renewables Limited (Zone 1 UK Round 3), together with EDP Renováveis.

1.2 National Policy and Offshore Wind Development

The introduction of the Climate Change Act (2008) committed the UK to a legally binding target of at least 34% reduction by 2020 and at least an 80% cut in greenhouse gas emissions by 2050. The Climate Change (Scotland) Act (2009) committed Scotland to cut emissions by 42% by 2020 and 80% by 2050. These targets meet and exceed European agreements of which the UK is subject. As part of the Renewable Energy Strategy for the UK, the Government has set national targets for >30% of electricity to be generated from renewables (DECC, 2009a). The Scottish Government has set a target of "50% of gross electricity consumed in Scotland to come from renewable sources by 2020" (Scottish Government, 2010).

Wind energy is a means of generating electricity without producing significant airborne or waterborne toxic emissions, and is not dependant on finite reserves of fossil fuels. It is ultimately a sustainable and proven technology, a fact that is recognised the UK Governments approach to the wind development. Previously the UK government has released areas for offshore wind development in 'rounds', similar to that of offshore oil and gas development. To date there have been three UK wide rounds of offshore wind development in the UK, administered by The Crown Estate. As of April 2010[1] the UK had an installed offshore wind generation capacity of 688.4 MW, with a further 1,147.8 MW under construction and 3,127.2 MW consented under Round 1 and 2 releases.

1.3 The Scottish Territorial Waters

In 2008 The Crown Estate requested initial expressions of interest from companies wishing to be considered for developing commercial scale wind farms within STW. The preliminary allocation of offshore wind farm exclusivity agreements under the STW process was announced in February 2009 with ten successful project developers having been granted the necessary approvals allowing them to commence site-specific survey works on ten sites with a total award capacity of 6,438 MW (see Figure 1-2).

An agreement for lease (under The Crown Estate Act 1961), which will enable developers to go ahead with construction works will only be only granted once site-specific EIAs have been undertaken and statutory consents and permissions from the Scottish Government been granted.

Developers of the three[2] proposed STW sites off the Firth of Forth / Tay have formed the Forth and Tay Offshore Wind Developers Group (FTOWDG). Section 3.1 provides further details on the collaborative working efforts of this group.

[1] www.bwea.com/statistics accessed on 21 April 2010.
[2] Note originally four STW developers. Development of the Bell Rock site has now been abandoned.

Table 1-1: Scottish Territorial Waters Sites. Source: The Crown Estate website

Site Ref	Site Name	Company/ Consortia	Size (MW)	Area (km^2)
1	Solway Firth	E.ON UK	300	61.46
2	Wigtown Bay	Dong Wind (UK) Limited	280	51.07
3	Kintyre	Airtricity Holdings (UK) Limited	378	69.40
4	Islay	Airtricity Holdings (UK) Limited	680	94.58
5	Argyll Array	ScottishPower Renewables Limited	1500	361
6	Beatrice	Airtricity Holdings (UK) Limited SeaEnergy Renewables Limited	920	121.3
7	Inch Cape	SeaEnergy Renewables Limited	905	149.9
8	Bell Rock (now withdrawn)	Airtricity Holdings (UK) Limited Fluor Limited	700	92.82
9	Neart na Gaoithe	Mainstream Renewable Power Limited	420	105.10
10	Forth Array	Fred Olsen Renewables Limited	415	128.40

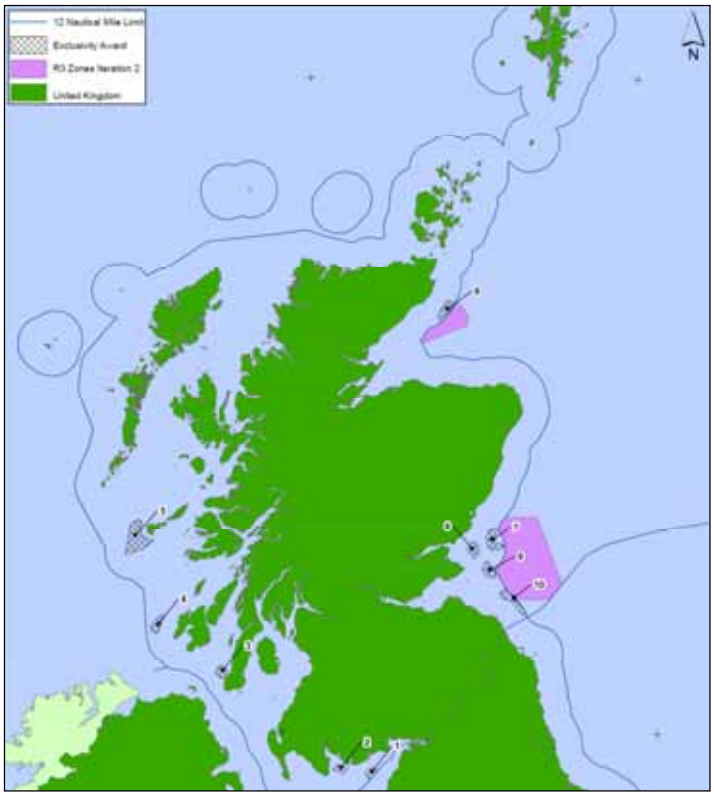


Figure 1-2: Scottish Territorial Waters Sites

1.3.1 Strategic Environmental Assessment

The Scottish Government has commenced a Strategic Environmental Assessment (SEA) of its 'Plan for offshore wind energy in Scottish Marine Waters' (the Plan). The Plan will be fundamental in taking forward the nine offshore wind farm sites (see Table 1-1) granted exclusivity agreements by The Crown Estate. The draft SEA was released for consultation on the 19 May 2010. Consultees are invited to consider the proposals in light of the environmental information presented in the SEA Environment Report. The consultation period ends on the 19th August 2010, after which the assessment will be finalised.

The SEA considers the environmental effects of offshore wind farm development around the Scottish coastline and will identify areas of environmental constraint and opportunity on a regional basis to support the assessment of offshore wind farm development.

1.4 Regulatory and Policy Background

1.4.1 Marine (Scotland) Act 2010

The Marine (Scotland) Act 2010 introduces a framework for sustainable management of the seas around Scotland, aiming to ensure environmental protection is balanced with economic growth of marine industries. It introduces a simpler licensing system, minimising the number of licences required for development in the marine environment with the aim to reduce time taken to consent and the current system's complexity.

A marine licence will be required under the Act for works within the Scottish marine area. The marine area is defined as *the area of the sea within the seaward limits of the territorial sea of the United Kingdom adjacent to Scotland and includes the bed and subsoil of the sea within that area*.

Part 4 of the Act outlines the licensable marine activities, including (5):

To construct, alter, or improve any works, within the Scottish marine area either –

a) In or over the sea, or

b) On or under the seabed.

Marine License

Marine licences will in effect replace the requirement for a consent under section 5 of the Food and Environmental Protection Act (1985) (for the deposit of objects on the seabed below mean high water springs) and a consent under section 34 of the Coast Protection Act (1949) (for the deposit of objects which may endanger the safety of navigation). The primary objectives of the legislation are to protect both the marine ecosystem and human health and to minimise interference and nuisance to other legitimate users of the sea. However, until secondary legislation is passed, there is still a requirement for separate FEPA and CPA licenses (see 1.4.5 and 1.4.6 below).

1.4.2 Electricity Act 1989 (Section 36)

The proposed Inch Cape offshore wind farm would be subject to an application for consent to Scottish Ministers under Section 36 of the Electricity Act 1989 for construction and operation. The scope of this consent will include the wind turbines, offshore substation(s) and inter-array cables.

Where a consent is granted in relation to construction and operation of an offshore wind farm under Section 36A (I) of the Electricity Act 1989 (Declaration), a declaration under Section 36A (I) (as outlined in Section 99 of the Energy Act 2004) and Section 100 of the Energy Act 2004, as respects rights of navigation may be made at the same time.

Under Section 36B of the Electricity Act 1989 (as outlined in Section 99 of the Energy Act 2004) the Scottish Ministers may not grant Section 36 consent where the generating station, whether in the territorial seas or the Renewable Energy Zone (REZ), would interfere with 'recognised sea lanes essential to international navigation'. In deciding whether navigation will be obstructed, the Scottish Ministers must take into account how they intend to exercise their powers in relation to any application for a declaration to extinguish public rights of navigation and any application for a safety zone.

1.4.3 Energy Act 2004 (Section 95) & Energy Act 2008

Under Section 95 of the Energy Act 2004 where a renewable energy installation is proposed to be constructed, and the Scottish Ministers consider it appropriate for safety reasons, that a notice declaring that specified areas are to be designated as safety zones may be issued. Such zones are intended to secure the safety of the renewable energy installation or other installations in the vicinity during construction, operation, extension or decommissioning. Importantly the purpose of the safety zone is also to secure the safety of individuals in or around the installation, vessels in the vicinity and individuals on such vessels.

Activities such decommissioning, offshore electrical infrastructure and safety are legislated under the amended Energy Act 2008.

1.4.4 Requirement for an Environmental Impact Assessment (EIA)

The EC Directive 85/337/EEC as amended by Directive 97/11/EC (the EIA Directive) requires wind farms to be subject to EIA. The purpose of the Directive is to ensure that, in considering whether to grant consents for developments that are likely to have significant environmental effects, the consenting authorities have all the necessary environmental information on which to base their decision. Offshore wind farms are listed as a Schedule 2 project as 'installations for the harnessing of wind power for energy production (wind farms)'.

The need for an EIA for electricity generation projects requiring consent under Section 36 of the Electricity Act 1989 is provided for in Scotland by the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 and amended in 2008, These set out the statutory process and minimum requirements for EIA. Regulation 7 of the 2000 Regulations enables a written request to be submitted to the Scottish Ministers to give an opinion as to the information to be provided with the Environmental Statement (ES) (a scoping opinion).

There is also a requirement to consider cumulative and in-combination impacts as part of the EIA process. Projects to be included in such an assessment must include existing projects and those currently in the planning system. Projects to be included in such an assessment must include not only the other potential renewable energy projects but also other types of project taking place in the marine environment.

1.4.5 Food and Environmental Protection Act 1985 (FEPA)

Under Section 5 of the Food and Environmental Protection Act 1985 a licence is required for the placement of the offshore wind infrastructure below mean high water springs. The primary objectives of the legislation are to protect both the marine ecosystem and human health and to minimise interference and nuisance to other legitimate users of the sea.

All FEPA licences will be applied for under a Marine Licence from April 2011.

1.4.6 Coast Protection Act 1949 (Section 34) (CPA)

Under Section 34 of the Coast Protection Act consent is required for construction of the proposed development to ensure works do not endanger the safety of navigation.

All CPA licences will be applied for under a Marine Licence from April 2011.

1.4.7 Crown Estate Act 1961

The Crown Estate, as the main landowner of the territorial seabed, requires a Lease to be granted for the development of offshore wind farms on the marine estate.

A lease will be granted when all the consents for the project have been obtained. Rights of Occupation are granted by The Crown Estate Commissioners under Section 3 of The Crown Estate Act 1961 for the purpose of placing structures on or passing cables over the seabed or foreshore. This is a statutory consent granted in the form of a lease.

1.4.8 Habitats and Birds Directive: Requirement for Appropriate Assessment

The Habitats Directive (92/43/EEC on the Conservation of natural habitats and of wild fauna and flora) was transposed into UK Law by the Conservation (Natural Habitats &c) Regulations 1994, as amended (Habitat Regulations). This requires an Habitats Regulation Assessment (of which an Appropriate assessment is part) to be conducted by the 'competent authority' before a plan or project that is likely to have a significant effect on designated or candidate Special Protection Areas (SPA) or Special Areas of Conservation (SAC), can be given consent, permission or other authorisation. The UK SACs and SPAs form the Natura 2000 network.

Habitats listed in Annex I and species listed in Annex II in the European Directive on the *Conservation of Wild Birds* (EC Directive 79/409/EEC) (the Birds Directive) are protected in the UK.

The Habitats Directive builds on the Birds Directive and together they underpin the protection of a network of protected sites across Europe referred to as the Natura 2000, including SPAs and SAC. There are 81 SACs with marine components and 73 SPAs with marine components around the UK.

1.4.9 European Protected Species and habitats

Annex IV of the Council Directive on the *conservation of natural habitats and of wild fauna and flora* (92/43/EEC) (the Habitats Directive) lists certain species of European Community interest which are in need of strict protection. Any of these species whose natural range includes any area in Great Britain are called 'European Protected Species'.

Licences may be given authorising activities involving European protected species of plants or animals which would otherwise be illegal under the Regulations. The licences are granted by Scottish Natural Heritage (SNH) or the Scottish Government depending on the reason for the license application.

Licences will also be required for Habitats in Annex I habitats and Annex II species in the UK protected by the Birds Directive.

1.4.10 Wildlife and Countryside Act 1981

The Wildlife and Countryside Act 1981 (as amended by the Countryside Rights of Way Act 2004) is the principal legislation by which wildlife is protected in the UK. All species of wild birds are afforded protection under Section 1 of the Act. Protection is afforded to animal species listed on Schedule 5 of the Act in Section 9.

1.5 OFTO Process

An Offshore Transmission Operator (OFTO) will be appointed to design, construct, manage and possibly consent the offshore transmission system from the offshore substation to the connection to the National Grid. This covers offshore substations, offshore export cables, landing points, the onshore substation and any onshore cables / overhead lines required to reach the onshore substation.

An OFTO will be appointed through a tendering process, run once a year and managed by OFGEM. This process will require ICOWL to submit all applicable data, studies and consents into a 'data room' for potential OFTO's to review and base their tender upon.

It is assumed at this stage that ICOWL will commence and possibly conclude all onshore surveys and offshore surveys, the EIA and pursue the relevant consents and licences for the onshore connection prior to entering the OFTO process.

It is anticipated that the offshore substations, export cables, ancillary onshore works and works in the inter-tidal zone required to connect the proposed offshore wind farm to the electricity transmission network will be covered under the Inch Cape Offshore Transmission Infrastructure EIA. However this process (OFTO) is in its preliminary stage and as such it is not currently known the extent to which ICOWL will conduct work on behalf of the to-be-appointed OFTO.

The onshore OFTO works will also be subject to an application for consent under Section 37 of the Electricity Act if elements of the development require new overhead power lines.

2. Project Description

This section provides a high level description of the proposed Inch Cape offshore wind farm based on information available at the time of writing. It should be noted that the wind farm design process is at an early stage, and therefore many of the detailed parameters of the project are yet to be determined.

2.1 Objectives of the Development

The primary objective of the development is the generation of energy from a renewable source, in line with the Scottish Government target of generating 50% of Scottish electricity demand from renewable sources by 2020. The project will offset the emission of greenhouse gases, in line with the UK's commitments under the Kyoto Protocol.

2.2 Clean Energy Generation / Electricity Supply

The proposed offshore wind farm will make a significant contribution towards the reduction of harmful greenhouse gas emissions that could otherwise be generated from fossil fuel electricity generation. It is estimated that the proposed offshore wind farm would produce enough power for over 680,000 homes[3].

2.3 Site Location

The proposed development site is approximately 15-22 km off the Angus coastline, to the east of the Firth of Tay, see Figure 1-1. The development area is approximately 150 km^2. The coordinates of the perimeter of the development area are listed in Table 2-1.

Table 2-1: Boundary coordinates for the Inch Cape project area

Boundary	Latitude	Longitude
	Degrees and Decimal Minutes	
1	56° 26' 53.519" N	02° 02' 48.839" W
2	56° 25' 20.272" N	02° 07' 33.456" W
3	56° 25' 22.800" N	02° 13' 48.504" W
4	56° 28' 41.872" N	02° 17' 13.703" W
5	56° 31' 22.796" N	02° 17' 10.680" W
6	56° 34' 39.727" N	02° 14' 55.716" W
7	56° 35' 40.563" N	02° 10' 08.256" W
8	56° 35' 02.400" N	02° 09' 30.132" W
9	56° 28' 37.920" N	02° 10' 00.120" W
10	56° 27' 47.876" N	02° 02' 50.352" W

WGS84 Ellipsoid & Datum, UTM Zone 30 (CM 3°W)

3 Predicted annual generation from the wind farm of over 3,000 GWh per year divided by the average annual electricity consumption of a Scottish household of 4,410 kWh per year = over 680,000 homes. Annual electricity consumption of a Scottish household is derived from a total Scottish domestic electricity consumption of 12,001 terawatt-hours (TWh) divided by 2.72 million individual domestic customers in Scotland (The Digest of UK Energy Statistics, 2009).

2.4 Site Selection

The proposed Inch Cape offshore wind farm site was selected following a study of wind resource and water depth data to identify a suitable region for offshore wind farm development in STW. This study identified the east coast of Scotland as having the most suitable physical characteristics. Within the study area, analysis of other marine users and environmental parameters were then assessed to identify a suitable site. Increased distance from shore was considered particularly important as initial discussions with local stakeholders (e.g. fisheries, nature conservation) highlighted conflicts in inshore coastal locations and potential increased impacts on other human environmental receptors (e.g. visual/seascape issues, tourism and recreation).

A summary of the key factors influencing the location of the proposed site are listed below:

- An excellent wind resource. The mean wind speed at 90 m hub height is estimated at 9.51 m/s;
- At the closest point, the site is approximately 15 km from the shore which will help minimise its visual aspect;
- Water depths and ground conditions suitable for jacket foundations;
- Potential electrical infrastructure near the coastline;
- Good access to suitable ports and local supply chain for construction and operations;
- No known Annex I habitats and outside any designated conservation area; and
- No known active oil, gas or aggregate interest in the site area.

2.4.1 Alternatives Considered

As part of the Scottish territorial waters bid process (as outlined in section 1.3) an analysis of other marine users, environmental and technical constraints was undertaken of the outer Firths of Forth and Tay to assess alternatives and subsequently identify the Inch Cape site as a suitable site to taken forward for detailed assessment.

Increased distance from shore was viewed as particularly important as initial discussions with local stakeholders highlighted potential conflicts of interest in the more coastal locations, especially in light of the forthcoming additional Round 3 proposals in the area. Criteria used to assess potential offshore wind farm development areas included:

- Expected energy yield;
- Foundation type;
- Seabed and tidal conditions;
- Marine Ecology;
- Ornithology;
- Marine Mammals;
- Nature Conservation Designations;
- Fish Resources and Commercial Fisheries;
- Shipping and Navigation;
- Other marine users;
- Grid connection; and
- Visual amenity.

Furthermore, nearby facilities for fabrication, assembly and maintenance support were also key factors in identifying the Inch Cape site. The distance to these ports will also be instrumental during operation as they will enable shorter response times for servicing thus improving availability and economic feasibility of the Inch Cape offshore wind farm.

2.5 The Proposed Scheme

2.5.1 Project Timeline and Competent Authority

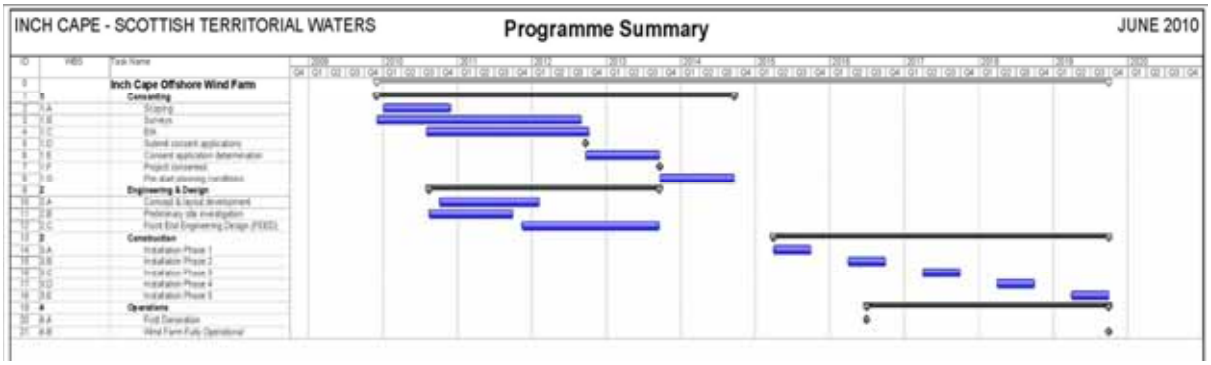


Figure 2-1: Illustrative timescale for the development

Figure 2-1 provides an illustration of the timeline for development of the Inch Cape offshore wind farm. The proposed programme for the development is to undertake two years of studies to support the EIA and consent applications.

It is currently understood that the Scottish Government Energy and Consents Unit and Marine Scotland aim to determine Section 36 consent applications within a 9 month period. It is anticipated that ICOWL will submit consents applications in Q3 2012. Therefore, the award of consents would be anticipated for early 2013. Pre-Front End Engineering Design (FEED) and FEED studies will be undertaken between 2010-2013 (see section 2.5.2). A phased installation process will begin in 2015 and the operational wind farm is anticipated for completion in 2019.

2.5.2 Offshore Wind Turbines

The offshore wind turbine generators are comprised of the following main components: rotor blades (three), hub, nacelle (containing gearbox and generator), tower and foundation.

The precise type and number of turbines that will ultimately be installed is currently unknown but the following will be assumed as a starting point for the purposes of the environmental assessment:

- Approximately 180 turbines, depending on the rotor diameter;
  (larger diameter rotors are likely to result in fewer turbines on the site);
- Wind turbines generating between 4 – 8 MW at capacity;
- Approximate hub height range 87 – 107 m (above LAT);
- Approximate rotor diameter range 120 - 150 m;
- Expected installed capacity approximately 1,000 MW;
- Blade tip water clearance of 22m (above MHWS); and
- Approximate blade tip height range 160-182 m (above LAT).

A range of turbines will be commercially available at the time of construction. The final choice of turbine will be dependent on economics and available technology at the time of construction. Data gathered throughout the geotechnical campaign will also influence the decision on the types of turbines to be deployed. The final layout could include a larger number of lower capacity turbines or a lower number of higher capacity turbines.

More detailed information on the turbine dimensions will be provided in the Environmental Statement (defined as a Rochdale Envelope). Figure 2-2 provides an illustration of the proposed wind farm layout.

Concept Development, Front End Engineering Design (FEED) and Detailed Design

The engineering process can be divided into three phases; chronologically these are - Concept Development, Front End Engineering Design (FEED) and Detailed Design.

Concept Development is the phase prior to the Application for Consent. The main deliverables of this phase are:

- A design concept (or concepts) developed to a sufficient level of maturity to define the project by a range of parameters (e.g. maximum and minimum size and number of turbines) for the Application for Consent. Defining the project by a range rather than a specific number (for each parameter) is known as a "Rochdale Envelope";
- A Basis of Design for FEED;
- A refined cost estimate; and
- Further technical information to facilitate continued dialogue and development with stakeholders and the supply chain.

FEED takes place between the Application for Consent and Financial Close. It is the engineering phase which refines and develops the concept(s) to the point where invitations to tender (ITT) for the major supply and construction contracts can be issued. The main deliverables of this phase are:

- A design for the project that complies with the consent conditions and is sufficiently detailed and robust to develop ITTs for major contracts;
- ITTs for major contracts;
- A cost estimate sufficiently accurate and robust for the project to proceed to Financial Close; and
- A Basis of Design for the Detailed Design phase.

Detailed Design is the phase for the engineering to proceed from FEED to construction.

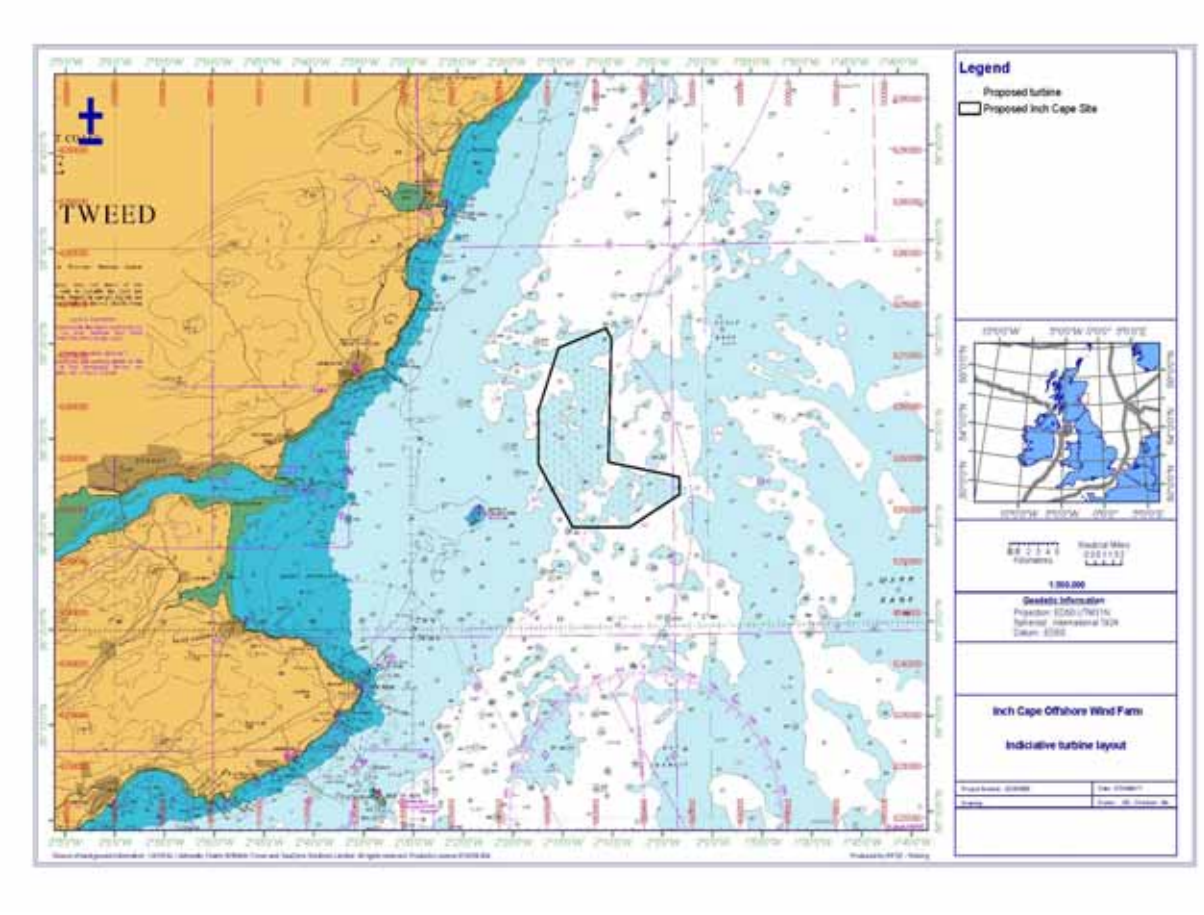


Figure 2-2: Indicative turbine layout

2.5.3 Offshore Wind Farm Infrastructure

Foundation & Support Structures

The overriding factors influencing the choice of foundation and support structure for a specific project are the type of wind turbine to be used, nature of ground conditions in the area and water depth. Preliminary studies have been carried out by Senergy Limited in 2009.

Based on the Inch Cape site description and the inherent uncertainty with the seabed properties, the most versatile and robust turbine support structure concept is likely to be a lightweight jacket structure. The generic description of 'lightweight jacket structures' covers a number of different concepts including:

- Braced monopods;
- Tripod structures; and
- Four legged jacket structures.

The actual structure type can be tailored to suit the variable water depth and seabed gradient. Jacket foundation design borrows from the expertise built up from oil and gas operational

experience in the North Sea, recognising the dynamics associated with wind turbine support structures. Possible foundation types will include pin piles or suction caissons.

Other structure concepts are considered less suitable for the following reasons:

- Monopiles appear to be practically and economically unfeasible in water depths greater than approximately 30 m as monopile diameter is limited by available hammers and lateral capacities, and their dynamic response becomes problematic;
- Gravity base structures are likely to be prohibitively large, heavy and expensive for the water depths under consideration, as well as being relatively 'soil sensitive structures';
- Guyed towers could appear to be highly efficient; however, the risks to shipping from the mooring wires and the reduced operating integrity of the wind farm due to potentially damaged wires is high; and
- Floating structures are a new technology currently under development, however they are typically better suited to sites with water depths greater than those expected across the Inch Cape site.

The installation methods for substructures are not detailed at this stage as there is limited experience in constructing offshore wind farms in deep water. The recent Alpha Ventus offshore wind farm substructure installation showed a refinement of the techniques used on the Beatrice Demonstrator project by using a template to drive the 4 corner piles before placing the jacket substructure on them. This is currently the most up to date installation method for this type of foundation but the exact methodology, vessels and logistics to be used will require detailed study and design work.

These represent preliminary findings and will be reviewed when site-specific survey data is available. Other than monopiles, ICOWL is not officially ruling any particular foundation type out at this stage due to changing economic and technological circumstances that may prove one or another technology more appropriate nearer to the time of construction.

Turbine support structures will include access facilities and appropriate lighting and marking for surface navigation. Options for the configuration of the support structures and details of their potential environmental impacts will be included in the Environmental Statement.

Scour Protection

The substructure and foundation concept as well as the current regime approaching seabed level defines the type and extent of scour protection required, and typically a 'scour allowance' is specified when designing types of North Sea jackets. However, as foundation size increases the potential scour depth around the structure also increases and hence there is a greater need to protect the foundation, i.e. it becomes more efficient to protect the foundation rather than utilise a design scour protection allowance.

North Sea gravity platforms have used rock dump in a relatively complex scour protection blanket, involving the dumping of carefully specified and graded rock to satisfy both stability criteria of the surface armour layer but also the performance of a filter layer to prevent finer material being drawn through the armour layer.

The suitability of installing rock dump or mattresses for cable protection especially around turbine bases will be assessed based on the seabed current data across the Inch Cape site.

Electrical Infrastructure

The electrical infrastructure required will comprise of inter-turbine cables: an array of submarine cables to collect the energy generated by the wind turbines and transmit it to a number of central points (offshore platforms). These cables are likely to be at 33 or 66 kV and may include fibre-optic communication links. A number of offshore substations may also comprise part of the offshore wind farm infrastructure. All other electrical infrastructure will be owned and operated by the offshore transmission operator (OFTO).

At this stage it is anticipated that array cables will be buried to a depth of approximately 1.0m (as is typical for offshore hydrocarbon pipelines and umbilicals) other than close to turbine and substation foundations and areas where ground conditions make it impracticable. The actual design depth of burial will be addressed in the concept development and defined in the FEED, based on a number of factors, including potential environmental effects, fishing and other activities, dropped object risk assessments and other considerations.

2.5.4 Offshore Transmission Infrastructure

The purpose and functions of the offshore and onshore transmission infrastructure associated with the Inch Cape offshore wind farm will be detailed in a separate OFTO scoping report. This and the following section aim only to provide stakeholders with an overview of the entire Inch Cape offshore wind farm development as it would exist in operation.

The Inch Cape offshore wind farm will require electrical infrastructure for transferring the energy generated by the wind turbines into the National Grid transmission system. This will form the offshore transmission infrastructure and will be constructed and owned by the OFTO, see section 1.5.

Electrical Infrastructure

The electrical infrastructure required will comprise the following:

- Offshore Substation Platforms: a number of platforms, located within the development area housing substations which will form the interface between the inter-turbine cables and the offshore transmission system;
- Offshore Transmission System: a number of submarine export cables between the offshore platforms and the shore, which are used to transmit the energy generated by the wind turbines to the shore. These cables are likely to be 220 kV AC but could be HVDC (High-voltage DC) depending on the distance to the onshore connection point. The number of cables required will be determined by the overall capacity of the wind farm and the voltage used (132 kV, 220 kV, 400 kV, HVDC). The cables may include fibre optic communication links;
- Cable Landfall: The point at which the submarine cables are physically brought ashore;
- Onshore Substation: the interface between the offshore and onshore transmission systems;

- Onshore Transmission System: a number of circuits (either overhead or underground) which transmit the energy generated by the wind turbines from the onshore substation to the connection point; and
- Transmission System Connection Point: the interface into National Grid transmission system.

Electrical Infrastructure – Detailed Design

The design of the electrical infrastructure is at an early stage. In order to provide the required level of detail on the project that will be required for the EIA, options are currently being considered by ICOWL for the following key components:

- Type, number and location of turbines;
- Number and location of offshore substation platforms;
- Subsea cabling specification (AC or DC, voltage levels i.e. 33 kV / 132 kV / 275 kV);
- Location of cable landfall site(s);
- Offshore cable routes between the platforms and the shore;
- Location of transmission system connection point and onshore substation(s); and
- Routes of overhead lines or underground cables for transferring the power from the shore to the transmission system.

2.5.5 Cable Landfall

The choice of sites for the cable landfall will be subject to the investigation and assessment and will be guided by the identification of an onshore substation location which will be dependent upon the grid connection offer from National Grid. All potential options will be considered in terms of technical, environmental and commercial terms before a final decision is made.

2.5.6 Meteorological Masts and Other Monitoring Equipment

Meteorological masts (met-masts) are used to measure the meteorological characteristics of the area. From 1982 – 1986, a met-mast was installed off the Bell Rock Lighthouse, which consisted of a cup anemometer arrangement mounted at 39 m. Meterological data dating from March 2000 to the present is also available from the Met Office UK Wave Model. This data is measured at a height of 19 m. However, it is known that the wave model data has a known negative bias in returned wind speed as the data nodes approach coastal zones (Oldbaum, 2008).

As part of the proposed Inch Cape offshore wind farm further meteorological measurement equipment will be required. The instrumentation to be deployed may include the following:

- An offshore met-mast;
- A wave-rider wind measurement buoy; and
- A LiDAR system.

The exact locations of all the instrumentation have yet to be decided, but it is anticipated that the met-mast will be installed within the proposed site area. The foundations of the met-mast are anticipated to comprise of a jacket structure and a steel lattice tower, the height of which will be nominally 100 m above mean sea level. The potential use and locations of the other infrastructure are still to be determined.

The required consents and licences will be sought for all proposed meteorological and oceanographic equipment that may need to be installed throughout the development process.

2.6 Environmental Management – Procedures, Monitoring and Mitigation

2.6.1 Environmental Management

Prior to construction a comprehensive Environmental Management Plan (EMP) will be implemented in consultation with statutory consultees, with a suite of complementary management plans corresponding to different aspects of the construction activity.

The EMP will form a component part of the construction contract for the development. The documents, which will be tailored specifically to ensure compliance with the consent conditions for the project and current environmental best practice, will include the following:

- Monitoring Protocol (as per statutory consents);
- Incident Reporting and Non Conformance Procedure;
- Emergency Response Plan;
- Collision Risk Management Plan;
- Marine Pollution Contingency Plan;
- Dropped Objects and Materials Recovery Plan;
- Archaeological Plan;
- Noise, Dust and Vibration Management Plan; and
- Waste Management Plan.

The EMP is a live document and will therefore be revised for pre-construction, construction and operational phases. Any monitoring and/or mitigation methods that are considered in the final Environmental Statement will be incorporated in the pre-construction, construction and operation EMPs, where relevant.

2.7 Wind Farm Construction

2.7.1 Construction

Offshore construction is likely to occur over a period of three to four years. Only limited information is available at present on the details of the construction process, since the major parameters of the proposed Inch Cape offshore wind farm have not yet been defined in detail. Key aspects in defining the construction methodologies (and therefore the likely construction activities) will be choices on the following:

- Port(s) used as a base for the construction phase; and
- Vessels to be used for the offshore construction works.

Decisions on these will also be influenced by the nature of the support structures to be used, which will be addressed during the EIA phase. More detail on the options for ports and vessels will be provided in the ES. However, for the purpose of this document it can be assumed that the principal stages of manufacturing and transporting the various wind farm components to the proposed site are likely to be as follows:

- Manufacture of components (including foundations, towers, nacelles, blades, gearbox, generators etc, as well as electrical components);
- Transport of components to the area;
- Storage and assembly of components as required at the port location(s) chosen as the construction base;
- Marine transportation of components to site of installation; and
- Moving construction vessels to the installation site.

It can be assumed that the key stages associated with the installation of the Inch Cape offshore wind farm are likely to be as follows:

- Pre-construction site investigation (i.e. Cone Penetrometer Testing CPT / boreholes);
- Foundation installation and associated site preparation;
- Disposal, if necessary, of any spoil excavated during installation;
- Installation of tower, nacelle, hub and blades;
- Installation of meteorological masts;
- Installation of offshore transformer platforms; and
- Inter-turbine cable installation.

Other works associated with the OFTO are likely to include:

- Export cable installation; and
- Construction of the required onshore electrical infrastructure (such as terrestrial cables, substations and overhead lines) to link the development to the National Grid transmission system, and associated traffic.

It should be noted that construction compounds and storage facilities are likely to be required at the ports used as the construction base(s). In addition, construction compounds, laydown areas and access / haulage tracks are likely to be required for the construction of any onshore electrical infrastructure.

It is likely that the installation of cables between wind turbines within the array and from the wind farm to the shore will be performed from floating or submerged craft. The applicability / suitability of burying the cables will be assessed using a detailed trenching review and burial protection index study.

2.8 Wind Farm Operation

2.8.1 Access to Site

Operation and maintenance of the Inch Cape offshore wind farm will continue 24 hours per day; 365 days per year, and therefore access to the wind farm will be required at any time.

2.8.2 Lighting and Marking

The lighting and marking of the Inch Cape offshore wind farm will be agreed in consultation with the Northern Lighthouse Board, the General Lighthouse Authority for Scotland and the Isle of Man, the Maritime and Coastguard Agency (MCA), the Civil Aviation Authority (CAA) and the Ministry of Defence (MOD).

The positions of the wind turbines, subsea cables and ancillary structures will be conveyed to the UK Hydrographic Office so that they can be incorporated into Admiralty Charts.

2.8.3 Wind Farm Control

Once commissioned, the Inch Cape offshore farm will operate automatically with each turbine operating independently of the others. The operation and control of the wind farm will be assessed by a Supervisory Control and Data Acquisition (SCADA) system, installed at each turbine and at the onshore control base. The SCADA system will enable the remote control of individual turbines in general, as well as information transfer, storage and the shutdown of any wind turbine in emergency circumstances.

2.8.4 Wind Farm Inspection and Maintenance

The Inch Cape offshore wind farm will be serviced and maintained throughout its life from a local port. Maintenance of a wind farm is normally separated in to three categories:

- Periodic overhauls;
- Scheduled maintenance; and
- Unscheduled maintenance.

Periodic Overhauls

These will be carried out in accordance with the turbine manufacturer's warranty. They are planned for execution in periods of the year with the best conditions, preferably in the summer.

They are carried out according to the supplier's specifications and typically include function and safety tests, visual inspections, analysis of oil samples, change of filters, lubrication, check of bolts, replacement of brake pads, oil change on gear box or hydraulic systems, etc.

Scheduled Maintenance

This applies primarily to inspections and work on wear parts susceptible to failure or deterioration in between the periodic overhauls. A scheduled inspection of each turbine is likely to occur every 6-12 months. Tasks will typically include inspection on faults and minor fault rectification.

Scheduled maintenance will be performed using small personnel craft operated from the local harbour.

Unscheduled Maintenance

This applies to any sudden defects. The scope of such maintenance would range from small defects to complete failure or breakdown of main components. Such maintenance would require the intervention of construction vessels similar to those involved with the construction of the wind farm.

Inspections of support structures and subsea cables will be performed on a regular basis as will ad-hoc visits for surveillance purposes.

2.9 Operation Management (Environmental)

The proposed Inch Cape offshore wind farm will be designed, constructed and operated to a high standard, incorporating the appropriate levels of environmental control. Effective and

environmentally aware management will minimise the impact of the development on the local environment.

ICOWL will require the main contractors responsible for construction, operation and decommissioning of the Inch Cape offshore wind farm to operate an Environmental Management System in accordance with ISO 14001 and the appropriate 'best practice' guidelines will be in place at the time of decommissioning.

2.10 Wind Farm Repowering and Decommissioning

The Crown Estate lease agreement is anticipated to be for 50 years. The design life of the turbines and other components of the wind farm are expected to be approximately 25 years. Therefore one option may be to repower the site after 25 years of operation and fully decommission the site 25 years later. Decommissioning will be a key requirement of The Crown Estate lease agreement and Energy Act 2008 and will influence all stages of design of the wind farm. A decommissioning plan will be prepared as part of the project.

The extent of repowering and decommissioning will be dependent on many factors including emerging electricity generation technologies, type of turbines and support structures selected.

3. Cumulative and In-combination Impact

3.1 Introduction

Three proposed offshore wind farm sites lie within the Firth of Forth/Firth of Tay region, in relatively close proximity to each other: Inch Cape, Neart na Gaoithe and Forth Array. In addition, zone 2 of the UK offshore wind Round 3 programme lies immediately to the east of these sites. Details of the STW sites are presented in Table 1-1. As a result of the proximity of these proposed offshore wind development areas, there is potential for cumulative environmental effects to arise as a result their development.

A cumulative effect could potentially arise as a result of two or more similar types of developments being constructed (i.e. wind farms and other wind farms).

An in-combination effect could potentially arise as a result of one type of development and different projects and/or activities (e.g. wind farms in combination with dredging or wind farms in-combination with shipping).

All current and foreseeable projects and activities in the study area which may interact to result in cumulative and in-combination effects have been considered. Activities and projects associated with the following sectors will be further studied as part of the EIA.

- Offshore wind farms;
- Commercial fisheries;
- Shipping and navigation;
- Waterfront and coastal development;
- Military activities;
- Cables and pipelines; and
- Tourism and recreation.

Note this list is not exhaustive.

As outlined in section 1.3 developers of the three proposed STW sites off the Firth of Forth / Tay and the adjacent Round 3 zone 2 sites have formed the Forth and Tay Offshore Wind Developers Group (FTOWDG), in association with The Crown Estate. The developers are currently collaborating in order to identify potential cumulative effects and ensure a standardised approach to their future assessment as part of individual project EIAs.

A similar approach was previously applied during the development of Round 2 offshore wind farm sites in the Thames and the Wash, whereby developers collaborated and agreed with statutory consultees and key stakeholders a common approach to baseline surveys and assessments which then supported the assessment of cumulative effects.

In September 2009, the FTOWDG produced a discussion paper on the potential cumulative effects (Wright, 2009). The objectives of this document were as follows:

- To demonstrate to statutory and other key consultees the commitment of the FTOWDG to addressing potential cumulative and in-combination effects early and effectively;
- To identify those potential cumulative and/or in-combination environmental impacts which will likely need to be assessed;
- To propose for discussion a list of issues which, while they may need to be assessed on an individual project basis, are unlikely to give rise to cumulative or in-combination effects and can therefore be 'scoped out' by agreement at an early stage;
- To outline an intended future approach to the assessment of cumulative and in-combination effects to inform the assessment of effects at site-level as part of individual EIAs;
- To invite comment from statutory and other key consultees on the initial thoughts of the FTOWDG; and
- To commence the process by which agreement on the approach, methodology and level of information to be applied to future assessment of cumulative effects can be sought with statutory and other key consultees.

The outcomes of this discussion document are detailed in the appropriate sections.

3.2 Transboundary Effects

Transboundary effects may occur some distance away from the impact source. It is considered unlikely that the proposed Inch Cape offshore wind farm will have a significant effect on the environment of another country. Transboundary effects however will be considered as part of the environmental impact assessment process, in particular studies completed with regard to the human environment (see section 5.3), including commercial fisheries and shipping, will account for these potential impacts.

4. Stakeholder Consultation

4.1 Relationships and Stakeholder Management

A Stakeholder Engagement Strategy has been prepared which outlines ICOWL's approach to stakeholder engagement, including:

- Stakeholder Identification;
- Stakeholder Management Process;
- Communications Management; and
- Media Protocol.

SERL has significant experience in the utility, renewables and oil and gas industry, with regard to engaging and consulting with stakeholders.

ICOWL remains committed to engaging with the communities in which they operate, to address any concerns they may have in advance of the project application submission. This will be achieved through various processes, including letters, meetings, stakeholder events, newsletters and websites.

A programme of activities has been developed for communication and consultation with key stakeholder groups including:

- Statutory consultees;
- Aviation organisations;
- Recreational organisations;
- Business & Enterprise;
- Environmental organisations;
- Fisheries;
- Government, Regional and Local Authorities;
- Landscape and Cultural Heritage;
- Elected Representatives;
- Local Communities;
- Defence;
- Navigation and Shipping organisations;
- Other Users; and
- Tourism.

A stakeholder introductory event was held on the 4th November 2009, introduced by Jim Mather, Scottish Minister for Enterprise, Energy and Tourism. The event was the first public exhibition of the then four STW projects in the Firths of Forth and Tay, with The Crown Estate representing the Round 3 interest. The event was well received by those who attended with the brief overview of projects providing a basis for future stakeholder discussions and meetings.

4.2 Consenting and Stakeholder Engagement

Energy developments are controlled by Electricity Act (1989) rather than the Planning Acts. For the construction of a power generation facility, such as a wind farm, Section 36 of the Electricity Act requires that an application be made to Scottish Ministers through the Scottish Government Energy Consents Unit, with additional principal consents obtained under Section 5 of the Food and Environmental Protection Act, 1985, and Section 5 of the Coast protection Act 1949. Clarification is currently being sought as to how this will be applied after recent legislative changes.

This is a different process to the conventionally understood planning procedure for major developments, and there is no statutory inclusion of public participation within the provisions of the Electricity Act. However Section 36 guidance suggests that engagement should be guided the Government's Planning Advice Note 81[4]. Furthermore, the Act was recently amended by the 2004 Energy Act, which broadened the scope of Section 36 to include certain marine and navigational matters. Consequently there is no longer the requirement to promote a private bill in Parliament , with its associated public consultation.

The Inch Cape offshore wind farm is considered to be of national importance as it offers Scotland the opportunity to be at the forefront of innovation in the large-scale development of low-carbon electricity generation. The development of offshore wind power in the challenging environment of the North Sea at depths of up to 60m will be of international significance, as well as having important local implications, and will be of interest to, and have implications for a considerably broader audience than the statutory consultees defined in legislation.

The proposed development will create a new feature in the out Firth of Tay and will therefore have the potential to interact with many aspects of the existing societal, cultural, aesthetic commercial and environmental setting, both on and offshore. It is therefore vital that the organisations, communities and individuals, who have an interest in the project, are able to be part of its development.

This is in line with the views of the Department for Energy and Climate Change, who state:

> *"We believe that consultation is a critical part of the development process and should be undertaken with the public, relevant Local Authorities and key stakeholders with an interest in offshore wind farms, at the earliest opportunity during the development of projects."*[5]

[4] Section 36 Guidance Notes – 2.2.1

[5] Advancing UK Offshore Wind Deployment, Dept. Energy & Climate Change, 2009

5. Preliminary Environmental Considerations

This section is divided into three areas and includes the potential for impacts of the proposed Inch Cape offshore wind farm development on the physical, biological and human environment. A holistic approach to the EIA process will be taken, which will identify the potential inter-linking of the environmental features and the potential for trans-boundary impacts.

Existing baseline information, data gaps, as well as scoping issues, guidance documents and EIA methodologies are presented if the information has been available at the time of writing.

The nature of any predicted impacts will be detailed in specific assessment methodologies. This includes consideration of whether or not impacts are:

- Direct and indirect;
- Secondary;
- Cumulative;
- Short, medium or long-term;
- Permanent or temporary; and
- Positive or negative.

Similarly the extent of the impact will be explored in specific assessment methodologies, including consideration of:

- Geographical area affected; and
- Size of the affected population/habitat or species.

Specific EIA methodologies will also include consideration of the magnitude and complexity of predicted impacts and their predicted frequency, duration and reversibility.

Where the nature, extent and complexity of impacts are known to date, details have been provided in this scoping document.

Section 2.6 outlined ICOWL's commitment to environmental management throughout the life time of the Inch Cape offshore wind farm project. Monitoring and mitigation procedures will be detailed in an EMP, guided by legislation and best practice and the outcomes of the specialist impact assessments that are proposed in the subsequent sections of this scoping report.

5.1 Physical Environment

Key aspects of the physical environment that are relevant to understanding the potential environmental impacts of construction and operation of the wind farm are categorised as follows:

- Bathymetry & Geological Environment;
- Metocean (Meteorology & Hydrodynamics); and
- Sedimentary and Coastal Processes.

Modification of these environmental factors does not necessarily imply an impact of the wind farm, if there is no resulting impact upon sensitive environmental, ecological or socio-economic receptors

that are either of concern to local stakeholders or subject to special protection under the law. These receptors must be separately identified and their sensitivity characterised by the EIA.

In the following sections, the present day baseline condition of the above items is summarised with particular consideration for the location of the proposed development. The understanding of the present day environment informs the subsequent EIA scoping.

In the EIA scoping section, consideration is given to particular potential modifications to the baseline environmental processes and pathways. Where the baseline environmental condition is thought likely to be modified by the development, an initial list of relevant receptors is identified (sections 5.1.2 to 5.1.4) and a study approach is then proposed to assess the overall physical environmental issues identified (section 5.1.5).

5.1.1 Data Sources

The following data sources provide information on the present natural physical environment:

General:

- UK Offshore Energy Strategic Environmental Assessment, DECC; and
- SEA 5: Strategic Environmental Assessment of parts of the northern and central North Sea to the east of the Scottish mainland, Orkney and Shetland, DTI.

Additional sources for:

Geology, bathymetry and Sedimentary and Coastal Processes -

- UK Hydrographic Office Admiralty Charts;
- British Geological Survey;
- Satellite geodesy and ship soundings by Smith & Sandwell (1997);
- SEA 5: Seabed and Superficial Geology and Processes (Holmes *et al*, 2004); and
- Remote sensing and aerial photography (e.g. Google Earth).

Wind -

- The Met Office

Hydrodynamics (waves and tides) -

- UK Hydrographic Office;
- UK Meteorological Office wave model data;
- Wavenet directional wave buoy data;
- British Oceanographic Data Centre;
- National Tide and Sea Level Facility;
- Scottish Environmental Protection Agency; and
- Atlas of Renewable Energy Resources (BERR, 2008).

5.1.2 Bathymetry and Geological Environment

Baseline Environment

A review of the existing bathymetry and geology for the Inch Cape site was undertaken by Senergy (2009). An environmental review, including geological conditions for the Firth of Forth and Firth of Tay region to 12 nm was undertaken by HR Wallingford on behalf of the FTOWDG. The following text is a summary of these documents.

Bathymetry

The following overview of the site bathymetry provides a general context within which to understand other metocean processes. Water depths within the site boundary range from approximately 35 m to 55 m LAT, plus a tidal range up to about 5.5 m, although the majority of the Inch Cape area is expected to vary between 40 m LAT to 45 m LAT (Admiralty Chart 1407; Admiralty Chart 1409; Smith & Sandwell, 1997). It should be noted that the bathymetry data sets used in this study are similar with the exception of the two overlapping Admiralty charts used in this study. Chart 1407 indicates more areas of water depths greater than 50 m within the Inch Cape area than Chart 1409.

The bathymetric datasets (Admiralty Chart 1407; Admiralty Chart 1409; Smith & Sandwell, 1997) suggest that the seabed undulates gently across Inch Cape with no indications of extreme or rugged topography. However, it should be noted that the data sets do not provide the detail level required to define local bathymetric features. Sand waves have been reported to both the south-east and north-east of Inch Cape. The associated characteristics of these are, approximately, 8m crest heights and wavelengths of 160 to 270 m (Gatliff *et al*., 1994). There is no evidence of whether the sand waves are mobile features or indeed if they are changing in size over time.

Geology

An understanding of the present Geological setting is important, to highlight the likely origins and stability of the seabed and the material types which may be encountered during the installation of turbine foundations. Comments based on a range of pre-existing broad-scale and regional information can be made, as follows.

Holocene seabed sediments describe surficial soils laid down within the last 10,000 years before present (bp), during the Holocene Epoch. The BGS data reports the seabed sediments comprise sand or gravelly sand present in a layer typically less than 0.5 m thick (Holmes, 1977 and Holmes *et al*. 2004).

The Quaternary soil of the Pleistocene Epoch describes that material deposited between 2,300,000 years bp and 10,000 years bp and is described by geological unit (see Table 5-1). The geological units present across Inch Cape overlie bedrock. It should be noted that the BGS mapping also interprets soft to stiff gravelly clay soils of the St Abbs Formation as being present to the south west of Inch Cape. Whilst there is a risk that St Abbs Formation soils could be present within the Inch Cape area, underlying the Forth Formation deposits, BGS suggests that this formation is not present across Inch Cape. The planned project specific geophysical survey will investigate the presence of the different formations within the site.

Table 5-1: Summary of soil deposits

Approximate Thickness of Unit (m)	Unit	Anticipated Soil Description
<0.5m thick	Holocene	Sand or gravelly sand
Typically 0 – 5m, locally up to 20m	Quaternary (Forth Formation)	Predominantly SAND with clay and silt layers
<5 – 10m	Quaternary (Wee Bankie Formation)	Stiff to hard CLAY with interbeds of SAND and silty CLAY

Source: Holmes, 1977 and Holmes *et al*. 2004

Triassic or Permian bedrock underlies the Quaternary deposits across the majority of the study area. The exception is at the extreme western margin where the Permo-Triassic sequence is absent and rocks of Lower Devonian age underlie the Quaternary deposits. The depth to the rock head is between 10-20 m over the central portion of the study area and less than 10 m elsewhere.

The Firth of Forth fault zone is present to the south west of Inch Cape, however there is no evidence to suggest that this fault zone extends into or across Inch Cape.

There is no evidence at this stage to suggest that shallow gas is present within the Inch Cape site boundary (Holmes *et al*. 2004).

No reported evidence was found of chalk or peat deposits in the underlying geology that might be resuspended as a result of drilling activities.

The UK is an area of low seismicity and the risk to offshore structures is considered to be correspondingly low (Health & Safety Executive, 2002).

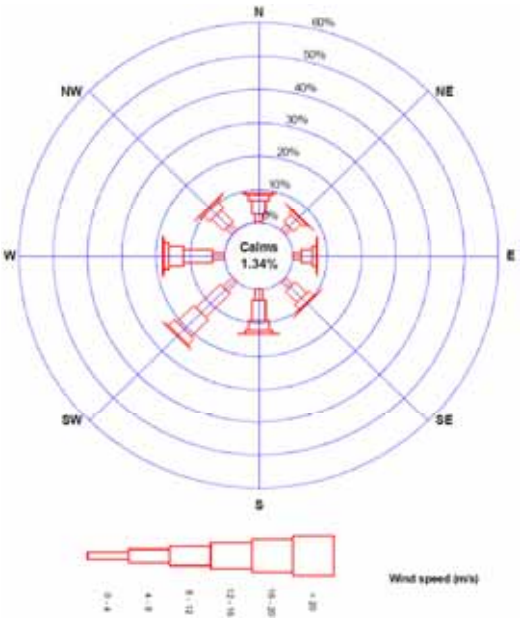
5.1.3 Metocean (Meteorology & Hydrodynamics)

The following overview of the metocean climate provides an indication of the magnitude and variability of the driving forces to the sedimentary environment. Of particular relevance is the wind and wave climate, which is shown in the following section to largely control sediment transport and natural turbidity in the Firth. Tidal processes, playing a secondary but not insignificant role in guiding the direction of sediment transport, are shown to be largely benign.

Wind Climate - Baseline Environment

Wind is relevant to the study as it is closely linked to the wave climate in the local area. Oldbaum Services (2008) reviewed wind climate as part of a resource assessment for the Inch Cape site. Estimated data were obtained from the Met Office wave hindcast model, from a point located to the west of the Inch Cape site. The data are for an effective height of 19 m above sea surface and span March 2000 to September 2008. The Bell Rock Lighthouse (located to the south-west of the Inch Cape site) provides measured wind data at an effective height of 38 m above sea surface for the period January 1976 to March 1987 (see Figure 5-1). However, about 25% of the latter data set is missing.

Oldbaum (2008) reviewed the available data to characterise the site and calculate the potential yield analysis. Modifying data from the Bell Rock Lighthouse to provide relevant conditions for the Inch Cape site, the mean wind speed is estimated at 8.70 m/s and the wind direction is predominately from the sector 225-255°N.



Wind rose for Bell Lighthouse (annual average conditions) (HR Wallingford (2009)

Figure 5-1: Bell Rock Lighthouse wind rose in 30 degree sectors

Hydrodynamics - Baseline Environment

Regional Tidal Regime

The general flow pattern in the Firth of Forth / Tay region is a southerly flood tide along the east coast of Scotland into the Firth of Forth, around Fife Ness.

Tidal Elevation

Tidal processes are often characterised initially by, or related to the nature of the tidal elevation signature. In the Firth of Tay region, the tidal regime is semi-diurnal with a mean spring tide of 4.6 m and a mean neap tide of approximately 2.3 m.

Tidal Currents

Tidal currents at any site are a potentially important factor in controlling the patterns and rates of naturally occurring sediment transport. South of the Tay Estuary, the southerly directed flood tide forms a large clockwise eddy in St Andrews Bay that extends over Abertay sands and into the main channel within the Tay (Charlton *et al*., 1975). Within the estuary tidal velocities can reach around 1.2 m/s towards the south-west of Buddon Ness, whilst Charlton *et al*. (1975) infer that the sand waves west of Newcombe shoal support the existence of strong tidal currents.

As for any tidal location, tidal currents across the outer Tay Estuary vary temporally as a function of the phase of the tide and the tidal range and spatially as they interact with the various seabed features (e.g. banks and channels). Data records indicate that tidal velocities offshore of the Tay Estuary are similar to those inshore, with measurements taken both at 6 km offshore from the Tay Estuary and 17 km offshore of Montrose indicating that the maximum spring tidal stream is around 1.2 knots (0.6 m/s) (UKHO Admiralty Chart 1407).

Although the River Tay is a dominant source of freshwater flow into the coastal environment, the potential for density driven currents arising from differences in salinity and/or temperature are considered not to be significant.

Regional Wave Climate

Waves at any site are a potentially important factor in controlling the patterns and rates of naturally occurring sediment transport. The wave regime in the proposed development area can be regarded as the combination of swell waves moving into the area (having been generated remotely from the area) and locally generated wind-waves. The wind farm site is exposed to waves from offshore sectors (north-north-east to south-south-east) that are generated within the North Sea. However, the prevailing winds resulting in the majority of locally generated waves come from south-westerly sectors and will therefore be fetch limited.

Offshore of the River Tay, wave coming directions are from around 340°N through to 200°N with the dominant wave conditions (35% of the time) coming from between 20°N and 60°N. Total sea significant wave heights of 6.23 m, 7.62 m and 8.95 m have return periods of 1, 10 and 100 years, respectively (HR Wallingford, 1998).

Swell wave conditions are dominated by waves coming from between 20°N and 60°N, with approximately 60% of swell conditions experienced from this sector. Swell conditions from the other directions is limited due to short fetch lengths or insufficient wind duration. Total sea significant wave heights of 3.56 m, 4.49 m and 5.36 m have return periods of 1, 10 and 100 years, respectively (HR Wallingford, 1998).

Hydrodynamic Conditions Across Inch Cape

Table 5-2 summarises the hydrodynamic conditions expected across the Inch Cape site (H.R. Wallingford, 2009; Senergy, 2009).

Table 5-2: Metocean conditions expected across the Inch Cape site

Metocean parameter	Value
Maximum astronomical tidal range(1)	5.1 m
Mean astronomical spring tidal range	4.6 m
Mean astronomical neap tidal range	2.3 m
Extreme tidal levels (mMSL):	2.78 m
1 year return period	3.02 m

10 years return period 50 years return period 100 years return period 1000 year return period	3.23 m 3.34 m 3.56 m
Peak spring tide current speed (depth averaged) Peak neap tidal current speed (depth averaged)	0.46 m/s 0.21 m/s
Annual mean significant wave height	1.4 - 2.1 m
Significant wave height, 50 year storm	9 - 11 m

(1)The tidal range above is taken from LAT to the Highest Astronomical Tide (HAT). Therefore, in general, the deepest water depths range from approximately 40.1 - 65.1 m HAT.
Sources: Admiralty Chart 1407; Admiralty Chart 1409; British Isles and Adjacent Waters Co-Tidal and Co-Range Lines Chart 5058 (1996); Health & Safety Executive (2002); ABPmer, 2008; Admiralty Tide Tables (2009).

Climate Change

Climate change is an important issue which may potentially affect the normal baseline environmental conditions at the site over the lifetime of the proposed development; the predicted effects of climate change are irrespective of the development's presence or chosen design. Of most relevance to an offshore wind development, climate change is predicted to cause a rise in mean sea level and an increase in average storm intensity with time. The exact magnitude and rate of these changes are not widely agreed at present due to the uncertainty involved in predicting climate change. However, the UK government does issue guidelines for appropriate consideration of these factors.

The effects of climate change are likely to be most evident along the shorelines where much of the wave energy is ultimately dissipated, potentially leading to modified rates of littoral sediment transport. The advancing position of mean high water on beaches may also lead to wave energy dissipation higher up on the foreshore with anticipated beach loss and scour in front of sea walls. In offshore areas, the relative water depth over sandbanks may increase, leading to greater exposure of the coast to the larger waves from offshore directions. Any potential effect of the proposed wind farm development will also need to be considered within the context of these natural changes.

Increased wave energy offshore may have consequences for the frequency and magnitude of sediment transport events resulting in elevated levels of suspended sediment concentrations (SSC) within the area, despite any influences brought about by the proposed development.

5.1.4 Sediment & Coastal Processes

Baseline Environment

Regional Sedimentary Processes

The contemporary sediment regime across the outer Forth and Tay estuaries comprises of a number of inter-related elements which include (i) bedload sediment deposits; (ii) suspended sediment

concentrations; (iii) mobile bedforms; and (iv) sediment sources and sinks. The behaviour of the different sediment populations within the study area depends on their respective response to the applied hydrodynamic forces of waves and tides. Large scale mobile sedimentary bedforms (sand waves and sand ripple fields) are not reported as present within the site extent but may be present in the surrounding area (Holmes, 1977).

Suspended Sediments

As outlined in the following section, the strength of the normal tidal regime at the site is considered insufficient to result in significant sediment transport. As a result, SSC, especially in the upper water column, will be typically low during periods of calm weather and/or in the absence of large swell waves.

Due to the local water depth and reported wave climate, local processes are instead thought to be dominated by nearbed wave action during occasional high-energy storm events. Levels of SSC can therefore be expected to rise significantly, both nearbed and extending upwards into the water column, during and for a short time after storm events when wave action at the seabed is sufficient to mobilise and resuspend the local sediments. Following a storm event, SSC will gradually decrease (settle out) to a baseline condition, controlled by the ambient regional tidal regime. The degree of local seabed disturbance and the resulting levels of SSC will depend upon the duration and intensity of the storm and the resulting character of the waves that are produced; local variability in SSC may also be observed depending upon the local sediment type (resistance to erosion) and water depth (controlling wave attenuation).

There are no known significant fluvial sources of SSC affecting the Inch Cape site.

Due to the seasonal nature of the frequency and intensity of storm events, levels of SSC will likely follow a broadly seasonal pattern. It is possible that seasonal blooms of marine organisms may also contribute to seasonality in measurements of total turbidity, but this is not directly associated with re-suspension of (inorganic) sediments.

5.1.5 Physical Environment EIA

Data Gaps

The available historical data describing the physical environment are suitable for examining the regional setting but are not presently of suitable quality or resolution to support either detailed EIA or the engineering design of the offshore wind farm. Therefore, more detailed survey data will be required from close to the site to fill these data gaps. The combined data set will be used to more accurately predict the potential for impacts of the development on known sensitive receptors.

Environmental Impacts Scoping

Based on available literature, it is considered that the potential impacts on the physical environment as a result of wind farms within the marine environment will be:

Impact Description	Potential site specific impact	Potential cumulative and/or in-combination Impact
Changes to coastal sediment processes	✓	✓
Changes to suspended sediment concentrations	✓	x

Consideration of the above issues will be made with respect to the following effects, as relevant, of the proposed development:

- Near-field (i.e. the area within the immediate vicinity of the turbine grid);
- Far-field (e.g. the coastline, sites of scientific and conservation interest); and
- Temporally varying effects (e.g. short term impacts versus climate change).

Site-specific Impact Assessment Methodology

For each of the potential impacts described above, the potentially present sensitive receptors, the surveys or studies required to address outstanding data gaps and a proposed method of impact assessment are described in the tables below. In each case, a more specific list of sensitive receptors relevant to the site will need to be identified via the scoping and stakeholder feedback and agreed in advance with the regulator for consideration in the ES.

Potential Impact	**Changes to coastal sediment processes**
Sensitive Receptors	Potentially sensitive receptors include: • The form and function of the surficial sediments of local sedimentary bodies • Sediment transport pathways affecting the form and function of similar adjacent sedimentary systems • Changes to patterns of coastal sediment transport affecting coastal stability and recreational beach resource • Loss of habitat due to sediment displacement as a result of scouring around the base of turbine foundations
Survey/Study Proposed to Assess Impact	To inform studies to determine the potential for impacts on the sedimentary environment during the operational phase of the wind farm, the following surveys and studies will be undertaken: • A more detailed review of sedimentary information including the location of potentially susceptible coastlines adjacent to the site. • Bathymetric surveys • Side-scan sonar • Benthic survey and review of key habitats present • Metocean surveys: ADCP surveys and wave buoys • Seabed sediment samples & particle size analysis • Suspended sediment concentration monitoring • Computational modelling

Method of Impact Assessment	A more specific list of sensitive receptors will be identified for study. Historical and newly collected survey data will be used to inform conceptual and numerical modelling which will be used in turn to determine the magnitude, extent and significance of changes in the sedimentary environment affecting the identified sensitive receptors.

Potential Impact	**Changes to suspended sediment concentrations**
Sensitive receptors	Potentially sensitive receptors include: • Habitats and ecosystems sensitive to modification of the naturally present levels of suspended sediment or rates of sediment deposition (if found to be present)
Survey/Study Proposed to Assess Impact	To inform studies to determine the potential for changes to normal patterns and levels of suspended sediment concentration during the construction (foundation and cable installation) and operational phases of the wind farm development, the following surveys and studies will be undertaken: • Benthic ecology surveys • Bathymetric surveys • Side-scan sonar • Metocean surveys: ADCP surveys and wave buoys • Seabed sediment samples & particle size analysis • Suspended sediment concentrations • Sub-bottom geophysical survey and vibro-coring • Computational modelling
Method of Impact Assessment	A more specific list of sensitive receptors will be identified for study on the basis of the benthic surveys, informed by the detailed bathymetric and side-scan sonar surveys. If sensitive receptors are found to be present, historical and newly collected survey data will be used to inform conceptual understanding in conjunction with numerical modelling which will be used in turn to determine the magnitude, extent and significance of changes in the typical levels of suspended sediment concentration and their potential for re-deposition.

The following issues have been considered and are scoped out of the proposed study:

- Due to the presence of only a thin layer of mobile Holocene sediments overlying erosion resistant sedimentary units, it is considered that there will be no significant impact on the underlying geology of the site or the regional bathymetry. Therefore, these subject areas have been **scoped out**.
- Due to the naturally benign tidal regime in the region, it is considered that there will be no significant impact on the tidal regime in relation to navigational safety either within the site or in the surrounding area. Therefore, this subject area has been **scoped out**.

Site-specific Survey Methodology

Best practice guidance

The survey designs will take into consideration industry best practice for survey types and quality of data required for offshore wind farms:

- Marine Guidance Note MGN 371 (compliance with International Hydrographic Organisation (IHO) Order 1 standards);
- CEFAS (2004)*. Offshore Wind Farms – Guidance note for Environmental Impact in respect of FEPA and CPA requirements;
- SUT (2005). Guidance Notes on Site Investigation for Offshore Renewable Energy Projects (UK Society for Underwater Technology (SUT);
- JNAPC (2006). JNAPC Code of Practice for Seabed Development – Joint Nautical Archaeology Policy Committee; and
- COWRIE (2009) Coastal Process Modelling for Offshore Wind Farm Environmental Impact Assessment: Best Practice Guide. Eds: Lambkin, D.O., Harris, J.M., Cooper, W.S., Coates, T.

*This guidance is expected to be revised in 2010 to account for the potential impacts of the Round 3 offshore wind farm programme.

Summary of Methodology

Geophysical & Geotechnical Surveys

Geophysical surveys will be used to define bathymetry, seabed sediment types, seabed features, obstructions and spatial variation of the near-surface sediments across the given area. Typical equipment used for geophysical surveys is summarised as:

- Swathe bathymetry or multi beam echo sounder – for definition of the seabed profile and morphology;
- Side scan sonar – to identify seabed surface objects, debris and seabed surface sediments;
- Single channel sub bottom profiler – to establish geological units present close to the seabed;
- Magnetometer / Gradiometer – to identify metallic objects, including UXO, present on or near the seabed; and
- Sediment and water quality (turbidity) samples – to allow sediment particle size analysis, water quality analysis and determination of suspended sediment concentrations (SSC). SSC samples will be taken at different tidal states.

Geotechnical surveys will be used to establish ground truth against which geophysical data can be correlated and to determine the sub-surface conditions. Following the execution of the detailed geophysical survey, and the integration of the results into a geo-spatial model, a preliminary geotechnical survey will be designed and specified. The scope for this survey is dependent on the apparent variability in soil conditions shown by the geophysical results. However, typical surveys may include:

- Seabed surficial sediment grab sampling and PSA analysis;
- Cone Penetration Tests; and
- Vibrocorer.

Metocean Surveys and Modelling

Using directional wave buoys with ADCP (acoustic doppler current profiler) monitoring devices, wave height, tidal and current data will be recorded and used to create coastal process models of the area. A met buoy may also be deployed to aid the calibration of long term wind and wave models with the primary data.

The wave buoy devices will be in the water for a period of at least 6 months in order to cover at least one 1 in 1 year storm event, with the ADCP's in for a minimum of 29 consecutive days to cover two full neap-spring tide cycle.

Meteorological data, including wind speed and direction) is expected to be collected from a combination of methods, such as onshore met mast, offshore based LiDAR and offshore met-mast.

A computation model of coastal process and metocean conditions will be used to assess the magnitude and significance of changes caused directly to the following:

- Hydrodynamics (e.g. waves, tidal flows);
- Sedimentary environment (e.g. sediment composition and particle size, sediment re-suspension, sediment transport pathways and sediment deposition);
- Sedimentary structures (e.g. channels, banks); and
- Suspended sediment concentrations (SSCs).

The results of the physical process modelling will also be used to feed into other impact assessment topics, for example:

- Benthic ecology;
- Fish;
- Nature conservation;
- Archaeology and culture heritage; and
- Potential cumulative and in-combination impacts.

Potential Mitigation

Any micro-siting should be informed by the results of the geophysical and geotechnical survey campaigns.

Potential mitigation measures associated with changes to the sedimentary environment include the type and design of turbine foundation, the use of scour mats around turbine bases and the choice of construction techniques, including installation of foundations and cable burial.

The mitigation measures proposed in the final ES will be dependent upon the infrastructure choices available after the preliminary front end engineering design work (which will be influenced by engineering properties of the area and the cost of materials) and the potential impacts to sensitive

receptors found to be present, as determined by the EIA scoping and further studies. Options of mitigation will be discussed and with the relevant authorities prior to submission of the ES.

Cumulative and In-combination Impact Assessment & Survey Methodologies

The methodologies and potential survey requirements by which cumulative effects will be assessed will be agreed with consultees as part of a future scoping exercise undertaken by the FTOWDG.

5.2 Biological Environment

The biological environment receptors are categorised as follows:

- Benthic Ecology;
- Fish;
- Marine Mammals;
- Ornithology;
- Designated Sites; and
- Noise.

5.2.1 Benthic Ecology

Baseline Environment

Sublittoral communities are determined by a number of factors (bathymetry, currents etc), but sediment type is considered one of the key influences. There is a lack of up-to-date benthic data for the offshore areas off the east coast of Scotland relating to marine benthos.

The main data sources are the Marine European Seabed Habitats (MESH) website and the European EUNIS habitat classification system (JNCC, 2009), which provide an indication of the expected habitat and associated faunal data and the SEA 5 report which compiled available information on the faunal characteristics of the offshore area of the east coast of Scotland south of Peterhead (Eleftheriou *et al*., 2004). The following text is a summary of the information from these sources.

The northern and southern sections of the proposed Inch Cape site are located over areas of deep circalittoral sand (SS.SSa.OSa) and the central section is located over an area of deep circalittoral coarse sediments (SS.SCS.OCS). These habitats extend to the east of the site where the Wee Bankie complex is located (see section 5.1.2) and west of the site also. The biota associated with deep circalittoral sand includes a diverse range of polychaetes, amphipods, bivalves and echinoderms. The biota associated with deep circalittoral coarse sediment is similar to that of deep circalittoral sand, being generally diverse with robust infaunal polychaete and bivalve species (JNCC, 2009).

The following information is summarised from Eleftheriou *et al*. (2004). Records indicate that central North Sea has a benthic species diversity of approximately 48 species, which is similar to the northern North Sea and greater than the southern North Sea. However, local diversity is low and trawls within the SEA 5 areas show an increase in species number with movement offshore and also to the south of the region. In comparison with the northern North Sea, the central North Sea has a higher biomass of benthic fauna, which is associated with the production rates in shallower waters.

From 1978-1998, the Seafield sewage treatment facility, located on the Firth of Forth, disposed of liquid effluent at the Bell Rock and St Abb's Head disposal sites (see Figure 5-2). Surveys of these

areas indicated the presence of a low abundance/high diversity community dominated by polychaetes.

Data Gaps

Site-specific surveys will be required to determine the potential for Annex I habitats and the anticipated similarity of benthic communities with previous surveys of the outer Firth of Tay.

Environmental Impacts Scoping

Based on available literature, the following are perceived to be the potential impacts on benthic ecology as a result of wind farms within the marine environment:

Impact Description	**Potential site specific impact**	**Potential cumulative and/or in-combination Impact**
Temporary increases in suspended sediment concentrations from trenching, augering, seabed preparation (plume effects) and temporary increases in sediment deposition from plumes	✓	✓
Release of contaminants bound in sediments	✓	✓
Loss of seabed habitat through presence of turbines and foundations, and (albeit temporary) loss due to inter array and export cabling	✓	✓
Change in hydrodynamic regime and sediment transport leading to changes in habitats such as scour effects	✓	✓
Colonisation of turbines leading to a change in the benthic ecology and/or an increase in biodiversity	✓	✓
Potential release of pollutants from construction plant e.g. from accidental spillage/leakage or sacrificial anodes	✓	✓
Secondary impacts of decreased primary production due to turbidity of the water column and smothering	✓	✓

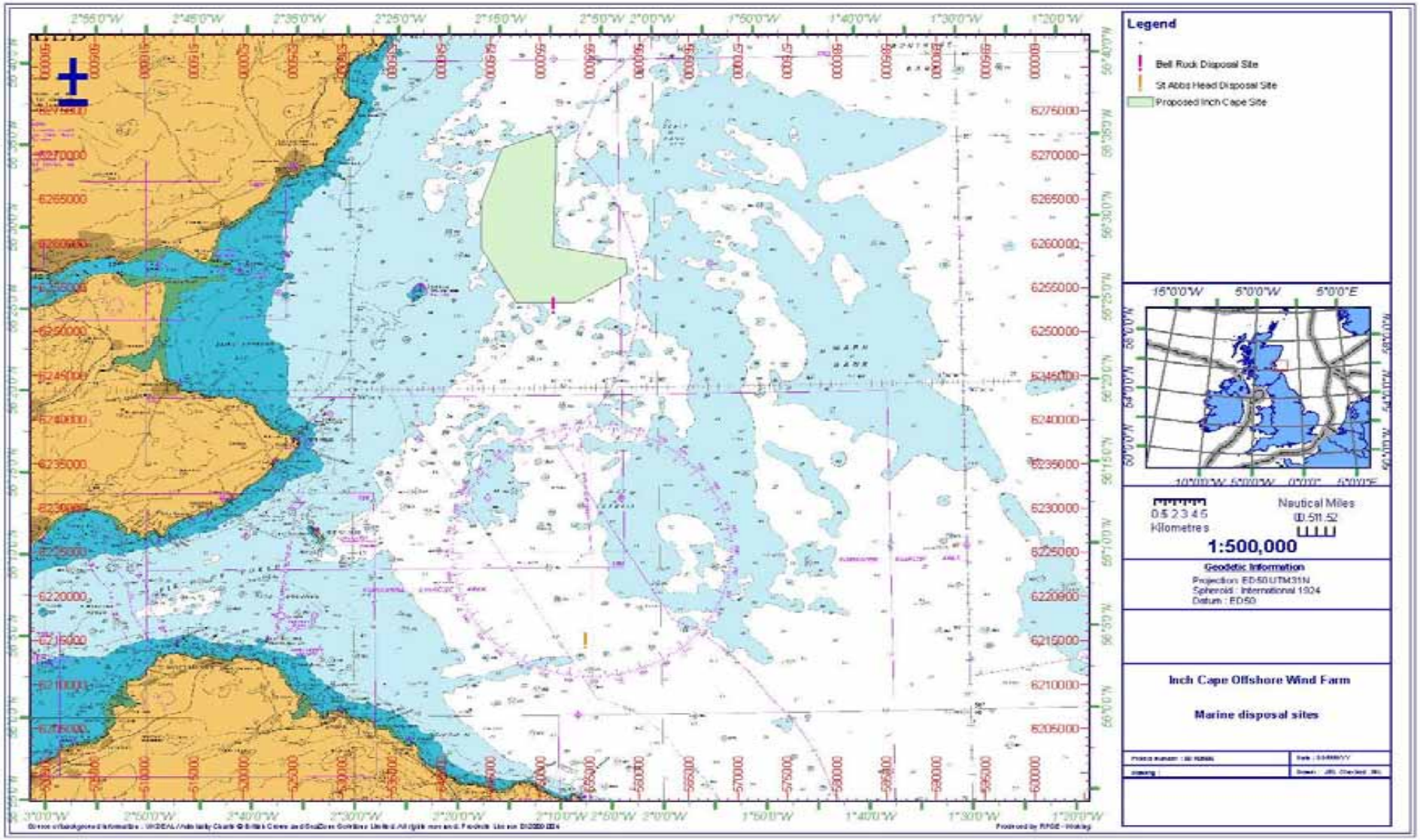


Figure 5-2: Location of Bell Rock and St Abb's Head disposal sites in relation to Inch Cape site

Impact Assessment Methodology

For each of the potential impacts described above a survey or study and method of impact assessment is described in the tables below. The potential effects listed have been developed from (a) relevant guidance notes and (b) ESs published for other Round 1 and Round 2 offshore wind farms.

Potential Impact	**Temporary increases in suspended sediment concentrations from trenching, augering, seabed preparation (plume effects) and resultant temporary increases in sediment deposition from plumes.**
Survey/Study Proposed to Assess Impact	To determine potential increases in suspended sediment loads and deposition the following studies and surveys are proposed: • Drop Down Video • Benthic Grabs: Infaunal and Particle Size Analysis (PSA) • Beam Trawls; 2m scientific
Method of Impact Assessment	The benthic environment will be described using standard marine ecological survey techniques (i.e. bathymetry and sidescan sonar with ground truthing using benthic grab, drop down video and epibenthic trawl; Davies *et al*., 2001; Boyd *et al*., 2002; CEFAS *et al.,* 2004). Ground truthing locations, both within the development area and the sphere of likely impact (i.e. tidal excursion), will be selected on the basis of data from the bathymetric and sidescan sonar surveys. The aim of ground truthing methods will be to characterise the benthic ecology of the area and determine the biotopes present, their extent and relative conservation importance. An assessment of impacts of sediment resuspension and deposition upon the benthic environment will be carried out within the EIA based on a review of the ecientific literature and results of monitoring data from other Round 1 and 2 OWF. Impact significance will be determined using standard EIA methodologies. Annex I reefs will be identified using methodologies compiled by JNCC (Gubbay, 2007; Irving, 2009).

Potential Impact	**Release of contaminants bound in sediments**
Survey/Study Proposed to Assess Impact	To determine potential contaminants bound in the sediments the following studies and surveys are proposed: • Desk top study of historical contaminants within the surrounding seabed. If historical contamination is identified then it may be necessary, following discussions with statutory authorities to undertake chemical analysis of sediments (from subsamples from the benthic grab survey)
Method of Impact Assessment	The data obtained during the desk study (and benthic survey) will be used to assess the likelihood of sediment contamination using standard EIA methodologies and comparison against Canadian Interim Sediment Quality Guidelines and CEFAS Action Levels In Dredged Materials.

Potential Impact	**Loss of seabed habitat through presence of turbines and foundations, and (albeit temporary) loss due to inter-array and export cabling**
Survey/Study Proposed to Assess Impact	To determine potential loss of seabed habitat the following studies and surveys are proposed: • Drop Down Video • Benthic Grabs (and PSA) • Beam Trawls • A detailed benthic characterisation survey is proposed across the Inch Cape site, plus the surrounding area (as described above) to identify the biotopes and habitats present (including Annex I reefs)
Method of Impact Assessment	Potential impacts through direct habitat loss will be assessed via quantifying any losses in terms of % loss of certain biotopes/habitats, previous experience gained during the assessment of Round 1 and Round 2 OWF and standard EIA methodologies.

Potential Impact	**Change in hydrodynamic regime and sediment transport leading to changes in habitats such as scour effects.** **Secondary impacts of decreased primary production due to turbidity of the water column and smothering.**
Survey/Study Proposed to Assess Impact	To determine potential impacts of alterations of the local hydrodynamic regime and sediment transport the benthic ecology will be characterised through the following studies and surveys: • Drop Down Video • Benthic Grabs (and PSA) • Beam Trawls
Method of Impact Assessment	Potential impacts on the benthic environment through scour/sediment transport changes will be assessed by applying the findings of the coastal processes assessment to the characterisation benthic datasets, and previous experience gained during the assessment of Round 1 and Round 2 OWF and standard EIA methodologies.

Potential Impact	**Colonisation of turbines leading to a change in the benthic ecology and biodiversity**
Survey/Study Proposed to Assess Impact	The benthic ecology and biodiversity will be characterised through the following studies and surveys: • Drop Down Video • Benthic Grabs (and PSA) • Beam Trawls
Method of Impact Assessment	This characterisation biotope data will be used to assess the impact of increased hard substrate area on the surrounding marine ecology. Reference will also be made to the results of monitoring programmes for other OWFs and other relevant literature (Linley *et al.*, 2007) in order to determine the communities likely to become established on the turbines. Standard EIA methodologies will be used to determine significance.

Potential Impact	**Potential release of pollutants e.g. from accidental spillage/leakage or sacrificial anodes**
Survey/Study Proposed to Assess Impact	The benthic ecology will be characterised through the following studies and surveys: • Drop Down Video • Benthic Grabs (and PSA) • Beam Trawls
Method of Impact Assessment	The potential impact of the release of pollutants will be assessed during the EIA using standard EIA methodologies and previous literature and experience gained from Round 1 and 2 OWF, taking consideration of the likely mitigation measures. Potential for accidental spillage or leakage to be mitigated by correct servicing and maintenance of equipment and vessels, together with adherence to best practice and appropriate legislation, including appropriate Pollution Control Plans, Site Environment Management Plans and onsite monitoring/reporting.

Site-Specific Survey Methodology

Best Practice Guidance

The following references provide best practice guidance for use in assessing impact upon benthic ecology:

- Davies *et al*. (2001). Marine Monitoring Handbook;
- Boyd *et al*. (2002). Guidelines for the Conduct of Benthic Studies at Aggregate Dredging Sites. (To be updated and reissued early 2010);
- NMMP (2003). National Marine Monitoring Programme Green Book. V7;
- CEFAS (2004). Offshore Wind Farms: guidance notes for Environmental Impact Assessment in respect of FEPA and CPA requirements. Version 2;
- DEFRA (2005) Nature conservation guidance on offshore wind farm development;
- Hendrick *et al.* (2006). *Sabellaria spinulosa* reef: a scoring system for evaluating 'reefiness' in the context of the Habitats Directive;
- Gubbay (2007). Defining and Managing *Sabellaria spinulosa* Reefs: Report of an Inter-agency Workshop;
- OSPAR (2008). OSPAR Guidance on Environmental Considerations for Offshore Wind Farm Development;
- IEEM (2009). Guidelines for Ecological Impact Assessment in Britain and Ireland - Marine and Coastal Consultation document; and
- Irving (2009). Identification of the Main Characteristics of Stony Reef Habitats under the Habitats Directive. Summary of an Inter-agency Workshop 26-27, March 2008.

Survey Design

The following provides an indicative scope to undertake a benthic ecology characterisation utilising Drop Down Video (DDV), benthic grabs and beam trawls, to characterise the site so that potential impacts may be identified and assessed and also to inform a subsequent preconstruction (baseline) survey. The proposed surveys and brief methodologies are outlined in the following sections. The

final survey design will be based upon the findings of the geophysical survey and will be agreed with Marine Scotland, JNCC and SNH.

The spatial extent and timing of the proposed benthic survey will be discussed with Marine Scotland Science and JNCC. The sampling methodology will be based on a systematic grid sampling array, over the extent of the tidal excursion and the wave affected region behind the device, and in discreet reference sites in similar areas of habitat but beyond the zone of influence of the Inch Cape development area. Exact sample locations will be informed by the suite of geophysical surveys proposed for the site, including swathe bathymetry, side scan sonar and sub bottom profiler. The analysis of this data will be used to inform the positioning of sites to ground truth broad sediment types identified and inform the micro-siting of sample locations in order to ground truth the presence of substrate features identified as possible Annex 1 habitats such as Sabellaria, Modiolus and Mytilus reefs. Final positions will be in agreement with Marine Scotland, SNH and JNCC.

Drop Down Video Survey

It is recommended and proposed that a combined DDV and benthic grab sampling survey be undertaken, with the DDV conducted prior to the deployment of a grab sampler. The deployment of a DDV would allow the identification of benthic species and biotopes, which will provide in-situ information to augment benthic data obtained using a grab sampler. The deployment of the DDV will also allow for the identification of any potential Annex 1 designated under the Habitats Directive features by trained marine biologists in the field, prior to the deployment of a grab. Any potential Annex 1 habitat (e.g. biogenic reefs such as *Sabellaria, Modioulus* and cobble reefs) features would be subject to DDV only, rather than a combination of drop down video and benthic grabs.

The video tracks and photographic stills from the DDV survey will be reviewed and analysed using office based facilities and undertaken by experienced marine ecologists. The DDV footage will be used to assign epibenthic biotopes based on the habitat and species present at each station. Species will be identified using video stills and their abundance or percent coverage quantified using the SACFOR scale. Substrate composition will be recorded based upon the Folk classification and textural group. Where possible, this assessment will be conducted on three images per station and one average relative abundance score (on the SACFOR scale) assigned to each station. Epibenthic biotope classification will then be conducted using the JNCC Marine Habitat Classifications for Britain and Ireland (Conner *et al*., 2004) based on those communities present.

Relevant data will then be transferred to GIS format so that spatial plotting of information can be achieved. Information gathered from the benthic surveys will be interpreted to provide a biotope map for the area and detailed information on the location and extents of any Annex I habitat features within the vicinity of the proposed Inch Cape offshore wind farm. The report will highlight significant species and habitats within the context of nature conservation. Where appropriate, reference will be made to relevant legislation and the known geographical distribution of the feature.

Benthic Grab Survey

Benthic infaunal sampling is required to characterise and determine baseline conditions and the sensitivity of benthic species and communities within proximity to the site. Limited benthic sampling may be undertaken in areas identified as containing potential Annex I habitats. Sediment sampling

will be undertaken in order to determine the physical nature of the substrate to aid faunal community characterisation and allow assessment of associated seabed disturbance. Samples will also be taken for sediment chemistry (if deemed necessary following discussion with client and regulatory authorities).

The survey has been designed based on guidance provided by 'Procedural Guideline No. 3-9 Quantitative sampling of sublittoral sediment biotopes and species using remote operated grabs' included in the JNCC Marine Monitoring Handbook (Davies *et al*., 2001). Reference has also been made to Guidelines for the conduct of benthic studies at aggregate extraction sites (Boyd *et al*., 2002).

Samples will be collected using a suitable grab. It is recommended that a day grab or Hamon grab be used depending on the substrate composition. The grab will be fitted with stainless steel jaws, to allow for sediment chemistry sampling if required.

Particle Size Analysis (PSA)

Each sediment sample will be processed in the laboratory through sieves over the range 64 mm to 63 µm (0.063 mm) on the Wentworth scale in accordance with (Boyd *et al*., 2002) to determine the particle size composition of the seabed sediments. The sediment is washed through a 63 µm (0.063 mm) sieve and the retained material oven dried at 80ºC before being transferred to the coarsest of a series of stacked sieves.

These are placed on an automatic shaker for 15 minutes and the contents of each sieve subsequently weighed. Material washing through the 63 µm sieve will be collected in pre-weighed beakers, oven dried at 30ºC and weighed as a separate fraction. This fraction can be analysed by laser sizing should this be required for coastal process studies.

For each sampling station the results will be expressed as cumulative percentage of each particle size passing through each sieve size. For the purposes of the report and the statistical analysis to be carried out, these percentages are converted to absolute percentage retained on each sieve size.

Benthic Infauna Analysis

The preserved sample material will be processed in a suitably accredited laboratory by carefully washing the samples with a large volume of tap water through a 1mm sieve. Samples will be elutriated with water in order to float off the smaller, lighter components of the fauna. These will be retained on a fine mesh sieve (250 µm), transferred to a petri dish and all fauna picked out under a binocular zoom microscope.

For samples with large quantities of retained material, (where time constraints make examination of the whole fraction under a microscope unrealistic) material will be placed in griddled, white trays and sorted by eye to remove all remaining fauna. The faunal samples will be preserved in 70% IMS for identification, enumeration and specimen coding following Picton and Howson (1999; CD ROM Version). Colonial organisms e.g. bryozoans, will be recorded as present (P) and for the purposes of abundance counts will be allocated a numerical value of 1. All samples will be subsequently retained in methanol for Quality Assurance Audit purposes if required. Ten percent (10%) of the benthic samples will be subject to internally QA. The laboratory undertaking the analysis will be a participant

in the National Marine Biological Analytical Quality Control scheme (NMBAQC), and thereby takes part in the UK wide Quality Assurance scheme for this type of analysis.

Biomass Determination

Blotted wet weight biomass will be obtained for major faunal groups by weighing after external fluid has been removed on filter paper. Animals will be left on the filter paper until no more distinct wet traces can be seen. Animals with shells are weighed with shells attached. In the case of bivalves, fluid is drained off prior to weighing. Similarly, echinoids are punctured and drained before weighing. Organisms will be weighed to the nearest 0.0001 g. This methodology is in accordance with the National Marine Monitoring Programme Green Book (NMMP, 2003).

Beam Trawling

Epibenthic sampling, using a standard scientific 2m Jennings beam trawl fitted with a 5mm cod end, will also be undertaken. This methodology is primarily designed to collect information on epibenthic invertebrate species, as well as small demersal and juvenile fish. Beam trawl tow distance at each site will depend on the nature of the seabed type, however it is anticipated that tows will be between 200-800 m in order to produce a manageable sample size. For the anticipated ground types in the area, each target tow will be of a 10 minute duration assuming a maximum towing speed of approximately 1.5 knots. A log will be maintained of the start heading, trawl speed, trawl direction, tidal state and weather condition. For the start position (when the trawl is on the seabed) the time, latitude, longitude, depth will be recorded. The same will be recorded for the end position (when the trawl is lifted from the seabed).

Where practicable, the entire catch will be processed onboard, with all species identified, enumerated and weighed. Species will be measured using the methods set out in EC Council Regulation 850/98 – For the Conservation of Fishery Resources Through Technical Measures For The Protection Of Juveniles Of Marine Organisms.

MS and local and district fishermen's organisations will be informed of the position, date, timing and expected duration of the benthic survey and epifaunal surveys. Dispensation for the use of under-sized mesh (5mm) on the beam trawl will also be obtained prior to commencement of the survey work.

Data Analysis

Species abundance and biomass data collated from the benthic grab and beam trawl surveys will be collated in excel spreadsheets, and each dataset will separately be run through the multivatriate statistical analysis package PRIMER v6.

Univariate analysis of the data will include Margalef's index of Richness, Pielou's Evenness index, the Shannon-Wiener Diversity index and Simpson's index of Dominance. Reference to the calculation of these indices can be found in Clarke and Warwick (1994). Such indices are useful in reducing large faunal datasets to a single figure, which may be used in comparison to other sites in assessing community structure.

Macro-invertebrate community structure will be investigated with the use of classification analysis (hierarchical agglomerative clustering). This uses the Bray Curtis similarity coefficient to assess the similarity of sites based on the faunal components.

Cumulative and In-combination Impact Assessment & Survey Methodologies

The methodologies and potential survey requirements by which cumulative effects will be assessed will be agreed with consultees as part of a future scoping exercise undertaken by the FTOWDG.

The initial assessment recommendations proposed by FTOWDG are to pool the site-specific data collected as part of the EIA process to define a regional baseline, which can be used to undertake assessment of the potential for cumulative and in-combination impacts. The regional marine benthic data set may also be used within the cumulative and in-combination impact assessments for fish and shellfish, marine mammals and ornithology.

A study area will be set on the basis of consultation with relevant bodies and will encompass the three Firth of Forth / Tay sites and the adjacent Round 3 zone, and for practical purposes is likely to follow ICES rectangle boundaries. The study area will also need to take account the potential spatial extent of noise disturbance during construction.

5.2.2 Fish and Shellfish Ecology

Baseline Environment

Some of the principal commercial and conservation fish and shellfish species of commercial and conservation importance which have geographical extents that include the central North Sea are listed in Table 5-4. The data does not indicate whether these species will be recorded within the Inch Cape site.

Spawning and Nursery Areas

Many species of fish spawn and have nursery areas within the North Sea, with a number of species using the proposed development site, at least in part (Figure 5-3 Spawning grounds, Figure 5-4 Nursery grounds) (Coull *et al*., 1998). It should be noted that these spawning and nursery grounds represent only a small proportion of the overall area utilised in UK waters, although the relative importance of different sites is not clear from the data. In addition to the spawning grounds listed in Table 5-5 it should be noted that there is a herring spawning area to the north of the proposed Inch Cape site (Chapman, 2004; MCS, 2004; ICES, 2009; Fishbase 2009; FRS, 2009).

The spawning and nursery areas illustrated should however be considered as indicative as these areas may change spatially and temporally due to local conditions.

Table 5-4: Species spawning and nursery grounds in proximity to the Inch Cape offshore wind farm

Species	Spawning Grounds	Nursery grounds
Herring	✓	✓
Cod	✓	✓

Whiting	✓	✓
Plaice	✓	✓
Lemon Sole	✓	✓
Sandeels	✓	✓
Sprat	✓	✓
Saithe	x	✓
Nephrops	✓	x

Table 5-5: Key commercial and conservation fish and shellfish species

Demersal Species	Pelagic Species	Migratory Species	Elasmobranchs	Shellfish
Whiting (*Merlangius merlangus*)	Sandeels (*Ammodytes* spp.)	Salmon (*Salmo salar*)	Skates	Long-finned Squid (*Loligo forbesii*)
Cod (*Gadus morhua*)	Herring (*Clupea harengus*)	Sea Trout (*Salmo trutta*)	Basking Shark (*Cetorhinus maximus*)	Curled Octopus (*Eledone cirrhosa*)
Plaice (*Pleuronectes platessa*)	Sprat (*Sprattus sprattus*)			Little Cuttlefish (*Sepiola atlantica*)
Haddock (*Melanogrammus aeglefinus*)	Mackerel (*Scomber scombrus*)			Giant Squid (*Arciteuthis* spp.)
Lemon Sole (*Microstomas kitt*)				Short-finned squid (*Todarodes sagittatus*)
Monkfish/Anglerfish (*Lophius piscatorius*)				Lesser flying squid (*Todaropsis eblanae*)
Saithe (*Pollachius virens*)				*Alloteuthis subulata*
Dab (*Limanda limanda*)				Edible Crab (*Cancer pagurus*)
Turbot (*Psetta maxima*)				Norway Lobster (*Nephrops norvaegicus*)
				Giant Scallop (*Pecten maximus*)
				Lobster (*Homarus gammarus*)

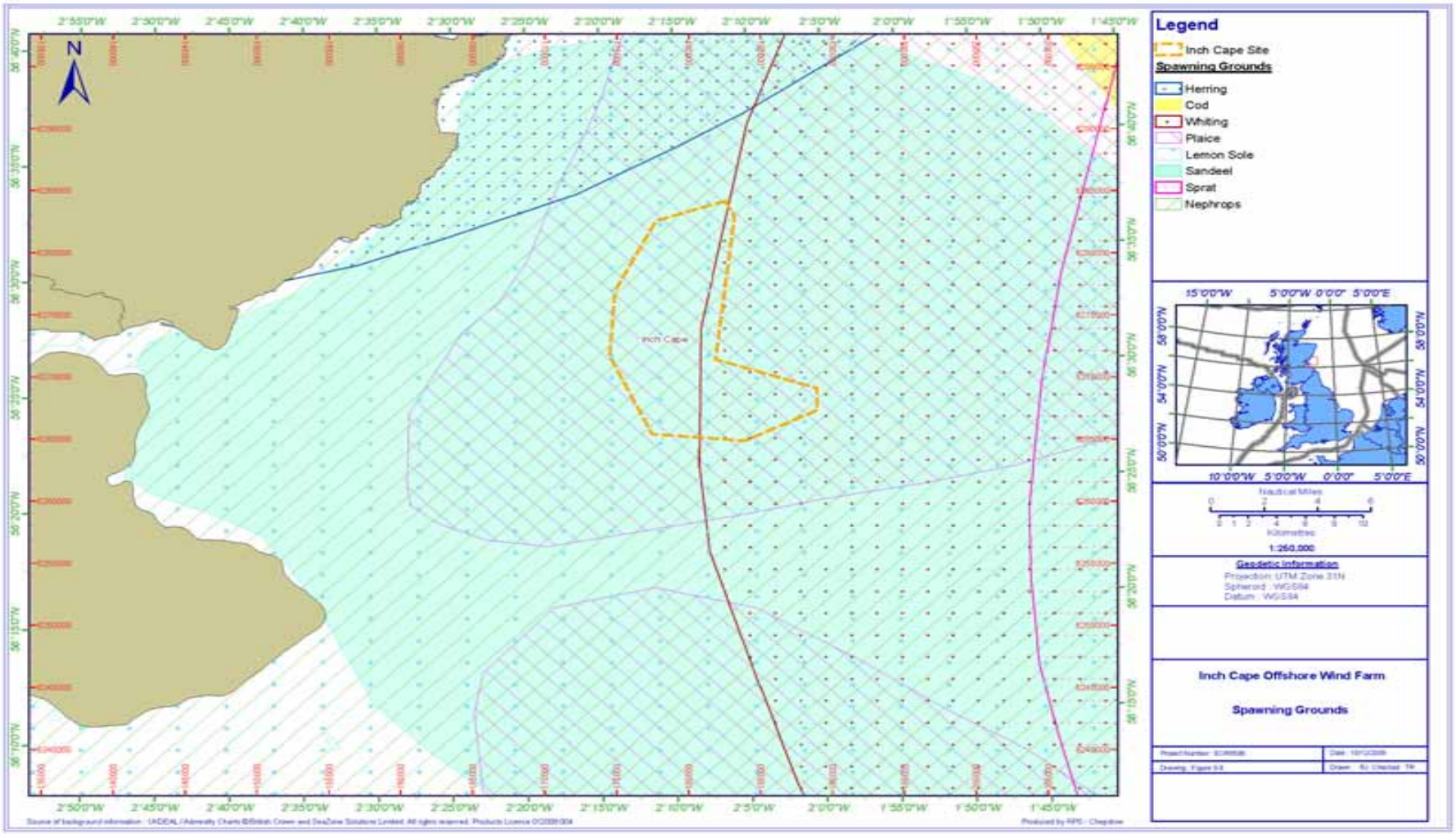


Figure 5-3: Spawning grounds

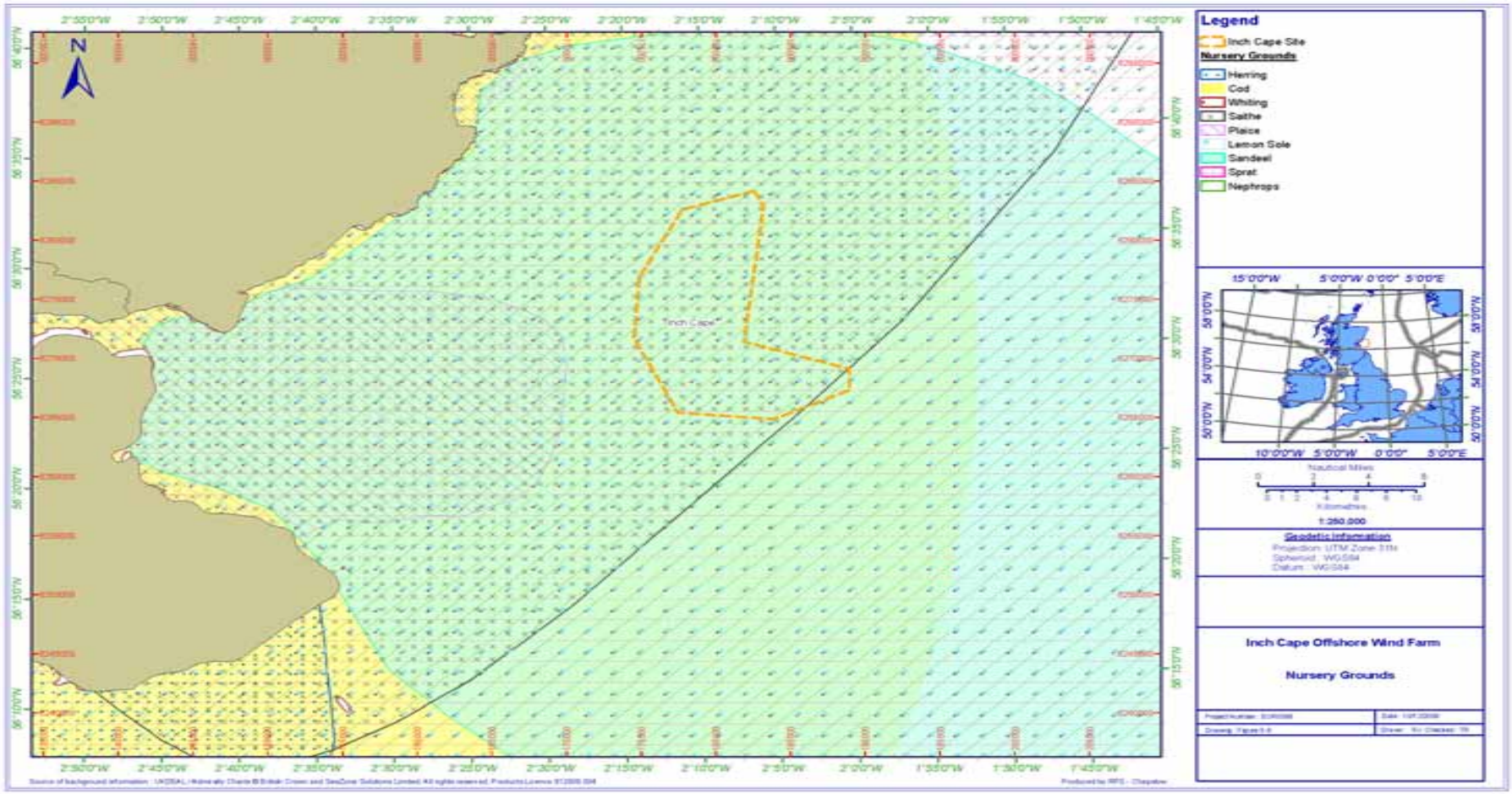


Figure 5-4: Nursery grounds

Natural Fisheries Resource

There are both recreational and commercial fisheries along the east coast of Scotland. Sea-angling is a small industry in Scotland with charter boats available for 3-6 hour trips. Locations include fishing grounds within inshore waters, such as Bell Rock, St Andrews Bay and wreck sites. There are no spatial data sets available which document the locations of offshore sea angling areas. The following discussion relates to commercial fish species.

The shellfish species which are primarily targeted are Norway lobster (*Nephrops norvegicus*), edible crab (*Cancer pagurus*) and giant scallop (*Pecten maximus*) (Chapman, 2004). The main demersal fish species targeted by Scottish fisheries in the North Sea include cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), whiting (*Merlangius merlangus*), saithe (*Pollachius virens*), monkfish (*Lophius* spp.) and sandeels (*Ammodytes* spp).

Sandeels have a central role within the North Sea ecosystem being an important prey for the top predators within the marine ecosystem, such as fish, birds, seals and cetaceans (Camphuysen *et al*., 2004; FSBI, 2007). Sandeel species form large aggregations and can support single species fisheries (FSBI, 2007). However, there is concern over sandeel stocks which have shown a decrease in abundance in recent years. The Wee Bankie/Marr Bank stocks have supported an industrial fishery since 1990 (FSBI, 2007). Climate change has been suggested as a factor that has caused a decrease in growth rates of this stock (Wanless *et al*., 2004 c.f. FSBI, 2007). Although there has been a moratorium on sandeel fishing on the east coast of Scotland since 2002, there is concern that the decrease in growth rates combined with past fishing pressure will cause a collapse of these stocks (FSBI, 2007). This may have wider implications for the species that prey upon these stocks.

Pelagic fish that are targeted by trawl nets include herring (*Clupea harengus*) and mackerel (*Scomber scombrus*) (FRS, 2009).

Electromagentic Species and Electromagnetic Fields

A number of reports have been produced in recent years that investigate issues surrounding the potential for sub-sea power cables required for offshore wind farms to create electromagnetic fields (EMF) (e.g. see www.offshorewind.co.uk/Pages/Projects/Research___project_areas/Fish__Shellfish_and_Benthos/). Specific concerns have been expressed that should such fields result, there is the potential for an effect on electrically and/or magnetically sensitive marine organisms, mainly fish species and in particular elasmobranchs (sharks and rays). However, Gill *et al*. (2008) has suggested that EMF may have no significant biological effects on sharks and rays.

From the available literature, it is clear that considerable concern exists regarding the current population status of some species of elasmobranch within the North Sea, with some species thought to have gone extinct within the southern and central North Sea (JNCC, 2009). However, relatively little information has been sourced as regards the potential distribution of such species within the Inch Cape site.

Conservation Species

Commercial fish species, basking shark, salmon, sea lamprey, river lamprey and sea trout are species of conservation significance that have been recorded or have the potential to have a distribution within the proposed Inch Cape site.

Data Gaps

The available data for fish and shellfish is not of a suitable quality or resolution to allow an accurate description of the site. Therefore, site-specific surveys will be required.

Environmental Impacts Scoping

Based on available literature, the following are perceived to be the potential impacts on fish and shellfish as a result of wind farms within the marine environment:

Impact Description	**Potential site specific impact**	**Potential cumulative and/or in-combination Impact**
Habitat loss and displacement	✓	✓
Disturbance to nursery/spawning grounds as a result of construction and increases in sediment deposition	✓	✓
Disturbance or physical injury associated with construction noise	✓	✓
Behavioural responses to electromagnetic fields associated with cabling	✓	✓
Sediment plumes and deteriorated water quality creating temporary disruption to migratory pathways and localised avoidance	✓	x
Reduced fishing pressure within wind farm site and increased fishing pressure within areas which previously may have seen limited effort (due to displacement)	✓	✓
Increased habitat complexity due to presence of turbines and creation of reef effects following construction (including changes to seabed composition).	✓	✓
Changes to the ecosystem such as effect upon shoaling due to presence of turbines	✓	✓

Site-specific Impact Assessment Methodology

For each of the potential impacts described above a survey or study and method of impact assessment is described in the tables below.

Potential Impact	**Habitat loss and displacement**
Survey/Study Proposed to Assess Impact	To determine the potential for habitat loss and displacement, the following surveys and studies will be undertaken: • Fish and shellfish desk based study • Benthic and epibenthic surveys (see section 5.2.1) • Fisheries surveys (e.g. Beam/otter trawling, or other appropriate fishing method)

Method of Impact Assessment	The spatial and temporal nature of habitats in the study area will be fully described and losses of these habitats through turbine placement and temporary losses during the inter-array and export cabling quantified. Potential affects from any fishery exclusion zone will also be highlighted.

Potential Impact	**Disturbance to nursery/spawning grounds as a result of construction and increases in sediment deposition**
Survey/Study Proposed to Assess Impact	To determine the potential for disturbance to nursery and spawning grounds the following surveys and studies will be undertaken: • Fish and shellfish desk based study • Benthic and epibenthic surveys (see section 5.2.1) • Should the desk based study indicate the presence of spawning or nursery areas within the proposed development site it may be necessary, following discussions with the statutory authorities, to complete Planktonic egg/larvae surveys- for sensitive species (e.g. herring) to more clearly define local spawning areas.
Method of Impact Assessment	Potential impacts on spawning habitats through increased sediment loads will be assessed using the outputs of the coastal process assessment and published data on the sensitivity of fish species found to be spawning in this area to high sediment loads (including Round 1 and 2 OWF data).

Potential Impact	**Disturbance or physical injury associated with construction noise**
Survey/Study Proposed to Assess Impact	To determine levels of disturbance to fish species associate with noise the following studies and surveys will be undertaken: • Fish and shellfish desk based study • Fisheries surveys (e.g. Beam/otter trawling, or other appropriate fishing method) • Data gathered will be used to determine the distribution and extents of fish populations and spawning and nursery grounds within the development and surrounding area • Baseline underwater noise survey
Method of Impact Assessment	Potential noise impacts during the construction phase on those fish species found to be present in the vicinity of the development area will be assessed via a review of the relatively large body of data that exists on this topic, including developer-led work and COWRIE projects (Bio/Consult AS, 2001; Wahlberg and Westerberg, 2005; Nedwell *et al.*, 2007). Use of assessment tools such as audiograms and species-metrics will be adopted, where appropriate. The underwater noise survey will also be used to estimate the potential impacts of construction noise.

Potential Impact	**Behavioural responses to electromagnetic fields associated with cabling**
Survey/Study Proposed to Assess Impact	To determine the distribution of electromagnetic sensitive species the following studies and surveys will be undertaken: • Fish and shellfish desk based study

	• Fisheries surveys (e.g. Beam/otter trawling, or other appropriate fishing method) • Consultation with fishermen and fisheries organisations.
Method of Impact Assessment	The findings of recent COWRIE projects (Gill *et al.,* 2005, Gill *et al.*, 2009) investigating the effects of EMF on sensitive fish species will be used to determine the significance of any impacts on fish species from EMF associated with the Inch Cape OWF and export cables.

Potential Impact	**Sediment plumes and deteriorated water quality creating temporary disruption to migratory pathways and localised avoidance**
Survey/Study Proposed to Assess Impact	To determine potential disturbance from sediment plumes the following studies will be undertaken: • Fish and shellfish desk based study • Benthic and epibenthic surveys (see section 5.2.1) • Fisheries Surveys (e.g. Beam/otter trawling, or other appropriate fishing method) • The potential disturbance caused by sediment plumes will also be informed by the Particle Size Analysis undertaken following the Benthic Grab survey
Method of Impact Assessment	Potential impacts on behavioural responses through increased sediment loads will be assessed using the outputs of the coastal process assessment, published data on the sensitivity of fish species (including Wound 1 and 2 OWF data) found in this area to high sediment loads and standard EIA methodologies.

Potential Impact	**Reduced fishing pressure within wind farm site and increased fishing pressure within areas which previously may have seen limited effort (due to displacement)**
Survey/Study Proposed to Assess Impact	To determine potential changes in fishing pressure the following studies will be undertaken: • Fish and shellfish desk based study, which will be informed and by the commercial fisheries studies • Fisheries Surveys (e.g. Beam/otter trawling, or other appropriate fishing method)
Method of Impact Assessment	Impact assessment will include a consideration of potential affects from a change/reduction/cessation in commercial fishing within the proposed development area and the displacement of commercial fisheries to other areas which previously were not used as intensively. Impact assessment methodology will be informed by previous experience and literature published following the development of Round 1 and 2 OWF and undertaken using standard EIA methodologies.

Potential Impact	**Increased habitat complexity due to presence of turbines and creation of reef effects following construction (including changes to seabed composition)**
Survey/Study Proposed to Assess Impact	To determine potential impacts of changes in habitat complexity the following surveys will be undertaken: • Fish and shellfish desk based study

	• Benthic and epibenthic surveys (see section 5.2.1) • Fisheries surveys (e.g. Beam/otter trawling, or other appropriate fishing method)
Method of Impact Assessment	A review of the potential colonisation of new structures (piles, scour protection etc) and potential benefits afforded by this will be undertaken. This requires an objective assessment of the relative merits of a general increase in biodiversity *per se* over an increase in species that naturally and locally colonise local hard substrata (Linley *et al*., 2007). However whether such "artificial reefs" increase productivity in the long-term is controversial and such structures should not automatically be assumed to be beneficial (CEFAS *et al*., 2004). The method of Impact Assessment is to be based on the findings from Round 1 and 2 developed sites where monitoring has already been instigated, supplemented with site-specific information on species and local conditions (e.g. turbidity).

Potential Impact	**Changes to the ecosystem such as the effect upon shoaling due to presence of turbines**
Survey/Study Proposed to Assess Impact	To determine changes to the ecosystem the following studies will be undertaken: • Fish and shellfish desk based study • Fisheries Surveys (e.g. Beam/otter trawling, or other appropriate fishing method)
Method of Impact Assessment	Recent research published following the development of Rounds 1 and 2 OWF will be used to inform the assessment of ecosystem effects.

Site-specific Survey Methodology

Best Practice Guidance

The following references provide best practice guidance for use in assessing impact upon fish and shellfish ecology:

- Davies *et al*. (2001) Marine Monitoring Handbook;
- CEFAS (2004) Offshore Wind Farms: guidance notes for Environmental Impact Assessment in respect of FEPA and CPA requirements. Version 2;
- DEFRA (2005) Nature conservation guidance on offshore wind farm development; and
- OSPAR (2008) OSPAR Guidance on Environmental Considerations for Offshore Wind Farm Development.

Proposed Survey Programme

The overall approach to the survey programme is intended to characterise the spatial and temporal variations in seasonal fish and shell fish assemblages, commercial fisheries species and establish the occurrence of any species of conservation concern within the vicinity of the proposed Inch Cape development area. The characterisation methodology will entail a suite of complementary surveys, as recommended by best practice guidelines and previous experience of requirements in the other OWF developments, over the period of a year.

The exact methodology will be determined following the completion of the desk based study of fish and shellfish within the area and through discussions with fisheries groups via the Fisheries Liaison Officer (FLO) for the project and the statutory authorities. The most appropriate method to be employed will be in line with commercial fisheries methodologies within the area.

Summary of Methodology

The following summary methodology is provided as a guide only and the final methodology will be determined in discussion with Marine Scotland and SNH.

Fish and Shellfish Desk-based Study

The study will be undertaken by marine scientists in order gather data for the area to inform the development of suitable site-specific sampling strategies. The desk based study will entail an interrogation of available datasets and literature, consultation with relevant authorities and fisheries associations through the FLO. Data will collated and mapped in GIS to illustrate the spatial and temporal scales of fisheries assemblages, species of commercial importance, nursery and spawning areas and the occurrence of species of conservation concern.

Otter Trawls

Otter trawls are biased towards sampling demersal (seabed associated) fish species. Demersal fish are likely to be affected by the proposed Inch Cape offshore wind farm development due to their territorial nature and predation on invertebrate species associated with the seabed. Otter trawl sampling locations will be concentrated within a survey area delineated by a tidal excursion from the proposed development site. Final locations will be determined following the desk top study, analysis of hydrographical data of the area and through discussions with Marine Scotland.

It is anticipated that a local fishing vessel will be used to carry out the otter trawl survey. The net used will be similar to nets used by commercial vessels in the area and will be approximately 10 m across the head line, 14 m across the ground line, 1 m high with an 80 mm mesh, knot to knot. The vessel will be accurately positioned with differential Geographic Positioning System (dGPS) using a Garmin GPS Map 76CS GPS receiver with external marine antenna. Differential corrections will be received from the EGNOS (European Geostationary Navigation Overlay Service) satellite network giving a final positioning accuracy of ± 3 m. The proposed trawl locations, admiralty chart background and real time vessel location will be displayed on a helmsman display using a Garmin Mapsource navigation package. Positions will be logged in WGS84 coordinates and converted to OSGB36 for import into GIS.

Once at the sampling station the otter trawl will be deployed and the co-ordinates logged when the net is in contact with the substrate. The trawl will be towed for 30 to 60 minutes at a speed of 1-2 knots (CEFAS, 2004). For each sample the following information will be recorded: date, time (GMT), depth of water (m), direction, orientation, speed (Knts) and the ground distance covered (m) by the trawl. The trawl track will be recorded for each trawl.

As the net is hauled in, any biota will be moved down towards the cod end or 'bosom' of the net. Once the net is on board the vessel the contents of the cod end will be placed into fish boxes and photographed. The specimens will then sorted, identified, enumerated, measured, weighed and recorded. Species will be measured using the methods set out in EC Council Regulation 850/98 – for

the Conservation of Fishery Resources Through Technical Measures for The Protection Of Juveniles Of Marine Organisms. The size of crab species will be measured across the carapace, the size of lobsters will be recorded from the eye socket to the distal end of the carapace, fish will be measured from the snout to the maximal extent of the caudal fin, and rays will be measured from wing tip to wing tip. Fish will be returned alive where possible. For species not readily identifiable in the field, voucher specimens (formalin, to a dilution of approximately 4% w/) and/or photographs will be retained and sent to specialists for identification.

Cumulative and In-combination Impact Assessment & Survey Methodologies

The methodologies and potential survey requirements by which cumulative effects will be assessed will be agreed with consultees as part of a future scoping exercise undertaken by the FTOWDG.

The initial assessment recommendations proposed by FTOWDG are to pool the site-specific data collected as part of the EIA process to define a regional baseline, which can be used to undertake assessment of the potential for cumulative and in-combination impacts.

A study area will be set on the basis of consultation with relevant bodies, will encompass the four Firth of Forth / Tay sites and the adjacent Round 3 Zone 2, and for practical purposes is likely to follow ICES rectangle boundaries. The study area will also need to take account the potential spatial extent of noise disturbance during construction.

5.2.3 Marine Mammals

The potential implications for the development of offshore wind farms vary, depending on issues such as the species present and how important the area is, with a number of Round 1 and 2 sites (together with several in mainland Europe) having been consented and developed in the presence of certain marine mammal species (e.g. harbour porpoise and seals), albeit in some instances with additional monitoring requirements and/or modifications to the proposed construction methodology. Marine mammals are subject to a range of legal protection and agreements, including:

- The Marine (Scotland) Act 2010;
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);
- Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS);
- The Wildlife and Countryside Act 1981 (as amended);
- The European Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive');
- Conservation (Natural Habitats, & c) Regulations 1994 (as amended);
- Nature Conservation (Scotland) Act 2004;
- Offshore Marine Conservation (Natural Habitat & c.) Regulations 2007; and
- Offshore Marine Conservation (Natural Habitats & c.) Regulations 2007 (as amended).

Under the amended Conservation (Natural Habitat & c.) Regulations (1994) and amended Offshore Marine Conservation (Natural Habitats, & c.) Regulations (2007), it is an offence to "deliberately disturb wild animals of any European Protected Species in such a way as to likely significantly affect

(i) the ability of any significant group of animals of that species to survive, breed or rear or nurture their young; or (b) the local distribution of abundance of that species". As a result, the onus is on the developer to assess whether there is a likelihood of committing an offence and to determine the mitigation that is required and whether a licence is required (JNCC, 2009). A wildlife licence, administered by SNH in STW (i.e. within 12 nm of the coastline), would be required, should the proposed activity be determined as causing harm to a European Protected Species (EPS).

Details are provided below of the species that are likely to be recorded within the Inch Cape site area. It should be noted that conservation sites associated with marine mammal species are discussed in section 5.2.3.

Baseline Environment

Cetaceans

The Firths of Forth and Tay are home to two resident cetacean species, one species which is abundant seasonally and three species which are occasional visitors. These are briefly described below.

The data available describing abundance and distribution of cetaceans in the area of interest are in the main from large-scale surveys which are designed to give abundance over large areas at a single point in time. Survey coverage of the area is patchy in both space and time. Spatial resolution in the data is therefore very low, precision is low and there is little information on seasonality. Sightings data from the UK Atlas of Cetaceans for the most commonly sighted species of cetaceans in the Firths of Forth and Tay is available. A variety of methods have been used to collect these data, namely land-based sightings, sightings from platforms of opportunity (including research vessels, fishery protection vessels, seismic vessels, whale watching ferries) and dedicated ship-board line transect surveys (SCANS).

Harbour porpoise (*Phocoena phocoena*)

Harbour porpoise is the most commonly encountered cetacean in the outer Firths of Forth and Tay. It is the most common small cetacean in the eastern north Atlantic and can be seen all around the Scottish coast (Reid *et al*., 2003). The conservation status assessment within the UK was considered favourable on the basis of this species' range, population, habitat and future prospects (JNCC 2007). Bjørge and Øien (1995) estimated that there were 82,600 porpoises in the North Sea north of 56ºN. This estimate is known to be biased downwards because the probability of detection on the transect line was assumed to be one.

Bottlenose dolphins *(Tursiops truncatus)*

Bottlenose dolphins have a worldwide distribution in tropical and temperate seas of both hemispheres. In coastal waters, bottlenose dolphins are commonly found in river estuaries, headlands and sandbanks, mainly where there is uneven bottom relief and/or strong tidal currents (Wilson *et al*., 1997). In Scottish waters, the majority of sightings of this species come from the east coast (Reid *et al*., 2003).

Part of the Moray Firth region is designated as a Special Area of Conservation (SAC) for bottlenose dolphins with a population of 129 individuals [95% CI = 110-174] (Wilson *et al*. 1999). In recent years,

there has been a range expansion and animals routinely use areas adjacent to the SAC in the southern Outer Moray Firth (Culloch & Robinson, 2008), off the Aberdeen coast (Weir *et al*., 2008) and south to St Andrews Bay (Quick, 2006). Individuals from the population have been sighted as far south as the Tyne (Kate Grellier pers comm). Changes in the distribution of prey resources were the most likely reason given for the apparent expansion in range for the eastern Scotland population (Wilson *et al.*, 2004).

Minke Whales *(Balaenoptera acutorostrata)*

Within UK waters, minke whales are most frequently sighted in the north-western North Sea (e.g. Robinson *et al.*, 2009; Tetley *et al.*,2008), the Hebrides (e.g Macleod *et al.,* 2004) and in the Irish Sea (Northridge *et al.,* 1995; Reid *et al.,* 2003). They are predominately sighted singly or in pairs, although when feeding they may aggregate in groups as large as 10 to 15 individuals (Reid *et al.*, 2003). There appears to be some seasonality in their occurrence.

White-beaked dolphin *(Lagenorhynchus albirostris)*

The white-beaked dolphin is one of the most abundant dolphin species observed in shelf waters around the UK (Hammond *et al*., 2002), but they do have a more limited range than most of the species present in UK waters, being found only in cool temperate and subarctic waters of the North Atlantic (Reid *et al*., 2003) . They are mainly distributed over the continental shelf and in the northern North Sea (off Scotland and northeast England) and adjacent areas, generally in waters between 50 m and 100 m in depth, and rarely out to the 200 m isobath (Northridge *et al*., 1995; Reid *et al*., 2003).

Seals

Two pinniped species are found in the Firths of Forth and Tay, grey and harbour seals (*Halichochoerus grypus and Phoca vitulina*).

Harbour seals (*Phoca vitulina*)

Harbour seals are the smaller of the two species occurring in the area. Approximately 30% of European harbour seals are found around the coasts of the UK. Scotland holds about 82% of the UK harbour seal population, with the remainder in England being found mainly in the estuaries of the Thames and the Wash (13%), and around the coast of Northern Ireland (5%). In Scotland they are widely distributed around the west coast, throughout the Hebrides and Orkney and Shetland.

Grey seals *(Halichoerus grypus)*

Grey seals are only found in the North Atlantic and have three population centres: the North-west Atlantic, the North-east Atlantic and the Baltic Sea. Approximately 37% of the world population of grey seals is found in the UK with approximately 90% of these breeding in Scotland, mainly in the Hebrides and in Orkney (SCOS, 2009). Grey seals are generalist, benthic feeders and forage over the continental shelf, at depths down to 200m. In the UK, their diet consists mainly of sandeels and other species which live on or close to the seabed but varies both seasonally and regionally (Hammond & Grellier, 2006; Hammond & Harris, 2006).

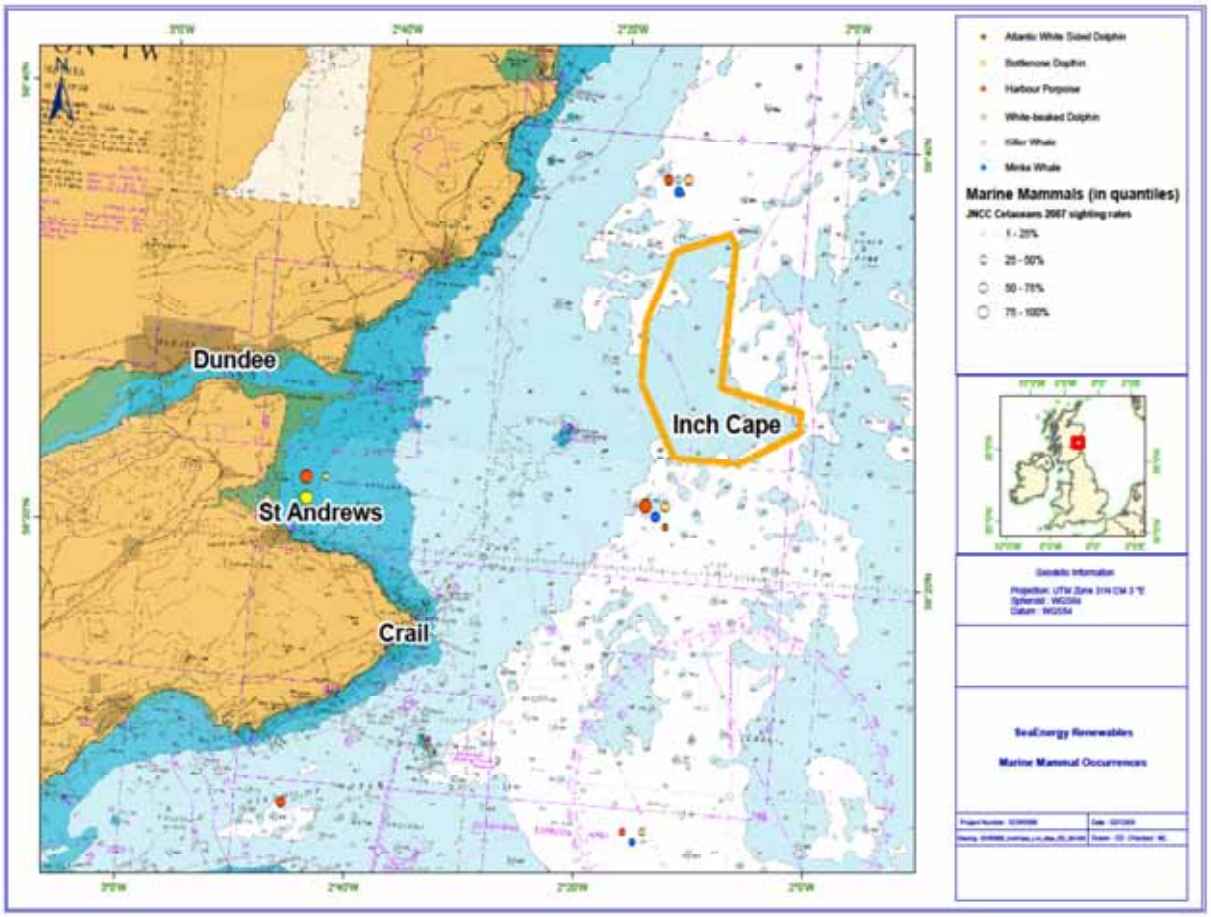


Figure 5-5: Sightings for cetacean species

Data Gaps

Cetaceans in the Firths of Forth and Tay are poorly studied relative to other areas around Scotland (e.g. the Moray Firth). Seals are relatively well-studied although important gaps in our knowledge exist in terms of our ability to fully assess the impact of any proposed development on local populations. The main (site-specific) data gaps (not covered by ongoing or planned work) are:

- A lack of information about the distribution and abundance of marine mammals in/around the proposed wind farm site, particularly in winter. Seasonal changes in species' presence, distribution and abundance at the proposed site are important in any assessment of the potential impact of development and for planning the timing of construction activities;
- Uncertainty over the range (temporal and spatial) and origin of bottlenose dolphins seen on the coast near the proposed site – are they likely to occur within the footprint of any potential impacts? Photo-identification studies may be required to determine the extent to which these animals are from the Moray Firth SAC; and
- The extent to which harbour seals from the Firth of Tay and Eden estuary SAC forage/travel over the site during different seasons, and the potential impacts of disturbance or habitat change. It may also be important to assess the age structure of the harbour seal population in order to be able to predict/understand how the population might be affected.

The main more general (non site-specific) gaps in current knowledge are:

- How to investigate the potential for cumulative effects on species whose range encompasses other potential wind farm development sites e.g. in relation to this and the other Forth and Tay, Aberdeen and the Moray Firth sites;
- Information about the spatial and temporal scale of potential responses of marine mammals to construction including increased shipping and noise from pile driving. This includes a requirement for data on the species-specific behavioural responses to noise – especially for bottlenose dolphins;
- An assessment of the suitability and efficacy of potential mitigation measures. In the absence of existing data, this development could provide an opportunity to test the efficacy of mitigation measures; and
- There are several other sites proposed for wind farm development in the area and all sites are likely to suffer from the same data deficiencies. This fact, in combination with the wide-ranging nature of the marine mammal species using the area, points towards the need for co-ordinated survey effort between all the developers concerned. This would not only be more cost effective but would greatly improve the quality of the data provided (e.g. increased power for ability to detect change, increased temporal and spatial and resolution).

Environmental Impacts Scoping

Based on available literature, the following are perceived to be the potential impacts on marine mammals as a result of wind farms within the marine environment:

Impact Description	**Potential site specific impact**	**Potential cumulative and/or in-combination Impact**
Disturbance and potential displacement as a result of elevated construction and operational noise (including vessel noise)	✓	✓
Barrier to movement	✓	✓
Potential longer term avoidance of the development area by marine mammals	✓	✓
Increased collision risk resulting in injury or death due to construction and maintenance impacts (including vessel movements)	✓	✓
Potential reduction of the feeding resource due to effects on prey of noise and vibration, and habitat disturbance	✓	✓
Potential changes in long-term prey availability caused by the presence of infrastructure and changes in fishing activity	✓	✓

Site-specific Impact Assessment Methodology

For each of the potential impacts described above a survey or study and method of impact assessment is described in the tables below.

Potential Impact	**Disturbance and potential displacement as a result of elevated construction and operational noise (including vessel noise)**
Survey/Study Proposed to Assess Impact	To determine the potential for disturbance and displacement, the following surveys and studies will be undertaken: • Survey of marine mammal density and distribution • Literature review of marine mammal species audiograms • Underwater noise survey to characterise baseline environment • Desk-top study and noise modelling to determine zones of noise around piling operations • Literature study of marine mammal behavioural responses to offshore wind farms and other related activities.
Method of Impact Assessment	Marine mammal species density and distribution data will be used to model population densities across the site over time. Background noise measurements will be used to model the severity of noise of piling operations over distance. These model outputs will be assessed in relation to audiograms and species density to quantify the potential level of impact on species during construction and operational works. The potential for impacts will also be assessed with regard to the time of year so that levels of impact may be assumed with regard to different seasonal patterns of use.

Potential Impact	**Barrier to movement** **Potential longer term avoidance of the development area by marine mammals**
Survey/Study Proposed to Assess Impact	To determine the potential for avoidance of the area, the following surveys and studies will be undertaken: • Survey of marine mammal density and distribution • Literature study of marine mammals behaviours responses to offshore wind farms and other related activities.
Method of Impact Assessment	An evidence based approach will be used in association with baseline data to determine the potential long-term impacts on marine mammal species behaviour throughout the lifetime of the proposed Inch Cape offshore wind farm.

Potential Impact	**Increased collision risk resulting in injury or death due to construction and maintenance impacts (including vessel movements)**
Survey/Study Proposed to Assess Impact	To determine the potential for disturbance and displacement, the following surveys and studies will be undertaken: • Survey of marine mammal distribution and density • Desk study of collision risk associated with existing offshore wind farms
Method of Impact Assessment	Marine mammal species density and distribution data will be used to model population densities across the site over time. The number of vessels required during construction and operation will be estimated over time. These data will be

	used to estimate collision risk with regard to the time of year so that levels of impact may be assumed with regard to different seasonal patterns of use. Where available, the results of the study will be cross-referenced against information from existing wind farms.

Potential Impact	**Potential reduction of the feeding resource due to effects on prey of noise and vibration, and habitat disturbance**
Survey/Study Proposed to Assess Impact	To determine the potential for reduction of feeding resource, the following surveys and studies will be undertaken: • Survey of marine mammal density and distribution • Habitat distribution identification (see section 5.2.1) • Survey of marine benthic species density and distribution (see section 5.2.1) • Survey of fish species density and distribution (see section 5.2.2) • Literature review of noise sensitive marine species audiograms (not including marine mammals) • Underwater noise survey to characterise baseline environment (see section 5.2.6) • Desk-top study and noise modelling to determine zones of noise around piling operations • Literature study of marine mammal foraging habits and changes to marine trophic web associated with offshore wind farms
Method of Impact Assessment	The potential for marine mammal species feeding within the site will be determined by assessing the distribution and density data of marine mammals within the site and relating this to literature accounts of species foraging habitats and habitat maps and the density and distribution of marine benthic organisms and fish within the site. The potential impact of construction and operation on habitats, benthic organisms and fish species will be determined using available information. In addition, background noise measurements will be used to model the severity of noise of piling operations over distance. The potential impact of increased noise on prey resources will be assessed where audiograms are available for noise sensitive fish and marine benthic species. These impact assessments will be used to assess the potential impact upon the foraging habits of marine mammals. The potential for impacts will also be assessed with regard to the time of year so that levels of impact may be assumed with regard to different seasonal patterns of use.

Potential Impact	**Potential changes in long-term prey availability caused by the presence of infrastructure and changes in fishing activity**
Survey/Study Proposed to Assess Impact	To determine the potential for changes in long-term prey availability, the following surveys and studies will be undertaken: • Desk-top review of marine mammal foraging habits • Desk-top review of biofouling of marine infrastructure

	• Survey of fishing activity within and around the site (see section 5.2.2) • Survey of fish density and distribution (see section 5.2.2) • Survey of marine benthic species density and distribution (see section 5.2.1)
Method of Impact Assessment	The potential for biofouling and long-term changes in prey availability for marine mammals will be estimated using the baseline survey information on biota and evidence from other marine industries. The potential for changes in fishing activity and fish species density and abundance within the wind farm site will also be estimated from the baseline data and evidence from other marine industries. The potential for interaction between changes in commercial fishing activity and biofouling will also be assessed. The potential impacts on prey species will be related to known foraging behaviour of marine mammal species recorded within the Inch Cape site.

Site-specific Survey Methodology

Best Practice Guidance

At present, there is limited guidance from Scottish Natural Heritage or the Scottish Government on how to tackle the issue of deliberate disturbance, however the JNCC (2008) has produced draft guidance which provides an interpretation of what constitutes a 'significant' group and explains the 'disturbance offence' in greater detail. It is anticipated that the final, post-consultation version of the guidance will be issued at some time in early 2010, following production of the draft version in July 2008. The guidance refers to the Habitats Directive Article 12 Guidance (European Commission, 2007) stating that in their view significant disturbance must have some ecological impact (see section 5.2.5).

Literature Study

A desktop literature search will be carried out to collect information on and inform impacts assessments for marine mammals. These literature searches will include:

- Marine mammal species density and abundance within and around the proposed Inch Cape offshore wind farm site;
- Audiograms for marine mammals and other noise sensitive species;
- Marine mammal behaviours (including foraging);
- Impacts associated with offshore wind farms and the success of mitigation measures;
- Biofouling of marine structures; and
- Consultation with Seawatch to make use of any existing data sets applicable to the Forth and Tay region.

Survey of Marine Mammal Density and Distribution

Visual Boat-based Surveys

Two years of monthly visual surveys are anticipated to be carried out to record the distribution of marine mammals in the region and to estimate the density of animals present. The marine mammal sighting survey will share vessel time with the on-going bird surveys and will follow the pre-

determined transects developed for the bird surveys that are designed to provide unbiased survey coverage of the site.

Acoustic Surveys

It is anticipated that C-PODs (or another static acoustic device) will also be deployed on site during the survey period. C-PODs are the digital successors of the T-POD, which have proved particularly useful in monitoring habitat use by harbour porpoises. An important improvement is that C-PODs are able to monitor the activity by dolphin species as well as harbour porpoises. To reduce the risk of data loss several C-PODs will be deployed within the project site. CPA consent will be obtained for the moorings.

Other Surveys

- Habitat distribution surveys are described in section 5.2.1;
- Marine benthic surveys are described in section 5.2.1;
- Fish surveys are described in section 5.2.2;
- Commercial fishing activity surveys are described in section 5.3.1; and
- Underwater noise surveys are described in section 5.2.6.

Cumulative and In-combination Impact Assessment & Survey Methodologies

COWRIE has recently issued new guidance on cumulative impact assessment for ornithology (King *et al.*, 2009). This proposes the use, at the scoping stage, of 'key features' tables to identify a list of species which may be at most risk of cumulative impacts. The tables are designed to provide a robust and auditable basis for initial discussions with SNH and other stakeholders about the potential for significant effects on priority species. A further aim is to assist with the identification of any additional studies that may be required over and above the normal boat-based and aerial surveys. It is important to note that the use of these tables is a novel development and the process will require refinement. The FTOWDG has opted to use this methodology for assessing the potential cumulative impacts on marine mammals.

The region proposed for cumulative impact assessment was agreed between the developers and The Crown Estate at a meeting on 18th May 2009 and was defined as the area within Regional Sea 1 between the Farne Islands and Peterhead. This is still subject to agreement with Scottish Natural Heritage (SNH) and other key stakeholders.

In line with the cumulative impact assessment scoping tables outlined by King *et al*. (2009) and feedback from SNH, the species identified for consideration within cumulative impact studies are grey seal, common seal, harbour porpoise, bottlenose dolphin, minke whale, Risso's dolphin, Atlantic white-sided dolphin, humpback whale, sperm whale, pilot whale and fin whale.

It should also be noted that grey seals, harbour seals and bottlenose dolphins are qualifying features for SACs on the east coast of Scotland and therefore impacts to favourable conservation status will be addressed.

Survey Requirements and Assessment Methodologies

The requirement for additional regional surveys will be considered by the FTOWDG and methodologies and assessment details issued as a separate document.

Mitigation Measures

A range of measures will be explored to mitigate any potential effects on mammals from construction activities, including:

- Timing of installation;
- Seasonal restrictions;
- Bubble curtains; and
- Vibro-piling.

A zone of potential impact will be defined as a result of the noise modelling (see section 5.2.6) and the appropriate mitigation measures will be considered.

5.2.4 Ornithology

The primary legislation under which birds are protected is as follows:

- the European Council Directive 79/409/EEC on the conservation of wild birds (the 'Birds Directive');
- the Wildlife and Countryside Act 1981, as amended;
- the Conservation (Natural Habitats, & c) Regulations 1994 (as amended); and
- The Nature Conservation (Scotland) Act 2004.

Species on Annex I of the Birds Directive are protected through a network of Special Protection Areas (SPAs). The species of prime interest with regards to impact assessment would be any Annex I birds that are linked to a SPA population. Although species on Annex I that are likely to be present within the proposed Inch Cape offshore wind farm site will be identified in this section, any associated potential impact on conservation sites will be discussed in section 5.2.5. In addition, under the Wildlife and Countryside Act 1981 (as amended) it is an offence to intentionally or recklessly kill, injure or take any wild bird or their eggs or nest. Species listed on Schedule 1 are also protected from disturbance at their nests or to their dependent young.

Details are provided below of the species that are likely to be recorded within the Inch Cape site areas. For each bird species, details are provided on local abundance and distribution (if available), levels of protection, conservation status, and a vulnerability index. Details are also provided for each bird species on their conservation status. These are obtained from a list of Birds of Conservation

Concern (Gregory *et al.*, 2002) which classifies species of conservation concern to a Red List or an Amber List. Red List species are defined as: being IUCN globally threatened; having a population in decline between 1800 and 1995; being in rapid decline (≥50%) in the UK in the last 25 years; and/or having a rapid range contraction (≥50%) in the UK in the last 25 years. Amber List species are defined as: having a population in decline between 1800 and 1995 but then recovered in the last 25 years; being in moderate decline (25-49%) in the UK in the last 25 years; having a moderate range contraction (25-49%) in the UK in the last 25 years; and/or having an unfavourable conservation status in Europe.

For this assessment, the area of the coastline between Montrose and St. Abbs Head has been investigated, with an emphasis on the Angus and Fife coastlines, as these lie directly opposite the Inch Cape site. However, it should be noted that the assessment of the potential for cumulative

impacts on ornithology and associated conservation sites considers an impact region between the Farne Islands and Peterhead, within Regional Sea 1 (see section 5.2.5).

Baseline Environment

The following information is summarised from a review of the available ornithological records and the possible presence of seabird species within the proposed Inch Cape site compiled by RPS (2008).

An important caveat to state at the outset is that although large seabird numbers are present all along the adjoining/adjacent coastlines, this does not infer that they would definitely be present at any time in the Inch Cape site. Counts of such birds from these coasts are simply meant as a guide to illustrate that large numbers of such birds are present at times along coastal stretches of the counties of north-east Scotland, Angus and Dundee, Fife, Lothian and associated islands.

There are over 30 seabird colonies along the Scottish east coast and due to their size, some of these colonies are deemed to be not only of national importance, but international importance, and are listed as designated sites (see section 5.2.5). There are seventeen species of breeding seabirds within these colonies and a further fifty species of non-breeding seabirds. Table 5-6 lists the breeding seabird species and Table 5-7 lists the non-breeding seabirds found inshore or along the coastlines either on passage, feeding, or over-wintering in the North Sea, off the Grampian, Angus, Fife, and Lothian coasts. The tables provide details of their legal status, conservation status and wind farm vulnerability index.

Seventeen key species have been identified as breeding along the coastlines closest to the proposed Inch Cape site (Table 5-6). Of these, four are in Annex 1, two are in Schedule 1, one is Red listed, 14 are Amber listed and two are UK Priority BAP species. Eider, cormorant, shag and sandwich tern have the highest wind farm vulnerability indices of these species.

A further 50 species are regularly found along the coastlines closest to the proposed Inch Cape site (RPS, 2008). Some of these over-winter, some are present in over-summering moulting flocks, some are foraging non-breeding seabirds, some are post-breeding seabirds after dispersal from nearby colonies, and some are moving through the area on passage migration.

Of these species, 16 are in Annex 1, 16 are on Schedule 1, one is red-listed, 35 are amber-listed and nine are UK Priority BAP species. Of these species which carry wind farm vulnerability indices, the highest rated are the three diver species.

Given the large distances often covered by breeding seabirds to reach feeding grounds, it is quite possible that many birds are present either passing through, around, or feeding in the Inch Cape site area during the breeding season. Two large offshore areas to the east of the site, the Wee Bankie and the Marr Bank, are known to provide rich feeding grounds for many seabirds during the breeding season. Camphuysen *et al*. (2004) investigated the relationship between bird population size and sand eel abundance in the Wee Bankie area. The authors reported that seabird density decreased with increasing distance from the shore with very low bird numbers at 100 km offshore. Seabird diversity also decreased with distance from the shore, with diversity greatest within 20 km and a significant decrease at distances >40 km. Camphuysen *et al*. (2004) found that pursuit diving auks were the most dominant species within the offshore assemblage within 80 km of the coast. This assemblage also included northern gannet, phalaropes, black-legged kittiwake and auks. Within 40 km, the assemblage included divers, grebes, cormorants, shearwaters, seaduck, skuas, *Larus*-gulls and terns. At distances >80 km, storm petrels and northern fulmars were recorded.

The studies by Camphuysen *et al*. (2004) also highlighted that the Wee Bankie and Marr Bank area are used for feeding grounds by bird species originating from colonies such as Bass Rock, the Isle of May, the Farne Islands and St Abbs. This data suggests that the Wee Bankie complex to the east of the proposed Inch Cape site is likely to be an important feeding ground for bird species originating from the east coast Special Protection Areas and RAMSAR sites (see section 5.2.5 for a full list of conservation areas).

UK Offshore SEA findings

Table 5-8 is an extract from the UK Offshore Energy Strategic Environmental Assessment (SEA) Environmental Report Briefing Report (Fenny & Walls, 2009). The report refers to Collision Risk Modelling predictions taken from various UK Round 1 & 2 Environmental Statements. These include Beatrice in the Moray Firth. The table identifies the priority species, and key risks, in relation to Round 3 wind leasing in each Regional Sea. Although the SEA for STW has not yet been concluded, the conclusions of the UK offshore SEA will be relevant to the proposed Inch Cape site, due to the offshore location of the site.

Table 5-6: Details for breeding seabirds along the east coast of Scotland

Species	Annex I	Schedule 1	Red list	Amber list	UK Priority BAP species	Vulnerability Index[a]	Foraging radius[b]	Number of colonies**	Colony within foraging distance[b]	Population estimate for coast**	Percentage of GB & Ireland population**	>20 records in ESAS database[c]
Common eider				✓		20.4	Not known		Not known	7,550***	(38% of Scottish population)	
Northern fulmar				✓		5.8	>100 km	>30	✓	13,436	2.5	✓
Northern gannet				✓		16.5	>100 km	2	✓	49,612	19.1	✓
Great cormorant				✓		23.3	15 km	9	✓	549	4.7	
European shag				✓		Not known	15 km	18	✓	1,811	5.6	✓
Lesser black-backed gull				✓		13.8	40 km	15	✓	7,790	8.5	✓
Herring gull				✓	✓	11.0	40 km	>30	✓	27,741	18.9	✓
Great black-backed gull						18.3	40 km	22	✓	121	0.6	✓
Black-legged kittiwake				✓		7.5	40 km	>25	✓	80,734	19.4	✓
Sandwich tern	✓			✓		25.0	20-30 km	2	✓	824	5.8	
Roseate tern	✓	✓	✓		✓	Not known	20- 30 km	3	✓	14	1.8	
Common tern	✓					15.0	20-30 km	8	✓	1,502	10.4	
Arctic tern				✓		Not known	20- 30 km	6	✓	1,252	2.2	
Little tern		✓		✓		Not known	5 km	3		65	3.0	
Common guillemot	✓			✓		12.0	40 km	16	✓	187,308	12.0	✓
Razorbill				✓		15.8	40 km	26	✓	23,403	10.8	✓
Atlantic puffin				✓		15.0	40 km	31	✓	74,793	12.4	✓

Species	Annex I	Schedule 1	Red list	Amber list	UK Priority BAP species	Vulnerability Index[a]	Foraging radius[b]	Number of colonies**	Colony within foraging distance[b]	Population estimate for coast**	Percentage of GB & Ireland population**	>20 records in ESAS database[c]
Total (17 species)	4	2	1	14	2				15			

a Garthe, S. & 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.
b Langston, R. (2008). Round 3 offshore wind farm developments and birds at sea. (RSPB, confidential)
c ESAS - JNCC UK 2004 data

** Seabird 2000 Data, North-east Scotland, Angus & Dundee, Fife, Lothian and associated islands.
*** Birds of Scotland 3.

Table 5-7: Non-breeding birds along the Scottish East coast

Species	Annex I	Schedule 1	Red list	Amber list	UK Priority BAP species	Vulnerability Index[a]	Occurring at sea[b]	>20 records in ESAS database[c]
Whooper swan	✓	✓		✓	✓	Not known	On passage only	
Pink-footed goose				✓		Not known	On passage only	
Greylag goose				✓		Not known	On passage only	
Canada goose						Not known	On passage only	
Barnacle goose	✓			✓		Not known	On passage only	
Brent goose				✓	✓	Not known	On passage only	
Wigeon				✓		Not known	On passage only	
Teal				✓		Not known	On passage only	
Greater scaup		✓		✓	✓	Not known	✓	
Long-tailed duck		✓		✓		Not known	✓	
Common scoter		✓	✓		✓	16.9	✓	
Velvet scoter		✓		✓		Not known	✓	
Goldeneye				✓		Not known	✓	
Red-breasted merganser						Not known	✓	
Red-throated diver	✓	✓		✓		43.3	✓	
Black-throated diver	✓	✓		✓	✓	44.0	✓	
Great northern diver	✓	✓		✓		Not known	✓	
Great crested grebe						19.3	Coastal	
Red-necked grebe				✓		18.7	Coastal	
Slavonian grebe	✓	✓		✓		Not known	Coastal	
Sooty shearwater						Not known	✓	✓

Species	Annex I	Schedule 1	Red list	Amber list	UK Priority BAP species	Vulnerability Index[a]	Occurring at sea[b]	>20 records in ESAS database[c]
Manx shearwater	✓			✓		Not known	✓	
Balearic shearwater					✓	Not known	✓	
European storm-petrel	✓			✓		Not known	✓	
Leach's storm-petrel	✓	✓		✓		Not known	✓	
Oystercatcher				✓		Not known	On passage only	
Golden plover	✓					Not known	On passage only	
Grey plover				✓		Not known	On passage only	
Northern lapwing				✓	✓	Not known	On passage only	
Red knot				✓		Not known	On passage only	
Sanderling						Not known	On passage only	
Purple sandpiper				✓		Not known	On passage only	
Dunlin	✓			✓		Not known	On passage only	
Ruff	✓	✓		✓		Not known	On passage only	
Bar-tailed godwit	✓			✓		Not known	On passage only	
Whimbrel		✓		✓		Not known	On passage only	
Curlew				✓	✓	Not known	On passage only	
Redshank				✓		Not known	On passage only	
Greenshank		✓				Not known	On passage only	
Turnstone				✓		Not known	On passage only	
Pomarine skua						Not known	✓	
Arctic skua					✓	10.0	✓	✓
Long-tailed skua						Not known	✓	
Great skua				✓		12.4	✓	✓
Mediterranean gull	✓	✓		✓		Not known	Coastal	

Species	Annex I	Schedule 1	Red list	Amber list	UK Priority BAP species	Vulnerability Index[a]	Occurring at sea[b]	>20 records in ESAS database[c]
Little gull	✓	✓				12.8	✓	✓
Black-headed gull				✓		7.5	✓	
Common gull				✓		12.0	✓	
Black tern	✓	✓				17.5	On passage only	
Little auk						Not known	✓	✓
Total (50 species)	16	16	1	35	9			5

a Garthe, S. & 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.

b passage means birds are only usually recorded passing through, coastal means birds usually lingering along coastlines, usually feeding or roosting, and a ✓ means it is possible individuals of this species would do both.

c ESAS - JNCC UK 2004 data

Table 5-8: Potential risk of collision and displacement of priority species in the North Sea

Area	Potential Collision	Potential Displacement
Regional Sea 1		
Firth of Forth	Gannet Kittiwake Gulls Little gull Sandwich tern Common tern Arctic tern Skuas Migrating waterbirds	Auks Divers Seaducks Grebes

Environmental Impact Scoping

Given the preliminary nature of a scoping assessment potential environmental impacts may only be broadly predicted prior to the completion of detailed baseline characterisation surveys. As such the impacts listed below are largely based on similar experiences with previous offshore wind development sites around the UK coast and in European waters in general.

Impact Description	Potential site specific impact	Potential cumulative and/or in-combination Impact
Indirect habitat loss and displacement from feeding areas as a consequence of disturbance of marine prey	✓	✓
Disruption to habitat function	✓	✓
Changes in prey availability associated with presence of turbines and changes in fishing activity	✓	✓
Disturbance leading to displacement of birds (construction and decommissioning)	✓	✓
Collision with turbines whilst in flight	✓	✓
Barrier effects caused by turbines resulting in modification of flight routes (e.g. to feeding areas or migration)	✓	✓

Site-specific Impact Assessment Methodology

For each of the potential impacts described above a survey or study and method of impact assessment is described in the tables below.

Potential Impact	**Indirect habitat loss and displacement from feeding areas as a consequence of disturbance of marine prey**
Survey/Study Proposed to Assess Impact	To determine the potential for habitat loss and impacts to prey, the following surveys and studies will be undertaken: • Surveys of bird species density and distribution • Surveys of bird behaviour within site area • Habitat distribution identification (see section 5.2.1) • Survey of marine benthic species density and distribution (see section 5.2.1) • Survey of fish species density and distribution (see section 5.2.2) • Information on fish species audiograms to be collected through desk-top study • Underwater noise survey to characterise baseline environment • Desk-top study and noise modelling to determine zones of noise around piling operations • Literature study of bird species foraging habits and changes to marine trophic web associated with offshore wind farms
Method of Impact Assessment	The potential for bird species feeding within the site will be determined by assessing the distribution, density and behaviour data of birds within the site and relating this to literature accounts of species foraging habitats and habitat maps and the density and distribution of marine benthic organisms and fish within the site. The potential impact of construction and operation on habitats, benthic organisms and fish species will be determined using available information. In addition, background noise measurements will be used to model the severity of noise of piling operations over distance. The potential impact of increased noise on prey resources will be assessed where audiograms are available for noise sensitive fish and marine benthic species. These impact assessments will be used to assess the potential impact upon the foraging habits of bird species. The potential for impacts will also be assessed with regard to the time of year so that levels of impact may be assumed with regard to different seasonal patterns of use.

Potential Impact	**Changes in prey availability associated with presence of turbines and changes in fishing activity**
Survey/Study Proposed to Assess Impact	To determine the potential for changes in long-term prey availability, the following surveys and studies will be undertaken: • Survey of bird foraging behaviour within the site • Desk-top review of bird species foraging habits • Desk-top review of biofouling of marine infrastructure

	• Survey of fishing activity within and around the site (see section 5.2.2) • Survey of fish density and distribution (see section 5.2.2) • Survey of marine benthic species density and distribution (see section 5.2.1)
Method of Impact Assessment	The potential for biofouling and long-term changes in prey availability for bird species will be estimated using the baseline survey information on biota and evidence from other marine industries. The potential for changes in fishing activity and fish species density and abundance within the Inch Cape offshore wind farm site will also be estimated from the baseline data and evidence from other marine industries. The potential for interaction between changes in commercial fishing activity and biofouling will also be assessed. The potential impacts on prey species will be related to observed and known foraging behaviour of bird species recorded within the Inch Cape site.

Potential Impact	**Disturbance leading to displacement of birds (construction and decommissioning)** **Disturbance may be initiated both by vessels (especially of swimming and diving species such as divers and auks) and by noisy construction activity such as pile-driving that may affect all species**
Survey/Study Proposed to Assess Impact	To determine the potential for disturbance and displacement, the following surveys and studies will be undertaken: • Survey of bird species density and distribution • Survey of bird behaviour • Review of construction, operation and decommissioning activities • Literature study of bird behavioural responses to offshore wind farms and other related activities
Method of Impact Assessment	Bird species density, distribution and behavioural data will be used to model population densities across the site over time and uses of the site. The impact of the anticipated construction, operation and decommissioning activities will be assessed in relation to this baseline data. The potential for impacts will also be assessed with regard to the time of year so that levels of impact may be assumed with regard to different seasonal patterns of use. The significance of potential impacts will be assessed using the sensitivity of the receptors against a measure of the magnitude of the effect (assessed from a measure developed by Garthe & Hüppop, 2004).

Potential Impact	**Collision with turbines whilst in flight**
Survey/Study Proposed to Assess Impact	To determine the potential for collision risk, the following surveys and studies will be undertaken: • Survey of birds in flight, including species, density and distribution • Review of migratory behaviour and on-passage behaviour • Review of collision risk and collision rates from existing offshore wind

	farms
Method of Impact Assessment	A collision risk analysis will be undertaken to assess the potential direct impacts of the presence of turbines and blades. This analysis will be on a per-species basis and will provide an indication of those species at greatest risk. This assessment will be related to the relative abundance and nature conservation status of each species and past studies from existing offshore wind farms to provide an overall assessment of the potential for the proposed development to significantly affect key species.

Potential Impact	**Barrier effects caused by turbines resulting in modification of flight routes (e.g. to feeding areas or migration)**
Survey/Study Proposed to Assess Impact	To determine the potential for barrier effects, the following surveys and studies will be undertaken: • Survey of birds in flight, including species, density and distribution • Review of migratory behaviour and on-passage behaviour • Review of flight behaviours around existing offshore wind farms
Method of Impact Assessment	The overall density and population size for each species using or passing through the Inch Cape offshore wind farm site will be calculated. The estimated maximum population size will be compared against the 1% threshold for regional, national and international figures for each species. Assuming displacement of particular proportions of the population present (worst-case being 100%) ultimately allows the significance impact of the loss of the OWF to be assessed in standard EIA methodologies. The results will be cross-referenced against existing wind farm studies.

Site-specific Survey Methodology

Best Practice Guidance

Guidance on offshore bird surveys is not currently available from Scottish Natural Heritage. However, guidance on surveys is available from the Collaboration for Offshore Wind Research in the Environment (COWRIE):

- Camphuysen *et al*. (2004). Towards standardised seabird at sea census techniques in connection with environmental impact assessments of offshore wind farms in the UK: a comparison of ship and aerial sampling methods for marine birds, and their applicability to offshore wind farm assessments. NIOZ report to COWRIE (Ref BAM-02-2002); and
- MacLean *et al*. (2009). A review of assessment methodologies for offshore windfarms.

Proposed Survey Programme

The overall approach to the survey programme is to carry out a full two year's survey and analysis and to review the results with the statutory agencies at intervals along the way in order to guide the ongoing survey campaign and potential further analyses for determining favourable conservation

status (see section 5.2.5). The programme of surveys to be used to gather information for the EIA will be developed through a combination of:

- The strengths and weaknesses of the different techniques;
- The seasonal occurrence of the target birds in the area; and
- The behaviour of the target birds in the area.

These elements have been combined into a survey programme of breeding and non-breeding season boat surveys. Boat based surveys are proposed year round in order to provide a baseline.

Aerial surveys were commissioned by The Crown Estate as part of enabling works for the STW sites. The data sets are representative of summer 2009 and winter 2009/20010 species. This data will be analysed as part of the ornithology and marine mammal studies. Further aerial surveys may be used to support future bird and mammal studies within the STW.

Boat-based Surveys

The survey methodology will follow the technique for ship-based seabird surveys outlined by Camphuysen *et al*. (2004) and the recommendations to improve this methodology outlined by MacLean *et al*. (2009). The method is designed to enable distance sampling of data and calculation of densities and is primarily aimed at birds, although marine mammals and other mega-fauna (e.g. sharks) will also be recorded.

The characteristic of this approach is the use of a line-transect survey method during which a series of regularly spaced transects are established within a survey area that incorporates all of the proposed Inch Cape offshore wind farm area as well as a buffer, extending to a distance of 4 km from the position of the outer turbines (see Figure 5-6). Surveys will be undertaken on a monthly basis, for a period of 2 years.

The area to be surveyed is to include a 4 km buffer around the site with transects orientated in an east-west direction with 2km intervals between transects. East-west transects routes have been selected as this places them generally perpendicular to the coast, running from shallower to deeper waters and potentially perpendicular to the majority of bird flights (which generally are expected to have a north-south orientation along the Angus coastline).

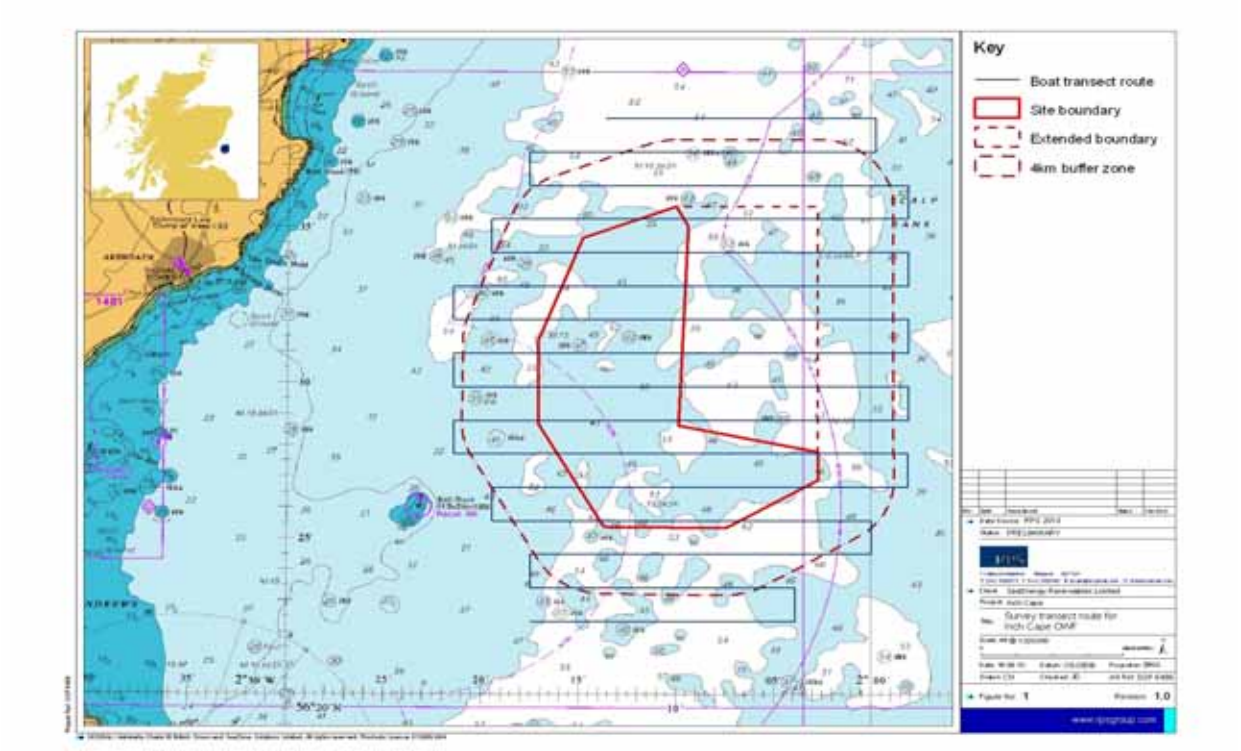


Figure 5-6: Illustration of boat survey transects and buffer zone

The minimum requirements for the survey vessel are as follows:

Characteristic	Parameters
Length	No less than 20 m No greater than 100 m
Forward viewing platform	No less than 5 m above sea level
Speed	10 knots (range 5 – 15 knots)

The boat based survey will be a line-transect method with a strip width of 300 m. The following parameters are key components of the proposed methodology:

- Surveys to be carried out with two observers to cover a 90° forward arc on a single side of the vessel. One team member will be acting as the primary observer, the other as scribe and secondary observer, recording sightings, weather conditions and other variables. A third team member will be onboard to allow for rotation of roles – avoiding fatigue;
- Bird detection to be undertaken by the naked eye, with binoculars primarily used for identification;
- Observations are made along the line transect with a strip width of 300 m;
- Subdivision of survey bands at the following intervals: 0-50 m, 50-100 m, 100-200 m, 200-300 m, 300+ m perpendicular to ship;

- Transects to be surveyed so that time of day is equally distributed over the entire area (changing start and end time over the area to take account of diurnal rhythms), where practical;
- Record in 1 minute sessions (continuous recording);
- Every minute, undertake instantaneous 'snapshots' in a box measuring 300x300m on one side and ahead of the vessel. Record the number, distance, flight height and behaviour of birds in flight present within the snapshot zone;
- Alternatively, or as appropriate 'snapshots' may be taken at fixed timed intervals. The precise method will be outlined in the final survey design, which will be agreed with SNH;
- Flight heights will be recorded in three bands - <20 m, 20-200 m and >200 m;
- Where feasible detailed information will be recorded on species, sex and age, foraging behaviour, etc.;
- All bird data and a number of environmental variables affecting visibility and thus survey efficiency (e.g. rain, cloud cover, glare, wind speed and sea state) will be recorded. Observers will be assigned an identification code, to allow additional analysis of results (MacLean *et al*. 2009);
- Boat speed and water depth will be recorded at each snapshot location;
- Hydrographical data such as sea surface temperature, salinity and water depth will be collected during each survey;
- No bird surveys will be undertaken in sea state 5 or more (moderate waves, some spray);
- No marine mammal observations in sea state 4 or more will be used for analysis;
- Transects will have a 2 km separation and will be orientated along an east-west axis;
- Each survey track will be traversed at a constant speed (target speed 10 knots); and
- The position of the vessel will be fixed at least at 1 minute intervals using a hand-held GPS as well as the vessel's GPS system – with track data from the latter recorded digitally using the WGS84 co-ordinate system.

All those undertaking surveys will be suitably trained to ESAS or JNCC standards. The surveyors will be familiar with the survey and recording methods and bird identification, including familiarity with all relevant scarce and common marine species and with some knowledge of rarities and a full understanding of plumages and moults.

For each observation the following information will be recorded:

- Species (using BTO two letter codes);
- Number (count);
- Distance from vessel (see above);
- Height of flight (see above);
- Direction (where applicable); and
- Additional information regarding, age, sex, plumage and behaviour should be recorded wherever possible using the behaviour codes given in Camphuysen *et al*. (2004).

Surveys will not be completed where sea state is five or more. Sea state will be recorded at the start of transects and when there are changes in sea state (MacLean *et al*., 2009).

Marine mammals and other mega-fauna sightings (e.g. sharks) will be recorded during bird surveys without dedicated marine mammal observers on board. The information to be recorded shall include:

- Species;
- Number (count);
- Distance from vessel (using the same distance bands as for birds); and
- Additional information regarding age and behaviour should be recorded wherever possible.

Cumulative and In-combination Impact Assessment & Survey Methodologies

As discussed above (5.3.4), COWRIE has recently issued new guidance on cumulative impact assessment for ornithology (King *et al*., 2009), which use 'key features' tables to identify a list of species which may be at most risk of cumulative impacts. It is important to note that the use of these tables is a novel development and the process will require refinement.

FTOWDG has commissioned the use of these tables to identify species which are potentially sensitive to the cumulative effects of the four STW sites.

The region proposed for cumulative impact assessment was agreed between the developers and The Crown Estate at a meeting of 18th May 2009 and was defined as the area between the Farne Islands and Peterhead, within Regional Sea 1. SNH has commented that this area is suitable for marine species such as gulls and auks. However, the region for passage species (e.g. terrestrial species such as geese and coastal and estuarine species such as waders) will need to be revised based on data collected, expert judgment and agreed between the agencies, NGO's and developers.

In feedback received from SNH (2009) on the potential for cumulative impacts on bird species, SNH has highlighted that species on passage between the UK and Scandinavia and possibly areas further north, may travel through the site or wider region. For example, barnacle geese and light-bellied brent geese are known to migrate down the east coast of Scotland from Svalbard. Other passerine species may also follow this migration route. Therefore the list above is not currently complete and data collection will be required to determine the final list of species to be assessed for cumulative impacts.

The species identified to be potential sensitive receptors for the cumulative impact assessment are considered to be as follows:

*Non SPA species [1] Amec (2010), [2] Langston (2009) [3] Maclean in King *et al* (2009)

Whooper swan
Bean goose (Taiga)
Pink footed goose
Greylag goose
Barnacle goose (Svalbard)
Brent goose (Svalbard)
Shelduck
Greater scaup
Eider
Common scoter
Long tailed duck
Velvet scoter
Common Gull*
Goldeneye
Red breasted merganser
Red throated diver
Black throated diver*
Great crested grebe
Red-necked grebe*
Slavonian grebe
Fulmar
Gannet
Cormorant
Shag
Kittiwake
Little gull
Greater black-backed gull*
Lesser black backed gull
Herring gull
Sandwich tern
Common tern
Roseate tern
Arctic tern
Guillemot
Razorbill
Puffin
Sooty shearwater*
Pomarine skua*
Black headed gull*

Survey Requirements and Assessment Methodologies

The requirement for additional regional surveys will be considered by the FTOWDG and methodologies and assessment details issued as a separate document.

5.2.5 Designated Sites

The UK has a responsibility to ensure the conservation and enhancement of habitats and species in both a national and international context. The national suites of sites providing statutory protection for flora, fauna, or geological or physiographical features are Sites of Special Scientific Interest (SSSIs), (Areas of Scientific Interest (ASSIs) in Northern Ireland) and Marine Nature Reserves (MNRs).

As well as underpinning other national designations (such as National Nature Reserves), this system also provides statutory protection for terrestrial and coastal sites which are important within Europe (Natura 2000 network) and globally (such as Wetlands of International Importance, Ramsar sites). Further designations exist for sites outside of the national suite (such as Local Nature Reserves), varying in the level of protection afforded.

The potential effects of the proposed Inch Cape offshore wind farm upon protected sites and their interest features need to be considered carefully. Where sites of international (Ramsar site) or European (SPA, SAC) importance are potentially affected, then the advice of the statutory nature conservation organisation (in this case SNH) will be required. If there is any indication of a likely significant effect (LSE) on any of these sites then SNH may advise the Competent Authority that an Appropriate Assessment is required.

Baseline Environment

The following baseline environment is described for those features considered most likely to interact with or use the environmental associated with the proposed Inch Cape offshore wind farm. These features include birds, bats, diadromous fish, marine mammals and coastal habitats.

Conservation Sites for Birds and Associated Habitats

From Montrose to St Abbs Head there are 22 locations which are designated conservation sites, some of which carry multiple designations (see Table 5-9). With respect to the Inch Cape site, the species and habitats that have the potential to be impacted by the offshore wind development are birds, marine mammals and offshore and coastal habitats.

There are 10 international designations (seven SPAs, and three Ramsar sites) at seven locations which have seabirds as designating features. Of these designated sites, four relate to internationally important populations of breeding birds, three relate to internationally important populations of wintering birds, two relate to internationally important populations of passage birds, five relate to nationally important populations of breeding birds, three relate to nationally important populations of wintering birds, and three relate to nationally important populations of passage birds. The birds using these sites will also interchange with a number of other important sites in the UK.

It should be noted that 31 of the seabird breeding colony SPAs around Scotland, including the Forth Islands and St Abbs to Fast Castle, recently received boundary extensions to protect their adjacent marine habitat (SNH, 2009). There are 13 SSSIs (two of which are NNRs and another two are LNRs), all of which are designated for their breeding seabirds or wintering waterbirds.

Conservation Sites for Diadromous Fish and Associated Habitats

Sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and salmon (*Salmo salar*) are Annex II species which are designating features for SACs around Scotland. Five of these SACs are located between Aberdeen and Eyemouth (JNCC, 2009). The River Teith has for sea lamprey and river lamprey as designating features and salmon as a qualifying feature. The River Tay has salmon as a designating feature and sea lamprey and river lamprey as qualifying features. The River Dee and River South Esk has salmon as qualifying species. Although these species are known to occur within the marine environment, it is currently unknown whether they will be present within the Inch Cape site.

Conservation Sites for Marine Mammals and Associated Habitat

There are two SACs within the study area which have marine mammals as designating features. The Firth of Tay and Eden Estuary SAC supports a nationally important breeding colony of harbour seals, which represents 2% of the UK population. The Isle of May SAC supports a breeding colony of grey seals, which is estimated to account for 4.5% of annual UK pup production. The site is the largest grey seal breeding colony of the east coast of Scotland the fourth largest in the UK (JNCC, 2009). As a result of the wide-ranging nature of marine mammals, it should also be noted that there are other SACs on the east coast of Scotland and on the north-east coast of England which could potentially be affected by the proposed Inch Cape development. These include the Moray Firth SAC for which bottlenose dolphin is a designating feature. The population of bottlenose dolphin is the only resident population in the North Sea (see section 5.2.3). The Berwickshire and North Northumberland coast SAC contains breeding colonies of grey seal which are representative of the breeding colonies in the south-east of its breeding range in the UK.

Inshore and Offshore Designated Sites

The proposed Inch Cape site is not situated within or adjacent to an offshore or inshore designated site. However, the nature conservation authorities are currently investigating the identification of further potential inshore (0-12 nm) and offshore (12-200 nm) SAC and SPA areas. A number of new sites are therefore likely to be designated over coming years. For the purposes of this assessment and according to the habitats directive, draft SAC/SPA will to be given the same consideration as if designated.

Table 5-9: Designated areas along the east coast of Scotland from Montrose to St Abbs

Site Name	International Designation	European Designation		National Designation		Local Designation
	RAMSAR	Special Protection Area	Special Area of Conservation	Site of Special Scientific Interest	National Nature Reserve	Local Nature Reserve
Barns Ness Coast				✓		
Barnsmuir Coast				✓		
Barry Links			✓	✓		
Bass Rock				✓		
East Haven				✓		
Eden Estuary				✓		✓
Elliot Links				✓		
Fife Ness coast				✓		
Firth of Forth	✓	✓		✓		
Firth of Tay and Eden Estuary	✓	✓	✓			
Forth Islands		✓		✓		
Fowlsheugh		✓		✓		
Imperial Dock Leith		✓				
Isle of May			✓	✓	✓	
Monifieth Bay				✓		
Montrose Basin	✓	✓		✓		✓
Rickle Craig / Scurdie Ness				✓		
River Dee			✓			
River Tay			✓			
River Teith			✓			
St Abbs Head to Fast Castle		✓	✓			
St Andrews / Craig Hartle				✓		
St Cyrus & Kinnaber Links				✓	✓	
Tayport / Tentsmuir Coast				✓	✓	
Whiting / Ness / Ethie Haven Coast				✓		

Data Gaps

There is good data for nature conservation designating species which is available from SNH and JNCC. However, data for species of conservation importance within the proposed development area is not necessarily available. Data gaps associated with species are discussed in sections 5.2.1, 5.2.2, 5.2.3 and 5.2.4. In addition, data on the distribution of Annex I habitats within the proposed development area is currently unavailable and surveys would be required.

Environmental Impacts Scoping

There is the potential for the proposed Inch Cape offshore wind farm to affect a range of physical and biological characteristics that create direct or indirect impacts upon features of nature conservation interest. The potential effects listed in the below table were identified from relevant guidance notes, environmental statements published for other UK offshore wind farms and knowledge of potential nature conservation issues in and around the proposed development area.

Given the distance offshore of the proposed Inch Cape offshore wind farm, the key qualifying features that are scoped in for the assessment are birds, diadromous fish, marine mammal species and coastal habitats. Bats features are scoped out of this assessment because the SAC features are not migrating species.

Impact Description	Potential site specific impact	Potential cumulative and/or in-combination Impact
Adverse effects on qualifying features which will impacts on the integrity of designated sites of nature conservation importance (e.g. Ramsar, SPA, SAC, SSSI, NNR).	✓	✓
Adverse effects on Annex I habitats and Annex II species, not currently covered by any specific designation	✓	✓
Adverse effects on UK BAP habitats and species	✓	✓

Site-specific Impact Assessment Methodology

For each of the potential impacts described above a survey or study and method of impact assessment is described in the tables below.

Potential Impact(s)	**Adverse effects on qualifying features and the integrity of designated sites of nature conservation importance (e.g. SAC or SPA)**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts on qualifying species, the following surveys and studies will be undertaken: • Review of nature conservation designating features and reasons • Baseline EIA surveys (as per relevant sections 5.1, 5.2, 5.3) • Additional surveys to determine favourable conservation status (to be determined)

Method of Impact Assessment	Potential impacts upon designated sites will be assessed via standard EIA methodologies, using significance criteria agreed with the relevant statutory nature conservation agency. The results of relevant EIA baseline surveys (e.g. fish, birds and marine mammals) will be reviewed at 6 and 12 months (out of the 24 month survey period). Species of conservation significance will be assessed to determine whether any are likely to potentially incur impacts. Further studies will be undertaken in the second half of the survey campaign to provide information on the impact of favourable conservation status. It is anticipated that all data collected through field surveys within the EIA will be compatible with the requirements of Appropriate Assessment.

Potential Impact(s)	**Adverse effects on Annex I habitats and Annex II species** **Adverse effects on UK BAP habitats and species**
Survey/Study Proposed To Assess Impact	To determine the potential for impacts on Annex I habitats, Annex II species and UK BAP habitats and species, the following surveys and studies will be undertaken: • Literature review of habitats and species distribution • Habitat distribution identification (see section 5.1.2, 5.2.1) • Coastal processes modelling (see section 5.1.4) • Survey of marine benthic species density and distribution (see section 5.2.1) • Survey of fish species density and distribution (see section 5.2.2) • Survey of marine mammals density and distribution (see section 5.2.3) • Survey of bird density and distribution (see section 5.2.4)
Method of Impact Assessment	Data from the geophysical survey of the site, in particular hi-resolution sidescan data and ground truthing, will be used to identify the potential distribution of Annex I and UK BAP habitats. The presence/absence of Annex II and UKBAP species within the site will be recorded via a combination of desk-based review of existing data-sets and data from relevant biological surveys. Potential impacts upon Annex I habitat, Annex II species and/or UK BAP habitat/species will be assessed via standard EIA methodologies, using significance criteria agreed with the relevant statutory nature conservation agency. Where species/habitats listed under the Habitats Directive are likely to be affected, there may be a requirement to provide information within the ES that enables the competent authority to undertake an Appropriate Assessment. It is anticipated that all data collected through field surveys within the EIA will be compatible with the requirements of Appropriate Assessment and therefore will not require further survey to be undertaken.

Site-specific Survey Methodology

Best Practice Guidance

The following references provide best practice guidance for use in assessing impact upon nature conservation:

- English Nature, RSPB, WWF-UK and BWEA (2001). Wind Farm Development and Nature Conservation: A Guidance Document for Nature Conservation Organisations and Developers when Consulting over Wind Farm Proposals in England, WWF-UK, 19pp;
- CEFAS, DEFRA, DTI and MCEU (2004). Offshore Wind Farms: Guidance Note for Environmental Impact Assessment in Respect of FEPA and CPA Requirements Version 2, Marine Consents Environment Unit, 48pp;
- DEFRA (2005). Nature conservation guidance on offshore windfarm development. A Guidance Note on the Implications of the EC Wild Birds and Habitats Directives for Developers Undertaking Offshore Windfarm Developments;
- SNH (2005a). A Handbook on Environmental Impact Assessment. Guidance for Competent Authorities, Consultees and Others Involved in the Environmental Impact Assessment Process in Scotland;
- ABPmer (2009a). Wet Renewable Energy and Marine Nature Conservation: Developing Strategies for Management; and
- IEEM (2009). Guidelines for Ecological Impact Assessment in Britain and Ireland - Marine and Coastal Consultation Document.

Summary of methodology

The assessments for nature conservation will be undertaken as part of the species specific surveys. The survey programme will be designed to include the data collection required for assessing the impact on favourable conservation status and for meeting the requirements of the Habitats Regulations Assessment. All methodologies will be discussed and agreed with SNH and JNCC.

The impact assessment for nature conservation aspects will be presented in a separate chapter from the more general environmental receptor issues upon which the assessment are based.

Sites Included Within the Assessment

It is proposed that the initial assessment of impacts upon designated sites will be undertaken for the sites listed in Table 5-9 above, although more distant designated sites may be included depending upon the outcome of the cumulative impacts FTOWDG collaboration work. Consultation with statutory agencies will be carried out in order to identify any sites that may potentially be identified as designated in the foreseeable future.

Review and Status of Qualifying Features

It is envisaged that during the Inch Cape EIA the potential impacts upon nature conservation interests in the area will be fully assessed. This will initially comprise of a desktop study utilising guidelines developed by nature conservation agencies and other key regulators. A number of existing data sets will be reviewed in the context of the pre-existing designations on or near the proposed development site in order to identify and assess potential impacts. This study will be

supplemented by review of the following surveys: habitats, marine benthos and fish. Review of these surveys will allow identification of any potential Annex I, II or UK BAP habitats or species.

Favourable Conservation Status

It is further proposed that there are 6 month and 12 month reviews of the data collected during the ornithology and marine mammal surveys, in order to allow early identification of any species of conservation significance that could potentially be impacted by the proposed Inch Cape offshore wind farm development. Should further surveys be required to determine the potential impact on favourable conservation status of species that are likely to be impact receptors, this requirement and survey methodology will be discussed with SNH. It is therefore anticipated that there may be a requirement for further data collection over at least 12 months. Where further surveys will not provide a practical method for assessing favourable conservation status of receptor species, the use of alternative methods, such as computational modelling, will be investigated.

Habitats Regulations Assessment

In order to ensure that any Habitats Regulations Assessment process undertaken for this development is robust, it is proposed that early discussion will be undertaken with statutory consultees, notably SNH. It is also recommended that other relevant stakeholders, e.g. JNCC and RSPB, are consulted at an early stage. An early objective would be to identify the scope of any Appropriate Assessment and specific information requirements (over and above the current survey programme) that may be required.

Cumulative and In-combination Impact Assessment & Survey Methodologies

As discussed in section 3, the Forth and Tay Offshore Developers' Group have used the King *et al*., (2009) method to scope the potential for cumulative impacts to birds, marine mammals and any SPAs or SACs for which species of these groups are designating features. SNH (2009) has also provided feedback on SPAs located outside of the east coast of Scotland and northern England which may be relevant to cumulative impact assessment.

The SPAs and SACs initially identified for assessment of the potential for cumulative impact are listed in Table 5-10. This list will be revised as data is collected and reviewed.

Table 5-10: Initial list of SPAs and SACs identified for cumulative impact assessment

Site Name	Special Protection Area	Area of Search for Inshore SPA	Special Area of Conservation
Barry Links			✓
Berwickshire & North Northumberland Coast			✓
Buchan Ness to Collieston Coast	✓		
Coquet Island	✓		
Dornoch Firth & Morrich More			✓
Firth of Forth	✓	✓	
Firth of Tay and Eden Estuary	✓		✓
Firth of Tay and St Andrew's Bay		✓	

Site Name	Special Protection Area	Area of Search for Inshore SPA	Special Area of Conservation
Fala Flow	✓		
Farne Islands	✓		
Forth Islands	✓		
Fowlsheugh	✓		
Gladhouse Resevoir	✓		
Imperial Dock Leith	✓		
Isle of May			✓
Loch Leven	✓		
Loch of Skene	✓		
Lindisfarne	✓		
Montrose Basin	✓		
Muir of Dinnet	✓		
Moray Firth			✓
Northumberland Coast		✓	
Slamannan Plateau	✓		
South of Tayside Goose Roosts	✓		
St Abbs Head to Fast Castle	✓		✓
Ythan Estuary, Sands of Forvie	✓		
Upper Solway Flats and Marshes	✓		

The methodologies and potential survey requirements by which cumulative effects will be assessed will be agreed with consultees as part of a future scoping exercise undertaken by the FTOWDG.

Potential cumulative and in-combination impacts of the proposed project on sites of nature conservation importance will be assessed via the EIA process on a site-by-site basis. This will include consultation with SNH in order to ensure that all designated sites and potential designated sites are included. In the event that an Appropriate Assessment is required for the project then cumulative and in-combination assessment will also be included at this time.

5.2.6 Underwater Noise

Baseline Environment

There is currently no publicly available information on the background levels of noise within the marine environment in the outer Firth of Tay area. Background noise levels will be comprised of a mixture of natural noise (e.g. wind, waves, natural seismic action, echolocation from marine mammals etc) and anthropogenic noise (e.g. vessels, military sonar, offshore and onshore construction etc). In relation to offshore wind farms, vessel movements, construction and turbine operation are the key features associated with potential noise generation. Best practice guidance is listed below.

Data Gaps

More detailed data will be required on offshore construction practices, specific equipment noise levels and turbine operation. This data will be used to more accurately predict the potential for impacts on environmental receptors.

Environmental Impacts Scoping

Based on available literature, it is considered that the potential impacts on underwater noise as a result of wind farms within the marine environment will be:

Impact Description	Potential site specific impact	Potential cumulative and/or in-combination Impact
Increased levels of underwater noise	✓	✓

It should be noted that it is the secondary impact on other receptor features (e.g. fish and marine mammals) that is of principal concern with respect to changes in background noise levels.

Site-specific impact assessment methodology

For the potential impact described above a survey, study and method of impact assessment is described in the table below.

Potential Impact	**Increased levels of underwater noise**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts on the underwater noise, the following survey and study will be undertaken: • Subsea acoustic modelling • Modelling of noise sources • Literature review of underwater noise generation
Method of Impact Assessment	Underwater noise measurements and existing studies of noise generation associated with offshore wind turbine processes will be used to assess the likely increase in background levels of underwater noise and potential impact zones.

Site-specific Survey Methodology

Best Practice Guidance

The survey designs will take into consideration industry best practice for survey types and quality of data required for offshore wind farms:

- Nedwell & Turnpenny (1998). The use of a generic frequency weighting scale in estimating environmental effect; and
- Nedwell *et al*. (2007). Measurement and interpretation of underwater noise during construction and operation of offshore wind farms in UK waters.

Summary of Methodology

Background noise will be measured within the site using towed or static hydrophones. Available data from any identified receptor sites will also be included where available. The data collected will be input into a computational model which will be used to assess impact zones associated with various noise generating actions.

The results of the noise modelling will also be used to feed into the following impact assessments:

- Fish;
- Marine Mammals;
- Nature conservation; and
- Potential cumulative and in-combination impacts.

Cumulative and In-combination Impact Assessment & Survey Methodologies

The methodologies and potential survey requirements by which cumulative effects will be assessed will be agreed with consultees as part of a future scoping exercise undertaken by the FTOWDG.

5.3 Human Environment

The effects on the human environment are categorised as follows:

- Commercial Fisheries;
- Commercial Navigation;
- Military and Civil Aviation;
- Abandoned Munitions;
- Marine Waste Disposal and Dumping;
- Offshore Oil and Gas;
- Subsea Cables and Pipelines;
- Marine Aggregate Extraction;
- Landscape/Seascape and Visuals;
- Archaeology and Cultural Heritage;
- Marine Recreation and Amenity;
- Socio-Economics; and
- Offshore Wind Farms.

5.3.1 Commercial Fisheries

Data and Information Sources

There is currently no single data set or model which can accurately quantify the precise levels or values of commercial or recreational fishing within a small discrete sea area such as an offshore windfarm. As a result, data and information used to compile the commercial fisheries baseline will be acquired from a range of sources:

- International Council for the Exploration of the Sea (ICES);
- EU Fisheries Committee Publications & Data sets (Europa & Eurolex);
- Marine Management Organisation (MMO)/Marine Scotland (MS) – Fisheries Statistics Unit & Data and Communications Team;
- Marine Scotland Science;

- Seafish;
- UK Oil & Gas (UKKOA);
- Scottish Fishermen's Federation (SFF);
- National Federation of Fishermen's Organisation (NFFO);
- Regional fishermen's associations and producer organisations;
- Local non affiliated fishermen's associations, groups and individual skippers;
- Local port merchants and agents;
- Marine Scotland District Fisheries Inspectors;
- Local Harbour Masters; and
- Foreign National Fisheries Agencies (as identified through the course of the EIA).

Baseline Environment

The following section provides an overview of the current commercial fishing activity in the area relevant to the Inch Cape offshore wind farm. The information given below is based on the analysis of MMO landings values data (2000-2008) and MMO VMS data (2005-2008) by ICES Rectangle.

ICES Rectangles are the smallest spatial units used for the collation of fisheries statistics. The boundaries of the Rectangles align to 1° longitude and 30' latitude. The Inch Cape site falls within two ICES Rectangles, 41E7 and 42E7 (see Figure 5-7).

In Rectangle 41E7, trawling for *Nephrops* accounts for the majority of the landings by value (62.2%). Potting for lobster, edible crab and velvet crab, combined, represents over a quarter of the value of the landings from this Rectangle (25.3%). Scallop dredging also records relatively high landings values in this Rectangle (6.7%).

In Rectangle 42E7, whilst trawling for *Nephrops*, potting and scallop dredging remain the principal fishing methods by value, their relative importance is different. Scallop is the principal species, accounting for 42.8% of the annual landings values, followed by lobster, edible crab and velvet crab which combined represent 41.8%, and then *Nephrops* at 10.5%.

With regards to vessel size, the large majority of landings values from both Rectangles are from vessels of less than 15m in length (83.7% in 41E7 & 59.4% 42E7), with the exception of scallop dredgers, which are for the most part 15m and over vessels, see Table 5-11 and Table 5-12.

Table 5-11 Annual landings values (average 2000-2008) for the top 10 species in rectangle 41E7

Species	Annual Average Landings Values (2000-2008) from 41E7	% of Total Values of 41E7
Nephrops	£2,507,735	62.2%
Lobsters	£778,383	19.3%
Scallops	£270,787	6.7%
Edible Crabs	£131,411	3.3%
Velvet Crabs	£109,662	2.7%
Surf Clams	£84,016	2.1%
Squid	£66,237	1.6%
Razor Clam	£42,467	1.1%
Haddock	£15,733	0.4%
Cod	£4,913	0.1%

Other	£21,689	0.5%
	Total: £4,033,034	

Table 5-12 Annual landings values (average 2000-2008) for the top 10 species in rectangle 42E7

Species	Annual Average Landings Values (2000-2008) from 42E7	% of Total Value of 42E7percentage
Scallops	£729,352	42.8%
Lobsters	£427,985	25.1%
Nephrops	£178,411	10.5%
Edible Crab	£169,224	9.9%
Velvet Crab	£115,882	6.8%
Squid	£54,739	3.2%
Haddock	£8,679	0.5%
Other Molluscs	£3,817	0.2%
Plaice	£3,664	0.2%
Cod	£2,433	0.1%
Other	£10,439	0.6%
	Total: £1,704,624	

An indication of the principal ports with landings from the area relevant to the Inch Cape development is given in Table 5-13 and Table 5-14. These show the top 10 ports by landings values, and the relative importance to the total value of the port that the landings from the relevant Rectangle represent.

Table 5-13 Top 10 ports with landings values from rectangle 41E7 (average 2000-2008)

Port	Annual Landings Values in 41E7 Average 2000-2008)	% of the Total landings Values in 41E7	Total Annual Port Value (average 2000-2008)	% of Total Port Value that landings from 41E7 represent
Pittenweem	£2,186,504	54.2%	£2,285,961	95.6%
Dunbar	£469,695	11.6%	£556,952	84.3%
Eyemouth	£267,303	6.6%	£3,681,730	7.3%
Crail	£233,657	5.8%	£234,826	99.5%
Methil and Leven	£197,953	4.9%	£205,254	96.4%
Aberdeen	£149,372	3.7%	£13,397,222	1.1%
Anstruther	£105,328	2.6%	£106,197	99.2%
St Andrews	£95,084	2.4%	£96,302	98.7%
Arbroath	£66,998	1.7%	£819,632	8.2%
Montrose	£36,950	0.9%	£238,503	15.5%

Table 5-14 Top 10 ports with landings values from rectangle 42E7 (average 2000-2008)

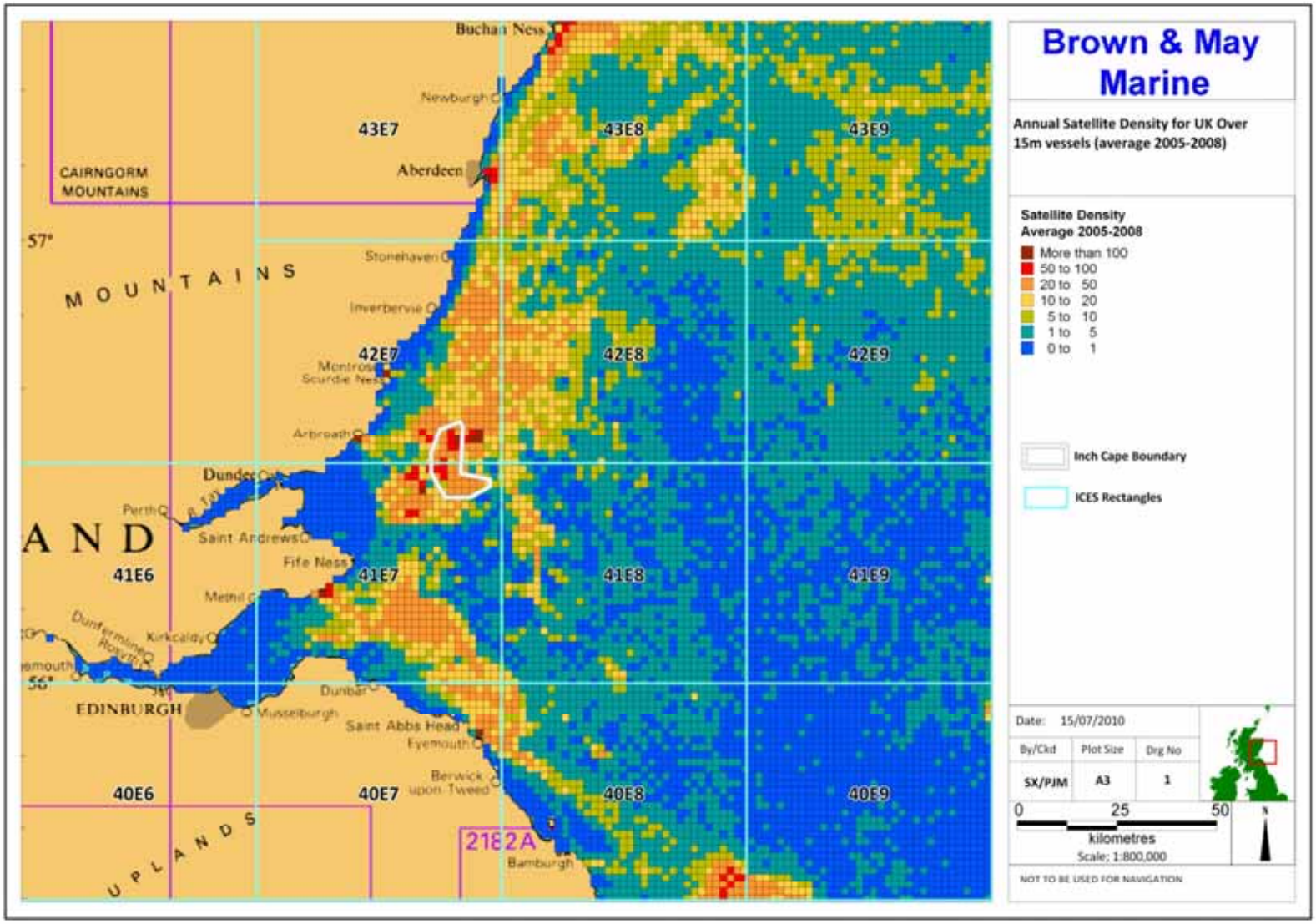
Port	Annual Landings Values in 42E7 Average 2000-2008)	% of the Total landings Values in 42E7	Total Annual Port Value (average 2000-2008)	% of Total Port Value that landings from 42E7 represent
Arbroath	£556,263	32.6%	£819,632	67.9%
Aberdeen	£496,092	29.1%	£13,397,222	3.7%
Gourdon	£248,867	14.6%	£265,574	93.7%
Montrose	£133,695	7.8%	£238,503	56.1%
Stonehaven	£75,677	4.4%	£89,417	84.6%
Johnshaven	£68,144	4.0%	£68,727	99.2%
Peterhead	£52,722	3.1%	£82,280,944	0.1%
Fraserburgh	£20,811	1.2%	£39,617,782	0.1%
Buckie	£15,552	0.9%	£3,241,696	0.5%
Pittenweem	£13,922	0.8%	£2,285,961	0.6%

An indication of the spatial distribution and intensity of fishing in and around the Inch Cape area is given in Figure 5-7. This shows annual average (2005-2008) satellite densities of UK vessels of over 15m in length, based on MMO VMS data.

Higher densities are recorded near shore in coastal Rectangles, with the Inch Cape site and its immediate vicinity recording the highest densities.

It should be noted that the densities shown below will to some extent understimate the true levels of fishing given the high percentage of vessels of less than 15m in length and therefore not satellite tracked, with the exception of scallop dredgers, the majority of which are of 15m and over.

Figure 5-7: Annual average satellite density of UK over 15m vessels (2005-2008)



Data Gaps

It is recognised that data and information sources used to contribute to the commercial fisheries baseline have limitations. Where practically possible, the sources identified above will combine to enable a comprehensive assessment of all types of fishing activities in the area of the windfarm. Consultation with local fisheries representatives throughout the duration of the EIA will inform this process.

Environmental Impact Assessment

Best Practice Guidance

The following references provide best practice guidance for use in assessing impact upon commercial fisheries:

- BWEA (2002). Best Practice Guidelines for Consultation for Offshore Renewable Developers;
- CEFAS (2004). Guidance note for Environmental Impact Assessment in respect of FEPA and CPA requirements, version 2 – June 2004;
- BERR (2008). Fishing Liaison with offshore wind and wet renewables group (FLOWW) recommendations for fisheries liaison; and
- OSPAR (2008). Guidance on Environmental Considerations for Offshore Wind Farm Development. Reference number: 2003-8.

To assist the assessment of potential impacts of the proposed development upon commercial fisheries, consultation will be undertaken with the relevant national and local marine fisheries bodies and fishermen's associations and representatives.

Based on available literature, the following are perceived to be the potential impacts on commercial fisheries as a result of wind farms within the marine environment:

Impact Description	**Potential site specific impact**	**Potential cumulative and/or in-combination Impact**
Presence of seabed obstacles	✓	✓
Adverse impacts on commercially exploited species	✓	✓
Increased steaming times to fishing grounds	✓	✓
Safety issues for fishing vessels	✓	✓
Complete loss or restricted access to traditional fishing grounds	✓	✓
Interference with fisheries activities	✓	✓

Impact Assessment Methodology

In the case of each impact, the assessment will take account of:

- the spatial extent of effect;
- the duration of effect;
- the scale of effect;
- recoverability of the receptor; and
- importance of the receptor.

Construction/Operational/Decommissioning

The impact assessment methodology will be separately applied to the potential impacts during the construction, operational and decommissioning phases of the development.

Cumulative/In-combination

In addition to the potential impacts of the development on the existing commercial fisheries baseline, the cumulative and in-combination impacts will be separately considered using the impact assessment methodology provided above.

Potential Mitigation Methods

The mitigation measures proposed for the development area will be dependent upon the final design of the site and the potential impacts as determined by the EIA studies. Options of mitigation will be discussed with the relevant authorities prior to ES submission.

5.3.2 Commercial Navigation

Baseline Environment

The North Sea is one of the busiest shipping regions in the world and is used by a variety of vessels, including cargo vessels, tankers, ferries and offshore service and supply vessels. In the offshore environment, the sizes of these vessels generally vary from <1,500 to >40,000 dead weight tonnes (DWT).

AIS (automatic identification system) data has been obtained for June 2008 and July 2009 in order to understand the shipping densities and movements across the Firths of Forth and Tay, and the Inch Cape site. The data from June 2008 was bought from Anatec Limited and the July 2009 data was collected on behalf of all the Firth of Forth and Tay developers by Marico Marine. Only vessels over 15 m in length (300 gross tonnes) are required to carry AIS and as such some small commercial vessels and recreational craft will not have been accounted for. Acquiring more detailed information on all shipping traffic will form part of the navigation risk assessment in the EIA.

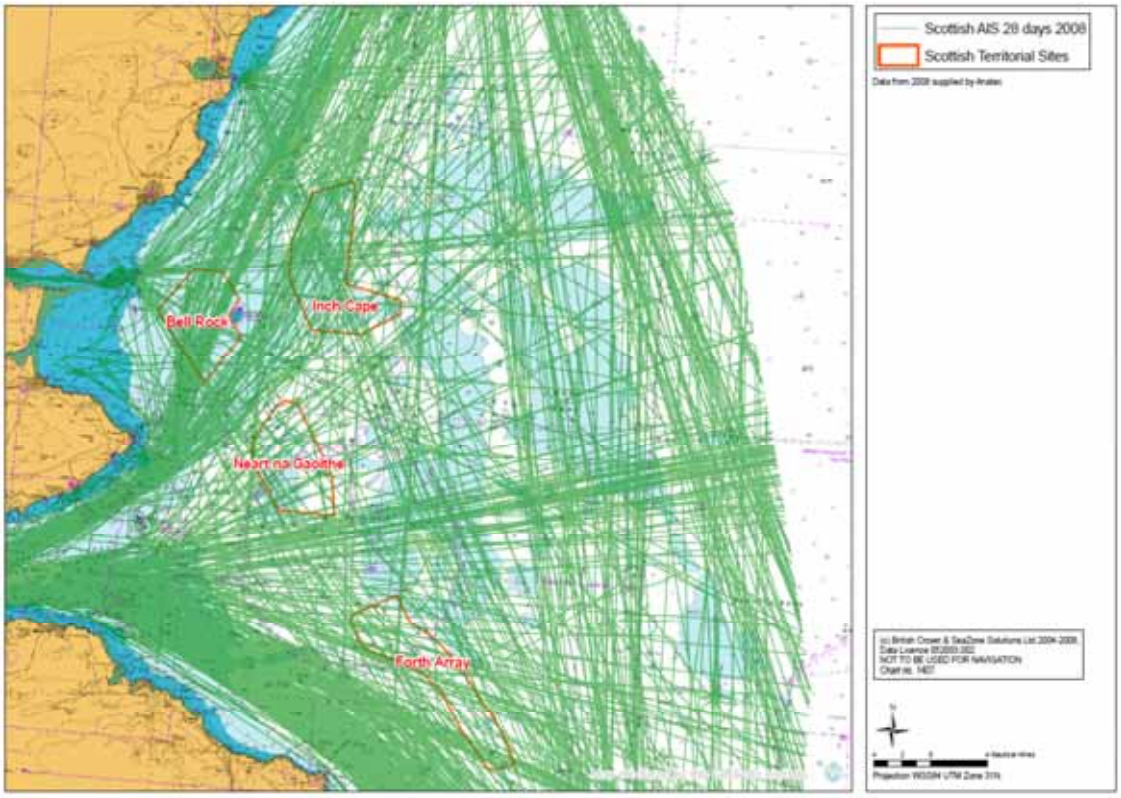


Figure 5-8: 2008 AIS track data

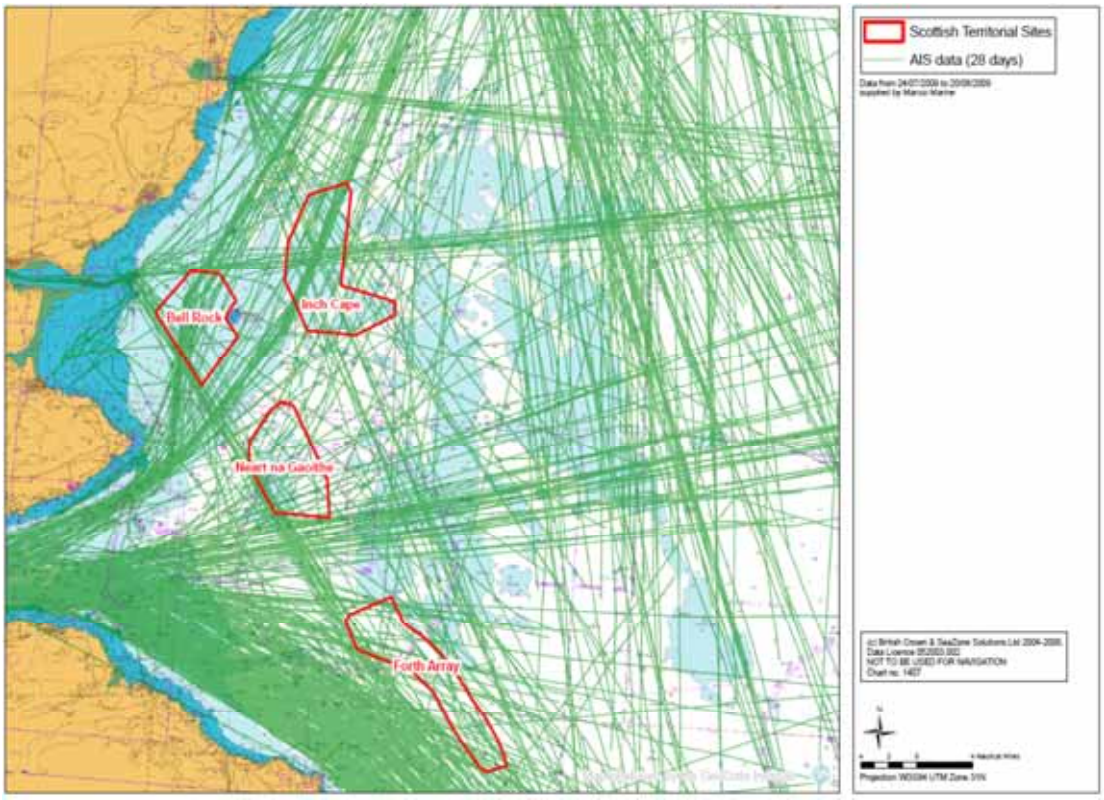


Figure 5-9: 2009 AIS track data

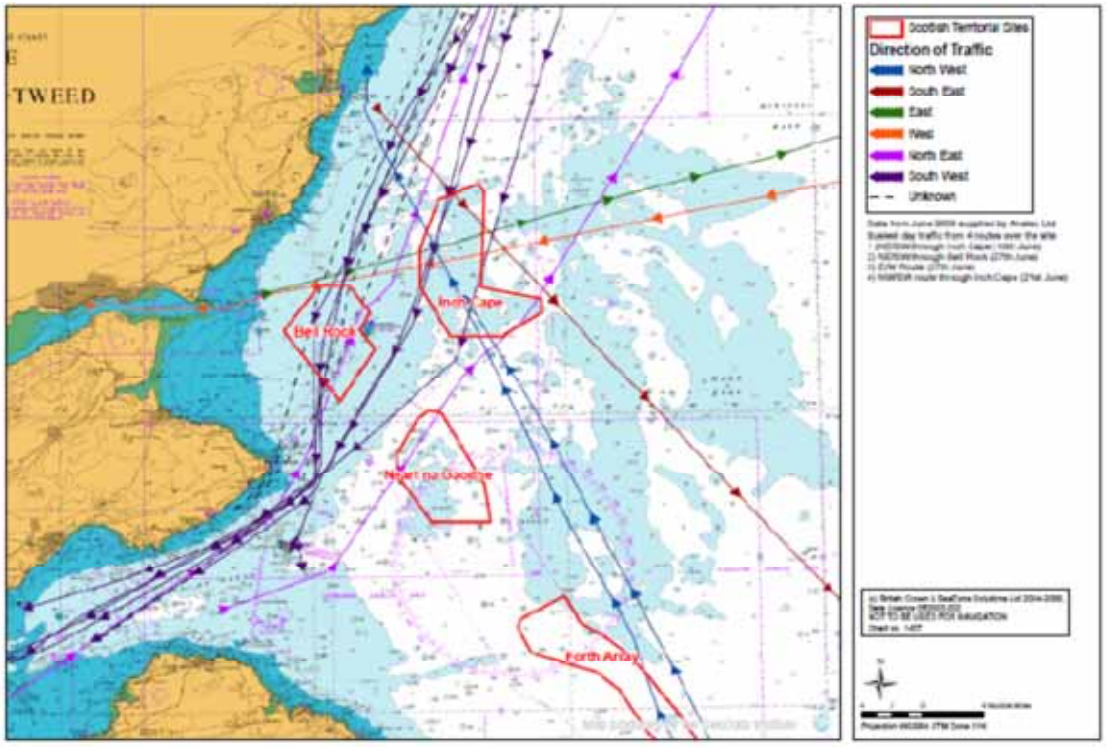


Figure 5-10: Direction of vessel traffic

Figure 5-8, Figure 5-9 and Figure 5-10 illustrate the AIS track data and direction for shipping traffic throughout the Firth of Forth and Tay region with a number of distinct routes emanating from the numerous ports around the coast. Those which directly pass through the proposed Inch Cape site are south-east / north-west heading to and from Montrose, east / west heading to and from the Tay estuary, and north-east / south-west route which naturally splits either side of the Bell Rock lighthouse before converging heading into the Firth of Forth estuary.

The traffic plots indicated that the volume of traffic reduced significantly between 2008 and 2009; 24% less overall, with a larger survey area in 2009 (SMS 2009). This has primarily been attributed to the economic downturn, although it should be noted that the navigation routes remain similar.

It is clear from both sets of data that there may be navigational conflicts, exacerbated by the cumulative effect of the wind farms. However the volume of traffic through Inch Cape and in the study area is generally low. A maximum of 3 vessels per day passed through the Inch Cape boundary during the July 2009 survey (Marico Marine, 2009); Figure 5-8 illustrating the 'worst case scenario' as recorded from the 2008 data.

Data Gaps

AIS data for the outer Firth of Tay is available but predominately relates only to vessels >15 m in length. The vessel tracks can also show spatial variation over time. Therefore, further data would be required for all sizes of vessel.

Environmental Impacts Scoping

Based on available literature, the following are perceived to be the main potential impacts on navigation as a result of the proposed wind farms:

Impact Description	Potential site specific impact	Potential cumulative and/or in-combination Impact
Disturbance to shipping traffic	✓	✓
Constriction of vessel routes	✓	✓
Increased collision risk	✓	✓
Severance of access and loss of area to shipping	✓	✓
Alterations of vessel routing	✓	✓
Impacts on navigational safety (including maritime radars)	✓	✓

Site-specific Impact Assessment Methodology

For each of the potential impacts described above a survey or study and method of impact assessment is described in the tables below.

Potential Impact(s)	**Disturbance to shipping traffic** **Constriction of vessel routes** **Severance of access and loss of area to shipping** **Alterations of vessel routing**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts to shipping access and area use, the following studies and surveys will be undertaken: • Vessel routing survey • Vessel density survey
Method of Impact Assessment	The density and travel routes of vessels will be assessed to determine the use of the proposed site over time and to allow the assessment for the potential for the impacts listed above.

Potential Impact(s)	**Increased collision risk** **Impact on navigational safety (including maritime radars)**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts to navigational safety, the following study will be undertaken: • Navigational risk assessment
Method of	A navigational risk assessment will assess the risk associated with ship to ship

Impact Assessment	collision, vessel grounding, collision with wind turbine array infrastructure and the potential impact on communication systems.

Site- specific Survey Methodology

Best Practice Guidance

The assessment will be undertaken in line with the following guidance:

- DTI (2005a). Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms; and
- Marine Guidance Note 371: Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response Issues.

Summary of Methodology

Routing and Density Surveys

A detailed site-specific assessment of the existing traffic, which will be performed in accordance with the guidelines recently published by the Maritime and Coastguard Agency. This will involve AIS radar surveys done over 14 days during two separate seasons. This assessment will validate and update the shipping data where necessary based on consultation with relevant experts, such as local harbour masters, pilots, Ship Masters and Ship Operators. This will ensure the best available data is used to assess the navigational impact of the site and subsequent decision-making to minimise obstruction and danger to shipping.

Navigational Risk Assessment

A Navigational Risk Assessment will be prepared which will assess the base level of risk in the area (ship to ship collision and vessel grounding risks) and the additional risks as a result of the wind turbine arrays to be located in the area (change in ship to ship, collision, grounding risks and ship to turbine collision risks). Such an assessment will provide information on whether safety zones in or around the wind farm are necessary.

The navigational risk assessment will also investigate the potential of the wind turbines to interfere with communications, radar and positioning systems.

Cumulative and In-combination Impact Assessment & Survey Methodologies

The methodologies and potential survey requirements by which cumulative effects will be assessed will be agreed with consultees as part of a future scoping exercise undertaken by the FTOWDG.

5.3.3 Civil Aviation

Baseline Environment

Radars

NATS En Route Plc ("NERL") is responsible for the safe and expeditious movement in the en-route phase of flight for aircraft operating in controlled airspace in the UK. To undertake this responsibility

NERL has a comprehensive infrastructure of radars, communication systems and navigational aids throughout the UK, all of which could be compromised by the establishment of a wind farm. In this respect NERL is responsible for safeguarding this infrastructure to ensure its integrity to provide the required services to Air Traffic Control (ATC).

NATS En Route plc prepared an assessment of the potential impacts of wind turbines on NATS infrastructure (NERL, 2009). The assessment concluded that the proposed Inch Cape site falls within the operational range of the NERL Infrastructure systems (Table 5-15). The radar safeguarding assessment reveals that the proposed turbine development resides in an area where the impact of wind turbine, of this type, on NATS en-route radar services appears insignificant. In addition, it was determined that the wind farm site would not impact upon NERL navigational aids or NERL air-ground voice communication systems.

Table 5-15: Preliminary radar study results

Radar	Easting	Northing	Range (nm)	Bearing (True)	Potential Impact
Claxby Radar	512440	396150	196.9	340.5°	Negligible
Great Dun Fell Radar	371030	532210	110.7	2.8°	Negligible
Lowther Hill Radar	289020	610710	84.8	35.1°	Negligible
Perwinnes Radar	392190	813510	41.7	187.1°	Negligible
Tiree Radar	96820	740140	154.3	86.6°	Negligible

Helicopters

Helicopters are used in some maritime search and rescue operations and it may be necessary to fly at less than 1,500 feet. Obstacle clearance from the turbines would then become an issue.

Environmental Impacts Scoping

NATS (En Route) Limited has no safeguarding objection to the proposal. The potential for site-specific impacts on Civil Aviation are therefore scoped out. However, there has been no assessment of the potential for cumulative impacts. Therefore following potential impacts are scoped in:

Impact Description	Potential site specific impact	Potential cumulative and/or in-combination Impact
Effects on radar	x	✓

Obstacle clearance for helicopters	✓	✓

Cumulative and In-combination Impact Assessment & Survey Methodologies

The methodologies and potential survey requirements by which cumulative effects will be assessed will be agreed with consultees as part of a future scoping exercise undertaken by the FTOWDG.

It is currently anticipated that the developers will undertake a shared radar effects study. The area for the study will be determined through consultation and advisory zones around civilian and military radar. It is also anticipated that joint consultation with the Ministry of Defence and Civil Aviation Authority will be undertaken.

5.3.4 Ministry of Defence

Baseline Environment

The proposed Inch Cape site is not located within any military practice areas. The following military in the vicinity of Inch Cape is as follows and is illustrated in Figure 5-11:

- A submarine exercise area is reported approximately 30 km south of the proposed site;
- A military firing practice area lies approximately 35 km to the east, east of longitude 01° 30'W; and
- Two disused ammunition dumping grounds lie to the east of the Isle of May, approximately 30km south west.

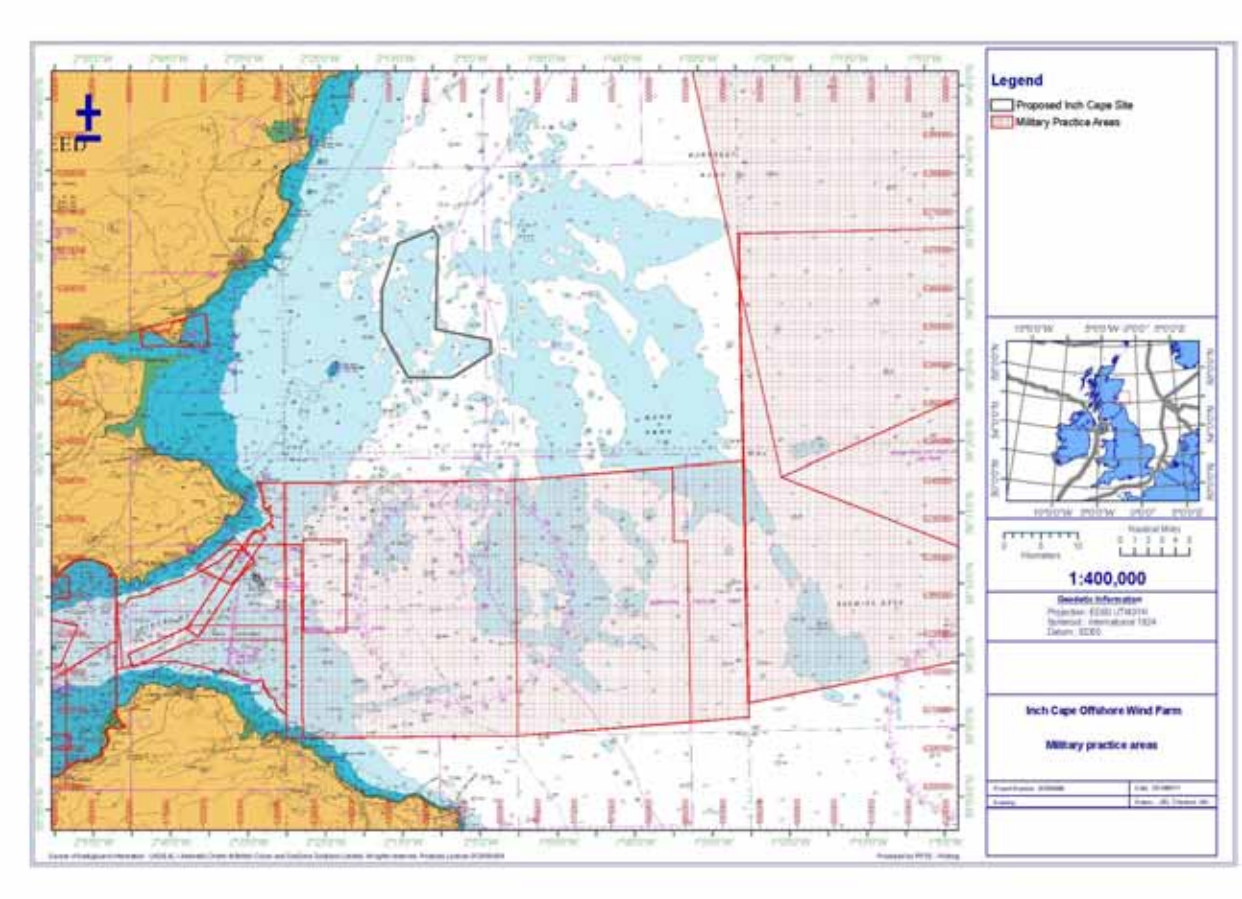


Figure 5-11: Military practice areas in the Firth of Forth / Tay region

Aviation

An initial screening exercise of the potential impacts on aviation was undertaken by Pager Power in 2008 (Knights & Watson, 2008). The study identified that the proposed Inch Cape site would have potential impacts on military aviation radar sites. However, the proposed site was outside any low flying military practice areas.

The Defence Estates responded to a screening proforma relevant to the current proposed Inch Cape site boundary. The screening assessment concluded that the military installations and facilities that could potentially be impacted by the proposed development were the Primary Surveillance Radar (PSR) and Precision Approach Radar (PAR) at RAF Leuchars and the Line of Sight (LOS) of air defence radars at Air Surveillance and Control System (ASACS) Buchan and ASACS Brizlee Wood. Further investigations have ruled out any impact on the PAR radar at Leuchars, therefore this potential impact has been scoped out of the EIA.

Subsequently two meetings have been held between the Forth and Tay offshore wind farm developers and the Defence Estates in order to establish a common understanding of the potential cumulative effects offshore wind farm developments may have on Defence Estate radars and to ensure a collaborative approach is taken to mitigate any potential effects identified. Meetings were held on the 12th of February 2010 and the 3rd June 2010. Regular meetings are proposed from 2010 onwards.

The Defence Estate has made a commitment to provide developers with coordinates of the RAF Leuchars PAR. Once this information is received an accurate assessment can be made of any potential constraints to developing the Inch Cape offshore wind farm.

Environmental Impacts Scoping

Based on available literature, the following are perceived to be the potential impacts on the Ministry of Defence and associated military activities as a result of wind farms within the marine environment:

Impact Description	**Potential site specific impact**	**Potential cumulative and/or in-combination Impact**
Creation of obstacles to low flying aircraft	x	n/a
Effects on radar	✓	✓

Site-specific Impact Assessment Methodology

In order to assess the potential impacts on radar the following survey method is proposed.

Potential Impact(s)	**Effects on radar**
Survey/Study Proposed to	To determine the potential for impacts to radar systems, the following studies will be undertaken:

Assess Impact	• Radar modelling • Air traffic/airspace operational assessment
Method of Impact Assessment	Radar modelling will be undertaken to determine the extent of radar visibility and the predicted effects on radar performance. The air traffic/airspace operational assessment will analyse traffic flows and airspace structure to determine the operational impact of any effects on radar.

Cumulative and In-combination Impact Assessment & Survey Methodologies

The methodologies and potential survey requirements by which cumulative effects will be assessed will be agreed with consultees as part of a future scoping exercise undertaken by the FTOWDG.

It is currently anticipated that the navigation and aviation cumulative and in-combination impact assessments will cover Ministry of Defence issues.

5.3.5 Telecommunications

Baseline Environment

An initial screening exercise of the potential impacts on telecommunications was undertaken by Pager Power in 2009 (Knights & Watson, 2008). The study identified that the proposed Inch Cape site would have no issues relating to microwave links, scanning telemetry or non-aviation radar and would not cause TV or radio interference.

Environmental Impacts Scoping

There are anticipated to be no issues on microwave links, scanning telemetry, non-aviation radar or TV and radio transmissions. However, as this conclusion is only based on a pre-screening assessment further consultation with relevant consultees will be undertaken to confirm whether these issues can be scoped out.

5.3.6 Marine Waste Disposal and Dumping

Baseline Environment

Maintenance and capital dredging activity is concentrated in estuarine and coastal waters, at harbours and ports in the Firth of Forth and on the Fife coastline some distance inshore of the proposed Inch Cape site. An historic marine munitions disposal site lies inshore of the STW sites, a short distance seaward of the Isle of May. It is no longer in use. The offshore waters along the central east coast of Scotland contain two historic sewage sludge disposal grounds; Bell Rock disposal site and St Abbs Head disposal site (Figure 5-2).

These sites were closed in 1998 after a total of 5.85 m tonnes of wet sludge were deposited at both sites over an operating period of 20 years. The proposed Inch Cape site is partially located over the Bell Rock disposal site. Details of the marine benthic community recorded at the Bell Rock disposal site are summarised in section 5.2.1.

Environmental Impacts Scoping

As the Bell Rock disposal site is now closed, the potential for impacts on the disposal site is scoped out.

Sampling results suggest a mild effect of sludge disposal but show that seabed sediments display no signs of serious organic or heavy metal contamination (CEFAS, 1997 & Hayes *et al*., 2005 – c.f. Wright, 2009). The current status of the closed disposal sites which received sewage sludge is not known but post-dumping monitoring indicates that the sites are highly dispersive and long-term contaminant issues are unlikely to be encountered. Therefore, the potential for in-combination and cumulative impacts with marine waste disposal and dumping are scoped out.

5.3.7 Offshore Oil and Gas

Baseline Environment

The proposed Inch Cape site is located within the following UKCS blocks: 25/14, 25/15, 25/19 and 25/20. There are no current oil or gas licences covering the study area. The 26th Seaward Licensing Round for oil and gas was launched Q1 in 2010 (DECC, 2009a).

There is no oil and gas infrastructure within the proposed Inch Cape site. The nearest oil and gas infrastructure, well 26/12-1, was drilled in 1985 by Cluff Oil plc and is located approximately 25 km to 30 km east of the northern tip of the proposed Inch Cape area. This well was plugged and abandoned.

There has been initial investigation into the possibility of creating carbon capture and storage sites beneath the seabed in the Firth of Forth (British Geological Survey website). It is not clear whether proposals have progressed beyond the feasibility study stage.

Additional information on future plans is anticipated to be obtained from consultation with relevant stakeholders.

Data Gaps

There is currently no information on the 26th seaward licensing round and therefore information on future plans will be identified on the announcements made by DECC.

Environmental Impacts Scoping

There is no oil and gas infrastructure or active licenses within or in proximity to the proposed Inch Cape site. Therefore, the site-specific potential for impact on the oil and gas sector is scoped out. Potential in-combination impacts and cumulative impacts are also scoped out.

5.3.8 Subsea Cables and Pipelines

Baseline Environment

There are no known sub-sea cables at present across the proposed Inch Cape site. In 2008, The Crown Estate published a report on the potential feasibility of a subsea east coast HVDC interconnctor (Econnect Consulting, 2008). However, there is currently no information on the potential of development of this proposed interconnector.

There are a further three offshore wind farms within proximity to the proposed Inch Cape site and the Round 3 zone, which lies to the west of the proposed Inch Cape site. These wind farms will also have export cables.

Environmental Impacts Scoping

There are no cables and pipelines within or in proximity to the proposed Inch Cape site. Therefore, the site-specific potential for impact on cables and pipelines is scoped out.

The potential for cumulative impacts associated with other wind farms in the area is scoped in. The potential for in-combination impacts are currently scoped out. However, the potential for impact will be reassessed and appropriate consultation undertaken if plans for the development of any cables or pipelines are advertised.

5.3.9 Marine Aggregate Extraction

Baseline Environment

There is no known marine aggregate extraction activity within or in proximity to the boundary of the proposed Inch Cape site. There are currently only two extant dredging licenses for sand and gravel in Scottish waters. One license is for the Firth of Forth and allows the extraction of 6,000,000 m^3 over 10 years. The other license is for the Firth of Tay and allows for extraction of 66,000 m^3/y.

Environmental Impacts Scoping

The potential for the proposed Inch Cape offshore wind farm and other wind farm developments within the Firth of Forth / Tay region to have impacts on the aggregate resources in the area is considered negligible. Therefore, the potential for site-specific and cumulative impacts on the aggregate industry are scoped out.

In addition, given the distances between the existing aggregate areas and the development site, the potential for in-combination impacts are considered to be negligible (HR Wallingford, 2009) and is therefore scoped out.

5.3.10 Landscape, Seascape and Visual Resources

Seascape is defined as "*the coastal landscape and adjoining areas of open water, including views from land to sea, from sea to land and along the coastline*" (DTI, 2005b). The impact upon landscape, seascape and visual resources is dependent upon a range of interacting factors, including, among others: the Zone of Theoretical Visibility (ZTV); the visual sensitivity of the area; the sensitivity of the landscape and seascape; meteorological conditions; the design and layout of the development; and, the location of the development. The completion of a seascape analysis allows the significance of effects of a proposal on the landscape, seascape and visual resources to be assessed, as well as effects on the setting of historic landscapes and monuments, with reference to established methodology and guidance.

Baseline Environment

A strategic seascape assessment for offshore wind development has been completed for Scotland, which is based upon regional seascape units (Scott *et al*., 2005). However, the assessment did not factor in all potential receptors and a bespoke methodology was used that assessed sensitivity and capacity based on only one development scenario (100 turbines, 150 m high set in an off-set grid layout and covering 25 km^2 and located 8 km offshore). The assessment investigated the potential impact on seascape as capacity for development, which is derived from an assessment of the

visibility of wind farms and the sensitivity and value of the seascapes. The capacity ratings are comparative and range from 1 (higher capacity) to 5 (lower capacity).

The proposed Inch Cape site is 15.5 km off the coast, to the north east of the Firth of Tay. The following information has been taken from Scott *et al.* (2005).

The regional seascape units/areas of relevance to the proposed wind farm are:

- Area 1: Berwick Upon Tweed;
- Area 2: Firth of Forth;
- Area 3: East Fife / Firth of Tay; and,
- Area 4: North East Coast.

The seascape types that are found within these seascape units/areas are:

- Type 1: Remote high cliffs;
- Type 2: Rocky coastline / open sea views;
- Type 3: Depression coastline / open views;
- Type 4: Outer firths; and
- Type 5: Narrow coastal shelf.

The key characteristics and sensitivity of the seascape units/areas are set out below:

Area 1: Berwick Upon Tweed

- rocky coastline with few major headlands and with cliffs generally rising up to 30 m height and occasional small sandy bays;
- productive arable farming up to coastal edge;
- views over the North Sea are wide and open with ships highly visible;
- villages and small towns located in sheltered bays or inlets;
- some isolated industrial features within East Lothian including Torness nuclear power station, cement works etc; and
- St Abbs Head more remote and sparsely settled, comprising high cliffs backed by moorland.

The sensitivity of this area to offshore wind farm developments, as assessed by Scott *et al*. (2005), is considered to be Low-Medium.

Area 2: Firth of Forth

- long sandy beaches interspersed with low rocky headlands;
- backed by arable farmed carse of varying width contained by Lammermuirs in East Lothian;
- coastal wooded braes contain a narrower coastal edge within Fife;
- well settled coastal fringe with Edinburgh and other large urban areas present;
- industry, bridges and infrastructure are a feature, some rigs and ports in Firth;

- views focus on distinctive islands within Firth and on land either side; and
- firth well used for recreation, including sailing, golf and holiday resorts.

The sensitivity of this area to offshore wind farm developments, as assessed by Scott *et al*. (2005), is considered to be Medium.

Area 3: East Fife / Firth of Tay

- long sandy beaches interspersed with sections of low rocky coast/raised beaches – expansive intertidal shores around the Eden estuary, significant dunes systems at Tentsmuir;
- narrow coastal edge, contained by wooded hills west of Tay Bridge in North Fife expanding to broad, flat plain in North-east Fife under agriculture and forestry. Broader Carse of Gowrie to north of Inner Tay backed by Sidlaw Hills;
- well settled coastal fringe with Dundee and other urban areas sited against coast;
- industry, bridges and infrastructure are fairly contained around Dundee with few tall structures evident;
- views focus on the Tay and particularly inland to the Sidlaws and interior hills. Flattened profile towards Outer Firth; and
- well used for recreation including sailing, golf and holiday resorts.

The sensitivity of this area to offshore wind farm developments, as assessed by Scott *et al*. (2005), is considered to be Medium.

Area 4: North East Coast

- long, east-facing generally 'straight' coastline with many small indentations and few significant headlands and with open views out to North Sea;
- mix of long broad sandy beaches backed by dunes and low cliffs/rocky coastline;
- farmland predominantly backs coast; flat and low lying against deposition coast; gently rolling against rocky headlands/cliffs – some remnant heathland in places e.g. Findon Moor;
- frequent fishing villages and harbours and several sizeable urban settlements; and
- industry is infrequent but large scale where it occurs e.g. St Fergus and Peterhead power stations are highly visible features within the lower lying north east.

The sensitivity of this Area to offshore wind farm developments, as assessed by Scott *et al*. (2005), is considered to be Low to Medium.

Seascape assessments based upon turbines with a height of 160 m have also been done for the Round 2 strategic areas (BMT Cordah Limited, 2003). The potential visual effect on the seascape units is defined in terms of high sensitivity, medium sensitivity and preferred unit. The significance of the effect within these areas is determined by distance offshore and the sensitivity of the unit. The DTI (2005) also suggested that the limit of visual significance of Round 2 offshore wind farms within

a national seascape unit was 35 km. Based on these reports, the zones of visual influence have been defined as:

- <8 km: highest potential impact upon seascape;
- 8-13 km: high potential impact on seascape;
- 13-24 km: moderate potential impact on seascape;
- 24-35 km: low potential impact on seascape; and
- >35 km: negligible potential impact on seascape.

Using these impact boundaries the proposed Inch Cape wind farm is located within the low-moderate effect band, i.e. between 13-24 km offshore. However, it is anticipated that the turbines to be constructed in the proposed Inch Cape site will be greater than 160m in height and therefore, the potential impact on seascape may be great.

Figure 5-12 presents an initial ZTV for the project (using 163 m blade tip height). The 'seascape impact buffers' are illustrated on the same figure.

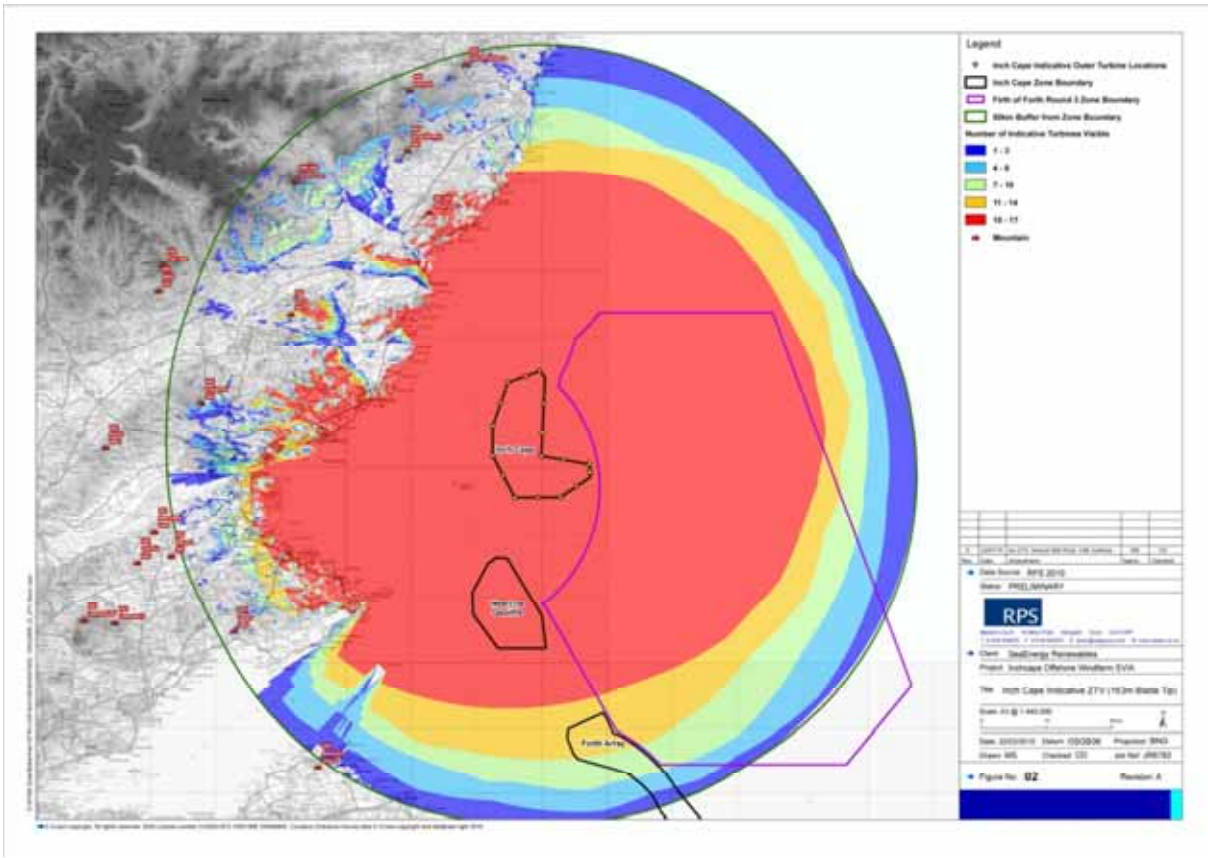


Figure 5-12: Zone of Theoretical Visibility with seascape impact boundaries

Data Gaps

A study to determine cumulative and in-combination viewpoints will be required. Site visits to viewpoints and the production of site-specific ZTVs will also be required.

Environmental Impacts Scoping

Based on available literature, the following are perceived to be the potential impacts on the seascape, landscape and visuals as a result of wind farms within the marine environment:

Impact Description	Potential site specific impact	Potential cumulative and/or in-combination Impact
Change in visual resource	✓	✓
Change in landscape character	✓	✓
Change in the setting of a historic environment feature	✓	✓

Site- specific Impact Assessment Methodology

For each of the potential impacts described above a survey or study and method of impact assessment is described in the tables below.

Potential Impact(s)	**Change in landscape and seascape character during construction, operation and decommissioning of the wind farm:** **Indirect effects on designated landscapes:** **Direct and indirect effects on undesignated seascapes.** **Indirect effects on undesignated landscapes.**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts on landscape character, the following studies will be undertaken: • Desk-based study using a ZTV. • Field work to confirm desk-based study and for descriptions of landscape character areas and seascape units/areas.
Method of Impact Assessment	The SVIA will be undertaken with due regard to best practice guidance set out in: • Department of Trade and Industry, Guidance on the Assessment of Impact of Offshore Wind Farms: Seascape and Visual Impact Report (November 2005) • Horner and MacLennan and Envision, Visual Representation of Windfarms: Good Practice Guidance (2006), for Scottish Natural Heritage, The Scottish Renewables Forum and the Scottish Society of Directors of Planning • Landscape Institute and Institute of Environmental Management and Assessment Guidelines for Landscape and Visual Impact Assessment': Second Edition (2002)

Potential Impact(s)	**Change in visual resources during construction, operation and decommissioning of the wind farm:** **Views from designated landscapes.** **Views from publicly accessible historic environment features.**

	Views from Core Paths. **Views from other promoted paths.** **Views from other public rights of way.** **Views from other publicly accessible land.** **Views from residential properties.** **Potential marine based views.**
Survey/Study Proposed to Assess Impact	To determine the potential for effects on visual resources, the following studies will be undertaken: • Desk-based study using a ZTV • Consultation with consultees to reach agreement on viewpoints • Assessment of meteorological data for visibility for the past 10 years • Assessment of sea use/users • Field work to confirm desk-based study and for descriptions of chosen viewpoints
Method of Impact Assessment	The SVIA will be undertaken with due regard to best practice guidance set out in: • Department of Trade and Industry, Guidance on the Assessment of Impact of Offshore Wind Farms: Seascape and Visual Impact Report (November 2005) • Horner and MacLennan and Envision, Visual Representation of Windfarms: Good Practice Guidance (2006), for Scottish Natural Heritage, The Scottish Renewables Forum and the Scottish Society of Directors of Planning • Landscape Institute and Institute of Environmental Management and Assessment Guidelines for Landscape and Visual Impact Assessment': Second Edition (2002)

Potential Impact(s)	**Change in setting of historic environment feature during construction, operation and decommissioning of the wind farm:** **Indirect effects on designated features:** **Indirect effects on undesignated features e.g. historic landscape character.**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts on landscape character, the following studies will be undertaken: • Desk-based study using a ZTV • Field work to confirm desk-based study and for descriptions of historic environment features or character areas
Method of Impact Assessment	The assessment of effects on the setting of historic monuments will be undertaken with due regard to best practice guidance set out in: Wessex Archaeology for COWRIE, Historic Environment Guidance for the Offshore Renewable Sector (2007).

Site-specific Survey Methodology

Best Practice Guidance

- COWRIE (2008). Guidance for assessment of cumulative impacts on the historic environment from offshore renewable energy;

- DECC (2009). UK Offshore Energy Strategic Environmental Assessment: Future Leasing for Offshore Wind Farms and Licensing for Offshore Oil and Gas Storage, Environmental Report;
- DTI (2005). Guidance on the Assessment of Impact of Offshore Wind Farms: Seascape and Visual Impact Report;
- Hill *et al*. (2001). Guide to Best Practice in Seascape Assessment;
- Historic Scotland (2009). Managing Change in the Historic Environment: Setting;
- Historic Scotland (2009). Scoping of Development Proposals: Assessment of Impact on the Setting of the Historic Environment Resource – some general considerations;
- Horner and MacLennan & Envision (2006). Visual Representation of Windfarms: Good Practice Guidance;
- Landscape Institute and Institute of Environmental Management and Assessment (2002). Guidelines for Landscape and Visual Impact Assessment. 2nd edition. Referred to below as the GLVIA;
- Scott *et al*. (2005). An assessment of the sensitivity and capacity of the Scottish seascape in relation to offshore windfarms (SNH commissioned report);
- Scottish Natural Heritage (2005a). Cumulative Effects of Wind Farms: Version 2;
- Scottish Natural Heritage (2007). Visual Representation of Windfarms: Good Practice Guidance;
- Scottish Natural Heritage (2009). Siting and Designing windfarms in the landscape. Version 1;
- Swanick, C. & Land Use Consultants (2002). Landscape Character Assessment: Guidance for England and Scotland;
- University of Newcastle (2002). Visual Assessment of Windfarms Best Practice; and
- Wessex Archaeology Limited (2007). Historic environment guidance for the offshore renewable energy sector.

Summary of Methodology

Identification of Potential Effects and Proposed Assessment Methodology

Using industry guidance contained within the relevant documents referred to below, the SVIA will undertake the following:

- A scoping exercise and consultation with statutory and non-statutory consultees to establish valued regional and local landscape and seascape resources and viewpoints;
- Baseline studies of existing landscape and seascape and historic environment resources and visual receptors incorporating national level conclusions;
- Assess the sensitivity of those resources and receptors to the proposals;
- Provide advice on any mitigation that may be possible, e.g. layout, and incorporate agreed mitigation into the scheme description;
- Propose and agree monitoring;
- Identify the potential effects of the proposal on the landscape, seascape and historic environment resources and visual receptors during the construction, operation and decommissioning phases of the project and assess the significance of these effects;
- A cumulative assessment on the combined effects of the proposed development in combination with any other major developments that lie within the agreed study area. A list of such developments would be agreed with the relevant authorities; and

- Present the finding in the Environmental Statement (ES) and Non-technical Summary (NTS).

Cumulative and In-combination Impact Assessment & Survey Methodologies

The methodologies and potential survey requirements by which cumulative effects will be assessed will be agreed with consultees as part of a future scoping exercise undertaken by the FTOWDG.

It is anticipated that the methodology will adhere to established practice in relation to Seascape and Visual Impact Assessment, which takes account of cumulative effects (e.g. DTI, 2005; Scottish Natural Heritage, 2005).

5.3.11 Archaeology and Cultural Heritage

Cultural heritage and archaeological remains are located on and below the seabed. Archaeological remains that are protected include wrecks and wreckage of historical, archaeological or artistic importance designated as protected or dangerous under the Protection of Wrecks Act (1973), military remains designated under the Protection of Military Remains Act (1986) and Scheduled Monuments designated under the Ancient Monuments and Archaeology Act (1979). It is an offence to cause damage to protected archaeological remains and in some cases where a restricted zone exists around the remains, a licence is required before any works or salvage can be undertaken within this zone. Restricted zones can vary in diameter. Obstructions and foul ground areas can also represent wrecks but have not been classified as such because they have not been fully investigated.

It is acknowledged that the seas around Britain contain many archaeological sites and remains. Such sites reflect the changing nature of both the coastline around Britain and the activities of the country throughout previous centuries, and broadly include:

- Archaeological landscapes formed when parts of the UK seas were still dry land;
- Remains and sites, including but not limited to shipwrecks, evidence of Britain's early history; and
- More recent sites, reflecting Britain's role as a major naval, mercantile, industrial and imperial power.

Baseline Environment

A search was undertaken by the UKHO, which identified 18 wrecks within and in the vicinity of the proposed Inch Cape offshore wind farm (see Figure 5-13, Table 5-16). None of the wrecks identified are currently protected wrecks, known to be of archaeological significance or designated as War Graves. However, wrecks can be classified within the lifetime of a project.

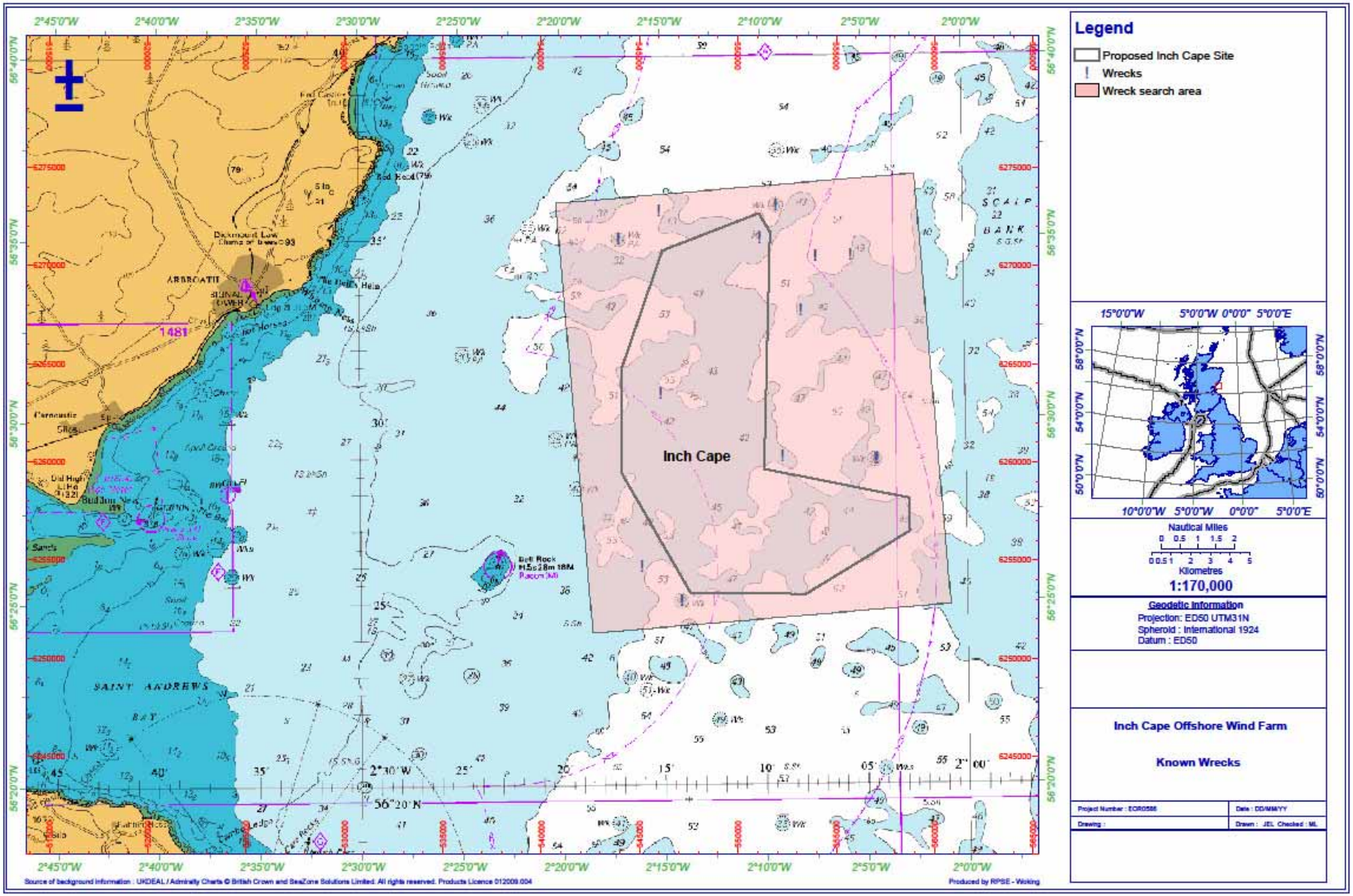


Figure 5-13: Wrecks identified within the vicinity of the Inch Cape site

Table 5-16: Wrecks identified within the search area

Wreck ID number	Wreck Name	General depth	Classification	Status description
71168	Unknown	48 m	Non-dangerous	Remains of wreck in two parts
3025	Bay Fisher	48 m	Non-dangerous	Degraded wreck
3139	Valhallah	47 m	Non-dangerous	Intact wreck
3041	Unknown	56 m	Non-dangerous	Large wreck in a highly degraded state. Scour runs from the south-east end
70435	Unknown	56 m	Non-dangerous	Intact wreck. Scour at bow and stern.
3115	Aurora	46 m	Non-dangerous	Intact wreck
71165	Unknown	47 m	Non-dangerous	Small, broken wreck partially buried at northern end
3033	Unknown	51 m	Non-dangerous	Degraded wreck with scour
3027	Grenmar (possibly)	53 m	Non-dangerous	Highly degraded and in two parts
3003	Unknown	56 m	Non-dangerous	Intact wreck
3040	Primrose	44 m	Non-dangerous	Not available
3037	HMS Braconburn	36 m	Undefined	Not available
3036	Unknown	51 m	Undefined	Not available
3034	Unknown	48 m	Undefined	Not available
3028	Grenmar	45 m	Non-dangerous	Not available
3141	Unknown	48 m	Foul ground	Possibly trawl gear or aircraft
3007	Unknown	48 m	Undefined	Not available
3002	Unknown	51 m	Undefined	Not available

Fleming (2004) stated that it was difficult to predict the potential for pre-historic remains within the central North Sea, but there was a low probability of finding in situ remains in the offshore environment because of the strong currents, exposure to North Atlantic storms, thin sediment cover and large areas of exposed bedrock in this area. The probability of finding remains within the region was greater in more sheltered coastal areas. However, there has not been a detailed study of the proposed Inch Cape site.

Unexploded Ordnance

Due to historic practices of inaccurate ammunition dumping there is a risk of potentially hazardous unexploded ordnance (UXO) being present within the proposed Inch Cape area (Senergy, 2009).

A search of the Mine Warfare Data Centre (MWDC) highlighted that the site is approximately 16 nm from the World War 2 east coast mine barrier and approximately 13 nm from a World War 1 mine lay. However, MWDC could not guarantee that there will be no unexploded ordnance present within the proposed Inch Cape area for a number of reasons:

The MWDC has no records of where German offensive mines may have been laid, however the following considerations will be made in the EIA:

- Currents/tidal streams can cause mines to migrate along seabed;
- There is uncertainty whether the MWDC has a complete set of mining publications and charts;
- UXO brought to the surface in fishing nets may have been dropped back in the water at a different location; and
- RAF bombers sometimes have to jettison offensive mines during emergencies at unrecorded locations.

Data Gaps

There is a lack of site-specific survey data and it is therefore anticipated that such data will be required to inform the environmental impact assessment.

Environmental Impacts Scoping

Based on available literature, the following are perceived to be the potential impacts on the archaeology and cultural heritage as a result of wind farms within the marine environment:

Impact Description	**Potential site specific impact**	**Potential cumulative and/or in-combination Impact**
Contamination, damage or loss of archaeological remains in or on the seabed	✓	x
De-stabilisation of sites through changed sedimentary regimes	✓	x
UXO	✓	x

There are a number of shipwrecks located across the study area; none of those within or immediately adjacent to the STW sites are protected. Turbine and cable placement would seek to avoid any features of historical interest on the seabed and it is expected that the chance of accidental disturbance of features will be minimal. During operation impacts will be limited to potential indirect effects associated with altered patters of seabed sediment erosion and accretion. Therefore, the potential for cumulative and in-combination impacts on archaeology and cultural heritage are scoped out.

Site-specific Impact Assessment Methodology

For each of the potential impacts described above a survey or study and method of impact assessment is described in the tables below.

Potential Impact(s)	**Contamination, damage or loss of archaeological remains in or on the seabed**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts on existing archaeological remains, the following studies will be undertaken: • Assessment of archaeological potential and significance • Geophysical survey (see section 5.1.4)
Method of Impact Assessment	The assessment of archaeological potential and significance will be used to identify the potential archaeological remains within the area and their importance. The potential for impact upon these features will be assessed using a risk assessment of the direct impacts of turbine location and construction methods.

Potential Impact(s)	**Destabilisation of sites through changed sedimentary processes**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts on existing archaeological remains, the following studies will be undertaken: • Assessment of archaeological potential and significance • Geophysical survey (see section 5.1.4) • Metocean studies (see section 5.1.3)
Method of Impact Assessment	The assessment of archaeological potential and significance will be used to identify the potential archaeological remains within the area and their importance. The potential for impact upon these features will be assessed in relation to the results of the potential for changes in the sediment transport regime (e.g. the potential to cause burial or exposure of features).

Potential Impact(s)	**Unexploded ordnance**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts to unexploded ordnance and information systems, the following study will be undertaken: • Magnetometer survey (see Section 5.1.4 Geophysical surveys)

Method of Impact Assessment	A magnetometer survey will be used to identify any unexploded ordnance or suspicious objects within the proposed wind farm site. This information will be used to develop a plan for safe disposal of ordnance or other mitigation measures as necessary.

Site-specific Survey Methodology

Best Practice Guidance

The scope will follow the non-statutory *Code of Practice for Seabed Developers* produced by the Joint Nautical Archaeology Policy Committee, and, where applicable, following the following guidance and legislation:

- Article 303 of the United Nations Convention on the Law of the Sea (UNCLOS);
- Article 2.ii. The European Convention on the Protection of the Archaeological Heritage (revised) (The Valetta Convention);
- Planning Advice Note 42 "Advice on the handling of archaeological matters within the planning process";
- Scottish Planning Policy 23 "Planning and the Historic Environment";
- Protection of Wrecks Act 1973;
- The Ancient Monuments and Archaeological Areas Act 1979;
- Protection of Military Remains Act 1986;
- The Merchant Shipping Act 1995;
- Historic Scotland Archaeological Procedure, Paper 4, 1996;
- BMAPA & English Heritage (2003). Marine Aggregate Dredging and the Historic Environment: Guidance Note; and
- Wessex Archaeology Limited (2007). Historic environment guidance for the offshore renewable energy sector.

Summary of Methodology

Archaeological Potential and Significance

The assessment would include collation of existing documentary evidence from a variety of sources in order to predict the likely character and extent of archaeological remains at the site. The desk-study would be supplemented by assessments of field data collected as part of the geophysical survey campaign, grab samples and geotechnical cores (if cores become available during the EIA process). For instance, review of swathe bathymetry, side-scan sonar and sub-bottom profiling can be used to identify features of archaeological relevance, such as river valleys or beaches (Fleming, 2004). The analysis of grab and if available, core samples, also allows an assessment of the potential for submerged landscapes through sedimentary facies and human activity.

It should be noted that if any offshore wreck material is recovered, the developer will inform the Receiver of Wreck under Section 236 of The Merchant Shipping Act 1995, and await further instruction.

Other Surveys/Studies

Geophysical, geotechnical and metocean surveys are described in sections 5.1.2 and 5.1.4.

5.3.12 Marine Recreation and Amenity

Baseline Environment

SNH commissioned a review of marine and coastal recreation in Scotland (Land Use Consultants, 2007). The review indicates that the most popular specialist activities on the Scottish coastline are walking, sea fishing, shoreline fishing, sailing, kayaking and canoeing, and wildlife and bird watching. Coastal golf courses are also popular sites for recreation. Based on analysis of the number of trips made by visitors, it is apparent that the Firths of Forth and Tay are particularly important for recreation.

In the coastal waters of the Firths, bird and wildlife watching are popular with boat trips running visitors to the Isle of May, Inchcolm Island, Bass Rock and other locations. Further offshore, in the vicinity of the proposed Inch Cape site, recreation is minimal. There is one medium-use sailing route (i.e. popular routes on which some recreational craft will be seen at most times during summer daylight hours) which passes to the west of the proposed site (Figure 5-14).

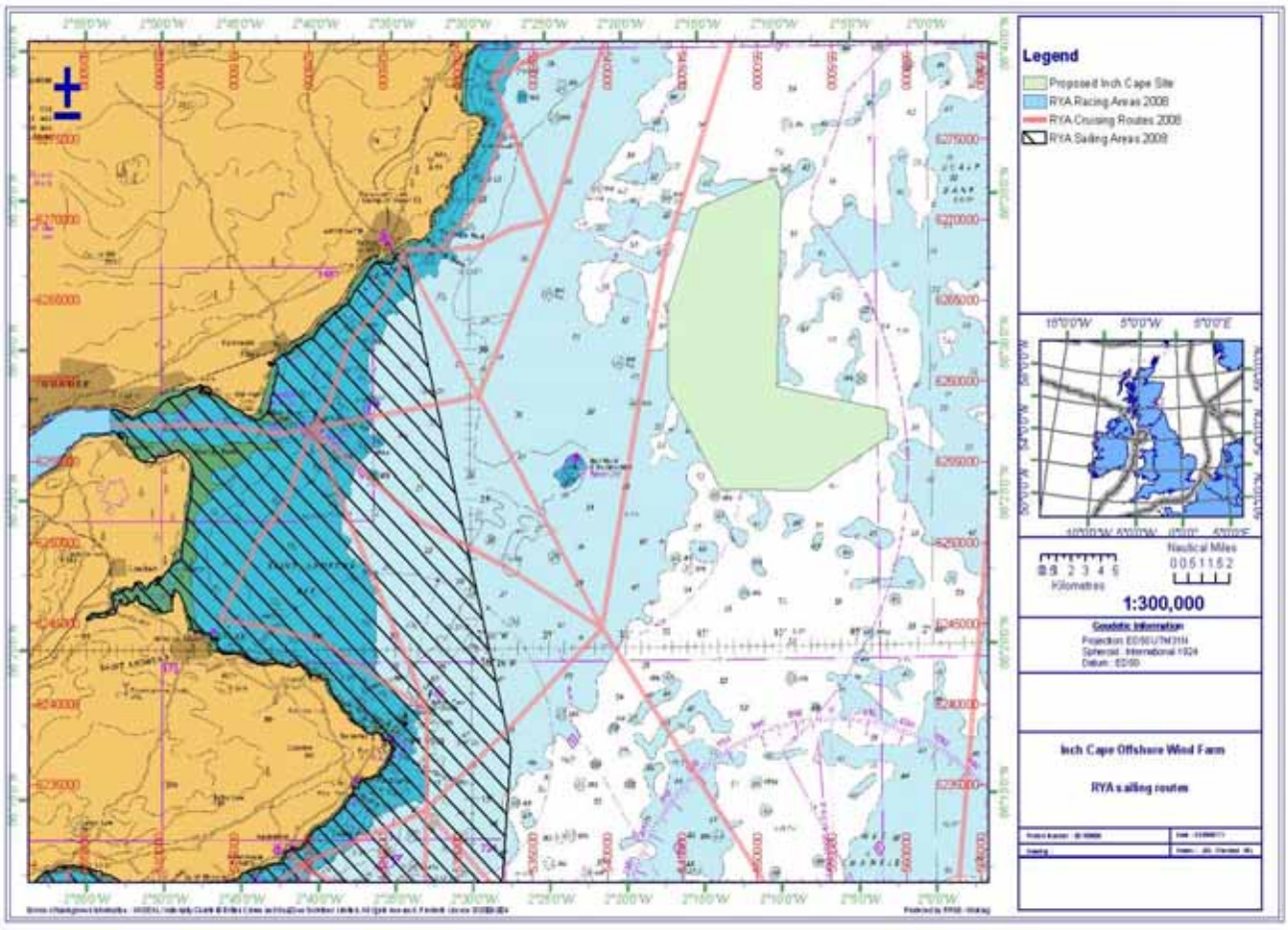


Figure 5-14: Sailing routes in proximity to the Inch Cape site

A number of dive sites offer abundant marine life and are suitable for novice to experienced divers. Some sites include Bass Rock, Fidra, Lamb Island, Craigleith Island and the Isle of May. There are ten popular wreck sites which include the Avondale Park and the Sneland 1, the two last ships to be sunk in WWII and U-Boat 77 a virtually intact WWI submarine. These dive sites are generally within inshore sites and no records of dive sites within the Inch Cape site were sourced. Although there are a number of charted wrecks that lie within and in proximity to the proposed site (section 5.3.11), but their depth will put them beyond the reach of many recreational divers. It may be expected that some recreational sea angling may take place within the study area (section 5.3.1).

Data Gaps

There is a lack of site-specific data and it is anticipated that such information will be collected through consultation with local recreation groups.

Environmental Impacts Scoping

Based on available literature, the following are perceived to be the potential impacts on marine recreation and amenity as a result of wind farms within the marine environment:

Impact Description	Potential site specific impact	Potential cumulative and/or in-combination Impact
Disturbance and/or loss of sites	✓	x
Impacts to safety	✓	x

Impacts on tourism and recreational activities will result from temporary disruption caused by construction activities. The limited seaborne activity, primarily sailing, will experience temporary disruption during the offshore works, while coastal activities may be affected by highly localised disruption at cable landfall and substation locations. In addition, the minimum safe (air) clearances between sea level conditions at mean high water springs (MHWS) and wind turbine rotors should be suitable for the vessels types identified in a traffic survey but generally should not be less than 22 metres (RYA, 2005). Given the minimal nature of effects offshore and the localised nature of effects at the coast, the potential for in-combination and cumulative impacts are scoped out.

Secondary effects on tourism and recreation associated with seascape, landscape and visual character, and socio-economics, will be addressed under those topic headings.

Site- specific Impact Assessment Methodology

For each of the potential impacts described above a survey or study and method of impact assessment is described in the tables below.

Potential Impact(s)	**Disturbance and/or loss of sites**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts on recreational sites, the following studies will be undertaken: • Assessment of offshore recreational activities
Method of Impact Assessment	The assessment will be used to determine the use of the proposed Inch Cape site in relation to recreation and amenity. The proposed engineering design, construction methodologies and operational procedures of the wind farm will be used to determine the potential for impact upon the receptors.

Potential Impact(s)	**Impact on navigational safety**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts to navigational safety, the following study will be undertaken: • Navigational risk assessment (see section 5.3.2)
Method of Impact Assessment	A navigational risk assessment will assess the risk associated with ship to ship collision, vessel grounding, collision with wind turbine array infrastructure and the potential impact on communication systems.

Site-specific Survey Methodology

Best Practice Guidance

There is currently no best practice guidance associated with the assessment of impacts on offshore recreational activities.

Summary of Methodologies

Assessment of Offshore Recreational Activities

The use of the offshore environment around the Inch Cape site will be determined through consultation with relevant stakeholder groups, such as the Royal Yachting Association, local clubs, societies and councils.

Other Surveys/Studies

Navigation risk assessment is described in section 5.3.2.

5.3.13 Socio-economics

Baseline Environment

Much of the open coastline between Aberdeen and Eyemouth is relatively sparsely populated although the Firths of Forth and Tay support major population centres (Edinburgh and Dundee respectively). Industries such as agriculture, fishing and construction have traditionally been important in the Fife and Angus regions. Engineering, new technology and tourism industries have replaced declining traditional industries.

Regional statistics published by VisitScotland indicate that during 2008 UK residents took 0.55 m tourist trips to Fife, resulting in a spend of £98 m in the area. Overseas visitor trip numbers totalled 0.14 m with an associated spend of £85 m. In Angus and Dundee trips by UK visitors reached 0.42 m and trips by overseas visitors numbered 0.09 m, resulting in spends of £71 m and £34 m respectively. The importance of tourism to these two regions is demonstrated by the proportions of local employment associated with the tourism sector; 9.2% of employment is accounted for by tourism in Fife, and 8.7% in Angus and Dundee. The coastlines and historical towns and villages of Fife and Angus are to a large extent the foundation of the local tourism, leisure and recreation industries, and the most-visited tourist attractions in these regions are all located on the coastal fringe.

In theory, the development of offshore infrastructure can have an impact on the local economy through local spend, use of services and good and employment. The economic impact will be most significant during the construction phase and given current programming for the development of sites, the impact will be spread over many years, and will conceivably extend up to 2020 and beyond. As a rule of thumb it is considered that for every megawatt installed, approximately £1 million of economic expenditure occurs (DTI, 2002). As well as economic benefits, wider beneficial effects will arise through the development of renewable energy, and will include reduced greenhouse gas emissions, energy consumption and education opportunities.

It is possible that specific sectors, such as commercial fisheries and tourism, will have concerns regarding the knock-on economic effects of wind farm development, resulting from, for example, restricted access to fishing grounds or altered visual character.

Data Gaps

It is considered that local, regional and national Government and other relevant stakeholder groups hold sufficient data for the region and that further data collection will not be required.

Environmental Impacts Scoping

Based on available literature, the following are perceived to be the potential impacts on marine recreation and amenity as a result of wind farms within the marine environment:

Impact Description	Potential site specific impact	Potential cumulative and/or in-combination Impact
Changes to local employment opportunities	✓	✓
Changes to expenditure within the local economy associated with goods and services	✓	✓
Impacts on economics of other marine users (e.g. fisheries or tourism/recreation)	✓	✓
Impacts on educational opportunities	✓	✓

Site-specific Impact Assessment Methodology

For each of the potential impacts described above a survey or study and method of impact assessment is described in the table below.

Potential Impact(s)	**Changes in expenditure within the local economy** **Changes to local employment patterns** **Economic impacts on other marine users** **Impacts on educational opportunities**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts on socio-economic receptors, the following studies will be undertaken: • Review of the regional economy • Review of regional socio-economic strategies • Review of socio-economic impacts associated with offshore wind development
Method of Impact Assessment	A socio-economic, tourism and recreation impact assessment will consider the effects of the proposed development on socio-economic activity, local and regional tourism and recreational marine users during the construction, operation and decommissioning of the proposed offshore wind farm. There are no recognised standards or methodologies for assessing these effects in

	an offshore wind farm EIA to date, however all relevant guidance and existing studies will be used to undertake the assessment. Furthermore, guidance from stakeholders and professional bodies will be drawn upon to inform the socio-economic, tourism and recreation impact assessment.

Site- specific Survey Methodology

Best Practice Guidance

There is currently no best practice guidance associated with the assessment of impacts on socio-economic factors, however the following UK infrastructure guidance should be considered within the assessment:

- Infrastructure UK, Strategy For National Infrastructure, March 2010.

Summary of Methodologies

The key method of assessment will be to undertake a literature review of available information on socio-economic receptors along the east coast of Scotland. This review will be coupled with consultation with relevant stakeholders.

Cumulative and In-combination Impact Assessment & Survey Methodologies

The methodologies and potential survey requirements by which cumulative effects will be assessed will be agreed with consultees as part of a future scoping exercise undertaken by the FTOWDG.

It is likely that assessment of effects will be undertaken on a site-specific basis and based on a review of available literature relating to the socio-economic effects of offshore wind farm development. It is anticipated that the developers will subsequently share information to enable an informed assessment of cumulative effects within their EIAs.

5.3.14 Offshore Wind Farms

Baseline Environment

There are no existing offshore wind farms within the study area, though four STW sites are proposed with a total capacity of approximately 2,380 MW. At present The Crown Estate has awarded STW developers exclusivity agreements, which enable the developer to explore the potential of the sites for offshore wind. Granting of a seabed lease, which will allow wind farm construction to proceed, will be subject to the outcome of a SEA for offshore wind that is expected to be completed during 2010, and subject to other statutory consents being obtained by developers.

Seaward of the STW sites is the Firth of Forth Round 3 Zone, which covers 2,859 km^2. Developers submitted applications for Round 3 Zones in March 2009 and successful bidders will be announced in 20010. The Firth of Forth Round 3 zone will be awarded to a single organisation or consortium and it is expected that development of the zone would involve the construction of several wind farm sites within the zone boundaries, with a potential capacity of up to 4,000 MW.

To the north of the study area there are operational and proposed offshore wind farm sites off Aberdeen and further north in the Moray Firth, and to the south off the north-east coast of England,

is Blyth offshore wind farm. Table 5-17 lists the existing and proposed offshore wind farms along the east coast of Scotland and the north-east coast of England.

Table 5-17: Existing and proposed offshore wind farms

Project	Description	Location	Status
Inch Cape	Installation of approx. 181 wind turbines, with approx. capacity 905 MW	Approx. 15.5 km east of the Angus coastline	Application for consent expected 2011 earliest
Neart na Gaoithe	Approx. capacity 420 MW	Approx. 15 km east of Fife Ness on the Fife coastline	Application for consent expected 2011 earliest
Forth Array	Approx. capacity 415 MW	Approx. 17 km east of St Abbs on the Northumberland coastline	Application for consent expected 2011 earliest
Firth of Forth Round 3 Zone	Approx. capacity 2,500MW	Outside of the 12 nm territorial waters limit, east of the Firth of Forth	Application for consent expected 2013 earliest
Beatrice	Approx. capacity 920 MW	Outer Moray Firth	Application for consent expected 2011 earliest
Moray Firth Round 3 Zone	To be confirmed	Outer Moray Firth	Application for consent expected 2013 earliest
Beatrice Demonstrator Project	2 turbines with max. capacity 10 MW	Outer Moray Firth	Operational since 2006
Aberdeen Offshore Wind Farm	5 turbines, approx. capacity 115 MW	1.5 – 5 km east of the Aberdeen coastline	Site not yet awarded
Blyth Offshore Wind Farm	2 turbines with max. capacity 3.8MW	1 km off Blyth Harbour, north-east England	Operational since 2000

Environmental Impacts Scoping

Cumulative impacts associated with the development of other wind farms are discussed in the above sections.

5.4 Structure of EIA

The Environmental Statement is likely to be presented in two volumes.

Non-Technical Summary

Volume 1: Environmental Impact Assessment

Chapters could be formed as follows:

Chapter 1 – Introduction (including definition of study area)

Chapter 2 – Legal and Policy Framework

Chapter 3 – Approach to EIA (including outline of EIA process and stakeholder engagement)

Chapter 4 – Site Selection and Consideration of Alternatives (including statement of need)

Chapter 5 – Project Description

Chapter 6 – Physical Impact Assessment

- Metocean and coastal processes

Chapter 7 – Biological Impact Assessment

- Marine Ecology
- Fish and Shellfish
- Marine Mammals
- Ornithology
- Designated Sites (including summary of data collected for Appropriate Assessment)
- Underwater noise

Chapter 8 – Human Impact Assessment

- Commercial Fisheries
- Commercial Navigation
- Civil Aviation
- Ministry of Defence
- Telecommunications
- Seascape, Landscape and Visuals
- Archaeology & Cultural Heritage
- Marine Recreation & Amenity
- Socio-economics

Chapter 9 – Evaluation of Environmental Effects, Proposed Mitigation and Monitoring

Chapter 10 – References

Volume 2: Technical Appendices

6. Scoping Consultation

SERL is seeking comments from stakeholders on the proposed EIA methodologies presented in this report.

The Scoping Report and Non-Technical Summary are also available at www.inchcapewind.com

The consultation period runs from 31 August to 30 November 2010. Please direct all inquiries and feedback to the Inch Cape Project Team:

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