Kincardine Floating Offshore Wind Demonstrator Project

Habitats Regulations Appraisal - Information to inform an Appropriate Assessment

Kincardine Offshore Windfarm Limited

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Plan Design Enable

Notice

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1. Introduction

Kincardine Offshore Windfarm Limited (KOWL) is a proposed demonstrator floating offshore windfarm development that is located to the south east of Aberdeen, approximately eight miles from the Scottish coastline. The development is considered a commercial demonstrator site, which will utilise floating semi-submersible technology to install approximately eight wind turbine generators (WTG) in approximately 60 to 80 m of water.

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

In Scotland, the Habitats Directive is implemented in inshore and offshore waters through the following legislation:

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

The regulations are collectively termed the Habitats Regulations for inshore waters and Offshore Marine Regulations (OMR) for offshore waters and give protection to SACs and SPAs.

Where a plan or project may affect a Natura site (whether the plan or project is in, adjacent to the site, or regardless of location), the Habitats Regulations require the competent authority to undertake a Habitats Regulations Appraisal (HRA). HRA includes an Appropriate Assessment which is required when a plan or project affecting a Natura site:

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

This applies to any plan or project which has the potential to affect a Natura site, no matter how far away from that site[1].

In Scotland, the Scottish Planning Policy document [2] states that Ramsar sites designated under the Ramsar Convention (The Convention on Wetlands (Ramsar, Iran, 1971)) are also Natura sites and protected under the same statutory regimes. However, where the interests of Ramsar sites correspond with overlapping SACs and SPAs there is no need to consider them separately. Sites protected either by law under the Habitats Regulations/OMR or by Government policy are referred to throughout the HRA process as European sites. Candidate SACs (cSACs), potential SPAs (pSPAs) and Sites of Community Interest (SCIs) are also considered in this process.

The 'plan or project' in this case is the proposed Kincardine Offshore Windfarm which will require an Appropriate Assessment prior to Marine Scotland issuing a Marine License and s36 consent if it is considered that there is potential for the project to adversely affect the conservation objectives of any of the European sites designated along the east coast of Scotland. The assessment will include considerations as to the likely impact of the Project either alone or in combination with other offshore wind developments.

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

[2] Scottish Government 2010a

HRA is a separate requirement from EIA due to the specific assessment needs for projects that may affect European sites. Although both may be informed by the same information, more detailed survey work may be required to conduct the assessment and provide the confidence levels necessary to satisfy the Natura Tests contained in Articles 6(3) and 6(4) of the Habitats Directive, but it is currently expected that the current aerial survey will obtain sufficient onsite data to undertake an appropriate assessment as per the Habitats Directive.

Baseline studies will give particular emphasis to gathering detailed information on the SPA and SAC qualifying species that utilise the development site. These species are identified in ***Section 6.2*** and survey methodologies and potential impacts that could be experienced are covered in detail in ***Appendix A*** of this document. It is considered that birds and marine mammals are the key species potentially requiring Appropriate Assessment at this stage in the EIA process. Marine Scotland has recently undertaken a series of benthic surveys of the site as part of their ongoing support of the offshore renewable sector within the Scottish territorial waters. It is believed that this survey is sufficient to undertake an appropriate benthic/sea bed assessment of the site due to the limited impact this project has on the sea bed (no piling required).

1.1. Approach to Undertaking a HRA

Stage 1 – Initial assessment

As part of the initial stage of the HRA process an assessment should be undertaken of whether a HRA should be carried out in relation to the project. The project size, its location relative to SPA and SACs along the eastern coast of Scotland and the possible impact that a development could have on nature conservation means that a HRA will be required as part of the project consenting process. This initial assessment has been undertaken by The Crown Estate as part of their leasing agreement with KOWL and this will be incorporated into the following stage of assessment.

Stage 2 – HRA Screening

This document represents the initial screening assessment for the Project following the completion of the initial year of aerial surveys at the site. These results will be used as part of this screening stage and in conjunction with associated data collected as part of the desk study, to assess what elements can be scoped out (see ***Section 6*** below) prior to undertaking Stage 3 (Appropriate Assessment). KOWL will seek advice from the appropriate bodies (including MS-LOT, SNH and JNCC) following the application of the SNH guidelines on the HRA process [3] to this screening stage. This will aim to allow a more rapid assessment by the appropriate authority (MS-LOT) for this project.

Stage 3 – Appropriate Assessment – this document

This stage will be undertaken by the appropriate authority (MS-LOT) and with advice from SNH, will assess whether the project has addressed all the adverse effects the development could have on conservation objectives of the site. To allow MS-LOT to undertake this assessment, the following information will be provided by KOWL:

- Identification of the area of the development and the possible receptors for the area (aerial data to be used to confirm bird and marine mammal activity at site);
- Identification of the possible impacts the development could have on birds e.g. collision risk, possible disturbance and displacement;
- Identification of key species (from aerial survey data) that could be impacted by the development in a regional setting;
- Identification of key onsite activities associated with the project development (construction, O&M and decommissioning);
- Identification of seasonal variations in designated features at the site;
- Assess whether the impact from development would have an adverse impact on the interest features of European sites in the region.

[3] SNH 2012 Habitats regulations Appraisal of Plans – Guidance for Plan Making Bodies in Scotland Version 2.

2. The Proposed Scheme

2.1. Background

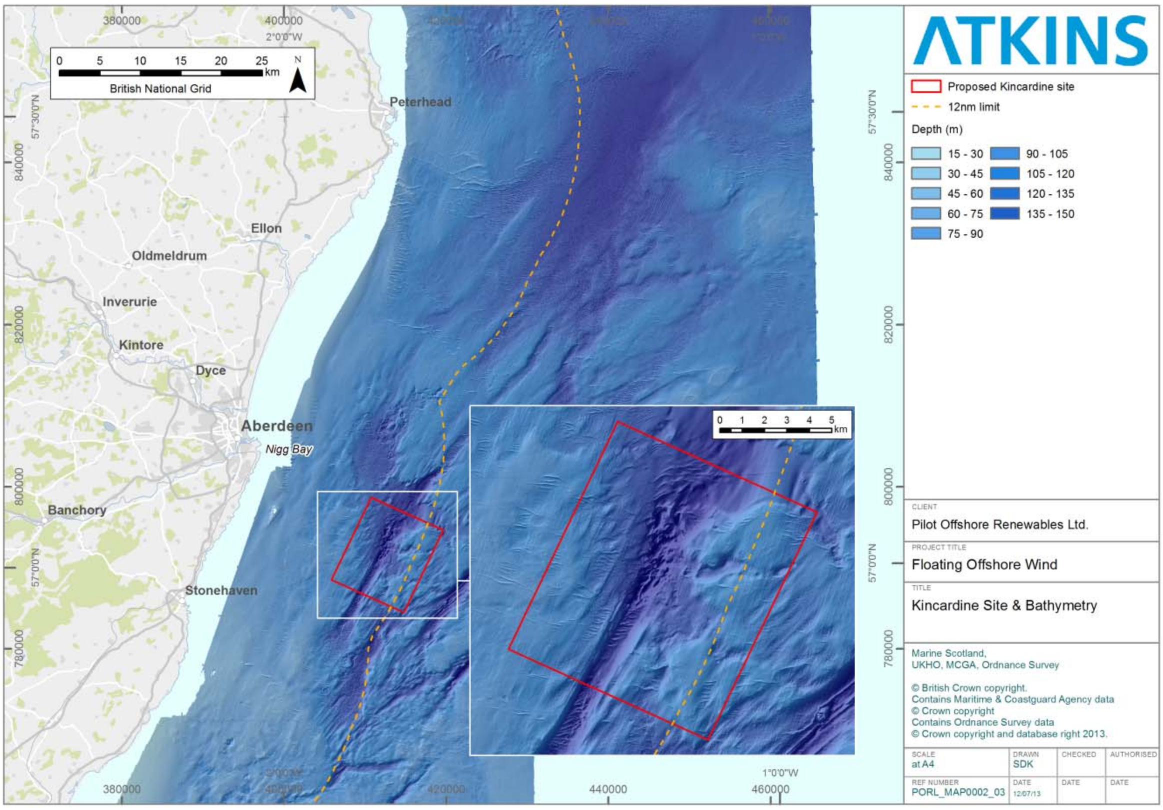
An EIA scoping report was submitted to Marine Scotland and Scottish Natural Heritage in April 2014 and a request was made for a scoping opinion under the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000. In their response dated 9th June 2014 Scottish Natural Heritage outlined in Appendices D and E[4], advice on undertaking the Habitats Regulations Appraisal (see ***Appendix B*** below). This advice has been followed in the production of this HRA screening document.

2.2. Site Location

The proposed site (***Figure 2-1***) is located south-east of Aberdeen and provides suitable water depth for a floating offshore wind demonstrator development. Grid connection and capacity was also available at this location (Redmoss substation) at a limited cost impact to the environment and the project. Therefore this site was selected for the purposes of this project and it will be referred to as the Kincardine Offshore Windfarm 'development'.

The development overlaps with the eastern half of site NE3, but the site boundaries have been slightly modified by the current project developers to move slightly south-eastwards and also over the 12 nautical mile limit to the west to allow greater flexibility in locating the floating offshore turbines and the substructure type during the initial concept development. This allows the project to take greater advantage of the area of deep water known on some charts as the "Dog Hole", if Spar-buoy technology was selected for the site. The site is rectangular with a width of 9.8 km and a length of 11.3 km (5.2 by 6.1 nm), representing an area of 110 km^2. The boundaries of the site are located approximately 15 km (8.1 nm) from the Kincardine coast at its closest point, shown in ***Figure 2-1***.

Figure 2-1 The Kincardine Offshore Windfarm site (red box)



[4] http://www.scotland.gov.uk/Resource/0045/00457478.pdf

Key advantages for the site:

- The water depths at the site are suitable for deployment of floating wind turbine substructures fitted with the next generation large-scale turbines (6MW and larger).
- The location is representative of typical operating conditions for offshore wind turbines in the UK and northern Europe, thus representing an attractive test site for manufacturers wanting to demonstrate their technology.
- The Regional Locational Guidance (RLG[5]) indicated that the site has an average depth of 87 m; and
- A mean annual wind speed of 9.33 ms^{-1}, ranging from 7.3 ms^{-1} in summer to a mean of 11.3 ms^{-1} in winter.
- Wave significant height at the site has a mean annual height of 1.54 m, a summer mean significant height of 1.05 m and a winter mean significant height of 1.94 m.
- The RLG suggested that connectivity options are numerous with electrical substations available in the vicinity of Aberdeen city. The closest (at Redmoss, near Altens) is at approximately 17 km (9.2 nm) from the site with four others between 24-28 km (13 to 15 nm) away; all these run at 132 V. A 275 V substation is situated north west of Aberdeen at approximately 30 km (16.2 nm).
- Fishing activity at the site is very limited, although some scallop dredging occurs at the site according to the 2007-2011 amalgamated fishing intensity data (MS-LOT data).

Furthermore, the site is readily accessible from harbour facilities at Aberdeen and the new development at Nigg Bay, Aberdeen (although the current developing consortium believes that the site could also be readily accessed from other harbour facilities elsewhere on the east coast of Scotland, e.g. Dundee or other deep water berth locations).

The south western section of the site offers a number of significant technical advantages for the location of the Wind Turbine Generators (WTG) to the project and overall development cost and complexity:

- It is closer to shore and grid connection location (no requirement for an offshore substation);
- No cable laying through trench system located in centre of development;
- Uniform sea bed and suitable anchoring location (initial data review);
- Limited impact to fishing industry (chapter 14 KOWL EIA Environment Statement); and
- Outside the 20 km radius of the Dyce Airport radar.

These factors mean that the location of the floating offshore turbines in the south west section of the development area would be the optimum location for the demonstrator site. This location does bring the turbines closer to the shoreline and will therefore be more visible from the Aberdeenshire/Aberdeen coastline.

2.3. Project Schedule

It is planned to have the offshore windfarm fully operational by September 2018. The following are indicative milestones in achieving that target:

- Receipt of Agreement for Lease from The Crown Estate — Q1 2016
- Submission of Consent Application — Q1 2016
- Receipt of Consent to build — Q3 2016
- Final Investment Decision — Q3 2016
- Grid Connection — Q2 2017
- Offshore Construction — Q2/Q3 2017/2018
- Completion of Commissioning — Q3 2018

2.4. Project Overview

There are currently three main potential floating offshore substructure options, Spar, Tension Leg (TLP) and semi-submersible (Chapter 2 KOWL 2015). Of these the semi-submersible has been selected as the preferred option for development due to its suitability for the shallower water depths off the Scottish coast

[5] Marine Scotland Regional Guidance Location – North East Wind 2012
http://www.gov.scot/Topics/marine/marineenergy/Planning/windrlg

(<100 m)) and its proven track record as a prototype design (Windfloat, Portugal). There are a number of floating offshore prototypes in operation currently representing the development profiled for the technology and provides the technology platform for a full scale commercial demonstrator project such as KOWL. The intent is to deploy sufficient WTG's to generate up to 50MW headline capacity, with each unit rated at 6MW or above. These will then be deployed into a pre-installed array with power exported to a grid connection point ashore via two export cables. This demonstrator project aims to demonstrate the commercial viability of floating offshore windfarm developments.

Currently it is envisaged that 6MW WTGs will be used, and therefore, there will be eight substructures deployed, connected by inter-array cables with the resultant power being exported directly to the onshore grid by two export cables. These will then connect into the power grid at Redmoss onshore substation, subject to final agreement with the operator.

KOWL would seek to demonstrate the principal advantage that floating structures bring to the offshore renewable wind industry; the ability to significantly reduce offshore construction activities, by pre-fabricating the sub-structure/WTG assembly in a construction port and utilising pre-installed catenary moorings to maintain the structures in place on location.

Inter array cables will connect the structures within the field, to gather generated power for onward export to shore. There will be no Offshore Substation Platform (due to the distance to shore) and the power will be exported at 33KV down a single or twin export cable(s) from the offshore site to the landing point ashore.

The transmission cables will come ashore via, preferably, directionally drilled conduit(s), for connection to land cable and onward transmission of the power, via an onshore substation, to the grid connection point (see ***Section 3.5***).

The development will be comprised of the following components, each of which will be discussed in turn in the following sections:

1) Turbines (tower, nacelle, rotors and hub)
2) Floating sub-structure (semi-submersible)
3) Anchors and moorings
4) Inter-array electricity cables
5) Export Cables to shore
6) Onshore connection to the Grid connection point at Redmoss (not part of the marine consent application).

Subsequent sections will describe considerations for protection of cables and foundations, potential cable and pipeline crossings as well as factors influencing the layout of turbines within the array.

2.5. Turbines

WTG's are typically three-bladed horizontal-axis type, with yaw-controlled upwind rotors with diameters of 80–130 m. To reduce the cost of energy generated from offshore wind the generation capacity has been rising to above 5MW per unit. With this comes an increase in blade diameter. KOWL are committed to using second generation WTG's on the Kincardine Project with a minimum of 6MW capacity being considered.

The conditions of the Crown Estate leasing round will limit the capacity of the site to 100 MW with a maximum of 14 turbines. KOWL have elected to limit our current request for consent to under 50MW. There are a number of turbines under development by a range of manufacturers in the range of 5 to 10 MW that could be suitable for inclusion in the Kincardine Offshore Windfarm project; however it is expected that 6MW will be used with 8 turbines giving a combined capacity of just over 48 MW.

For illustrative purposes a potential site layout is discussed in ***Section 2.10***, although the final design of the windfarm will depend upon a number of technical, physical, environmental, and economic factors.

The colour of the Kincardine Offshore Windfarm turbines is likely to be matt light grey, similar to other offshore wind turbine developments, unless the Civil Aviation Authority (CAA) or other stakeholders advise differently. The lighting scheme and navigation marks will be designed following consultation with stakeholders.

Table 2-1 Summary of WTG options

Type/option	Possible requirements
WTG Nameplate Capacity	6-8MW*
Development Size	Under 50 MW
WTG Hub Height (to centreline of hub)	100 m (including 12m substructure)
WTG Blade Length (to centreline of hub)	76 m
Effective Tip Height	176 m
Colour	Matt light grey
Navigation Lighting	As required by CAA, MCA etc.

*all parameters would be the same if either 6 or 8 MW turbines were chosen

2.6. Floating sub-structures

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

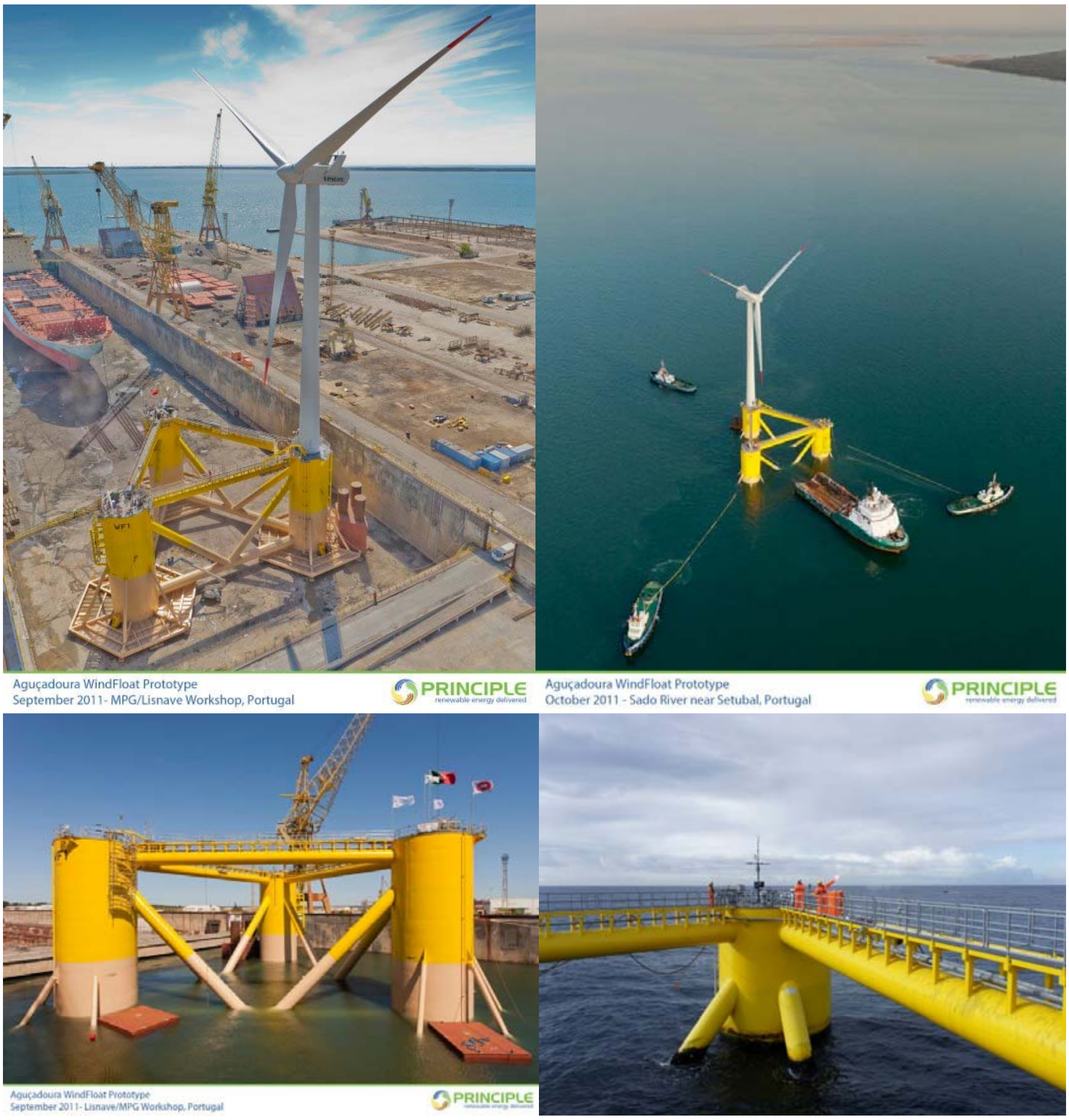
Fixed substructures WTGs are less suitable for deeper waters (>50m), and floating substructures, where water depth presents less of an issue, could be a viable option in water depths exceeding 50m.

In addition to allowing turbines to be installed in deeper waters further from shore, floating structures offer benefits in that their construction is largely yard based, with significantly less offshore construction activity, therefore reducing the impacts of offshore construction and decommissioning, the cost and scheduling uncertainties traditionally associated with more conventional fixed windfarm construction (multiple large construction vessels). The substructure can be constructed and the turbine installed in a dry dock or alongside a deepwater quay location and will undergo full system verifications whilst in port, thus reducing the high costs of assembly and installation at sea. Once the machine is complete it is towed to site where the pre-installed moorings and cables will be connected (up to four anchor points per WTG). The substructure is then fully ballasted (active and static ballast water systems in an enclose system), and power cable head pulled-in and connected to the WTG and the machine commissioned.

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

The Windfloat semi-submersible prototype, designed by Principle Power, was installed and grid connected in October 2011 in the Atlantic Ocean approximately 2.2 nm (4 km) offshore of Aguçadoura, Portugal in approximately 45 m of water. The Windfloat design involves a tri-column triangular platform with the WTG installed on one of the three corners of the platform. The triangular platform is moored using at least four mooring lines, two of which are connected to the column supporting the turbine, thus creating an asymmetric mooring system. The semi-submersible foundation provides improved dynamic stability via a secondary hull-trim system that moves ballast water between each of the three cylindrical columns, allowing the substructure to maintain an even keel without having to de-power the WTG in higher wind speeds or wave heights. Its shallow draft allows for depth-independent siting and wet tow; the turbine and substructure was fully commissioned onshore prior to the unit being towed over 215 nm (400 km) by tugs from the manufacturing site to its deployment location. The prototype in Portugal employs a 2.0 MW wind turbine, and was the first offshore wind turbine to be deployed without the use of any offshore heavy lift vessels.

Figure 2-2 Photos of the Windfloat semi-submersible prototype, designed by Principle Power.



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

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

The WTG will be attached via a transition piece mounted on the upper surface of the substructure. The deck level of the sub-structure will be at approximately 12 m above the waterline, the centreline of the nacelle hub of the WGT will be no higher than 100 m and the tip of the blades at maximum extension, 188 m above the waterline, at high water.

2.6.1. Corrosion, markings and navigational aids

It is likely that the floating sub-structure elements exposed above sea level will be painted yellow to aid marine navigation and this will comply with the Northern Lighthouse Board and MCA requirements for marine navigational safety. The substructures will require protection against corrosion, either via a polyurethane or epoxy coating, and/or the use of sacrificial aluminium anodes. The final design will incorporate recommendations arising from experience of corrosion protection in existing offshore windfarms as well as current industry best practice.

The foundation mounted turbine will be painted a matt light grey as per standard offshore windfarm developments.

Discussions will also be held with MCA and Trinity House to determine the most appropriate markings for the turbines, their lighting and requirements for marking the boundaries of the site as a potential navigation hazard.

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

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

2.7. Anchors and moorings

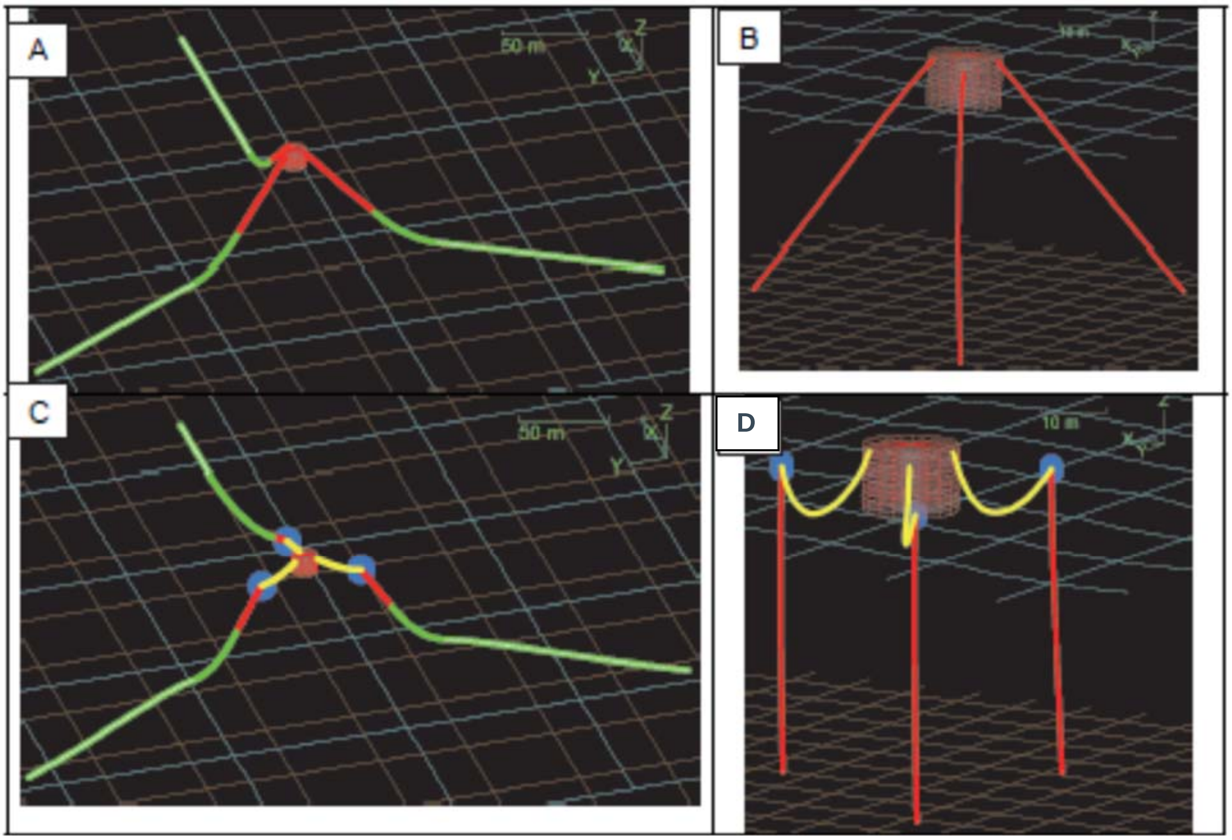
The preferred substructure option identified above will require moorings to anchors on the sea bed to maintain position over the lifetime of the development. The type and number of anchors and moorings employed at the development will depend upon the type of substructure, loads imposed on the mooring system by the substructure/WTG assembly in the metocean conditions prevailing on site, in addition to the geotechnical and environmental considerations. These issues will be closely evaluated in the FEED engineering phase of the project. The significant advantage of floating offshore wind substructures is the reduction, and possible elimination of subsea piling operations, which are known to have an adverse impact upon marine mammals (SNH 2008[6]). Although the development area is not known as an area that has a high population of marine mammals, and indeed the 18 month surveys of the site have encountered very low numbers of marine mammals, it is the intention to develop the project without use of piled anchors systems.

Table 2-3 Summary of mooring system options

Type	Possible requirements
Sub-structure type	Semi-submersible
Number of Mooring lines	4
Mooring type	Catenary Anchor (see ***Figure 2-3*** below)
Anchor Type	Drag embedment anchors, Torpedo Anchors, Gravity Based Anchors
Clump Weights	Steel or reinforced concrete circa 25 tonnes in weight
Mooring lines	Anchor chain, Mooring cables, polyester mooring lines
Pennant Wires/Buoys	Temporary surface buoys during construction
Pennant Wires/Buoys	Permanent submersible buoys at seabed for ROV recovery
Mooring Line Radius	Max Approx 9 x Water Depth Dependent upon configuration and engineering Analysis

[6] SNH Report No. 265 Anthropogenic noise in the Moray Firth SAC; Potential sources and impacts on bottlenose dolphins 2008.

Figure 2-3 Mooring configurations used for the present mooring parameter modelling study. A) Catenary mooring configuration; B) Taut mooring configuration; C) Catenary mooring configuration with accessory buoys; D) Taut mooring configuration with accessory buoys.



2.8. Export and Inter-array cables

Power generated by the individual WTG's will be collected via a series of inter-array cables for export to the onshore grid. The arrangement of the cables, connecting the turbines into an array, is determined by the layout of the windfarm, which is usually optimised for production of power given the prevailing wind direction on site. A priority of the array cabling is to provide redundancy, in the case of cable failure or breakdown, whilst seeking to ensure cable integrity. Further studies (geophysical and geotech) will be required to optimise the cable array once the turbine and foundation type have been confirmed (these will require EPS licences).

Inter array cabling is usually surface laid and, where required, post lay buried to provide protection from external aggression. Given that the development are using floating sub-structures to support the turbines, a focus of the early stage engineering will be ensuring that all inter-array and export cable approaches to the structures are properly addressed to ensure the longevity of the assets. Dynamic cable types have been designed to resist the potential of cables to fatigue under these circumstances but additional work will be required once the array and foundation type has been confirmed. The assessment of possible post lay burial/protection will be undertaken following a review of the site layout and mooring design for the floating structures as part of the environmental impact, including a review of navigational safety at site with the mooring system design selected. The anchoring systems associated with floating offshore structures may require an exclusion zone extending around each WTGand this may result in a fishing exclusion zone that covers most of the development site. It is currently proposed that the inter-array cables are not buried.

The decision to limit the KOWL project to less than 50 MW and the distance to the onshore substation means that the project will not require an offshore substation platform. Power will be gathered at 33 KV, via the inter array cabling, and then exported to shore via dedicated 33 KV export cable(s). At present the development would like to retain the option to install two export cables, as this maintains KOWL's philosophy to provide redundancy in the system. Export cables are often a point of vulnerability for offshore wind as failure in the transmission asset can render the entire farm inoperative. Damage, once in operation, usually arises from external factors originating from fishing operations or vessel anchoring. To overcome this and to provide security during installation cables are usually separated by a distance that is a function of water depth. In the water depths envisaged along the export route from the site to shore we would expect this separation to be a minimum of 100 m, converging locally at the landing point, and diverging at the offshore site to terminate at different substructure locations.

Cable route engineering is very important to ensure the integrity of the export cable systems. Cables need to be routed through areas where there is sufficient sediment to allow for burial, whilst avoiding side slopes and variable seabed conditions. It is usual to lay and bury export cables in a single operation feeding the cable through a cable plough that buries the cable via a depressor into the seabed as the vessel tracks along the defined cable route. Often export cable installation is undertaken from an anchored vessel and therefore the proposed cable separation provides a measure of safety for the second of the two cables installed in parallel routes. The separation also helps ensure that should a cable be caught by fishing or anchor operations during its operation, then only one cable is impacted in any 'damage event'. Cable burial/armouring will be assessed following the completion of the side scan and sub bottom profiling survey work as this will determine the requirements of the export cable route (but is not expected to exceed 10 % of the total export cable length).

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

Table 2-4 Summary of Export Cable options

Type	Possible requirements
Export Cable No.	Max 2
Export Cable Length	Max 15 km ea
Export Cable OD	Max 180 mm
Cable Burial	Target depth 1.5 m
Inter Array Cable	Max 12
Inter Array Cable lengths	Max 2.5 km ea
Inter Array Cable OD	180mm
Cable Burial	None Proposed
Cable Protection (if required)	Localised burial, rockdump or mattressing

Type	Possible requirements
Bend restrictors	Localised as required

2.9. Scour Protection

Marine structures such as fixed turbine foundations, and cables, can be susceptible to erosion, or scouring of the bed sediment in the vicinity of their foundations due to the action of waves, currents and tides. Floating sub-structures, reliant upon a catenary mooring system, reduce interaction with the seabed significantly when compared to traditional turbine foundations and therefore pose a much reduced potential for local scour. In general the potential for scour is dependent on the prevalent sediment type, the variation in sediment type over depth and current velocity. The risk of sediment scour around the anchors for the floating turbines will be assessed as part of the EIA process (Chapter 3).

2.10. Windfarm Layout

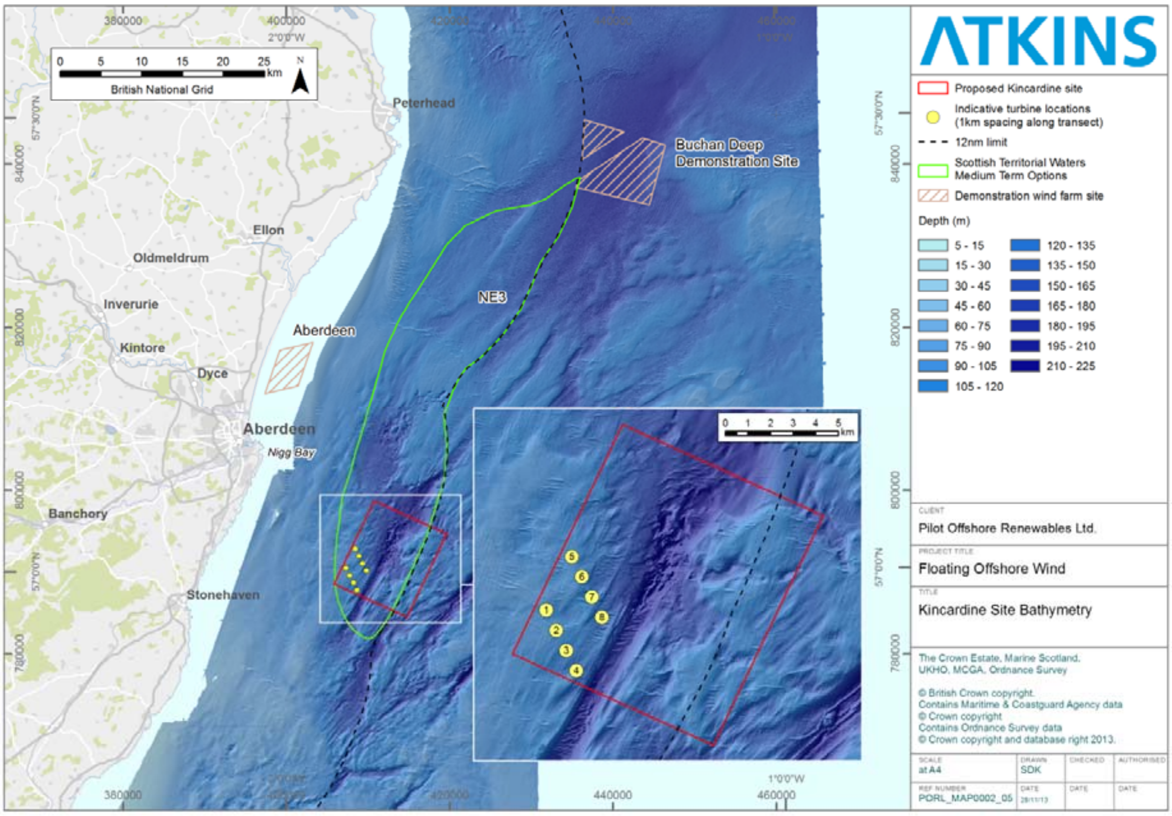
The wind turbines would be placed in a layout which gives the best utilisation of the wind resource available while at the same time offering the most harmonic visual impression, whilst fitting any navigation and environmental constraints. The visual impact for the proposed development is expected to be minimal as the minimum distance to the coastline is 15 kilometres. The final turbine model would not be selected until after all of the statutory consents are in place, however, the turbines would be of one type. They would be three bladed with a horizontal axis nacelle positioned on a floating semi-submersible support.

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

Technical, environmental and human use considerations, determined through the baseline site assessment would guide the final layout of the windfarm components including cable and array design. Results of surveys and consultation may highlight constraints on the site that will influence the overall site layout. In particular, design considerations for the final layout would be influenced by seabed characteristics (avoiding rock where possible), benthic communities, geotechnical conditions, metocean conditions determined through modelling, and foundation and installation options. Constraints highlighted through site studies including designated areas, visual effects, energy yield etc. will also influence final site design.

The preliminary arrangement of the turbines in the Kincardine Offshore Windfarm is given in ***Figure 2-4*** below.

Figure 2-4 Indicative layout of Kincardine Offshore Windfarm turbine array.



2.11. Onshore connection to the Grid connection point

2.11.1. Marine Export Cable Landing Location

The precise location of the landfall for the marine export cables has not yet been finalised (discussions with land owner are ongoing). Further discussions are required to understand the siting of any onshore facilities and the resultant optimal onshore cable routing to the Redmoss substation. The preferred option is to land the cable(s) via horizontal directionally drilled bores that exit off the coast for the marine installation spread to initiate lay and burial operations along the pre-determined route to the offshore site. It is probable that an onshore jointing pit will be constructed at the Export Cable landing to allow jointing of the single or twin marine export cable to a single land cable arrangement for onward connection to the Grid connection point at Redmoss.

2.11.2. Onshore Electrical Facilities

In order to accommodate the power generated by the development into the grid additional electrical infrastructure will be required, including dedicated switchgear and a separate substation between the marine cable landing point and the Grid connection point at Redmoss. The project is in the process of determining a suitable area to house these facilities. Until such time as system studies have been completed the extent of these facilities will be unclear.

2.11.3. Onshore Cable Route

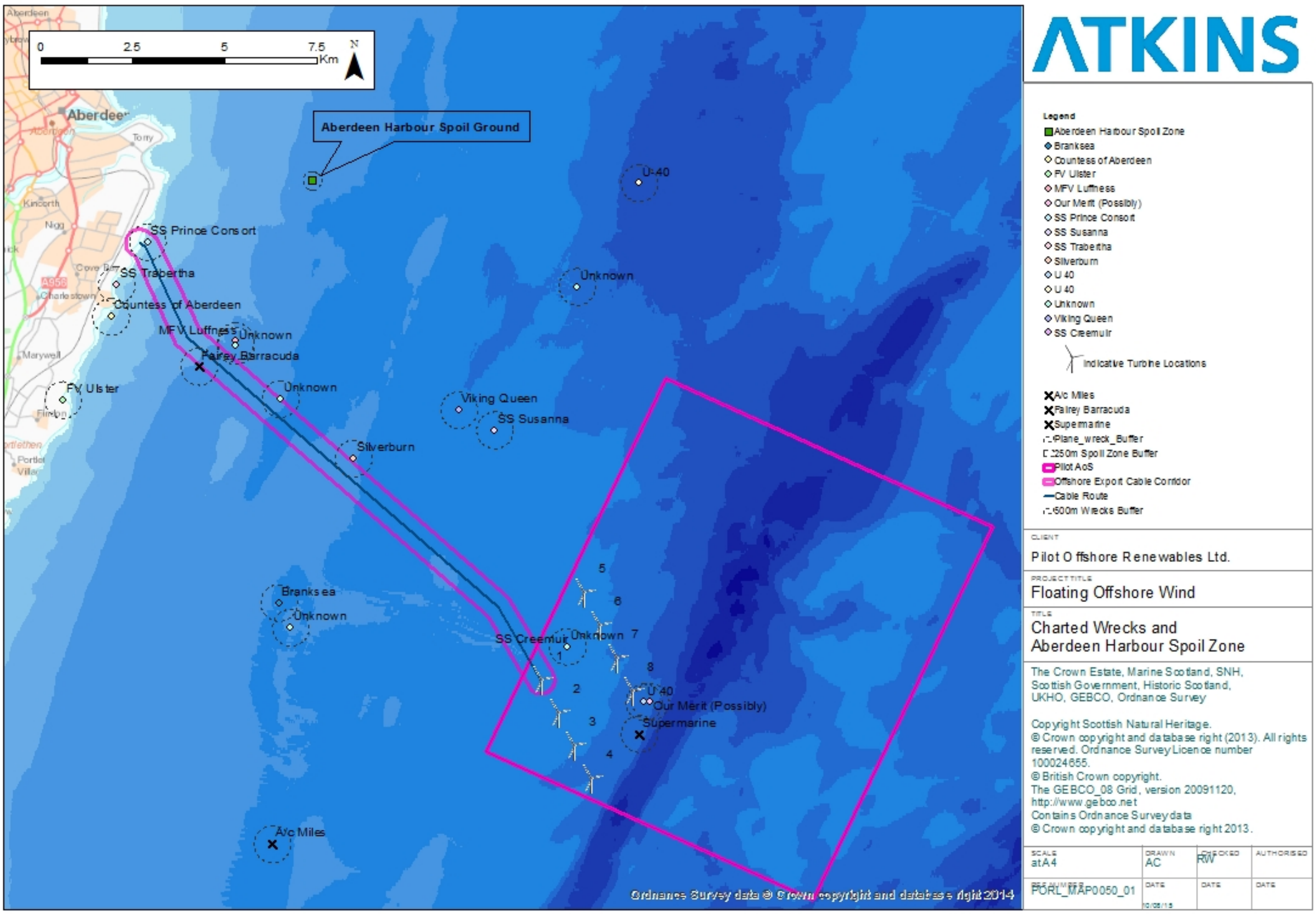
The land cable route will be determined following confirmation of the Grid connection point, the location of the additional electrical facilities and the marine cable landing point. The preferred route would make use of the existing road network in the area. The land cable would be buried using conventional open trench installation techniques. Based on the use of Redmoss as the grid connection point, it is anticipated that the land cable route would be no more than 2km long from the cable joining pit.

3. Grid

3.1. General Description

The site is approximately 17km (9.2 nm) south-east of Aberdeen Figure 3.1, and runs approximately parallel to the adjacent coastline in order to enable orientation of the turbine array against the prevailing wind direction (south westerly). It is approximately 26.5 km (14.3 nm) from the Buchan Deep Demonstrator Site, which is located to the north of the site (***Figure 4.1***).

Figure 3-1 Kincardine Offshore Windfarm bathymetry and cable route



3.2. Inter-array Cable

The wind turbines would be inter-connected by 33kV subsea cables which connect to one or two export cables to transmit the power ashore. Both the inter array and export cables are included as part of the Kincardine Offshore Windfarm development. It is envisaged that an estimated 30 km of inter-array cabling will be required to connect eight turbines (6MW WTGs), although this may vary with the number of turbines installed.

3.3. Potential Cable Crossings

Initial review of the Marine Scotland RLG and UKHO charts indicate that there are no offshore cables or pipelines between the site and the proposed cable landing point (***Figure 3-1***) and therefore it is not likely that cable crossing will be required as part of this demonstrator project. However there is a proposed east coast HVDC connector cable that could be routed over the export cable route, this proposal has not been progressed past initial scoping and is not currently within the planning system.

3.4. Offshore Cables

From the offshore windfarm site to the grid connection point, ownership and installation of the asset will be the responsibility of KOWL as the total MW is below 50MW for the site. The windfarm development would require two offshore export cables connecting to a single onshore export cable for onward transmission to the Grid connection point at Redmoss.

The onshore cable section will be undertaken as part of a separate onshore planning application (Town and County Planning via Aberdeen/Aberdeenshire council. An onshore chapter (16) has been included within the EIA for completeness, but will not be part of the offshore consent application.

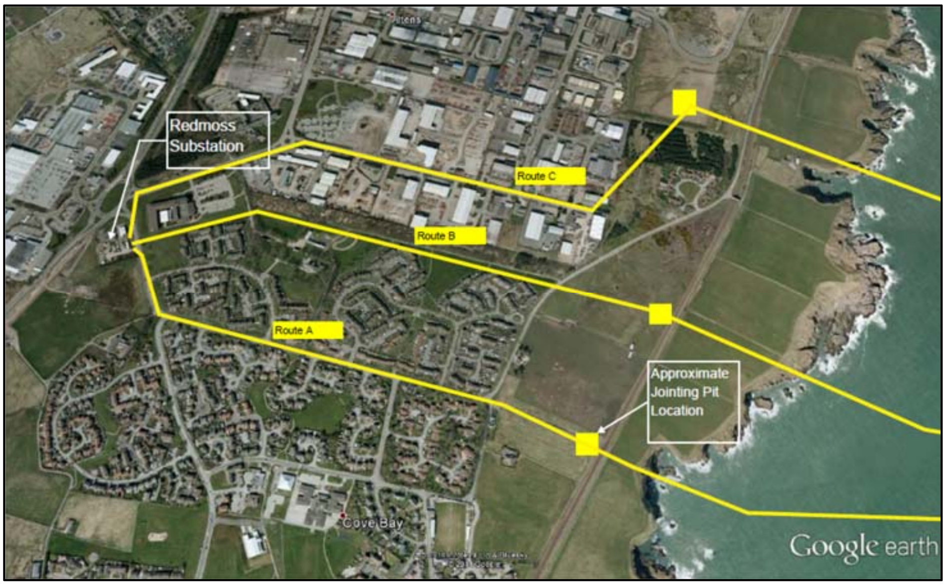
The export cable has been routed to avoid all known wrecks from the UKHO bathymetric chart (chart 0210), any hard rock location (adjacent to Findon Ness) (***Figure 3-1***) and the major sand waves that are evident from the high resolution UKHO bathymetric chart for the area. No sub bottom profiling data is presently available for the area and therefore amendments to the cable route could be required following further investigation to ensure difficult sea bed areas are avoided i.e. hard rock outcrops on the sea bed. Therefore a cable route corridor of 1.5 km has been included as part of the ES to allow changes in the export cable route from the development site to the cable landing location.

3.5. Cable Landfall

Three cable options for the connection of the offshore cable to the Redmoss Substation are shown in ***Figure 3-2***. Option c is currently the preferred option due to the land availability and the route to the substation.

The location of the landfall and connection routes in relation to the designated sites is shown in ***Figure 3-2.***

Figure 3-2 Cable route



Appropriate cable corridor options will be assessed further during the detailed design phase of work. Where the cable comes ashore, detailed surveys of the foreshore landing area will be undertaken to assess the suitability. This element of work will be subject to a separate onshore planning application and will not form part of the marine consent application.

3.6. Grid Connection and Onshore Works

Cable landing and potential grid connection for the development is at Redmoss substation (***Figure 3-3***). Further investigation will be required to determine any issues with regards to sensitivity of this area and access to the landing site. Horizontal directional drilling and a cable pit will be required onshore. The potential environmental impacts of any onshore works will be addressed as part of the Environmental Statement for the project from the landing point to the Redmoss substation (Chapter 16).

3.7. Existing Substation

Connections into the existing SHETL substations would predominantly be via an underground cable. Initial investigations have shown that Redmoss substation could physically accommodate the connection.

Figure 3-3 Redmoss aerial photograph

3.8. Overhead Line Connection

Running south from Aberdeen there is a single circuit overhead line which connects between Craigiebuckler – Fiddes – Bridge of Dun – Arbroath – Teal. This circuit is summer rated at 90MVA. Dependant on running arrangements the offshore generator could connect into this circuit.

A suitable site would need to be investigated for a new substation between Aberdeen and Arbroath. Following initial review of the distribution and transmission networks, a connection to either Redmoss a 132kV substation or to the 132kV overhead line running south from Aberdeen could enable the Kincardine Offshore Windfarm to be connected into the SHETL transmission network (the connection from the development site will be at 33kV).

3.9. Repowering and Decommissioning

If the KOWL obtains sea bed consent, the Crown Estate will award a lease for the site. The length of this lease period is expected to be longer than the expected design life of current offshore wind turbine technology. It is possible that a programme of 'repowering' could be considered during the course of the lease, but this will require additional consent from the Crown Estate and will be at their sole discretion. The grid infrastructure has a design life in excess of the forty year lease and, therefore, would plan to reuse the existing intra-array and grid connection cables, subject to their suitability for any replacement turbine technology.

At the end of the lease for the development, the grid infrastructure assets and inter-array cabling would be decommissioned and removed.

4. Internationally Designated Sites

In the appendices of their scoping opinion[7], SNH recommended considering impacts to the following European protected sites as part of this HRA (see ***Appendix B*** below).

SPAs – see *Table 4-1*
- Buchan Ness to Collieston Coast SPA
- Fowlsheugh SPA
- Troup, Pennan and Lions Heads SPA
- Forth Islands SPA
- East Caithness Cliffs SPA
- North Caithness Cliffs SPA
- Ythan Estuary, Sands of Forvie and Meikle Loch SPA
- Montrose Basin SPA
- Fair Isle SPA
- Flamborough head and Bempton Cliffs SPA
- Loch of Strathbeg SPA
- Loch of Skene SPA
- Noss SPA
- Foula SPA
- Sumburgh Head SPA
- West Westray SPA
- Calf of Eday SPA
- Hoy SPA
- Copinsay SPA
- St Abbs Head to Fast Castle SPA

SACs – see *Table 4-2*
- Buchan Ness to Collieston Coast SAC
- Moray Firth SAC
- River South Esk SAC
- River Dee SAC
- River Spey SAC

The designated features of these sites are outlined in *Table 4-1* and *Table 4-2*.

[7] http://www.scotland.gov.uk/Resource/0045/00457478.pdf

Figure 4-1 A map of the proposed site in relation to designated sites.

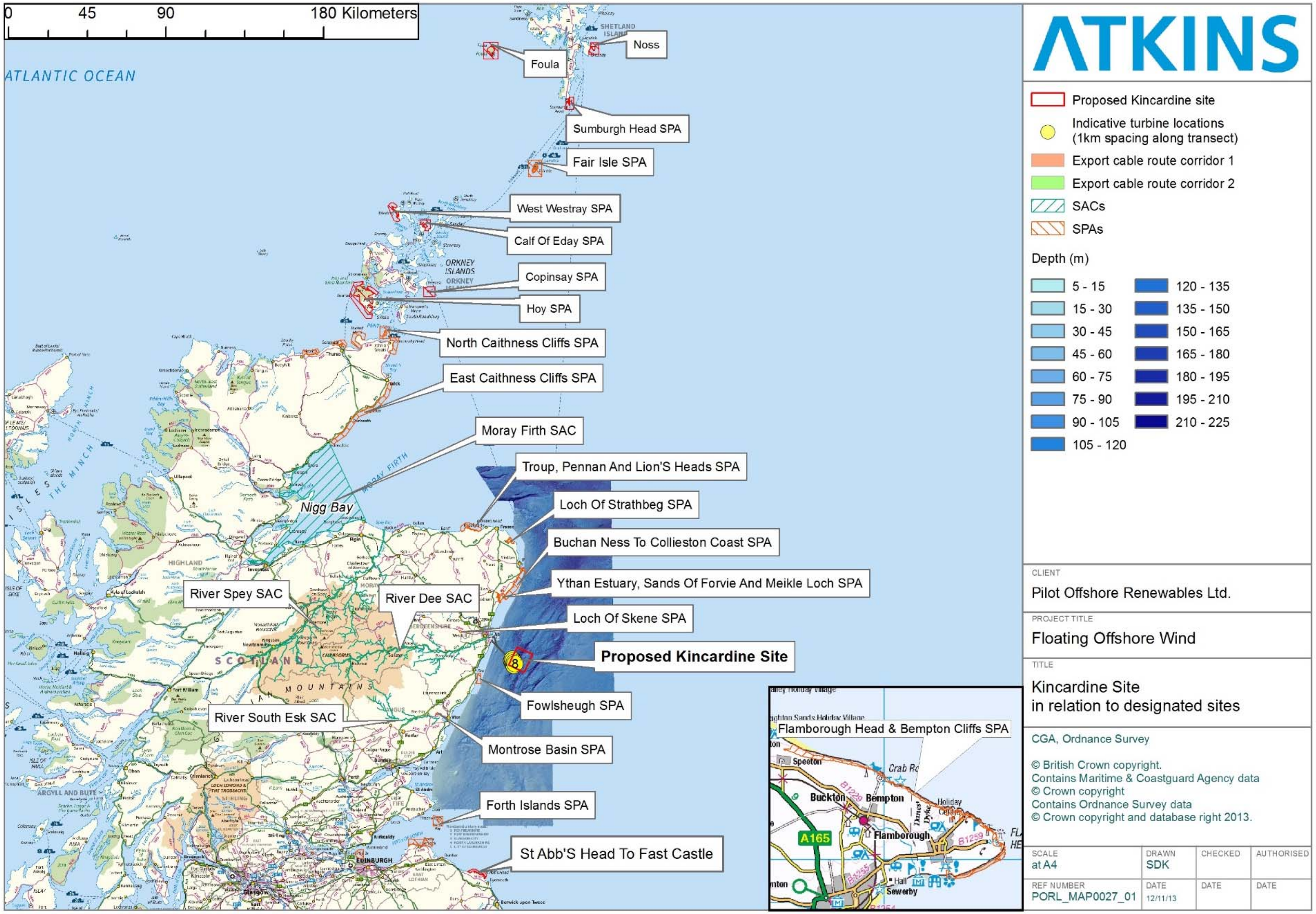


Table 4-1 A list of SPAs considered as part of this HRA, along with their designated features and distance from the proposed site.

Nature Conservation Site	Designation	Features	Distance from Scheme
Fowlsheugh	SPA	Fowlsheugh SPA qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. The colony regularly supports 145,000 seabirds. The colony further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: common guillemot *Uria aalge* (56,450 individuals, 5% of GB population, 1.7% of Western European population), and black-legged kittiwake *Rissa tridactyla* (36,650 pairs, 7.5% of the GB population, 1.2 % of World population). The colony also regularly supports nationally important populations of razorbill *Alca torda** (5,800 individuals, 3.9% of the GB population), Northern fulmar* *Fulmarus glacialis* (1,170 pairs, 0.2% of the GB population), and herring gull *Larus argentatus** (3,190 pairs, 2% of the GB population).	16km
Buchan Ness to Collieston Coast	SPA	Buchan Ness to Collieston Coast SPA qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 95,000 seabirds including nationally important populations of the following species: black-legged kittiwake *Rissa tridactyla** (30,452 pairs, 6.2% of the GB population), common guillemot *Uria aalge** (8,640 pairs, 1.2% of GB population), herring *gull Larus argentatus** (4,292 pairs, 2.7% of the GB population), European shag *Phalacrocorax aristotelis** (1,045 pairs, 2.7% of the GB population) and Northern fulmar *Fulmarus glacialis** (1,765 pairs, 0.3% of the GB population).	27km
Loch of Skene	SPA	Loch of Skene qualifies under Article 4.1 by supporting populations of European importance of the following species listed on Annex I of the Directive: Over winter; Whooper Swan *Cygnus cygnus*, 203 individuals representing up to 3.7% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6) This site also qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species: Over winter; Greylag Goose *Anser anser*, 10,840 individuals representing up to 10.8% of the wintering Iceland/UK/Ireland population (5 year peak mean 1991/2 - 1995/6)	32km
Ythan Estuary, Sands of Forvie and Meikle Loch	SPA	This site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive: During the breeding season; Common Tern *Sterna hirundo*, 265 pairs representing up to 2.2% of the breeding population in Great Britain (Count, as at early 1990s); Little Tern *S. albifrons*, 41 pairs representing up to 1.7% of the breeding population in Great Britain (Count, as at early 1990s); Sandwich Tern *S. sandvicensis*, 600 pairs representing up to 4.3% of the breeding population in Great Britain (Seabird Census Register) This site also qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species: Over winter; Pink-footed Goose *Anser brachyrhynchus*, 17,213 individuals representing up to 7.7% of the wintering Eastern Greenland/Iceland/UK population (winter peak means) Assemblage qualification: A wetland of international importance. The area qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl. Over winter, the area regularly supports 51,265 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including:	32km

		Redshank *Tringa totanus**, Lapwing *Vanellus vanellus**, Eider *Somateria mollissima**, Pink-footed Goose *Anser brachyrhynchus*.	
Montrose Basin	SPA	This site qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species: Over winter; Greylag Goose *Anser anser*, 1,080 individuals representing at least 1.1% of the wintering Iceland/UK/Ireland population (5 year peak mean, 1987/8-1991/2); Knot *Calidris canutus*, 4,500 individuals representing at least 1.3% of the wintering North-eastern Canada/Greenland/Iceland/North-western Europe population (5 year peak mean 1991/2 - 1995/6); Pink-footed Goose *Anser brachyrhynchus*, 31,622 individuals representing at least 14.1% of the wintering Eastern Greenland/Iceland/UK population (5 year peak mean 1991/2 - 1995/6); Redshank *Tringa totanus*, 2,259 individuals representing at least 1.5% of the wintering Eastern Atlantic - wintering population (5 year peak mean 1991/2 - 1995/6): Assemblage qualification: A wetland of international importance. The area qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl Over winter, the area regularly supports 54,917 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including: Dunlin *Calidris alpina alpina**, Oystercatcher *Haematopus ostralegus**, Eider *Somateria mollissima**, Wigeon *Anas penelope**, Shelduck *Tadorna tadorna**, Redshank *Tringa totanus*, Knot *Calidris canutus,* Greylag Goose *Anser anser,* Pink-footed Goose *Anser brachyrhynchus*.	50km
Loch of Strathbeg	SPA	Loch of Strathbeg SPA qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive: During the breeding season; Sandwich Tern *Sterna sandvicensis*, 530 pairs representing up to 3.8% of the breeding population in Great Britain (5 year mean, 1993-1997) Over winter; Barnacle Goose *Branta leucopsis*, 226 individuals representing up to 1.9% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6); Whooper Swan *Cygnus cygnus*, 183 individuals representing up to 3.3% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6) This site also qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species: Over winter; Greylag Goose *Anser anser*, 3,325 individuals representing up to 3.3% of the wintering Iceland/UK/Ireland population (winter peak means): Pink-footed Goose *Anser brachyrhynchus*, 39,924 individuals representing up to 17.7% of the wintering Eastern Greenland/Iceland/UK population (5 year peak mean 1991/2 - 1995/6) Assemblage qualification: A wetland of international importance. The area qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl. Over winter, the area regularly supports 49,452 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including: Teal *Anas crecca**, Greylag Goose *Anser anser*, Pink-footed Goose *Anser brachyrhynchus*, Barnacle Goose *Branta leucopsis*, Whooper Swan *Cygnus cygnus*.	60km
Troup, Pennan and Lions Heads	SPA	The site qualifies under Article 4.2 by regularly supporting over 20,000 individual breeding seabirds. In 1995 the site supported about 150,000 individual seabirds of 9 species. The site qualifies further under Article 4.2 by regularly supporting internationally important breeding populations of the migratory species black-legged kittiwake *Rissa tridactyla** (31,600 pairs in 1995; 6% of the British population and 1% of	69km

		the total population of the sub-species *R. t. tridactyla*) and common guillemot *Uria aalge* (44,600 individuals in 1995; 4% of the British and 1% of total population of the sub-species *U. a. aalge* and *U. a. albionis*). In addition to the species mentioned above, the assemblage of breeding seabirds includes the regularly occurring migratory species Northern fulmar *Fulmarus glacialis** (4,400 pairs), herring gull *Larus argentatus** (4,200 pairs; 2% of the British breeding population), and razorbill *Alca torda** (4,800 individuals). All figures in brackets are estimates for 1995.	
Forth Islands	SPA	Forth Islands SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species Arctic tern *Sterna paradisaea* (mean between 1992 and 1996 of 540 pairs, 1.2% of the GB population), roseate tern *Sterna dougallii* (an average of 8 pairs, 1997 - 2001; 13% of GB population and the most northerly of only six regular British colonies), common tern *Sterna hirundo* (an average of 334 pairs, 1997-2001; 3% of GB population) and Sandwich tern *Sterna sandvicensis* (22 pairs representing at least 0.2% of the breeding population in Great Britain (5 year mean, 1993-1997). Forth Islands SPA further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species; Northern gannet *Morus bassanus* (34,400 pairs representing at least 13.1% of the breeding North Atlantic population (Count, as at 1994)), European shag *Phalacrocorax aristotelis* (2,887 pairs, 2.3% of N Europe biogeographic population), lesser black-backed gull *Larus fuscus* (2,920 pairs, 2.4% of total *L.f. graellsii* biogeographic population) and Atlantic puffin *Fratercula arctica* (21,000 pairs, 2.3% of total *F.a.grabae* biogeographic population). Forth Islands SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. The site regularly supports 90,000 seabirds (three year mean, 1986 – 1988) including nationally important populations of the following species: razorbill *Alca torda** (1,400 pairs, 1.4% of GB population), common guillemot *Uria aalge** (16,000 pairs, 2.2% of GB population), black-legged kittiwake *Rissa tridactyla** (8,400 pairs, 1.7% of GB population), herring gull *Larus argentatus** (6,600 pairs, 4.1% of GB population), great cormorant *Phalacrocorax carbo** (200 pairs, 2.8% of GB population), Northern gannet *Morus bassanus* (21,600 pairs), lesser black-backed gull *Larus fuscus* (1,500 pairs), European shag *Phalacrocorax aristotelis* (2,400 pairs), Atlantic puffin *Fratercula arctica* (14,000 pairs), Northern fulmar *Fulmarus glacialis** (798 pairs), Arctic tern *Sterna paradisaea* (540 pairs), common tern *Sterna hirundo* (334 pairs), roseate tern *Sterna dougallii* (8 pairs) and Sandwich tern *Sterna sandvicensis* (440 pairs).	94km
St Abbs to Fast Castle	SPA	St Abb's Head to Fast Castle SPA qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. The site regularly supports 79,560 seabirds including nationally important populations of the following species: razorbill *Alca torda* (2,180 individuals, 1% of the GB population); common guillemot *Uria aalge* (31,750 individuals, 3% of the GB population); black-legged kittiwake *Rissa tridactyla* (21,170 pairs, 4% of the GB population); herring gull *Larus argentatus* (1,160 pairs, 0.7% of the GB population); and European shag *Phalacrocorax aristotelis* (560 pairs, 1% of the GB population).	117km
East Caithness Cliffs	SPA	East Caithness Cliffs SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species peregrine *Falco peregrinus* (6 pairs, 0.5% of the GB population). East Caithness Cliffs SPA further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: common guillemot *Uria aalge* (106,700 individuals, 3.1% of north Atlantic biogeographic population); razorbill *Alca torda* (15,800 individuals, 1.8% of total *A. t. islandica* biogeographic population), herring gull *Larus argentatus* (9,400 pairs, 1.0% of NW European biogeographic population), black-legged kittiwake *Rissa tridactyla* (32,500 pairs, 1.0% of north Atlantic biogeographic population), and European shag *Phalacrocorax aristotelis* (2,300 pairs, 1.8% of the north Europe biogeographic population). East Caithness Cliffs SPA	158km

		also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 300,000 individual seabirds including nationally important populations of the following species: great black-backed gull *Larus marinus* (800 pairs, 4% of the GB population), cormorant *Phalacrocorax carbo* (230 pairs, 3% of the GB population), Northern fulmar *Fulmarus glacialis* (15,000 pairs, 3% of the GB population), razorbill (15,800 individuals, 11% of the GB population), common guillemot (106,700 individuals, 10% of the GB population), black-legged kittiwake (32,500 pairs, 7% of the GB population), herring gull (9,400 pairs, 6% of the GB population), European shag (2,300 pairs, 6% of the GB population) and Atlantic puffin (1750 pairs, over 10% of the minimum qualifying assemblage of 20,000 individuals.)	
North Caithness Cliffs	SPA	North Caithness Cliffs SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species: peregrine *Falco peregrinus* (6 pairs, 0.5% of the GB population). North Caithness Cliffs SPA further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: common guillemot *Uria aalge* (38,300 individuals, 1% of the North Atlantic biogeographic population). North Caithness Cliffs SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. The site regularly supports 110,000 seabirds including nationally important populations of the following species: Northern fulmar *Fulmarus glacialis* (14,700 pairs; 3% of the GB population); black-legged kittiwake *Rissa tridactyla* (13,100 pairs, 3% of the GB population); common guillemot (38,300 individuals, 4% of the GB population); razorbill *Alca torda* (4,000 individuals, 3% of the GB population) and Atlantic puffin *Fratercula arctica* (1,750 pairs, over 10% of the minimum qualifying assemblage of 20,000 individuals)	180km
Copinsay	SPA	Copinsay qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 70,000 seabirds including nationally important populations of the following species: common guillemot *Uria aalge* (29,450 individuals, 3% of the GB population), black-legged kittiwake *Rissa tridactyla* (9,550 pairs, 2% of the GB population) greater black-backed gull *Larus marinus* (490 pairs, 3% of the GB population) and Northern fulmar *Fulmarus glacialis* (1,615 pairs, 0.3% of the GB population).	215
Hoy	SPA	Hoy SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species: red-throated diver *Gavia stellata* (58 territories, 6% of the GB population) and peregrine *Falco peregrinus* (6 pairs, 0.5% of the GB population). Hoy SPA further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: great skua *Stercorarius skua* (1,900 pairs, 14% of the world biogeographic population). Hoy SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 120,000 seabirds including nationally important populations of the following species: Atlantic puffin *Fratercula arctica* (3,500 pairs, 0.7% of the GB population); black-legged kittiwake *Rissa tridactyla* (3,000 pairs, 0.6% of the GB population); Arctic skua *Stercorarius parasiticus* (59 pairs, 2% of the GB population); Northern fulmar *Fulmarus glacialis* (35,000 pairs, 6% of the GB population); great black-backed gull *Larus marinus* (570 pairs, 3% of the GB population); common guillemot *Uria aalge* (13,400 pairs, 2% of the GB population).	227
Calf of Eday	SPA	Calf of Eday SPA qualifies under Article 4.2 of the EC Wild Birds Directive by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 30,000 seabirds including nationally important populations of the following species: great cormorant *Phalacrocorax carbo carbo* (223 pairs, 3% of the GB population), great black-backed gull *Larus marinus* (938 pairs, 5% of the GB population), common guillemot *Uria aalge* (12,645 individuals, 1% of the GB population), Northern fulmar *Fulmarus glacialis* (1,955 pairs, 0.4% of the GB population) and black-legged kittiwake *Rissa tridactyla* (1,717 pairs, 0.4% of the GB population).	253

West Westray	SPA	West Westray qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species: Arctic tern *Sterna paradisaea* (1,140 pairs; 3% of the British breeding population). The SPA also qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: common guillemot *Uria aalge* (42,150 individuals, 1.2% of the North Atlantic biogeographic population). The SPA further qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. West Westray regularly supports 113,000 seabirds including nationally important populations of the following species: razorbill *Alca torda* (1,946 individuals, 1% of the GB population); black-legged kittiwake *Rissa tridactyla* (23,900 pairs, 5% of the GB population); Arctic skua *Stercorarius parasiticus* (78 pairs; 2% of the GB population) and Northern fulmar *Fulmarus glacialis* (1,400 pairs, 0.2% of the GB population).	265
Fair Isle	SPA	Fair Isle SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species: Fair Isle wren Troglodytes *troglodytes fridariensis* (33 territorial males, 100% of the GB population) and Arctic tern *Sterna paradisaea* (1100 pairs, 1% of the GB population). Fair Isle SPA further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: common guillemot *Uria aalge* (32,300 individuals, 1.4% of the north Atlantic biogeographic population). Fair Isle SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 180,000 seabirds including nationally important populations of the following species: Atlantic puffin *Fratercula arctica* (23,000 individuals, 2% of the GB population), razorbill *Alca torda* (3,400 individuals, 2% of the GB population), black-legged kittiwake *Rissa tridactyla* (18,160 pairs, 4% of the GB population), great skua *Stercorarius skua* (110 pairs, 1% of the GB population), Arctic skua *Stercorarius parasiticus* (110 pairs, 3% of the GB population), European shag *Phalocrocorax aristotelis* (1,100 pairs, 3% of the GB population), Northern gannet Morus bassanus (1,166 pairs, 0.6% of the GB population), Northern fulmar *Fulmaris glacialis* (35,210 pairs, 7% of the GB population), common guillemot *Uria aalge* (32,300 individuals, 3% of the GB population), and Arctic tern *Sterna paradisaea* (1100 pairs).	270km
Sumburgh Head	SPA	Qualifying Interest (N.B. All figures relate to numbers at the time of classification except where amended by the 2001 SPA Review): Sumburgh Head SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species: Arctic tern *Sterna paradisaea* (700 pairs, 2% of GB). Sumburgh Head SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. The site regularly supports 35,000 seabirds including nationally important populations of the following species: common guillemot *Uria aalge* (16,000 individuals, 1% of GB); black-legged kittiwake *Rissa tridactyla* (1,366 pairs, 0.3% of the GB population); and Northern fulmar *Fulmarus glacialis* (2,542 pairs, 0.5% of the GB population).	319
Flamborough Head and Bempton Cliffs	SPA	Flamborough Head and Bempton Cliffs SPA qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species: Kittiwake *Rissa tridactyla*, 83,370 pairs representing at least 2.6% of the breeding Eastern Atlantic - Breeding population (Count, as at 1987) Assemblage qualification: A seabird assemblage of international importance The area qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 seabirds During the breeding season, the area regularly supports 305,784 individual seabirds including: Puffin *Fratercula arctica*, Razorbill *Alca torda*, Guillemot *Uria aalge*, Herring Gull *Larus argentatus*, Gannet *Morus bassanus*, Kittiwake *Rissa tridactyla*.	332km

Foula	SPA	Foula SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species: Arctic tern *Sterna paradisaea* (up to 1,500 pairs, 2% of GB); Leach's storm-petrel *Oceanodroma leucorhoa* (50 pairs, <0.1% of the GB population); and red-throated diver *Gavia stellaria* (11 pairs in 1994, 1.2% of the GB population). Foula SPA further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: great skua *Stercorarius skua* (2,270 pairs, 17% of world biogeographic population), common guillemot *Uria aalge* (37,500 individuals, 0.8% of the North Atlantic biogeographic population); Atlantic puffin *Fratercula arctica grabae* (48,000 pairs, 5% of the total *F.a.grabae* biogeographic population); and European shag *Phalacrocorax aristotelis* (2,400 pairs, 1.9% of the North Europe biogeographic population). SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 250,000 seabirds including nationally important populations of the following species: black-legged kittiwake *Rissa tridactyla* (3,840 pairs, 0.8% of the GB population); razorbill *Alca torda* (6,200 individuals, 4% of the GB population); Arctic skua *Stercorarius parasiticus* (133 pairs, 4% of the GB population); Northern fulmar *Fulmarus glacialis* (46,800 pairs, 9% of the GB population); Atlantic puffin (48,000 pairs, 11% of the GB population); common guillemot (37,500 individuals, 4% of the GB population); great skua (2,270 pairs, 29% of the GB population); European shag *Phalacrocorax aristotelis* (2,400 pairs, 7% of the GB population); Leach's storm-petrel (50 pairs); and Arctic tern (1,500 pairs).	346
Noss	SPA	Noss qualifies as a Special Protection Area under Article 4.2 of the EC Wild Birds Directive by regularly supporting populations of European importance of the migratory species: Northern gannet *Morus bassanus* (6,860 pairs, 3% of the western European breeding population); great skua *Stercorarius skua* (420 pairs, 5% of EC, and 3% of western European) and common guillemots *Uria aalge* (38,970 individuals 3% of EC and 1% of western European). The site also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 35,000 seabirds including, in addition to the species listed above, nationally important populations of the following species: Northern fulmar *Fulmarus glacialis* (6,350 pairs, 1% of the GB population) blacklegged kittiwakes *Rissa tridactyla* (7,020 pairs, 1% of the GB population) and Atlantic puffin (2,348 individuals, over 10% of the minimum qualifying assemblage of 20,000 individuals).	354

Table 4-2 A list of SACs considered as part of this HRA, along with all their designated features and distance from the proposed site.

Nature Conservation Site	Designation	Features	Distance from Scheme
River Dee	SAC	**Qualifying interests:** Annex II species that are a primary reason for selection of this site: Atlantic Salmon (*Salmo salar)* The River Dee supports a high-quality Atlantic salmon *Salmo salar* population in a river draining a large catchment on the east coast of Scotland. There is a weak nutrient gradient along its length, but it is essentially a nutrient-poor river. The high proportion of the river accessible to salmon has resulted in it supporting the full range of life-history types found in Scotland, with sub-populations of spring, summer salmon and grilse all being present. The headwaters which drain the southern Cairngorm and northern Grampian mountains are particularly important for multi sea-winter spring salmon, but there has been a significant decline in their abundance in recent years. The extensive areas accessible to salmon means the River Dee supports a significant proportion of the Scottish salmon resource. In recent years it has contributed about 4 or 5% of all salmon caught in Scotland. Otter (*Lutra Lutra)* The Dee is a major east coast Scottish river, which flows uninterrupted for some 130 km from its upland reaches in the high Cairngorms to the North Sea. Surveys have indicated that the otter *Lutra lutra* is found throughout Dee catchment, from its mouth at Aberdeen to many of the high-altitude lochs. The river system contains extensive areas of suitable habitat for otter feeding, resting and breeding, including watercourses with a high fish biomass and islands and marshy areas for resting. This is a strong, high quality population, representative of north-east Scotland. Freshwater Pearl Mussel (*Margaritifera margaritifera)* The Dee is a major east coast Scottish river, which flows uninterrupted for some 130 km from its upland reaches in the high Cairngorms to the North Sea. It supports a functional population of freshwater pearl mussel *Margaritifera margaritifera*, which is common in the Dee, recorded from a location approximately 30 km from the river source to approximately 6-7 km upstream from its mouth. Juveniles make up approximately 30% of the recorded population, among the highest proportions recorded in Scotland. This indicates that the population is recruiting strongly and is one of the most important in the UK.	20km
River South Esk	SAC	Annex II species that are a primary reason for selection of this site Freshwater Pearl Mussel (*Margaritifera margaritifera)* Freshwater pearl mussels *Margaritifera margaritifera* are abundant in the River South Esk, representing the south-eastern range of the species in Scotland. The pearl mussel population is most abundant in the middle reaches of the river where they attain densities > 20m^2. The conservation importance of the site is further increased by the abundance of juveniles which comprise approximately 20% of the population. The presence of juvenile pearl mussels less than 20mm long indicates that there has been successful recruitment since 1996. Atlantic Salmon (*Salmo salar)* The South Esk supports a large, high-quality salmon *Salmo salar* population in a river draining a moderate-sized catchment on the east coast of Scotland. It has a strong nutrient gradient along its length, rising in the nutrient-poor Grampians and flowing for half of its length through the rich agricultural lands of Strathmore. The high proportion of the	50km

		South Esk which is accessible to salmon and the range of ecological conditions in the river allows it to support the full range of life-history types found in Scotland, with sub-populations of spring, summer salmon and grilse all being present.	
Moray Firth	SAC	Annex I habitats that are a primary reason for selection of this site: Inshore sublittoral sediment (marine) – Subtidal sandbanks. The Moray Firth in north-east Scotland supports the only known resident population of bottlenose dolphin *Tursiops truncatus* in the North Sea. The population is estimated to be around 130 individuals (Wilson *et al*. 1999). Dolphins are present all year round, and, while they range widely in the Moray Firth, they appear to favour particular areas.	158km
River Spey	SAC	Qualifying interests: Annex II species that are a primary reason for selection of this site: <u>Atlantic Salmon (*Salmo salar*)</u> The Spey supports one of the largest Atlantic salmon *Salmo salar* populations in Scotland, with little evidence of modification by non-native stocks. Adults spawn throughout virtually the whole length of the river, and good quality nursery habitat is found in abundance in the main river and numerous tributaries. Salmon in the Spey system are little affected by artificial barriers to migration, and the waters in the catchment are largely unpolluted (the river is oligotrophic throughout its length). For a system of its size, the Spey is also relatively free from flow modifications such as abstractions, diversions and impoundments. The salmon population includes fish of all ages including migrating smolts and returning adults, possibly reflecting genetic differences within the Spey stock. <u>Otter (*Lutra Lutra*)</u> The Spey represents an important otter *Lutra lutra* site in Scotland, with good quality freshwater habitat. Surveys have identified high levels of otter presence throughout the Spey catchment. Riverine habitat features which are known to be important to otters are present, such as reedbeds and islands, and populations of important prey species are relatively healthy. The persistence of a strong population of otter on this river indicates that habitat conditions are particularly favourable for the survival of the species. <u>Freshwater Pearl Mussel (*Margaritifera margaritifera*)</u> The River Spey is a large Scottish east coast river that drains an extensive upland catchment and supports an outstanding freshwater pearl mussel population in its middle to lower reaches. In parts of the River Spey, extremely dense mussel colonies have been recorded (225 m^2) and the total population is estimated at several million. As the population also shows evidence of recent recruitment and a high proportion of juveniles, the River Spey is considered to support a pearl mussel population of great international significance. <u>Sea lamprey (*Petromyzon marinus*)</u> The River Spey represents the sea lamprey *Petromyzon marinus* in the northern part of its range in the UK. It is absent from rivers north of the Great Glen, and the River Spey is virtually at the northern limit for this species. Recent surveys show that sea lamprey larvae are widely distributed throughout the middle and lower reaches of the river, where the particularly fast-flowing waters of the River Spey provide ideal spawning conditions for this species. In addition, as an unpolluted and relatively little modified system, the River Spey matches the other key habitat requirements of the sea lamprey in terms of good water quality, clean gravels and marginal silts and an unhindered migration route to the sea.	163km

5. Conservation Objectives of the Site Features.

The conservation objectives for a European marine site are intended to represent the aims of the Habitats and Birds Directives in relation to that site. SNH provide advice on the conservation objectives and operations that may cause deterioration of the habitats or species, or disturbance of the species for which sites have been designated. This advice is in the form of ‘Regulation 35 advice’ for marine SACs and SPAs (i.e. SACs and SPAs with a marine component) or ‘management plans’ for other sites.

Measures taken under the Habitats Directive should be designed to maintain or restore habitats and species of European Community importance at / to “favourable conservation status” (FCS). The conservation objectives for a site set the standards which must be met if the features of the site (habitats and species) are to be at FCS.

FCS is defined in Article 1 of the Habitats Directive as:

> ***Conservation status of a natural habitat*** *means the sum of the influences acting on a natural habitat and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species within the territory referred to in Article 2.*
>
> *The conservative [sic] status of a natural habitat will be taken as ‘favourable’ when:*
>
> - *its natural range and the areas it covers within that range are stable or increasing, and*
> - *the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and*
> - *conservation status of typical species is favourable as defined in [Article] 1(i).*
>
> ***Conservation status of a species*** *means the sum of the influences acting on the species concerned that may affect the long-term natural distribution and abundance of its populations within the territory referred to in Article 2;*
>
> - *The conservation status will be taken as ‘favourable’ when:*
> - *population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and*
>   - *the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and*
>   - *there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis*

The conservation objectives recognise and acknowledge that the features are part of a complex, dynamic, multi-dimensional environment which human activity has already modified and continues to modify in various ways, to varying degrees and at varying spatial and temporal scales, either acutely or chronically.

The conservation objectives do not aim to prevent all change to the habitat and species features, or to achieve an indefinable, abstract natural or pristine state, since these would be unrealistic and unattainable aspirations. Rather, they seek to prevent further negative modification of the extent, structure and function of natural habitats and species’ populations by human activity and to ensure that degradation and damage to the features that is attributable to human activities or actions is prevented. The conservation objectives, therefore, seek to:

- Encompass inherent dynamism rather than to work against it;
- Safeguard features and natural processes from those impacts of human activity that cause damage to the features through the degradation of their range, extent, structure, function or typical species;
- Facilitate, where necessary, restoration of features or components of features that are currently damaged or degraded and in unfavourable condition.

The overarching conservation objectives for the features of the designated sites are set out below.

Table 5-1 Conservation Objectives for SPA Species.

To ensure that site integrity is maintained by: **(i)** Avoiding deterioration of the habitats of the qualifying species. **(ii)** Avoiding significant disturbance to the qualifying species. To ensure for the qualifying species that the following are maintained in the long term: **(iii)** Population of the bird species as a viable component of the SPA. **(iv)** Distribution of the bird species within the SPA. **(v)** Distribution and extent of habitats supporting the species. **(vi)** Structure, function and supporting processes of habitats supporting the species. **repeat of (ii)** No significant disturbance of the species.

Table 5-2 Conservation Objectives for Bottlenose Dolphin.

The conservation objectives for bottlenose dolphin are: **(i)** to avoid deterioration of the habitats of bottlenose dolphin or **(ii)** Significant disturbance to bottlenose dolphin, thus ensuring that the integrity of the Moray Firth SAC is maintained and that the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features. And to ensure for bottlenose dolphin that the following are established then maintained in the long term: **(iii)** Population of bottlenose dolphin as a viable component of the site. **(iv)** Distribution of bottlenose dolphin within site. **(v)** Distribution and extent of habitats supporting bottlenose dolphin. **(vi)** Structure, function and supporting processes of habitats supporting bottlenose dolphin. **repeat of (ii)** No significant disturbance of bottlenose dolphin.

Table 5-3 Conservation Objectives for Atlantic Salmon.

The SAC conservation objectives for Atlantic salmon are:

(i) to avoid deterioration of the habitats of the qualifying species or

(ii) Significant disturbance to them, thus ensuring that the integrity of the SAC is maintained and that they make an appropriate contribution to achieving favourable conservation status for the qualifying species.

And to ensure for the qualifying species that the following are maintained in the long term:

(iii) Population of the species, including range of genetic types for salmon, as a viable component of the SACs.

(iv) Distribution of the species within sites.

(v) Distribution and extent of habitats supporting each species.

(vi) Structure, function and supporting processes of habitats supporting each species.

repeat of (ii) No significant disturbance of the species.

Table 5-4 Conservation Objectives for Atlantic Salmon and Freshwater Pearl Mussel.

The SAC conservation objectives for Atlantic salmon and freshwater pearl mussel (where appropriate) are:

(i) to avoid deterioration of the habitats of the qualifying species or
(ii) Significant disturbance to them, thus ensuring that the integrity of the SAC is maintained and that they make an appropriate contribution to achieving favourable conservation status for each species.

And to ensure for each species that the following are maintained in the long term:

(iii) Population of the species, including range of genetic types for salmon (where relevant), as a viable component of the SACs.

6. Test of Likely Significant Effect

6.1. Extent of Bird Surveys

Sixteen months of aerial bird surveys have been carried out on a monthly basis by Hi-Def, a specialist aerial survey company (Appendix A). The area surveyed includes the proposed project site and an 8km buffer around it.

High resolution and high sensitivity digital video cameras were mounted onto an aircraft to sample a 500m-wide strip of the sea, as the aircraft flew seven transects within the development area. A standard process for reviewing video footage was used to detect objects with a high level of quality control to ensure virtually all objects present were detected. The detected objects were assessed by expert ornithologists and marine mammal scientists to identify them, where possible to species level, following the same quality control process. Robust statistical analysis of the data was then used to estimate the abundance and distribution of birds and mammals during the surveys.

The survey is typically flown at an aircraft altitude of either approximately 1250ft (~380m) or approximately 1800ft (550m) above sea level. More sensitive species, such as Common Scoter (*Melanitta nigra*) and Manx Shearwaters (*Puffinus puffinus*), which are known to be disturbed when sitting on the sea by aircraft flown at altitudes of less than 1500ft (450m) (Hi-Def, personal observations and A. Webb, personal observations) are rarely present in the identified survey sites[8].

Sixteen surveys were completed from the first survey on 1st May 2013 to the last survey on 26th September 2014. Additional surveys were added covering May, July, August and September. Overall a total of 20,460 birds of 19 species and 93 non-avian animals of six species were recorded during the project. An overall identification rate to species level of 93.1% was achieved.

Aerial surveys have the following key advantages over traditional vessel based surveys:

- Large area of survey;
- Increased weather operability;
- Species identification;
- Accurate flight height calculations;
- Abundance estimates;
- Density mapping over a large area;
- Direction of flight (without disturbance);
- Digital record of surveys for review/QA;

Flight height selection ensures no flushing of species from survey area;

After basic presentation, data were processed for estimating abundance and distribution of the key species and species groups. All confidence levels of species identifications were used in the analysis. Generally, high levels of species identification were achieved during these surveys. However, for species groups where species identification was most difficult (e.g. terns and auks), lower species identification rates were achieved.

6.1.1. Abundance Estimates

The abundance of each species observed within the overall survey area and the project area were estimated separately using a design-based strip transect analysis with variance and confidence intervals derived through 10,000 bootstraps. The bootstrapping technique uses total length of transect to limit selection rather than total number of transects. This method has an advantage when transects are of unequal length and provides better precision estimates.

[8] Stone, C.J., Webb, A., and Tasker, M.L. (1995) *The distribution of auks and Procellariformes in north-west European waters in relation to depth of sea. Bird Study*, **42**:50-56.

In a strip transect analysis each transect is treated as an independent analysis unit, and the assumption is made that transects can be treated as statistically independent random samples from the site. The length of each transect and its breadth (i.e. the width of the field of view of the camera) multiplied together give the transect area; dividing the number of observations on that transect by the transect area gives a point estimate of the density of that species for the site. The density of animals at the site (and hence the population size), the standard deviation, 95% confidence intervals and coefficient of variance are then estimated using a non- parametric bootstrap method with replacement.

The exact limits and location of the development area are not known at this time. The survey area covers approximately 991km^2, which includes the project area and an 8km buffer. The NE3 project area itself is approximately 110km^2. The footprint of the development area, based on information on the number of turbines (8) and possible turbine spacing (500m), is expected to be approximately 8km^2 or around 0.8% of the survey area.

The density estimate is expressed as the average number of animals per square kilometre surveyed over the whole site, and the population estimate is simply the average density multiplied up to the area of the whole site. The standard deviation is a measure of the variance of the population estimate, standardised by the number of samples (transects). The upper and lower confidence intervals define the range that the population estimate falls within with 95% certainty. For example, the population estimate for the zone or site may be 1000 individuals with a 95% certainty that this estimate lies between 500 and 2000 individuals. The coefficient of variance (CV), also referred to as the relative standard error, is a measure of the precision of the population and density estimates. A CV value of less than 16% allows a 50% decline or 100% increase in abundance between two samples to be detected with greater power than 0.8. This is usually regarded as the minimum precision required for monitoring effects of developments on key species.

Figure 6-1 Hi-Def flight plan for KOWL showing the survey area (turquoise) and the NE3 Project area (light green)

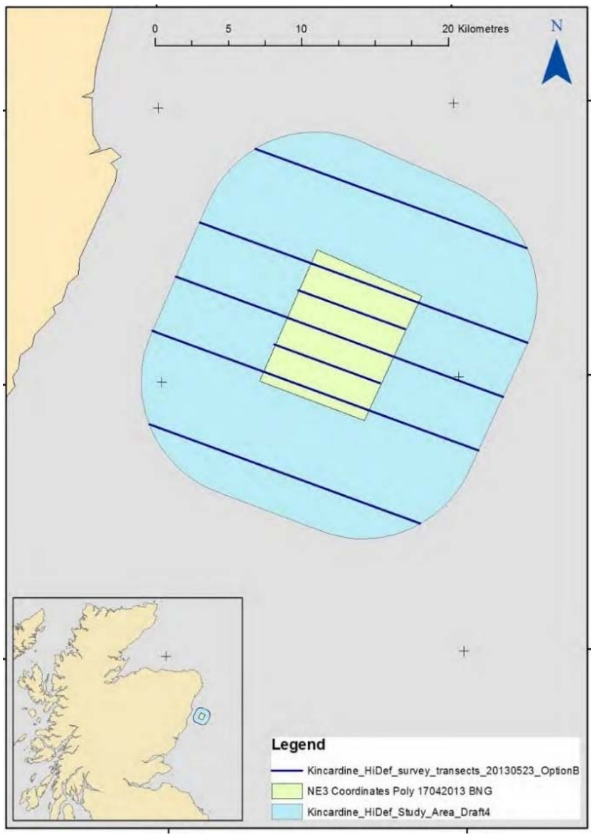


Figure 6-2 Representative view of camera arrangement and orientation and for Hi-Def digital video surveys.

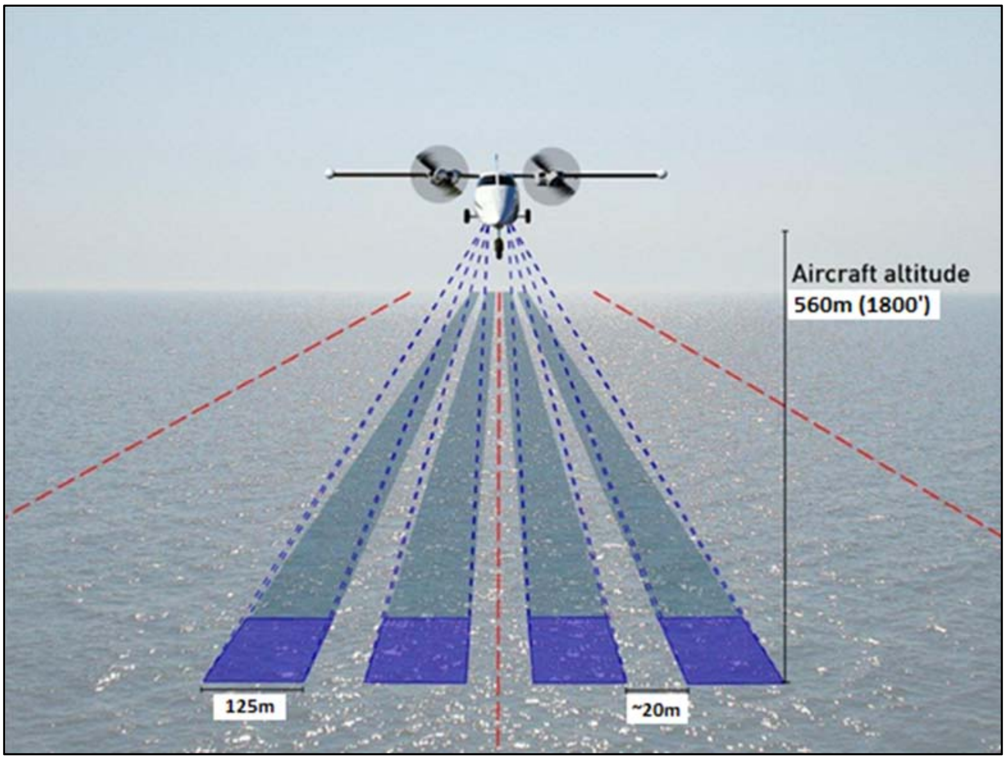
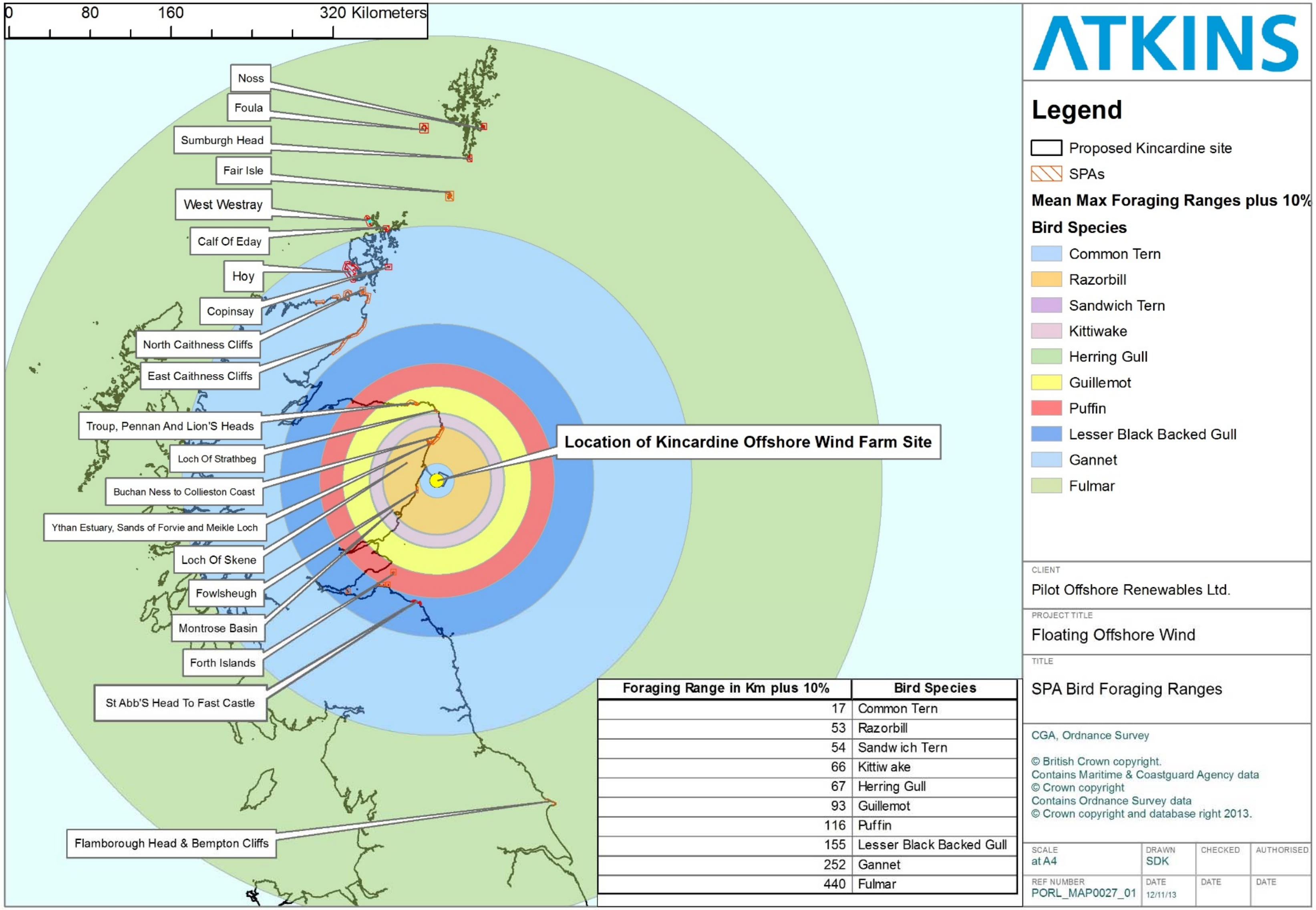


Table 6-1 SPA Seabird populations.

Species	NE3 Pop Estimate (individuals)	Mean Max Foraging Range[1] in Km (Max)	Foraging Range (km) + 10% (rounded to the nearest km)	SPA	Distance from KOWL Site	SPA pop at designation[2]	Most recent pop estimate[3] – Individuals* (date)	
Kittiwake	327	60 (120)	66	Fowlsheugh	16	36,650	9,337 (2012)	⇩ (75%)
				Buchan Ness to Collieston Coast	27	30,452	12,542 (2007)	⇩(59%)
				Troup, Pennan and Lions Heads	69	31,600	14,896 (2007)	⇩(52%)
				Forth Islands	94	8,400	3,339 (2014)	⇩(60%)
Guillemot	2609	84.2 (135)	93	Fowlsheugh	16	56,450*	44,920 (2012)*	⇩(20%)
				Buchan Ness to Collieston Coast	27	8,640*	19,296 (2007)*	⇧(44%)
				Troup, Pennan and Lions Heads	69	44,600*	16,325 (2007)*	⇩(63%)
				Forth Islands	94	16,000*	24,164 (2014)*	⇧(34%)
				St Abbs to Fast Castle	117	31,750*	34,803 (2013)*	⇧(9%)
				East Caithness Cliffs	158	106,700*	120,798 (1999)*	⇧(12%)
Fulmar	18	400 (580)	440	Fowlsheugh	16	1,170	158 (2013)	⇩(86%)
				Buchan Ness to Collieston Coast	27	1,765	1,370 (2007)	⇩(22%)
				Troup, Pennan and Lions Heads	69	4,400	1,600 (2007)	⇩(64%)
				Forth Islands	94	798	616 (2014)	⇩ (23%)
				East Caithness Cliffs	158	15,000	14,202 (1999)	⇩(5%)
				North Caithness Cliffs	180	14,700	13,237 (1999-00)	⇩(10%)
				Copinsay	215	1,615	1,094 (2012)	⇩(32%)
				Hoy	227	35,000	19,586 (2007)	⇩(44%)
				Calf of Eday	253	1,955	1,842 (2002)	⇩(6%)
				West Westray	265	1,400	677 (2007)	⇩(52%)
				Fair Isle	270	35,210	29,649 (2011)	⇩(16%)
				Sumburgh Head	319	2,542	233 (2009)	⇩(91%)
				Foula	346	46,800	21,106 (2000)	⇩(55%)
				Noss	354	6,350	5248 (2011)	⇩(17%)
Herring Gull	3	61.1 (92)	67	Fowlsheugh	16	3,190	259 (2012)	⇩(92%)
				Buchan Ness to Collieston Coast	27	4,292	3,079 (2007)	⇩(28%)
				Troup, Pennan and Lions Heads	69	4,200	1,597 (2007)	⇩(62%)
Razorbill	79	48.5 (95)	53	Fowlsheugh	16	5,800*	5,260 (2012)*	⇩(9%)
				Forth Islands	94	1,400*	4,347 (2014)*	⇧(68%)
Gannet	59	229.4 (590)	252	Forth Islands	94	21,600	75,259 (2014)	⇧(71%)
				Fair Isle	270	1,166	3,591 (2014)	⇧(68%)
				Flamborough Head and Bempton Cliffs	332	2,501	7,859 (2009)	⇧(68%)
Sandwich tern	No records	49 (54)	54	Ythan Estuary, Sands of Forvie and Meikle Loch	32	600	757 (2014)	⇧(20%)
				Loch of Strathbeg	60	530	0 (2013)	⇩(100%)
Common tern	No records	15.2 (30)	17	Ythan Estuary, Sands of Forvie and Meikle Loch	32	265	1433 'Comic' (2014)	⇧(82%)
Lesser black backed gull	No records	141 (181)	155	Forth Islands	94	1,500	2,525 (2014)	⇧(41%)
Puffin	28	105.4 (200)	116	Forth Islands	94	14,000	52,817 (2013-14)	⇧(73%)

Notes: *Individuals
1. Mean Maximum foraging range from Thaxter *et al.* 2012. In some cases SPAs just outside this range are included on a precautionary basis (e.g. if they fall within or just outside the mean maximum range in Thaxter et al. 2012 + 10%).
2. From SPA citations on SNH sitelink (http://gateway.snh.gov.uk/sitelink/) or JNCC SPA review species accounts (http://jncc.defra.gov.uk/page-1417)
3. Seabird Monitoring Programme http://jncc.defra.gov.uk/smp/sitesBrowser.aspx

Figure 6-3 Mean Maximum Seabird Foraging Ranges[9] plus 10% in relation to SPAs



Foraging Range in Km plus 10%	Bird Species
17	Common Tern
53	Razorbill
54	Sandwich Tern
66	Kittiwake
67	Herring Gull
93	Guillemot
116	Puffin
155	Lesser Black Backed Gull
252	Gannet
440	Fulmar

[9] Maximum foraging ranges from Thaxter *et al.* 2012.

6.2. Pathways for LSE – Potential Impacts of windfarms on Birds

The potential impacts from Kincardine offshore windfarm on SPA designated bird species can be both temporal, covering migratory and breeding seasons for the lifespan of the scheme through operation, maintenance and decommissioning; and spatial, with bird movements occurring nationally between SPAs and internationally between countries, with some species moving across to Europe and others heading north to areas like Greenland and Iceland.

These potential impacts come in several different forms. For the sake of this HRA screening document, five potential impact categories will be used, considering potential impacts for three development stages, operation, maintenance and decommissioning (construction and decommissioning) will occur with a dry dock on land and therefore no impacts to SPA bird species are anticipated in this phase, as the operation of the dry dock has been permitted already. As such it has been removed from the assessment).

The five potential impact categories are as follows:

- disturbance;
- habitat loss;
- collision risk
- displacement; and
- barrier effect.

The results of this impact assessment are shown in table 6-6 below.

6.2.1. Disturbance

There will be no sea-based construction activities associated with the Project and, as a result, there will be no piling activities. By removing the need for piling this scheme does not include a significant source of disturbance commonly associated with offshore windfarm developments.

The aerial bird surveys undertaken as part of this scheme have shown that the site is used by a wide variety of seabirds (see ***Table 6-1*** above) and for some species, in significant numbers. As such the possibility of disturbance impacts to seabirds from the scheme cannot be ruled out.

Such impacts are likely to be a result of boat movements to and from the site and the associated noise. The movements with the potential to cause the largest disturbance impacts will be when the Wind Turbine Generators (WTGs) are first towed out to site. This is likely to involve three large tugs (see ***Figure 2-2*** above) that will tow the WTG over 400km from the manufacturing site to its deployment location.

Other disturbance impacts could occur to loafing and diving seabirds through the deployment of the anchor weights and mooring lines. Each weight is likely to be steel or reinforced concrete weighing approximately 25 tonnes. The length of the mooring lines will be approximately nine times the depth of the water, so initially during this deployment phase, there will be a large area of disturbance to the sea surface immediately surrounding the wind turbine for a very short space of time, with installations occurring every six hours (estimated) per mooring anchor system.

These disturbance impacts however are likely to only cover the deployment and decommissioning phases and will be very short in duration, meaning impacts will be minimal.

6.2.2. Habitat loss

Although the KOWL scheme will have no foundations commonly associated with habitat loss from traditional windfarm developments, there will still be a small amount of habitat loss from the placement and operation of the anchor weights (maximum $10m^2$ per anchor). The most likely mechanism for impacts to birds from habitat loss is indirect, through changes in the distribution of prey and foraging habitat (for SPA bird foraging depths, see ***Table 6-2*** below) although this will be very limited in terms of the development area.

The seabed around the proposed site mainly consists of sand and muddy sand. As a result the capacity this habitat has to provide an important source of prey and foraging habitat is minimal. Although the size of the mooring anchors will be relatively small (25 tonnes) when compared to traditional windfarm foundations

(1000's of tons), the limited movement of mooring system on the seabed still has the ability to cause impacts to any habitats surrounding the sub-structure. This is mitigated by very limited lateral movement of the mooring system (it only points towards the WTG) which means the mooring system will not vary from its direction of travel. Any indirect impacts to seabirds through scour will therefore need to be considered further in the appropriate assessment (also Chapter 3 in ES).

It may be the case that the anchor weights provide a hard substrate to allow marine life to settle and grow, becoming an artificial reef. In turn this could act as a fish aggregation device that improves the availability of prey species for birds. Such results are commonly seen with jetty, dock and boat moorings.

6.2.3. Collision Risk

While the chances of bird collision with wind turbines and the associated structures is relatively low, it will almost certainly result in the death of the bird. This low risk is mainly due to the birds' ability to take avoiding action.

The established modelling approach to estimating collision risk employed in an environmental assessment of windfarms (the Band model) was developed by Band in 2000, and updated in 2007 for use in the marine environment relating to offshore windfarms (Band 2012). For seabirds this now includes flight height distributions to help refine collision estimates.

Assessing collision risk depends on a number of assumptions including:

- Migratory routes;
- Bird distributions along those routes;
- Flight heights;
- Turbine avoidance rates (98% for most species); and
- Population estimates or, if not available, historic population counts.

Collision mortality estimates are assessed in relation to an indicative threshold value of 1% of the passage population. It should be noted though, that this 1% value has been used as an indicative threshold to guide interpretation and does not have a specific biological basis (Marine Scotland, July 2014).

Overall, birds on migration through Scottish waters are not considered to be at risk of significant levels of additional mortality, due to collisions with Scottish offshore windfarms. Possible exceptions are large gulls, cormorant and common tern (Marine Scotland, July 2014).

When assessing the Likely Significant Effect of the KOWL scheme on SPA bird species through collision, the maximum flight heights of each species have been recorded as part of the 16 monthly aerial surveys carried out as part of this scheme.

This data, along with peak counts, will determine whether impacts through collision need to be taken forward to the Appropriate Assessment (AA) where collision modelling will be undertaken for those species to determine if the scheme will have an adverse effect on the integrity of the site, through the additional mortality caused by collisions.

If the maximum possible flight height of the species is below the height of the turbine blades (between 24 and 176m) then the chances of impacts through collision are significantly reduced. Likewise, if no birds of a particular species have been recorded either sitting, taking off or flying through the site during any of the monthly aerial surveys, then the chances of that species being impacts through collision is also significantly reduced.

By identifying species that are at the highest risk of collision mortality through this HRA screening, it allows more in depth collision modelling to be undertaken as part of the AA. This process will follow the guidance set out in the Strategic assessment of collision risk of Scottish offshore windfarms on migrating birds[10] as it offers the most up to date guidance on collision risk.

[10] Strategic assessment of collision risk of Scottish offshore windfarms on migrating birds, July 2014, Marine Scotland, Scottish Marine and Freshwater Science, Vol 5 No 12

As well as collision with turbine blades, the risk of collision with the floating sub-structure and mooring chains by sea birds that regularly dive as part of their foraging behaviour, also has to be considered. The maximum foraging depths of seabirds are listed in ***Table 6-2*** below.

6.2.4. Displacement

The extent to which SPA bird species are displaced by windfarms is very difficult to quantify.

Displacing birds is the equivalent of excluding them from suitable breeding, roosting and feeding habitats around a larger area than would otherwise occur through direct habitat loss. The extent to which a species will avoid a windfarm site can be quite species dependant. Some species show no avoidance, while others, such as divers and auks, appear to avoid flying or foraging to within several hundred meters of turbines[11].

Due to the design of the Project turbines and associated structures, it may be the case that the potential for impacts through displacement are greater than those of traditional windfarm design. This is largely due to the triangular framework of the floating sub-structures (see ***Figure 2-2*** above). These comprise of vertical tubular sections, up to 12m in diameter, at each corner, connected by horizontal and vertical diagonal members above and below the water line. The maximum length of each face of the structure will be around 55m from the centrelines of the 12m columns. This will effectively give a maximum of 67m overall length. When considering the length of each face of the structure, and that each turbine has to have at least 500m clearance with the turbine next to it, this gives an area required by each turbine of approximately 1.07km^2. With 8 turbines this is an area of approximately 9km^2. In addition, the mooring lines holding the turbine structures in place will be a length of approximately 9 times the water depth (touch down on the sea bed is likely to occur within 200 m of the WTG). It is unclear whether the presence of the floating sub-structure and mooring lines will have any displacement effects on diving seabirds, but it could be the case that they have some minor impacts.

The aerial bird surveys carried out as part of this scheme show that the site is well used by seabirds that dive as part of their foraging behaviour (see ***Table 6-2*** below).

Table 6-2 Seabird Foraging Depths (m)

Species	Foraging Depth
Kittiwake	N/A
Fulmar	N/A
Gannet	34m
Puffin	70m
Razorbill	140m
Guillemot	200m

Source: Seabird Wikispaces: http://seabird.wikispaces.com/

It could be the case however that the floating sub-structures, mooring anchor weights and lines act to encourage birds to use the area, rather than displacing them. The floating sub-structure, mooring anchor weighs and lines could act as artificial reefs and fish aggregation devices, increasing prey species in the immediate area of the turbines and the design of the triangular sub-structures is such that they would provide suitable resting and perching areas for birds. The triangular shape of the structures would also create a central area of open water that could help to provide shelter and protection to bird species during adverse weather and sea conditions (see ***Figure 2-2*** above).

6.2.5. Barrier Effect

The presence of a windfarm may result in deviations in bird flight paths. This deviation results in additional energy expenditure as birds have to fly around the windfarm. The more times a bird has to fly the route through the windfarm, the higher the energy expenditure and the greater the potential impact on bird survival. During the breeding season this is particularly important as breeding birds will often have to make

[11] Kerlinger, P. & Curry, R. (2002). Desktop Avian Risk Assessment for the Long Island Power Authority Offshore Wind Energy Project. Prepared for AWS Scientific Inc. and Long Island Power Authority.

multiple trips to feed and raise young. If a deviation on each of these trips is required it is likely to not only impact on the parent birds but also the survival of their young, with potential population effects.

The number of deviations on a route will also have the same effect. While deviating around one windfarm may not result in a significant change in energy expenditure, having to deviate around many windfarms during a sustained period of flight could have much higher energy costs.

As a result it will be important to consider the barrier effect of KOWL windfarm in-combination with other windfarm developments along SPA bird flight lines, when determining whether impacts from barrier effects will have an adverse effect on the integrity of the population of SPA birds.

6.3. SPA Species

The list of SPA designated sites and features covered in this TSLE follows the advice as outlined in Appendix D of SNH's scoping opinion (see ***Appendix B*** below), dated 9th June 2014. Likewise the approach taken to assess impacts to designated bird species follows SNH advice, stating:

"We are content for the applicant to use a reasoned approach to apportioning, and recommend that colony size and distance from the proposed site are factored into any calculation".

The following precautionary measures were taken when assessing impacts of the proposal on SPA bird populations (see ***Table 6-3*** below):

- As outlined in Appendix D of SNH's advice, the process of designated sites and species considered is based on the mean maximum foraging ranges[12] plus a 10% buffer in order to develop a long list of species of birds that are qualifying features from relevant SPAs that may be affected by the project.
- The population figures used are for the entire survey area, which includes the NE3 Kincardine development area plus an 8km buffer (see ***Figure 6-1*** above).
- The maximum flight height of birds was used in order to determine potential collision risk. The average flight height of birds is significantly lower.

This information is presented in an SPA impact matrix (see ***Table 6-3*** below). For further information on bird survey methodologies, see ***Appendix A*** below or section 10.7.16 of the KOWL Environmental Scoping Assessment document[13].

6.3.1. Kittiwake (*Rissa tridactyla*)

Kittiwake is a designated feature of three Special Protection Areas within foraging range from the proposed Project site, including one only 16km away (Buchan Ness to Collieston Coast, Fowlsheugh and Troup, Pennan and Lions Heads). They are found on the Kincardine site in large numbers (a maximum estimate of 1,826 individuals) and their maximum flight height is well within the height of the turbine blades.

Based on this information it can be determined the Project will have a Likely Significant Effect on kittiwake alone, or in combination with other plans or projects, through disturbance and the potential for physical damage/injury.

6.3.2. Guillemot (*Uria aalge*)

Guillemot is a designated feature of three Special Protection Areas within foraging range from the proposed Project, including one only 16km away (Buchan Ness to Collieston Coast, Fowlsheugh and Troup, Pennan and Lions Heads). They are found on the Kincardine site in significant numbers (a maximum estimate of 13,476 individuals) and their maximum flight height is just within the height of the turbine blades.

Based on this information it can be determined the Project will have a Likely Significant Effect on guillemot alone, or in combination with other plans or projects, through disturbance and the potential for physical damage/injury.

[12] Mean maximum foraging range from Thaxter *et al.* 2012 plus one standard deviation (where this does not exceed the maximum foraging range)
[13] http://www.scotland.gov.uk/Resource/0044/00448819.pdf

6.3.3. Fulmar (*Fulmarus glacialis*)

Fulmar is a designated feature of 14 Special Protection Areas within foraging range from the proposed Project site, including one only 16km away (Buchan Ness to Collieston Coast, Fowlsheugh, Troup, Pennan and Lions Heads and Forth Islands) and 10 outside of 100km (see ***Table 6-3*** below). They are found on the Kincardine site in low numbers (a maximum estimate of 189 individuals) and their maximum flight height is just within the height of the turbine blades.

Based on this information it can be determined the Project will have a Likely Significant Effect on fulmar alone, or in combination with other plans or projects, through disturbance and the potential for physical damage/injury.

6.3.4. Herring gull (*Larus argentatus*)

Herring Gull is a designated feature of three Special Protection Areas within foraging range from the proposed Project, including one only 16km away (Buchan Ness to Collieston Coast, Fowlsheugh, Troup, Pennan and Lions Heads). They are found on the Kincardine site in very low numbers (a maximum estimate of 23 individuals) and their maximum flight height is well within the height of the turbine blades.

Based on this information, a Likely Significant Effect from the Project on herring gull through disturbance and the potential for physical damage/injury cannot be ruled out. The scale and magnitude of these impacts will need to be considered further through the appropriate assessment.

6.3.5. Razorbill (*Alca torda*)

Razorbill is a designated feature of one Special Protection Area within foraging range, Fowlsheugh, located 27km away from the site. They are found on the Kincardine site in quite large numbers (a maximum estimate of 503 individuals) but their maximum flight height is below the height of the turbine blades.

Based on this information, a Likely Significant Effect from the Project on razorbill through disturbance cannot be ruled out. The scale and magnitude of these impacts will need to be considered further through the appropriate assessment.

6.3.6. Puffin (*Fratercula arctica*)

Puffin is a designated feature of one Special Protection Area within foraging range, Forth Islands, located 94km away from the site. They are found on the Kincardine site in quite large numbers (a maximum estimate of 232 individuals) but their maximum flight height is below the height of the turbine blades (a max flight height of 20m).

Based on this information, a Likely Significant Effect from the Porject on puffin through disturbance cannot be ruled out. The scale and magnitude of these impacts will need to be considered further through the appropriate assessment.

6.3.7. Gannet (*Morus bassanus*)

Gannet is a designated feature of three Special Protection Areas within foraging range at a distance of 94km, 270km and 332km from the proposed Kincardine site respectively (Forth Islands, Fair Isle and Flamborough Head and Bempton Cliffs).

Based on this information, and taking account of the large foraging range of gannet, a Likely Significant Effect from the Project on gannet through disturbance cannot be ruled out. The scale and magnitude of these impacts will need to be considered further through the appropriate assessment.

6.3.8. Sandwich tern (*Sterna sandvicensis*)

Sandwich tern is a designated feature of one Special Protection Area within foraging range, Ythan Estuary, Sands of Forvie and Meikle Loch, located 32km from the Kincardine site. They were not identified on site or flying through the site in any of the bird surveys and therefore their flight heights were not recorded.

Based on this information, it can be determined that the Project will not have a Likely Significant Effect on sandwich tern alone, or in combination with other plans or projects and does therefore not need to be considered further in the appropriate assessment.

6.3.9. Non-breeding eider (*Somateria mollissima*)

Non-breeding eider is a designated feature of two Special Protection Areas, Ythan Estuary, Sands of Forvie and Meikle Loch, located 32km from the Kincardine site and Montrose Basin, located 50km from the KOWL site. They were not identified on site or flying through the site in any of the bird surveys and therefore their flight heights were not recorded.

Based on this information, it can be determined that the Project will not have a Likely Significant Effect on non-breeding eider alone, or in combination with other plans or projects and does therefore not need to be considered further in the appropriate assessment.

6.3.10. Lesser black backed gull (*Larus fuscus*)

Lesser black backed gull is a designated feature of one Special Protection Area, Forth Islands, located 94km from the Kincardine site. They were not identified on site or flying through the site in any of the bird surveys and therefore their flight heights were not recorded.

Based on this information, it can be determined that the Project will not have a Likely Significant Effect on lesser black backed gull alone, or in combination with other plans or projects and does therefore not need to be considered further in the appropriate assessment.

6.4. Non-breeding goose and swan features given consideration during the migratory period.

6.4.1. Pink-footed goose (*Anser brachyrhynchus*)

Pink-footed goose migrate to the UK from Greenland and Iceland, arriving early September and returning mid-April. They are a designated feature of three Special Protection Areas, Ythan Estuary, Sands of Forvie and Meikle Loch, Montrose Basin, and Loch of Skene, located 32km, 50km and 60km respectively from the Project site. It has been estimated that approximately 30% of pink-footed goose will fly at collision risk height (Wright et al 2012). They were not identified on site or flying through the site in any of the bird surveys covering the autumn and spring migratory periods.

Based on this information, it can be determined that the Project will not have a Likely Significant Effect on pink-footed goose alone, or in combination with other plans or projects and does therefore not need to be considered further in the appropriate assessment.

6.4.2. Greylag goose (*Anser anser*)

Greylag goose is a designated feature of three Special Protection Areas, Loch Skene, Montrose Basin and Loch of Strathbeg, located 32km, 50km, and 60km away from the KOWL site respectively. It has been estimated that approximately 30% of greylag goose will fly at collision risk height (Wright et al 2012). They were not identified on site or flying through the site in any of the bird surveys covering the autumn and spring migratory periods.

Based on this information, it can be determined that the Project will not have a Likely Significant Effect on greylag goose alone, or in combination with other plans or projects and does therefore not need to be considered further in the appropriate assessment.

6.4.3. Svalbard barnacle goose (*Branta leucopsis*)

Svalbard barnacle goose is a designated feature of one Special Protection Area, Loch of Skene, located 60km from the Project site. It has been estimated that approximately 30% of Svalbard barnacle goose will fly at collision risk height (Wright et al 2012). They were not identified on site or flying through the site in any of the bird surveys covering the autumn and spring migratory periods.

Based on this information, it can be determined that the Project will not have a Likely Significant Effect on Svalbard barnacle goose alone, or in combination with other plans or projects and does therefore not need to be considered further in the appropriate assessment.

6.4.4. Whooper swan (*Cygnus cygnus*)

Whooper swan Autumn migration takes place from mid-September to November. They are a designated feature of 1 Special Protection Area, Loch of Skene, located 60km from the Project site. It has been estimated that approximately 50% of Whooper Swan will fly at collision risk height (Wright et al 2012). They were not identified on site or flying through the site in any of the bird surveys covering the autumn and spring migratory periods.

Based on this information, it can be determined that the Project will not have a Likely Significant Effect on whooper swan alone, or in combination with other plans or projects and does therefore not need to be considered further in the appropriate assessment.

6.5. SAC Species

The list of SAC designated sites and features covered in this TLSE follows the advice as outlined in Appendix E of SNH's scoping opinion, dated 9th June 2014. Several important factors that are unique to this scheme have been taken into account when assessing impacts to SAC designated features. Most importantly:

- There will be no marine piling associated with this scheme and therefore no noise impacts associated with piling.

These factors account for why this assessment may deviate slightly from SNH's advice.

This information is presented in an SAC impact matrix (see ***Table 6-4*** below).

6.5.1. Otter (*Lutra lutra*)

Otter is a designated feature of two Special Areas of Conservation, the River Dee, located 20km from the KOWL site and the River Spey, located 163km from the KOWL site.

The location of the KOWL site offshore and the distance of the site from the SACs means that it is very unlikely that the site will be used by otters as they are a riverine or coastal species. The location of the Project being 20 km (minimum) out to sea from the coast means it is significantly out of the habitat of otters. The depth of the water at the proposed Project site is also much deeper than that used by otters for foraging, which is in areas of water that are less than 20m deep[14].

The sea-based construction activities associated with the proposal, which involves towing the turbines out to site, anchoring them to fixed moorings and laying 180mm cable (buried to a target depth of 1.5m) to shore are unlikely to cause disturbance to otter any more than any other boat activity.

Based on this information, it can be determined that the Project will not have a Likely Significant Effect on otter alone, or in combination with other plans or projects and does therefore not need to be considered further in the appropriate assessment.

[14] Chanin P (2003). Ecology of the European Otter. Conserving Natura 2000 Rivers Ecology Series No. 10. English Nature, Peterborough

6.5.2. Sea Lamprey (*Petromyzon marinus*)

Sea lamprey is a designated feature of one Special Areas of Conservation, the River Spey, located 163km from the Project site.

The location of the Project offshore and the distance of the site from the SACs means that it is very unlikely that the site will be used by sea lamprey, who tend to migrate along the coast and into and between estuaries. The sea-based construction activities associated with the proposal, which involves towing the turbines out to site, anchoring them to fixed moorings and laying cable to shore are unlikely to cause disturbance to sea lamprey. The size of the cables is 180mm thick and will be buried to a target depth of 1.5m. The size and depth of the cables means that it is unlikely to emit or cause any electromagnetic interference that would disturb sea lamprey.

Based on this information, it can be determined that the KOWL scheme will not have a Likely Significant Effect on sea lamprey alone, or in combination with other plans or projects and does therefore not need to be considered further in the appropriate assessment.

6.5.3. Bottlenose Dolphin (*Tursiops truncatus*)

Bottlenose Dolphin is a designated feature of one Special Area of Conservation, the Moray Firth, located 158km from the KOWL site.

The dolphins range widely beyond the SAC boundary along the east coast of Scotland. The sea-based construction activities associated with the proposal do not involve any piling activities and therefore there will be no disturbance to bottlenose dolphin through piling noise impacts. Other sources of noise could include those associated with towing the turbines out to site, anchoring them to fixed moorings and laying cable to shore as well as the movement of mooring lines/chains and noise and vibration from the movement of the turbines and disturbance from maintenance vessels. There is also the potential for collision with underwater structures and displacement effects.

Despite the low level of potential impacts, a Likely Significant Effect from the Project on bottlenose dolphin cannot be ruled out. The scale and magnitude of these potential impacts will therefore be considered further in the appropriate assessment.

6.5.4. Atlantic Salmon (*Salmo salar*)

Atlantic Salmon is a designated feature of three Special Areas of Conservation, the River Dee, River South Esk and the River Spey, located 20km, 50km and 163km from the KOWL site respectively.

The location of the Project site offshore and the distance of the site from the SACs means that it is possible for salmon to be present based on estimated salmon migration distances and depths[14]. The sea-based construction activities associated with the proposal, which involves towing the turbines out to site, anchoring them to fixed moorings and laying cable to shore will therefore have the potential to cause disturbance to salmon.

The size of the 33KV cables is 180mm thick and will be buried to a target depth of 1.5m. The size and depth of the cables means that it is unlikely to emit or cause any electromagnetic interference that would disturb salmon. That said, there is not a lot of existing evidence about the potential impacts of electromagnetic interference on migrating salmon. A literature review of the potential effects of electromagnetic fields, commissioned by SNH in 2010 concluded by stating the following:

“Based on current knowledge, during Marine Renewable Energy Development operation, *S. salar*, *S. trutta* or *A. anguilla* may respond to B or iE fields generated from subsea cables, either by short-term attraction or avoidance. If such behaviour occurs, then it may waste time and energy for the fish, and perhaps be a causal effect in delayed migration or alterations to movement and distribution. However, it is important to note that this review identified no clear evidence that either attraction or repulsion due to anthropogenic

EMFs will have an effect on any of the fish species identified in this report, including *S. salar*, *S. trutta* or *A. anguilla*"[15].

Based on this information, any potential impacts to migrating salmon from electromagnetic interference and disturbance cannot be ruled out at this stage. These potential Likely Significant Effects on Atlantic salmon alone, or in combination with other plans or projects will therefore need to be considered further as part of the appropriate assessment.

6.5.5. Freshwater Pearl Mussel (*Margaritifera margaritifera*)

Freshwater pearl mussel is a designated feature of two Special Areas of Conservation, the River Dee and the River South Esk, located 20km, 50km from the KOWL site respectively.

The long-term survival of the freshwater pearl mussel (FWPM) depends ultimately upon host availability (Skinner *et al*, 2003). Juvenile Atlantic salmon and sea trout are host fish of the larval stage of freshwater mussels called glochidia, attaching themselves to the gill filaments in the fast flowing sections of rivers over July - September. Therefore healthy populations of juvenile salmonid (salmon and sea trout) fry and parr are required to ensure their survival over winter before they drop off in May and early June[16]. The relative importance of salmon and sea trout to the FWPM population varies depending on location. Potential impacts to sea trout may be similar to those for salmon.

Any potential likely significant effects of the Project on Atlantic salmon and sea trout cannot be ruled out (see above) and therefore, by association, it cannot be possible to rule out any likely significant effects on freshwater pearl mussel either, and therefore these impacts will need to be considered further in the appropriate assessment.

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[15] Gill, A.B. & Bartlett, M. (2010). Literature review on the potential effects of electromagnetic fields and subsea noise from marine renewable energy developments on Atlantic salmon, sea trout and European eel*. Scottish Natural Heritage Commissioned Report No.401*

[16] Skinner, A., Young, M. & Hastie, L (2003), Ecology of the Freshwater Pearl Mussel, Conserving Natura 2000 Rivers Ecology Series No. 2, English Nature, Peterborough, http://www.snh.gov.uk/docs/B337911.pdf

Table 6-3 TLSE SPA Impact Matrix

SPA/Feature	Distance from KOWL Site	Kittiwake	Guillemot	Fulmar	Herring gull	Razorbill	Puffin	Gannet	Sandwich tern	Non-breeding Eider	Lesser black backed gull	Non-breeding Migratory Species			
												Pink-footed goose	Greylag goose	Svalbard barnacle goose	Whooper swan
Fowlsheugh	16km	Yes	Yes	Yes	Yes	Maybe	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Buchan Ness to Collieston Coast	27km	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Loch of Skene	32km	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A	N/A
Ythan Estuary, Sands of Forvie and Meikle Loch	32km	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	No	N/A	No	N/A	N/A	N/A
Montrose Basin	50km	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A	No	No	N/A	N/A
Loch of Strathbeg	60km	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A	N/A	No	No	No	No
Troup, Pennan and Lions Heads	69km	Maybe	Yes	Yes	Maybe	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Forth Islands	94km	No	No	Yes	No	No	Maybe	Yes	No	N/A	N/A	N/A	N/A	N/A	N/A
St Abbs to Fast Castle	117km	No	No	N/A	No	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
East Caithness Cliffs	158km	No	No	Yes	No	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
North Caithness Cliffs	180km	No	No	Yes	N/A	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copinsay	215km	No	No	Maybe	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A	N/A	N/A	N/A
Hoy	227km	No	No	Maybe	N/A	N/A	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Calf of Eday	253km	No	No	Maybe	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
West Westray	265km	No	No	Maybe	N/A	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fair Isle	270km	No	No	Maybe	N/A	No	N/A	Maybe	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sumburgh Head	319km	No	No	Maybe	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Flamborough head and Bempton Cliffs	332km	No	No	N/A	No	No	N/A	Maybe	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Foula	346km	No	No	Maybe	N/A	N/A	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Noss	354km	No	No	Maybe	N/A	N/A	No	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Bird Numbers on Site (Pop estimate)	N/A	1,826	13,476	189	23	503	357	362	0 (common tern – 2, Arctic tern – 7)	0	0 (greater black backed gull – 21)	0	0	0	0
Maximum Flight Height (m)	N/A	58.3% flying at sea level, 17.4% above 20m	76.1% below 2m, 0.7% over 20m	93.5% recorded at or below 20m	Majority above 25m	92.98% below 2m	82.35% below 2m	48% flying at sea level, 28%	20 (all tern species)	N/A	78 (greater black backed gull)	N/A	N/A	N/A	N/A

SPA/Feature	Distance from KOWL Site	Kittiwake	Guillemot	Fulmar	Herring gull	Razorbill	Puffin	Gannet	Sandwich tern	Non-breeding Eider	Lesser black backed gull	Non-breeding Migratory Species			
												Pink-footed goose	Greylag goose	Svalbard barnacle goose	Whooper swan
								above 20m							
Do birds fly at Blade height? **Turbine height (bottom to top) = 22-188m**	N/A	Yes	No	No	Yes	No	No	Yes	N/A	N/A	N/A	30%	30%	30%	50%

Source: Maximum counts and heights of species in the Kincardine Survey Area during combined monthly surveys between May 2013 and September 2014.

N/A – the species is not an interest feature of that site, therefore there is no likely significant effects of the scheme on these interest features, either alone or in-combination with other plans or projects.

- The scheme **is likely to have a significant effect on the interest features, either alone or in combination with other plans or projects.**

- The potential for the scheme to **have a likely significant effect on these interest features cannot be ruled out** and will therefore need to be considered further as part of an appropriate assessment.

- Is a feature of the site but the proposed scheme will have **no likely significant effects, alone or in-combination with other plans or projects**

- A species that is a designated feature of a site, but is scoped out based on the limits of its Mean Max foraging range (including a 10% buffer). Therefore it is unlikely they would be within the facility of the Wind Turbine Generators and there are therefore no likely significant effects of the scheme on these interest features, either alone or in-combination with other plans or projects.

Table 6-4 TLSESAC Impact Matrix

SAC/Feature	Distance from KOWL Site	Otter	Sea lamprey	Bottlenose dolphin	Atlantic Salmon	Freshwater Pearl Mussel
River Dee SAC	20km	No	N/A	N/A	Maybe	Maybe
River South Esk SAC	50km	N/A	N/A	N/A	Maybe	Maybe
Moray Firth SAC	158km	N/A	N/A	Maybe	N/A	N/A
River Spey SAC	163km	No	No	N/A	Maybe	N/A

N/A – either the species is not an interest feature of that site, or there is no way, based on their foraging range (including a 10% buffer) that they could be within the facility of the Wind Turbine Generators. Therefore there is no likely significant effects of the scheme on these interest features, either alone or in-combination with other plans or projects.

- The scheme **is likely to have a significant effect on the interest features, either alone or in combination with other plans or projects**

- The potential for the scheme to **have a likely significant effect on these interest features cannot be ruled out** and will therefore need to be considered further as part of an appropriate assessment.

- Is a feature of the site but the proposed scheme will have **no likely significant effects, alone or in-combination with other plans or projects**

Table 6-5 Impact pathways to SPA designated Species that were identified as being impacted upon by the Project (see *Table 6-1* and *Table 6-3* above).

SPA (in order of distance)	Distance	Qualify Species impacted on.	Potential for LSE	Potential impacts (to be considered further as part of AA)	Rationale All bird population percentage figures assume that 100% of all the birds of that species on the KOWL site originated from that SPA. This is unlikely to be the case, particularly as distance of the SPA from the KOWL site increases.
Fowlsheugh	16km	Kittiwake	Yes	• Disturbance • Collision risk • Displacement • Barrier Effect	The maximum population estimate for kittiwake was 1826 individuals, this represents about 2% of the Fowlsheugh SPA population (36,650 pairs at classification; see ***Table 6-1***) Preliminary collision risk estimates at 98.9% avoidance using the basic model (as recommended by SNH) indicate the potential for collisions with turbines.
Fowlsheugh	16km	Guillemot	Yes	• Disturbance • Displacement • Collision risk	The maximum population estimate for guillemot was 13,476 individuals, this represents about 23% of the Fowlsheugh SPA population (56,450 individuals at classification; ***Table 6-1***) Preliminary collision risk estimates at 98% avoidance (as recommended by SNH) indicate the potential for collisions with turbines. Given the numbers of guillemot on site, however, disturbance and displacement impacts cannot be ruled out.
Fowlsheugh	16km	Fulmar	Yes	• Disturbance • Displacement • Collision risk	The maximum population estimate for fulmar was 189 individuals, this represents about 9% of the Fowlsheugh SPA population (1,170 pairs at classification; ***Table 6-1***) Preliminary collision risk estimates at 98% avoidance (as recommended by SNH) indicate the potential for collisions with turbines. Given the numbers of fulmar on site, however, disturbance and displacement impacts cannot be ruled out.
Fowlsheugh	16km	Herring gull	Yes	• Disturbance • Collision risk • Displacement • Barrier Effect	The maximum population estimate for herring gull was 23 individuals, this represents about 1% of the Fowlsheugh SPA population (3,190 pairs at classification; see ***Table 6-1***) Preliminary collision risk estimates at 99.5% avoidance using the basic model and 99% using the extended model (as recommended by SNH) indicate the potential for collisions with turbines, particularly as herring gull have been observed flying at turbine height.
Fowlsheugh	16km	Razorbill	Maybe	• Disturbance • Displacement • Collision risk?	The maximum population estimate for razorbill was 503 individuals, this represents about 9% of the Fowlsheugh SPA population (5,800 individuals at classification; ***Table 6-1***) Preliminary collision risk estimates at 98% avoidance (as recommended by SNH) indicate the potential for collisions with turbines.
Buchan Ness to Collieston Coast	27km	Kittiwake	Yes	• Disturbance • Collision risk • Displacement • Barrier Effect	The maximum population estimate for kittiwake was 1826 individuals, this represents about 3% of the Buchan Ness to Collieston Coast SPA population (30,452 pairs at classification; see ***Table 6-1***) Preliminary collision risk estimates at 98.9% avoidance using the basic model (as recommended by SNH) indicate the potential for collisions with turbines.
Buchan Ness to Collieston Coast	27km	Guillemot	Yes	• Disturbance • Displacement • Collision risk	The maximum population estimate for guillemot was 13,476 individuals, this represents about 78% of the Buchan Ness to Collieston Coast SPA population (8,640 pairs at classification; ***Table 6-1***) Preliminary collision risk estimates at 98% avoidance (as recommended by SNH) indicate the potential for collisions with turbines.

SPA (in order of distance)	Distance	Qualify Species impacted on.	Potential for LSE	Potential impacts (to be considered further as part of AA)	Rationale All bird population percentage figures assume that 100% of all the birds of that species on the KOWL site originated from that SPA. This is unlikely to be the case, particularly as distance of the SPA from the KOWL site increases.
					Given the numbers of guillemot on site, however, disturbance and displacement impacts cannot be ruled out.
Buchan Ness to Collieston Coast	27km	Fulmar	Yes	• Disturbance • Displacement • Collision risk	The maximum population estimate for fulmar was 189 individuals, this represents about 6% of the Buchan Ness to Collieston Coast SPA population (1,765 pairs at classification; ***Table 6-1***) Preliminary collision risk estimates at 98% avoidance (as recommended by SNH) indicate the potential for collisions with turbines. Given the numbers of fulmar on site, however, disturbance and displacement impacts cannot be ruled out.
Buchan Ness to Collieston Coast	27km	Herring gull	Yes	• Disturbance • Collision risk • Displacement • Barrier Effect	The maximum population estimate for herring gull was 23 individuals, this represents about 0.4% of the Buchan Ness to Collieston Coast SPA population (4,292 pairs at classification; see ***Table 6-1***) Preliminary collision risk estimates at 99.5% avoidance using the basic model and 99% using the extended model (as recommended by SNH) indicate the potential for collisions with turbines, particularly as herring gull have been observed flying at turbine height.
Troup, Pennan and Lions Heads	69km	Kittiwake	Maybe	• Disturbance • Collision risk • Displacement • Barrier Effect	The maximum population estimate for kittiwake was 1803 individuals, this represents about 3% of the Troup, Pennan and Lions Heads SPA population (31,600 pairs at classification; see ***Table 6-1***) Preliminary collision risk estimates at 98.9% avoidance using the basic model (as recommended by SNH) indicate the potential for collisions with turbines.
Troup, Pennan and Lions Heads	69km	Guillemot	Yes	• Disturbance • Displacement • Collision risk	The maximum population estimate for guillemot was 12,994 individuals, this represents about 15% of the Troup, Pennan and Lions Heads SPA population (44,600 individuals at classification; ***Table 6-1***) Preliminary collision risk estimates at 98% avoidance (as recommended by SNH) indicate the potential for collisions with turbines. Given the numbers of guillemot on site, however, disturbance and displacement impacts cannot be ruled out.
Troup, Pennan and Lions Heads	69km	Fulmar	Yes	• Disturbance • Displacement • Collision risk	The maximum population estimate for fulmar was 189 individuals, this represents about 2% of the Troup, Pennan and Lions Heads SPA population (4,400 pairs at classification; ***Table 6-1***) Preliminary collision risk estimates at 98% avoidance (as recommended by SNH) indicate the potential for collisions with turbines. Given the numbers of fulmar on site, however, disturbance and displacement impacts cannot be ruled out.
Troup, Pennan and Lions Heads	69km	Herring gull	Maybe	• Disturbance • Collision risk • Displacement • Barrier Effect	The maximum population estimate for herring gull was 33 individuals, this represents about 0.4% of the Troup, Pennan and Lions Heads SPA population (4,200 pairs at classification; see ***Table 6-1***) Preliminary collision risk estimates at 99.5% avoidance using the basic model and 99% using the extended model (as recommended by SNH) indicate the potential for collisions with turbines, particularly as herring gull have been observed flying at turbine height.

SPA (in order of distance)	Distance	Qualify Species impacted on.	Potential for LSE	Potential impacts (to be considered further as part of AA)	Rationale All bird population percentage figures assume that 100% of all the birds of that species on the KOWL site originated from that SPA. This is unlikely to be the case, particularly as distance of the SPA from the KOWL site increases.
Forth Islands	94km	Fulmar	Yes	• Disturbance • Displacement • Collision risk	The maximum population estimate for fulmar was 189 individuals, this represents about 13% of the Forth Islands SPA population (798 pairs at classification; ***Table 6-1***) Preliminary collision risk estimates at 98% avoidance (as recommended by SNH) indicate the potential for collisions with turbines. Given the numbers of fulmar on site, however, disturbance and displacement impacts cannot be ruled out.
Forth Islands	94km	Puffin	Maybe	• Disturbance • Displacement	The maximum population estimate for puffin was 232 individuals, this represents about 1% of the Forth Islands SPA population (14,000 pairs at classification; ***Table 6-1***) Given the numbers of Puffin on site, however, disturbance and displacement impacts cannot be ruled out.
Forth Islands	94km	Gannet	Yes	• Disturbance • Collision risk • Displacement • Barrier Effect	The maximum population estimate for gannet was 362 individuals, this represents about 0.8% of the Forth Islands SPA population (21,600 pairs at classification; see ***Table 6-1***) Preliminary collision risk estimates at 98.9% avoidance rate using the basic model (as recommended by SNH) indicate the potential for collisions with turbines.
East Caithness Cliffs	158km	Fulmar	Yes	• Disturbance • Displacement • Collision risk	The maximum population estimate for fulmar was 189 individuals, this represents about 0.7% of the East Caithness Cliffs SPA population (15,000 pairs at classification; ***Table 6-1***) Preliminary collision risk estimates at 98% avoidance (as recommended by SNH) indicate the potential for collisions with turbines. Given the numbers of fulmar on site, however, disturbance and displacement impacts cannot be ruled out.
North Caithness Cliffs	180km	Fulmar	Yes	• Disturbance • Displacement • Collision risk	The max population estimate for fulmar was 189 individuals, this represents about 0.7% of the North Caithness Cliffs SPA population (14,700 pairs at classification; see ***Table 6-1***) Preliminary collision risk estimates at 98% avoidance (as recommended by SNH) indicate the potential for collisions with turbines. Given the numbers of fulmar on site, however, disturbance and displacement impacts cannot be ruled out.
Copinsay	215km	Fulmar	Maybe	• Disturbance • Displacement • Collision risk	The maximum population estimate for fulmar was 189 individuals, this represents about 6.2% of Copinsay SPA population (1,615 pairs at classification; ***Table 6-1***) Preliminary collision risk estimates at 98% avoidance (as recommended by SNH) indicate the potential for collisions with turbines. Given the numbers of fulmar on site, however, disturbance and displacement impacts cannot be ruled out.
Hoy	227km	Fulmar	Maybe	• Disturbance • Displacement • Collision risk	The maximum population estimate for fulmar was 189 individuals, this represents about 0.3% of the Hoy SPA population (35,000 pairs at classification; ***Table 6-1***) Preliminary collision risk estimates at 98% avoidance (as recommended by SNH) indicate the potential for collisions with turbines. Given the numbers of fulmar on site, however, disturbance and displacement impacts cannot be ruled out.

SPA (in order of distance)	Distance	Qualify Species impacted on.	Potential for LSE	Potential impacts (to be considered further as part of AA)	Rationale All bird population percentage figures assume that 100% of all the birds of that species on the KOWL site originated from that SPA. This is unlikely to be the case, particularly as distance of the SPA from the KOWL site increases.
Calf of Eday	253km	Fulmar	Maybe	• Disturbance • Displacement • Collision risk	The maximum population estimate for fulmar was 189 individuals, this represents about 5% of the Calf of Eday SPA population (1,955 pairs at classification; ***Table 6-1***) Preliminary collision risk estimates at 98% avoidance (as recommended by SNH) indicate the potential for collisions with turbines. Given the numbers of fulmar on site, however, disturbance and displacement impacts cannot be ruled out.
West Westray	265km	Fulmar	Maybe	• Disturbance • Displacement • Collision risk	The maximum population estimate for fulmar was 189 individuals, this represents about 7.1% of the West Westray SPA population (1,400 pairs at classification; ***Table 6-1***) Preliminary collision risk estimates at 98% avoidance (as recommended by SNH) indicate the potential for collisions with turbines. Given the numbers of fulmar on site, however, disturbance and displacement impacts cannot be ruled out.
Fair Isle	270km	Gannet	Maybe	• Disturbance • Collision risk • Displacement • Barrier Effect	The maximum population estimate for gannet was 362 individuals, this represents about 10% of the Fair Isle SPA population (1,166 pairs at classification; see ***Table 6-1***) Preliminary collision risk estimates at 98.9% avoidance rate using the basic model (as recommended by SNH) indicate the potential for collisions with turbines.
Sumburgh Head	319km	Fulmar	Maybe	• Disturbance • Displacement • Collision risk	The maximum population estimate for fulmar was 189 individuals, this represents about 4.0% of the Sumburgh Head SPA population (2,542 pairs at classification; ***Table 6-1***) Preliminary collision risk estimates at 98% avoidance (as recommended by SNH) indicate the potential for collisions with turbines. Given the numbers of fulmar on site, however, disturbance and displacement impacts cannot be ruled out.
Flamborough head and Bempton Cliffs	332km	Gannet	Maybe	• Disturbance • Collision risk • Displacement • Barrier Effect	The maximum population estimate for gannet was 362 individuals, this represents about 5% of the Flamborough head and Bempton Cliffs SPA population (2,501 pairs at classification; see ***Table 6-1***) Preliminary collision risk estimates at 98.9% avoidance rate using the basic model (as recommended by SNH) indicate the potential for collisions with turbines.
Foula	346km	Fulmar	Maybe	• Disturbance • Displacement • Collision risk	The maximum population estimate for fulmar was 189 individuals, this represents about 0.2% of the Foula SPA population (46,800 pairs at classification; ***Table 6-1***) Preliminary collision risk estimates at 98% avoidance (as recommended by SNH) indicate the potential for collisions with turbines. Given the numbers of fulmar on site, however, disturbance and displacement impacts cannot be ruled out.
Noss	354km	Fulmar	Maybe	• Disturbance • Displacement • Collision risk	The maximum population estimate for fulmar was 189 individuals, this represents about 1.6% of the Noss SPA population (6,350 pairs at classification; ***Table 6-1***) Preliminary collision risk estimates at 98% avoidance (as recommended by SNH) indicate the potential for collisions with turbines.

SPA (in order of distance)	Distance	Qualify Species impacted on.	Potential for LSE	Potential impacts (to be considered further as part of AA)	Rationale All bird population percentage figures assume that 100% of all the birds of that species on the KOWL site originated from that SPA. This is unlikely to be the case, particularly as distance of the SPA from the KOWL site increases.
					Given the numbers of fulmar on site, however, disturbance and displacement impacts cannot be ruled out.

6.6. In-Combination Effects

In-combination impacts relate to the impacts of the proposed development when considered alongside other developments capable of impacting on the environment within the same area or time period.

For the eight SPAs that have been identified for Likely Significant Effects from the proposed Project, any impacts will need to be considered in combination with constructed and proposed offshore windfarms within the foraging range of the SPA designated Species.

As part of the Appropriate Assessment an analysis of the foraging ranges of each of the bird species from each of the 8 SPAs will be undertaken. This will take the form of GIS mapping similar to that displayed in ***Figure 6-3*** above. By undertaking this analysis, it will identify which proposed and constructed offshore windfarms will act in combination with the Project and give an indication of the magnitude of the impact, based on distance from the site, flight height of the bird species and potential collision risk.

The plans or projects that are likely to be included in this analysis will include, but not be limited to, a number of developments highlighted below. For the location of other offshore windfarms in relation to the KOWL scheme, see ***Figure 6-4*** below.

SNH, in their scoping response, initially identified a number of developments that could act in-combination with the Project and require further investigation. These included:

- **European Offshore Wind Deployment Centre**
  The European Offshore Wind Deployment Centre is a new facility currently being developed by Aberdeen Offshore Windfarm Ltd (AOWFL), a joint venture between Vattenfall and Aberdeen Renewable Energy Group (AREG). Scottish Ministers granted approval for the project on 26th March 2013. The 11 turbine scheme located off the Aberdeen coast will have an installed capacity of up to 100MW.

- **Moray Firth Offshore Windfarm applications**
  Moray Offshore Renewables Limited (MORL) is a joint venture between two leading European Energy Companies: EDP Renewables (EDPR UK) and Repsol Nuevas Energias UK. On 19 March 2014, Moray Offshore Renewables Ltd was awarded consent from the Scottish Government for the construction and operation of up to 62 turbines of 6MW to 8MW capacity on each of three sites totalling a capacity of 1.116MW of offshore wind generation in the Outer Moray Firth.

- **National Renewable Infrastructure Plan (NRIP)** (harbour and port applications) – the purpose of the NRIP is to support the development of a globally competitive offshore renewables industry based in Scotland.

- **Eastern HVDC Link** – a development by National Grid Electricity Transmission and Scottish Hydro Electricity Transmission Ltd. This cable route will go from Sandford Bay Beach, approximately 30km north of Aberdeen to Hawthorn Pit, just south of Newcastle Upon Tyne.

<u>Forth and Tay Offshore Windfarm applications</u>

- **Inch Cape Offshore Windfarm** is located approximately 15-22km east of the Angus coastline in the Firth of Tay region. It is anticipated to consist of up to 213 wind turbines covering an area of 150km^2 and an estimated capacity of 1,000MW. It received consent from the Scottish government in October 2014 but construction has not started yet.

- **Neart ne Gaoithe** is a windfarm development by Mainstream Renewable Power Ltd. It consists of 75-125 turbines with an installed capacity of 450MW and covering an area of 105km^2. It is located in the outer Firth of Forth approximately 15km east of Fife Ness and 16km East of the Isle of May.

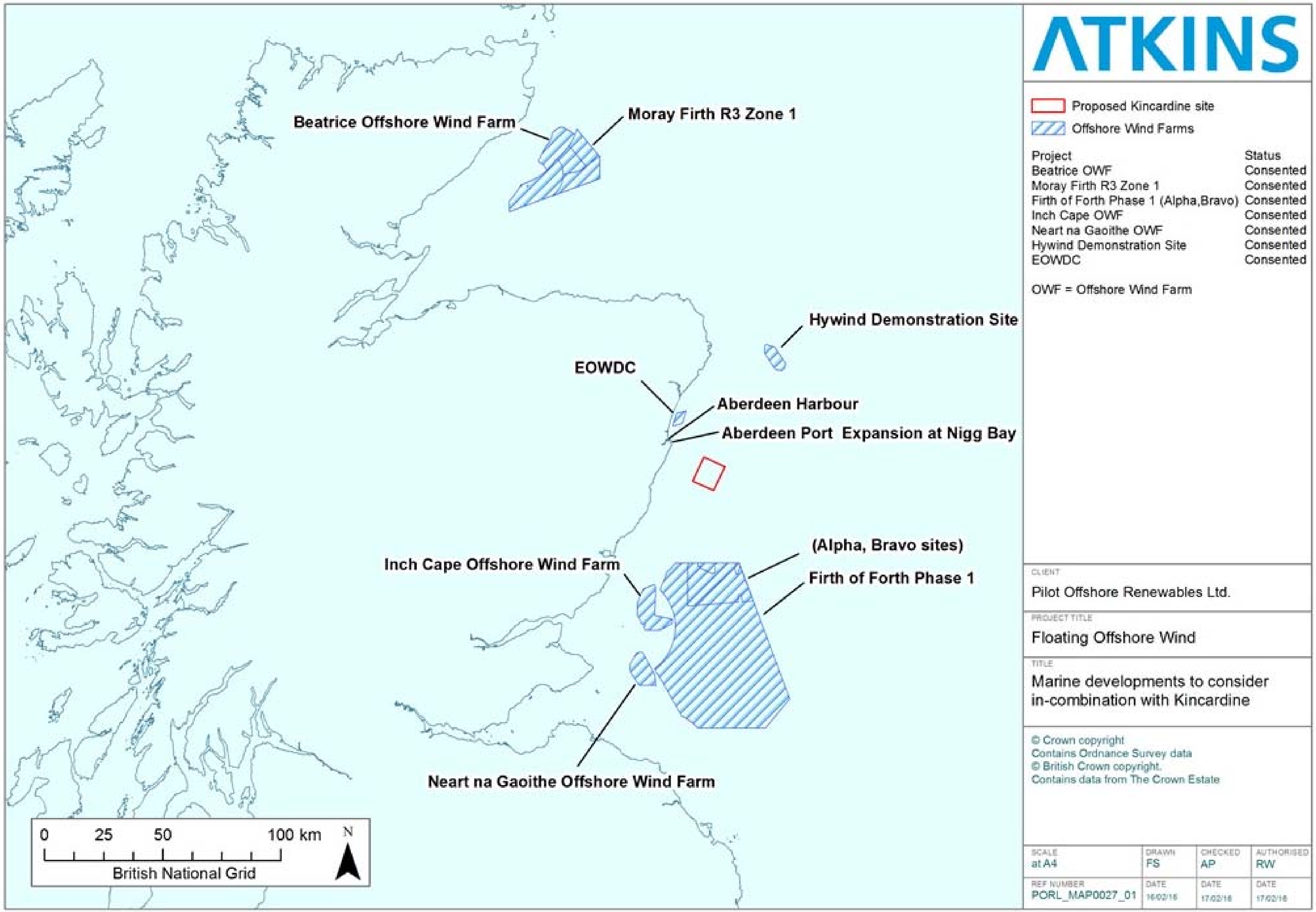
- **Firth of Forth** ‘Round 3’ Zone is a development by Seagreen Wind Energy Ltd and is located approximately 25km east of Fife Ness and the Isle of May. The **Seagreen Alpha and Bravo** developments combined will consist of up to 150 turbines and could generate up to 1050MW.

- **Hywind proposed floating wind demonstrator project** consists of 5 turbines with a capacity of 6MW each. It is located approximately 25km east of Peterhead in an area known as the Buchan Deeps.

Others include:

- **Methil Wind Turbine** – to be located on the coast at Methil, Fife. A single turbine with a generating capacity of up to 7MW. This development is currently operating and has consent to operate for a period of up to 5 years.
- **Blyth Offshore Windfarm** – located just off the Northumberland coast, comprising 2 turbines with a generating capacity of 4MW. This small development has been operating since 2000.
- **Blyth Offshore Wind Demonstration Site -** located just off the Northumberland coast, comprising 15 turbines with a generating capacity of up to 100MW. This development was consented in 2013.
- **Teesside Offshore Windfarm** – located off the coast of Teesside, England, comprising 27 turbines with a generating capacity of 62MW. Construction was completed in 2013 and the turbines are currently operating.

Figure 6-4 Offshore Windfarm Developments with the potential to act in combination with the KOWL scheme.



7. Appropriate Assessment.

The proposed scheme will result in a Likely Significant Effect to a number of European sites and interest features. These are highlighted below.

Following the conclusions of this HRA Screening document, Atkins will undertake a note to inform an Appropriate Assessment, to allow the competent authority (in this case the Marine Scotland Licensing Operation Team) to carry out a full Appropriate Assessment.

The appropriate assessment will assess the impact of the proposed Project on the conservation objectives of the designated sites to determine whether the scheme will have an Adverse Effect on the Integrity of the interest features of the European sites, either alone or in-combination with other plans or projects.

The integrity of a site is defined within EC and UK Government guidance as "*the coherence of the site's ecological structure and function, across its whole area, that enables it to sustain the habitats, complex of habitats and/or populations of species for which the site is or will be classified*".

Amendments to this Appropriate Assessment were produced following comments on the original HRA from Scottish Natural Heritage (SNH) on 2nd October 2015 (ref: CNS/REN/OSWF/DS/KINCARDINE/CPA138336, see ***Appendix C***), and an email from Marine Scotland (MS) on the 12th October 2015.

Following these comments, a proposal was submitted by KOWL to both SNH and MS along with a spreadsheet of all comments along with a response from KOWL addressing how each of the comments will be addressed (see ***Appendix D***). The purpose of this proposal was to:

- Outline a way forward to address all outstanding concerns;
- Scope out impacts that are already considered to be covered in sufficient detail in this HRA to allow SNH and MS to understand the potential impacts and make an informed decision.
- Update bird data and Collision Risk Modelling (CRM) results based on the submission of the final Hi-Def aerial survey final monitoring report (see ***Appendix A*** below) that included 4 months of additional survey data.

The main amendments made to this Appropriate Assessment following the SNH comments include the following impacts:

- Turbine details and collision risk calculations
  - Further assessment based on eight 6MW turbines, as expected these are the most appropriate turbine models to go ahead with.
  - Inclusion of the additional 12m height of the sub-structure in collision risk modelling.
- Survey Area/Densities
  - Inclusion of analysis of both the NE3 area and the wider Kincardine area (NE3 with 8km buffer) bird density data.
  - Inclusion of the Hi-Def flight height data tables rather than a graph.
- CRM options and Flight height data
  - Carrying out additional CRM on **Kittiwake, Guillemot and Gannet only**. Impacts to all other species are considered to be negligible (see greyed out species in **Table 7-5** below).
  - CRM will be carried out on adult birds only. It is proposed to use the proportions of adults of each of the three bird species as highlighted through the Hi-Def amended aerial survey report to ensure an accurate figure for each species (see Table 109 on page 254 of the Final Hi-Def report).
  - The CRM results will be re-presented in a simpler manner, differentiating between the options, particularly options 3 and 4 (see **Table 7-5** below and comments 4.2, 4.3 and 4.4 in ***Appendix D***)
- Displacement
  - Proportions of breeding adults will be used from the Hi-Def final aerial survey report and displacement rates will be based on those used in ICOL (see ***Table 7-11*** below).
- Apportioning impacts

   - Impacts will be assessed to bird species outside of SPAs including the Kittiwake data (see comments 6.1, 6.2, 6.3 in ***Appendix D***).

These amendments to the HRA did not include any further work/analysis on the following impacts (i.e. the information in the existing HRA is adequate to allow competent authorities to understand the potential impacts):

- Disturbance
- Habitat Loss
- Impacts to migratory birds
- In-combination impacts

The sites and interest features to be taken forward to the Appropriate Assessment stage of the HRA include:

Special Protection Areas

Fowlsheugh
- Kittiwake (*Rissa tridactyla*)
- Guillemot (*Uria aalge*)
- Fulmar (*Fularus glacialis*)
- Herring Gull (*Larus argentatus*)
- Razorbill (*Alca torda*)

Buchan to Collieston Coast; and Troup, Pennan and Lions Heads
- Kittiwake (*Rissa tridactyla*)
- Guillemot (*Uria aalge*)
- Fulmar (*Fularus glacialis*)
- Herring Gull (*Larus argentatus*)

Forth Islands
- Fulmar (*Fularus glacialis*)
- Gannet (*Morus bassanus*)
- Puffin (*Fratercula arctica*)

East Caithness Cliffs; North Caithness Cliffs, Copinsay, Hoy, Calf of Eday, West Westray, Sumburgh Head, Foula; and Noss
- Fulmar (*Fularus glacialis*)

Fair Isle; and Flamborough Head and Bempton Cliffs
- Gannet (*Morus bassanus*)

Special Areas or Conservation

Moray Firth
- Bottlenose Dolphin (*Tursiops truncates*)

River Dee, River South Esk and River Spey
- Atlantic Salmon (*Salmo salar*)
- Freshwater Pearl Mussel (*Margaritifera margaritifera*)

7.1. Special Protection Areas

7.1.1. Collision Risk Modelling

The risk of bird collisions with the blades of the turbines of Kincardine Windfarm were assessed using the Band Model (2012). The Collision Risk Model (CRM) results were presented for both the 'Basic' and 'Extended' Model across a range of recommended avoidance rates for each species (see ***Table 7-5*** below).

A description of the difference between the Band 2012 CRM 'Basic' and 'Extended' Models are outlined below:

Basic Model

Option 1 – This assumes a uniform distribution of flight heights and collision risk between lowest and highest levels of the rotors. It uses figures for the proportion of birds at risk height derived from site-specific surveys (see ***Table F-1*** below for site specific bird flight height distributions derived from Hi-Def aerial bird surveys).

Option 2 – This option is similar to Option 1 but the proportion of birds at risk height is derived from modelled flight height data. The corrigendum for Johnston *et al*[17].(2014) provides the most up to date information on modelled flight heights and effectively supersedes the previous flight height model (Cook *et al*, 2012).

The 'Extended' model.

The extended model also has two options: Options 3 and 4;

Option 3 uses the generic flight height data from the corrigendum for Johnston *et al*. 2014[1],

Option 4 uses site specific data in the extended model (see ***Table F-1*** below for site specific bird flight height distributions derived from Hi-Def aerial bird surveys).

Option 4 has not been used in any offshore windfarm assessment in Scotland, but the option 4 figures have been included alongside options 1, 2 and 3 for information (see ***Table 7-5*** below).

The 'extended' model differs methodologically from the 'basic' model in that it does not assume that the density of flying birds is uniform across all heights between the minimum and maximum rotor swept height. Instead, this option uses flight height values for specific height bands (1m flight bands by default) from modelled data to calculate collision rate in each part of the rotor swept area and then integrates that across the rotor disk.

It accounts for a number of factors that change with height across the rotor swept area which together result in the collision risk varying with height. For example, the diameter of the circle (and therefore the number of birds flying through the circle) varies with height and the collision risk on transit through the swept area also depends on height (due to for example, variation in rotor speed across the radius).

If the density of birds in flight also varies with height (as observed in most seabird species) rather than being uniform, then the result is a different number of predicted collisions than if the flight height distribution were assumed to be uniform (as in Options 1 and 2). The author of the Band model has clearly stated that the extended model undertakes the more correct calculation and should be used in preference over the basic model where appropriate flight height data allow (emailed note to Avoidance Rate Review project steering group received 14/5/14). Following the findings of the Marine Scotland Science Avoidance Rate Review[18], the statutory nature conservation bodies[19] issued advice stating that the extended band model is not appropriate for predicting collisions for northern gannet or black-legged kittiwake at the current time.

[17] http://www.bto.org/sites/default/files/u28/downloads/Projects/Final_Report_SOSS02_FlightHeights2014.xls
[18] Cook, A.S.C.P., Humphries, E.M., Masden, E.A., and Burton, N.H.K. 2014. The avoidance rates of collision between birds and offshore turbines. BTO research Report No 656 to Marine Scotland Science.
[19] To be read as comprising the Joint Nature Conservation Committee (JNCC), Natural England (NE), Natural Resource Wales (NRW), Northern Ireland Environment Agency (NIEA), Scottish Natural Heritage (SNH).

7.1.2. Collision Risk Model Parameters

For the development, the collision risk model required specific parameters to ensure an accurate estimation of collision impact. These parameters relate to the location of the site, the specifications of the turbine model most likely to be used, data relating to bird size, flight speed and type and activity. It also relies on flight height data derived from both modelled data and actual data collected from aerial surveys, as well as data on bird densities for each species.

The details of the information used to support each of the Band 2012 collision risk model parameters are outlined below:

1. **Windfarm Data**

Name of windfarm site – Kincardine
Latitude in degrees – 57
Number of turbines – Eight 6MW turbines.
Width of windfarm – The NE3 site 9.8km wide and the Kincardine site is 25.8km (9.8km wide NE3 site with an 8km buffer = 9.8+8+8 = 25.8)
Tidal offset – although the tidal offset for a floating windfarm is 0, a figure of 12m has been used to take account of the height of the floating substructure above the waves. This is in line with SNH comment 2.2 (see **Appendix D**).

2. **Turbine Data**

The Kincardine Turbine Model used in the assessment is the Senvion 6.2 MW 152 model.
Average wind speed at Kincardine site: 8.79 – 9.45m/s

Table 7-1 Turbine Data

Turbine Manufacturer's data	6 MW Model
Number of blades	3
Rotor Radius	76 m (24 to 176m)
Hub Height	100 m*
Tower height	88m
Maximum blade width	4.5
Average pitch	15
Rotation speed	6.4 – 10.1 rpm
Cut-in wind speed	3.5 m/sec
Cut-out wind speed	25 m/sec
Rated wind speed	12 m/sec
Derived mean rotation speed at this site	9.3 rpm

Source: https://www.senvion.com/global/en/wind-energy-solutions/wind-turbines/6xm/62m152/
* The hub height used in the CRM modelling is a combination of 88m of tower and 12m of substructure above the water surface.

3. **Bird Data**

Bird Length and Wingspan – BTO Birdfacts http://www.bto.org/about-birds/birdfacts

Bird Speed – Table 4 from Strategic assessment of collision risk of Scottish offshore windfarms to migrating birds, Migratory species collision risk modelling assessments, July 2014 - http://www.scotland.gov.uk/Resource/0046/00461026.pdf

Derived from Alerstam T., Rosén M., Bäckman J., Ericson P.G.P., Hellgren O. 2007. Flight speeds among bird species: allometric and phylogenetic effects. PLoS Biol, 5, 1656-1662. DOI:10.1371/journal.pbio.0050197

Nocturnal Activity Factor - Garthe, S. and Hüppop, O. (2004). Scaling possible adverse effects of marine windfarms on seabirds: developing and applying a vulnerability index. J. Appl. Ecol. 41: 724-734 - http://onlinelibrary.wiley.com/doi/10.1111/j.0021-8901.2004.00918.x/epdf

Flight type – Flapping versus gliding – Flapping is used as it will result in a slightly more precautionary estimate (i.e. a higher collision estimate) than for gliding flight.

Modelled flight height distributions ('Flightheight' tab) – spreadsheet that accompanies Cook *et al* 2012 flight height review (see SOSS 02), updated following publication of corrigendum to the peer reviewed paper, Johnston *et al*, 2014 (Modelling flight heights of marine birds to more accurately assess collision risk with offshore wind turbines, Alison Johnston, Aonghais S. C. P. Cook, Lucy J. Wright, Elizabeth M. Humphreys and Niall H. K. Burton, Journal of Applied Ecology, Volume 51, Issue 1, pages 31–41, February 2014, DOI: 10.1111/1365-2664.12191)

4. **Bird Survey Data**

Daytime bird data – averages taken per month from Hi-Def bird survey data – monthly estimates of bird density per km^2 for the NE3 and Kincardine Site (see ***Appendix A*** below).

Proportion flying at rotor height - A S C P Cook, L J Wright, N H K Burton. A review of flight heights and avoidance rates of birds in relation to offshore windfarms. BTO on behalf of the Crown Estate (2012). SOSS Website http://www.bto.org/science/wetland-and-marine/soss/projects, see SOSS 02.

Proportion of flights upwind – Assumed 50%

7.1.2.1. Hi-Def Kincardine Bird Data

The bird data used in the Collision Risk Modelling was collected by Hi-Def and outlined in the accompanying Hi-Def final report (see Tables 8 – 41, pages 64 -102 for the Kincardine survey area and Tables 42 – 75, pages 103 -138 for the NE3 survey area) using the methodology outlined in ***Section 6.1*** above.

The bird densities used in the collision risk modelling were only densities of birds that were in flight during the survey. This figure was calculated by identifying the proportion of birds in flight in each of the surveys and applying this proportion to the densities of all birds (both flying and sitting on the water). The densities of birds in flight are shown in ***Appendix F*** below.

The Band CRM Model has a limit of only allowing 12 months of density data to be entered. In the Band model guidance it suggests taking an average of two years of data in order to get a good indication of densities for each of 12 months. For this assessment, only 16 months of data has been collected; 12 months of initial data and an additional four months covering the time of year with greatest bird densities (the breeding season period). Following a meeting with SNH and Marine Scotland on the 23rd March 2015, it was agreed that for the four months where two years of data is available, it should be the figure for the year with the highest densities of birds present that should be used in the model. It was recognised that this approach would be the most precautionary in nature and give an indication of the 'worst case' scenario with regards to the impacts of the scheme. Within ***Table 7-3*** and ***Table 7-4*** below, the figures highlighted in yellow represent figures that are the higher of two years of bird density data for that month.

The methodology used by Hi-Def to determine the densities of auks that dive a large proportion of the time to feed, such as guillemots, razorbills and gannets, involved manually increasing density levels based on the estimated amount of time these birds may be underwater and therefore may have been 'missed' by the aerial surveys. In order to apply the correction to the density figures based on the proportion of birds flying, it was necessary to first remove this diving correctional factor.

The flight height data was collected as part of the Hi-Def surveys and this data was used to calculate flight height distribution curves for each of the species for use in the Band 2012 Collision Risk Model Options 1 and 4. The flight height distributions were only calculated for birds in flight, so birds that were sitting on the water were excluded from the flight height calculations and not identified as having a flight height of 0 metres. Any birds with a flight height of 0 metres are birds that were flying at a low level above the water and fitted into the 0-1m flight height bracket. A table of the Hi-Def aerial survey flight height distributions is shown in ***Table F-1***.

7.1.2.1.1. Number of Adult Birds present

While it was previously recommended by SNH to use the Inch Cape boat-based adult bird ratios (97% adults for gannet and 87% adults for Kittiwake – ICOL Appendix 15A), the updated Hi-Def final survey report also records the ratios of adult birds (see Table 109 on page 254 of the Hi-Def Final report).

This data is more accurate for use at this site and is therefore proposed to be used instead of the ICOL data.

The proportion of adult, immature and juvenile birds is outlined in ***Table 7-2*** below:

Table 7-2 Percentage of Adult Birds using the Kincardine Site

Species	Adult	Immature	Juvenile	Total	Percentage Adults
Gannet	275	59	1	335	82.09%
Guillemot	146	0	146	292	50.00%
Kittiwake	1043	24	29	1096	95.16%
Razorbill	3	0	1	4	75%

Source: Hi-Def Final aerial survey report, Table 109 on page 254.

As shown above, the percentage of adult birds for Kittiwake represents a more precautionary figure with 95% of birds present on site being adults, compared to 87% of birds using the Inch Cape site.

7.1.2.1.2. Proportion of birds in flight

The proportion of birds in flight has been taken from the final Hi-Def Survey report (Tables 76, page 236 – 92, page 248).

The bird densities for each of the 2 sites (NE3 and Kincardine), along with the proportion of flying birds and the corrected density based on the number of adults, are outlined in ***Table 7-3*** and ***Table 7-4*** below.

Please note the densities for guillemot are the adjusted densities that take account of the potential numbers of birds that might have been unavailable for detection (see Tables 111 and 112 in the accompanying Hi-Def final survey report).

Table 7-3 Corrected bird densities for the NE3 site.

NE3 Site																
Gannet	Survey Dates															
	8th Jan 2014	7th Feb 2014	26th Mar 2014	15th Apr 2014	1st May 2013	25th May 2013	14th June 2013	26th July 2013	3rd Sep 2013	5th Oct 2013	29th Oct 2013	4th Dec 2013	30th May 2014	15th July 2014	24th Aug 2014	26th Sep 2014
Density (n/km^2)	0	0	0.11	0.26	0.26	0.26	0.68	1.98	0.21	0.26	0	0	1.25	0.73	0.41	5.27
Percentage Flying (%)	0.00	0.00	100.00	60.00	92.68	27.50	80.00	89.77	96.55	61.11	27.27	80.00	50.40	71.11	66.67	56.41
Corrected Density	0.00	0.00	0.11	0.16	0.24	0.07	0.54	1.78	0.20	0.16	0.00	0.00	0.63	0.52	0.27	2.97
Corrected density for percentage of adults	**0.00**	**0.00**	**0.09**	**0.13**	**0.20**	**0.06**	**0.45**	**1.46**	**0.17**	**0.13**	**0.00**	**0.00**	**0.52**	**0.43**	**0.22**	**2.44**
Guillemot	**Adjusted Density Estimates**															
	8th Jan 2014	7th Feb 2014	26th Mar 2014	15th Apr 2014	1st May 2013	25th May 2013	14th June 2013	26th July 2013	3rd Sep 2013	5th Oct 2013	29th Oct 2013	4th Dec 2013	30th May 2014	15th July 2014	24th Aug 2014	26th Sep 2014
Density (n/km^2)	17.33	0.97	3.23	20.62	2.89	28.54	24.03	186.27	55.48	13.94	15.35	3.59	31.2	67.24	12.09	146.32
Percentage Flying (%)	0.12	0.00	27.15	9.88	53.62	9.34	4.24	0.51	0.03	0.58	3.39	0.90	4.18	2.95	0.23	0.84
Corrected Density	0.02	0.00	0.88	2.04	1.55	2.67	1.02	0.95	0.02	0.08	0.52	0.03	1.30	1.98	0.03	1.23
Corrected density for percentage of adults	**0.01**	**0.00**	**0.44**	**1.02**	**0.77**	**1.33**	**0.51**	**0.47**	**0.01**	**0.04**	**0.26**	**0.02**	**0.65**	**0.99**	**0.01**	**0.61**
Kittiwake																
	8th Jan 2014	7th Feb 2014	26th Mar 2014	15th Apr 2014	1st May 2013	25th May 2013	14th June 2013	26th July 2013	3rd Sep 2013	5th Oct 2013	29th Oct 2013	4th Dec 2013	30th May 2014	15th July 2014	24th Aug 2014	26th Sep 2014
Density (n/km^2)	0.47	0.1	0.73	1.56	2.08	10.72	5.21	20	0.31	0.36	1.21	0.31	2.09	4.21	8.31	8.01
Percentage Flying (%)	97.14	47.06	97.87	76.19	83.78	39.03	86.24	67.48	39.68	28.99	79.31	95.83	84.15	63.02	42.73	33.28
Corrected Density	0.46	0.05	0.71	1.19	1.74	4.18	4.49	13.50	0.12	0.10	0.96	0.30	1.76	2.65	3.55	2.67
Corrected density for percentage of adults	**0.43**	**0.04**	**0.68**	**1.13**	**1.66**	**3.98**	**4.28**	**12.84**	**0.12**	**0.10**	**0.91**	**0.28**	**1.67**	**2.52**	**3.38**	**2.54**

Note:
- Cells highlighted in blue represent the additional 4 months of aerial surveys.
- Cells highlighted in yellow represent the higher of the 2 years of bird survey to be used in collision risk modelling (as a precautionary measure).

Table 7-4 Corrected bird densities for the Kincardine site (NE3 site with 8km buffer)

Kincardine Site																
Gannet	Survey Dates															
	8th Jan 2014	7th Feb 2014	26th Mar 2014	15th Apr 2014	1st May 2013	25th May 2013	14th June 2013	26th July 2013	3rd Sep 2013	5th Oct 2013	29th Oct 2013	4th Dec 2013	30th May 2014	15th July 2014	24th Aug 2014	26th Sep 2014
Density (n/km^2)	0	0	0.09	0.17	0.64	0.65	0.41	1.51	0.42	0.2	0.19	0.08	2.12	0.76	0.54	3.16
Percentage Flying (%)	0.00	0.00	100.00	60.00	92.68	27.50	80.00	89.77	96.55	61.11	27.27	80.00	50.40	71.11	66.67	56.41
Corrected Density	0.00	0.00	0.09	0.10	0.59	0.18	0.33	1.36	0.41	0.12	0.05	0.06	1.07	0.54	0.36	1.78
Corrected density for percentage of adults	**0.00**	**0.00**	**0.07**	**0.08**	**0.49**	**0.15**	**0.27**	**1.11**	**0.33**	**0.10**	**0.04**	**0.05**	**0.88**	**0.44**	**0.30**	**1.46**
Guillemot	**Adjusted Density Estimates**															
	8th Jan 2014	7th Feb 2014	26th Mar 2014	15th Apr 2014	1st May 2013	25th May 2013	14th June 2013	26th July 2013	3rd Sep 2013	5th Oct 2013	29th Oct 2013	4th Dec 2013	30th May 2014	15th July 2014	24th Aug 2014	26th Sep 2014
Density (n/km^2)	16.54	1.51	2.93	13.82	4.09	43.63	23.36	102.26	64.07	17.18	7.73	9.11	41.1	43.72	14.46	91.21
Percentage Flying (%)	0.12	0.00	27.15	9.88	53.62	9.34	4.24	0.51	0.03	0.58	3.39	0.90	4.18	2.95	0.23	0.84
Corrected Density	0.02	0.00	0.80	1.37	2.19	4.08	0.99	0.52	0.02	0.10	0.26	0.08	1.72	1.29	0.03	0.77
Corrected density for percentage of adults	**0.01**	**0.00**	**0.40**	**0.68**	**1.10**	**2.04**	**0.50**	**0.26**	**0.01**	**0.05**	**0.13**	**0.04**	**0.86**	**0.64**	**0.02**	**0.38**
Kittiwake																
	8th Jan 2014	7th Feb 2014	26th Mar 2014	15th Apr 2014	1st May 2013	25th May 2013	14th June 2013	26th July 2013	3rd Sep 2013	5th Oct 2013	29th Oct 2013	4th Dec 2013	30th May 2014	15th July 2014	24th Aug 2014	26th Sep 2014
Density (n/km^2)	0.58	0.26	0.81	1.07	3.95	7.92	5.29	9.6	1.09	0.36	1.35	0.74	2.78	3.26	7.47	8.2
Percentage Flying (%)	97.14	47.06	97.87	76.19	83.78	39.03	86.24	67.48	39.68	28.99	79.31	95.83	84.15	63.02	42.73	33.28
Corrected Density	0.56	0.12	0.79	0.82	3.31	3.09	4.56	6.48	0.43	0.10	1.07	0.71	2.34	2.05	3.19	2.73
Corrected density for percentage of adults	**0.54**	**0.12**	**0.75**	**0.78**	**3.15**	**2.94**	**4.34**	**6.16**	**0.41**	**0.10**	**1.02**	**0.67**	**2.23**	**1.96**	**3.04**	**2.60**

Note:
- Cells highlighted in blue represent the additional 4 months of aerial surveys.
- Cells highlighted in yellow represent the higher of the 2 years of bird survey to be used in collision risk modelling (as a precautionary measure)

7.1.2.1.3. Bird flight height distributions

As outlined above, the generic flight height data comes from the corrigendum for Johnston et al[20]. 2014. The CRM uses the 'maximum likelihood' flight height distribution figures.

The site specific data for use in options 1 and 4 comes from the Hi-Def final aerial survey report that accompanies this addendum. The methodology used by Hi-Def to determine flight heights is outlined in Section 2.7.4 of the report on page 35.

The site specific flight height distributions used in the CRM modelling are shown in ***Table F-1*** in ***Appendix C***.

7.1.3. Collision Risk Modelling Results

The results of the collision risk modelling are outlined in **Table 7-5** and **Table 7-6** below. Based on the joint SNCB guidance[21], the recommended avoidance rate for kittiwake and gannet is 98.9%. For all other species the recommended avoidance rate is 98% apart from Herring Gull, with an avoidance rate of 99% or 99.5% depending on the option used. The joint SNCB guidance also recommends that Option 3 (the 'Extended' model) of the CRM Band Model is not currently appropriate for kittiwake or gannet. For all other species the Option 3 model can be used.

Taking the above recommendations into consideration, **Table 7-5** below shows the predicted number of bird collisions for each species. The additional avoidance rate of 99.2% has been suggested previously for kittiwake, however, following discussions with SNH it was recommended that this figure not be used.

Table 7-5 Collision Risk Modelling Results for the NE3 and Kincardine (NE3 plus 8km buffer) survey areas for a range of model options (with flight height data type).

Species (avoidance rate)	Survey Area	Option 1 (site specific)	Option 2 (modelled)	Option 3 (modelled)	Option 4 (site specific)
Kittiwake (98.9%)	NE3	79	34	9	35
	Kincardine	75	32	9	33
Gannet (98.9%)	NE3	26	6	2	16
	Kincardine	21	5	1	13
Guillemot (98%)	NE3	14	0	0	5
	Kincardine	13	0	0	4
Fulmar (98%)	Kincardine	0	0	0	2
Herring Gull (99% and 99.5%)	Kincardine	1	1	1	3
Razorbill (98%)	Kincardine	0	0	0	0
Puffin (98%)	Kincardine	0	0	0	0

[20] http://www.bto.org/sites/default/files/u28/downloads/Projects/Final_Report_SOSS02_FlightHeights2014.xls
[21] Joint Response from the Statutory Nature Conservation Bodies to the Marine Scotland Science Avoidance Rate Review, Cook, A.S.C.P., Humphries, E.M., Masden, E.A., and Burton, N.H.K. 2014. The avoidance rates of collision between birds and offshore turbines. BTO research Report No 656 to Marine Scotland Science

Table 7-6 Collision Risk Modelling Results by month

Species (avoidance rate)	Option	Survey Area	Month											
			Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Kittiwake (98.9%)	Option 2	NE3	0	0	1	1	2	5	16	4	3	0	1	0
		Kincardine	1	0	1	1	4	5	7	4	4	3	1	1
Gannet (98.9%)	Option 2	NE3	0	0	0	0	1	1	2	0	2	0	0	0
		Kincardine	0	0	0	0	1	0	1	0	1	0	0	0
Guillemot (98%)	Option 3	NE3	0	0	0	0	0	0	0	0	0	0	0	0
		Kincardine	0	0	0	0	0	0	0	0	0	0	0	0

Migratory Birds
Table 7-7 shows the results of the Collision Risk Modelling for migratory species passing through the Kincardine site, which was calculated using the SOSS Migratory Impact methodology[22]. The results of this assessment are outlined in ***Appendix G***.

[22] Strategic assessment of collision risk of Scottish offshore windfarms on migrating birds, Scottish Marine and Freshwater Science, Vol 5 No 12, Marine Scotland. http://www.bto.org/science/wetland-and-marine/soss/projects

Table 7-7 Collision Risk Modelling for Migratory birds crossing the Kincardine site in numbers over 10,000 (Common gull included as a precautionary measure).

Model Parameters: Nocturnal activity factor: 2.5 (out of 5), Flight type: flapping, Width of migration corridor: 9.8km (the width of Kincardine site crossed by the migrating birds)

Species	Number of Migratory Pop crossing Kincardine site.	Body Length	Wingspan	Flight speed	Proportion at flight height	Option 1 - 98% avoidance rate (% of pop crossing Kincardine site)	Number of Birds Identified through Hi-Def surveys (pop estimate)
Pink Footed Goose *Anser brachyrhynchus*	57,992	0.75	1.70	17.1	30	2 (0.003%)	0
Icelandic Greylag Goose *Anser anser*	35,573	0.90	1.80	17.1	30	1 (0.003%)	0
Barnacle Goose (Greenland population) *Branta leucopsis*	32,402	0.70	1.45	17.0	30	1 (0.003%)	0
Manx Shearwater *Puffinus puffinus*	13,651	N/A	N/A	N/A	N/A	N/A	0
Golden Plover *Pluvialis apricaria* (non-breeding)	12,036	0.30	0.83	17.9	25	0	0
Knot *Calidris canutus*	11,630	N/A	N/A	N/A	N/A	N/A	0
Snipe *Gallinago gallinago*	19,437	0.27	0.47	17.1	25	0	0
Common Gull *Larus canus*	9,703	0.41	1.20	13.5	12.7	0	18

Source: Strategic assessment of collision risk of Scottish offshore windfarms on migrating birds, Scottish Marine and Freshwater Science, Vol 5 No 12, Marine Scotland. http://www.bto.org/science/wetland-and-marine/soss/projects.

7.1.4. Bird Impacts – Breeding vs Non-Breeding

For each species the collision impacts have been split between the breeding season (the colony attendance period) and a non-breeding season (outside colony attendance period). The breeding seasons for each species were agreed following consultation with SNH. These are outlined in ***Table 7-8*** below.

Table 7-8 Breeding Season Periods for SPA species.

Species	Breeding Season Period
Gannet	April - September
Kittiwake	April - August
Herring Gull	April - August
LBBG	April - August
Fulmar	May - September
Puffin	April - August
Guillemot	April - July
Razorbill	April - July
Common tern	May - August
Arctic tern	May – August
Shag	February – September

The number of potential bird collision impacts during the breeding and non-breeding seasons are outlined in ***Table 7-9*** below. These figures were derived from the monthly collision risk modelling results, shown in ***Table 7-6*** above.

Table 7-9 Bird Collision Impacts - Breeding vs non-breeding

Species	Avoidance Rate	CRM Option	No of birds potentially impacted (percentage of total)	
			Breeding Season	Non-Breeding Season
Kittiwake Breeding Season: April - August	98.9%	Option 2	28	6
Gannet Breeding Season: April - September	98.9%	Option 2	6	0
Guillemot Breeding Season: April - July	98%	Option 3	0	0

Source: NE3 survey area CRM results from Table 7-6 above.

7.1.5. SPA Apportionment

Given that SPA seabird breeding colonies are situated at different distances from the Kincardine Site, and that different species have different foraging ranges, a process of apportioning seabird collision impacts to each of the SPAs is required in order to understand the magnitude of impacts to individual SPAs.

This apportionment was carried out based on the distance of the SPA from the Project Site, the bird species' colony size and the proportion of foraging range that is out to sea (i.e. in the direction of the Kincardine site). The process of apportioning bird collision impacts to individual SPA breeding colonies within foraging range is shown in ***Table 7-10*** below. This apportionment is a pre-requisite for considering the effects of the windfarm on individual SPAs where these species are qualifying interest features.

The results of the collision risk modelling in **Table 7-5** above indicate very low collision impacts for fulmar, herring gull, razorbill and puffin. It can therefore be considered at this stage that any apportionment to SPAs within foraging range for these species will result in negligible impacts to individual SPAs that would either be no impacts at all (zero birds) or impacts on fractions of a bird.

Table 7-10 Number of breeding bird collisions apportioned to SPAs and sites outside of SPAs within foraging range (see Figure 6-3 above).

Kittiwake							
SPA Name	**Count of Adult Birds on SPA**	**Distance from Development**	**Proportion of forage range as Sea**	**Resulting Weight for SPA**	**Proportional weight of SPA**	**Total adult collisions from each SPA**	**Percentage of SPA Population**
Fowlsheugh	18,674	16	0.6	18.33	0.29	8	0.044%
Buchan Ness to Collieston Coast	25,084	27	0.5	7.20	0.11	3	0.013%
Troup, Pennan and Lions Heads	29,792	69	0.6	1.57	0.02	1	0.002%
Outside of SPAs						16	N/A

Gannet							
SPA Name	**Count of Adult Birds on SPA**	**Distance from Development**	**Proportion of forage range as Sea**	**Resulting Weight for SPA**	**Proportional weight of SPA**	**Total adult collisions from each SPA**	**Percentage of SPA Population**
Forth Islands	150,518	94	1	65.69	0.38	2	0.002%
Fair Isle	7,182	270	1	0.37	0.002	0	0.000%
Troup, Pennan and Lions Heads	3,621	69	1	2.93	0.017	0	0.000%
Outside of SPAs						4	N/A

Guillemot							
SPA Name	**Count of Adult Birds on SPA**	**Distance from Development**	**Proportion of forage range as Sea**	**Resulting Weight for SPA**	**Proportional weight of SPA**	**Total adult collisions from each SPA**	**Percentage of SPA Population**
Fowlsheugh	44,920	16	0.6	372.65	0.82	0	0.000%
Buchan Ness to Collieston Coast	19,296	27	0.5	46.84	0.10	0	0.000%
Troup, Pennan and Lions Heads	16,325	69	0.6	7.28	0.016	0	0.000%
Outside of SPAs						0	N/A

7.1.6. Collision impacts to SPA Species

7.1.6.1. Kittiwake

The results of the collision risk modelling (using option 2 - see ***Table 7-5*** above) predict a total annual mortality of 34 kittiwake through collisions with turbine blades, based on NE3 survey area density estimates and 32 based on Kincardine survey area density estimates (NE3 area with 8km buffer). The predicted annual mortality during the breeding season is 28 kittiwake (see ***Table 7-9*** above). From this total figure of 28 birds, an annual mortality of eight birds has been apportioned to Fowlsheugh SPA, three birds to Buchan to Collieston Coast and one bird to Troup, Pennan and Lions Heads SPA (see ***Table 7-10*** above). These figures equate to an increase in breeding adult mortality from collisions of 0.044% of Fowlsheugh SPA, 0.013% of Buchan to Collieston Coasts SPA and 0.002% of Troup, Pennan and Lions Heads SPA populations.

7.1.6.2. Guillemot

The results of the collision risk modelling (using option 3 - see ***Table 7-5*** above) predict that no guillemot will be lost through collisions with turbine blades, based on NE3 and Kincardine (NE3 area with 8km buffer) survey area density estimates.

7.1.6.3. Gannet

The results of the collision risk modelling (using option 2 - see ***Table 7-5*** above) predict a total annual mortality of 6 gannet through collisions with turbine blades, based on NE3 survey area density estimates and 5 based on Kincardine survey area density estimates (NE3 area with 8km buffer). The predicted annual mortality during the breeding season is 6 gannets (see ***Table 7-9*** above). From this total figure of 6 birds, an annual mortality of 2 bird has been apportioned to Forth Islands SPA and no birds have been apportioned to either Fair Isle or Flamborough Head and Bempton Cliffs SPAs (see ***Table 7-10*** above). This figure equates to an increase in breeding adult mortality from collisions of 0.002% of Forth Islands SPA population.

Collision impacts to other species are considered to be negligible in impact and are not considered further.

7.1.7. Displacement Assessment

At a meeting with SNH on the 23rd March 2015, it was agreed that the potential additional level of displacement impacts on adult survival rates and breeding success arising from Kincardine Floating Offshore Windfarm are likely to be minimal. This conclusion was based on the fact that Kincardine will have up to eight turbines and these will be spread over a relatively large site, so the potential for a windfarm of this size and scale to cause any displacement impacts to SPA birds is considered to be low.

With this in mind, it was agreed that a 'back of an envelope' approach to calculating the potential impacts on kittiwake and auk species through displacement would seem appropriate, given Kincardine's size and scale.

Methodology:

The NE3 Survey Area is approximately 73km^2. The area estimated to be covered by the turbines is approximately 9km^2 (1.07km^2 per turbine, including a 500m buffer between each turbine, multiplied by 8 turbines). With the addition of a 1km[23] buffer, this area will be approximately 25km^2.

This area represents approximately 34% of the total NE3 survey area.

Table 7-11 Bird Displacement Assessment

Species	Estimated Breeding Pop size from NE3 survey area[1]	Pop size of turbine coverage area + 1km (25km^2), assuming even distribution across the NE3 survey area.	Predicted displacement rate[2] (%)	Number of breeding birds displaced from turbine coverage area.	Number of breeding adults displaced from turbine coverage area[3].
Kittiwake Breeding Season: April - August	669	229	30	69	66
Gannet Breeding Season: April - September	120	41	75	31	25
Guillemot Breeding Season: April – June (- high influx)	1846	632	50	316	158
Razorbill Breeding Season: April – June (- high influx)	64	22	50	11	8
Puffin Breeding Season: April - August	56	19	50	10	5

1. The NE3 breeding population estimates were calculated using the max mean peak population density estimates from the breeding season months (shown in ***Table 7-8*** above). Refer to Tables 44-75 on pages 107-138 of the Hi-Def Final Aerial Survey Report for monthly density estimates.
2. Displacement rate based on Inch Cape, the closest of the Forth and Tay windfarms to the Kincardine site.
3. The proportion of adults was calculated from the Hi-Def aerial survey data and are outlined in **Table 7-2** above. It has assumed that all adult birds present during the breeding season are adult breeding birds. The exception to this is guillemots and razorbills that experience high influx periods between July and September. Following advice from SNH (see comment 5.3 in **Appendix D**) the population estimates for these months has been removed from the breeding adult proportion calculations. The proportion of puffins that are adults is assumed to be 50%.

[23] As recommended in 'Population consequences of displacement from proposed offshore wind energy developments for seabirds breeding at Scottish SPAs, Scottish Marine and Freshwater Science, Vol 5 No 13, Final report to Marine Scotland Science, Ref: CR/2012/03'.

Table 7-12 SPA Bird Numbers displaced by Kincardine

Bird Species	SPA	Predicted Number of individual breeding adults displaced, apportioned to each SPA.	% of SPA Adult Breeding Pop displaced	SPA Breeding Pop (pairs) and Annual Breeding Success (chicks per pair per year[1])	Predicted Productivity for SPA pop (no. chicks)	No of Chicks 'Lost'	Predicted Reduction in Breeding Success	Adult mortality due to displacement[2] (% of SPA pop)
Kittiwake	Fowlsheugh	19	0.1%	9,337 0.988	9,225	19	0.1%	10 (0.05%)
	Buchan Ness to Collieston Coast	8	0.03%	12,542 0.695	8,717	6	0.03%	4 (0.015%)
	Troup, Pennan and Lions Heads	2	0.006%	14,896 0.77	11,470	2	0.008%	1 (0.003%)
	Outside of SPAs	37						
Gannet	Forth Islands	10	0.006%	75,259 0.77	57,949	8	0.007%	5 (0.003%)
	Outside of SPAs	15						
Guillemot	Fowlsheugh	130	0.28%	22,460 0.66	14,824	86	0.29%	65 (0.14%)
	Buchan Ness to Collieston Coast	16	0.08%	9,648 0.66	6,368	11	0.09%	8 (0.04%)
	Troup, Pennan and Lion's Heads	3	0.02%	8,162 0.66	5,387	2	0.019%	2 (0.01%)
	Outside of SPAs	9						
Razorbill	Fowlsheugh	8	0.15%	2,630 0.60	1,578	5	0.16%	4 (0.08%)
Puffin	Forth Islands	5	0.005%	52,817 0.60	31,690	3	0.004%	3 (0.003%)

Note: It is assumed that 100% of displaced adult breeding birds will fail to reproduce.
[1] Various sources – see ***Section 7.2.3***.
[2]An adult mortality of 50% has been applied following SNH advice (see comment 5.4 in **Appendix D**)

7.1.8. Displacement Assessment

7.1.8.1. Kittiwake:

Breeding success: Annual estimates of the number of fledged chicks produced per nest were available from the Seabird Monitoring Programme (JNCC, 2011[24]) for both SPAs (Fowlsheugh and Buchan Ness to Collieston).

Fowlsheugh SPA
A total of 19 adult breeding kittiwake from Fowlsheugh SPA (0.1%% of the SPA population) were predicted to be displaced by the scheme (see ***Table 7-12*** above). Based on the annual breeding success of this SPA and 100% breeding failure of displaced birds, this would equate to 19 chicks being 'lost', which would result in a predicted reduction in breeding success at this SPA of 0.1%.

Buchan Ness to Collieston Coast and Troup, Pennan and Lion's Heads SPA
A total of 8 adult breeding kittiwake from Buchan to Collieston Coast (0.03% of the SPA population) and 2 bird from Troup, Pennan and Lions Heads (0.006% of the SPA population) were predicted to be displaced by the scheme (see ***Table 7-12*** above). Based on the annual breeding success of this SPA and 100% breeding failure of displaced birds, this would equate to 6 chicks being 'lost' from Buchan to Collieston Coast SPA, which would result in a predicted reduction in breeding success of 0.03%. Two kittiwake were apportioned to Troup, Pennan and Lions Heads SPA (0.006% SPA population) resulting in 2 chicks lost and a reduction in breeding success of 0.008%.

7.1.8.2. Guillemot:

Breeding success: Annual estimates of the number of chicks produced per nest on the Isle of May were used for the period 2007 - 2012 (http://www.ceh.ac.uk/sci_programmes/2012-seabird-breeding-isleofmay.html). The mean (and associated SD) was calculated for those years. No recent data were known to be available from other SPAs, or sites, within the region of interest.

Fowlsheugh SPA
A total of 130 adult breeding guillemot from Fowlsheugh (0.28% of the SPA population) were predicted to be displaced by the scheme (see ***Table 7-12*** above). Based on the annual breeding success of this SPA and 100% breeding failure of displaced birds, this would equate to 86 chicks being 'lost', which would result in a predicted reduction in breeding success at this SPA of 0.29%.

Buchan Ness to Collieston Coast and Troup, Pennan and Lion's Heads SPA
A total of 16 adult breeding guillemot (0.08% of the SPA population) were predicted to be displaced by the scheme (see ***Table 7-12*** above) from Buchan to Collieston Coast SPA and 3 birds displaced from Troup, Pennan and Lions Heads SPA (0.02% of the SPA population). Based on the annual breeding success of this SPA and 100% breeding failure of displaced birds, this would equate to 11 chicks being 'lost' from Buchan to Collieston Coast SPA and 2 chicks being lost from Troup, Pennan and Lions Heads SPA. This would result in a predicted reduction in breeding success at Buchan to Collieston Coast SPA of 0.09% and a reduction from Troup, Pennan and Lions Heads SPA of 0.019%.

7.1.8.3. Razorbill:

Breeding success: Annual estimates of the number of chicks produced per nest on the Isle of May were used for the period 2007 - 2012 (http://www.ceh.ac.uk/sci_programmes/2012-seabird-breeding-isleofmay.html). The mean (and associated SD) was calculated for those years. No recent data were known to be available from other SPAs, or sites, within the region of interest.

Fowlsheugh SPA
It is estimated that approximately 8 adult breeding razorbill will be displaced by the Kincardine site with a 1km buffer. This figure equates to 0.15% of the population of Fowlsheugh SPA. The number of chicks per pair per year for this SPA is 0.60. If 8 individual adult breeding birds are displaced there is the potential for 5 chicks to be 'lost' as a result of displacement. This figure equates to a predicted reduction in breeding success of 0.16%.

[24] Source of Data: Seabird Monitoring Project – JNCC - http://jncc.defra.gov.uk/smp/

7.1.8.4. Gannet

Breeding success: Annual estimates of the number of fledged chicks produced per nest were available from the Seabird Monitoring Programme (JNCC, 2012[25]) for Bass Rock (Forth Islands SPA).

Forth Islands SPA

A total of 10 adult breeding gannet (0.006% of the SPA population) were predicted to be displaced by the scheme (see ***Table 7-12*** above). Based on the annual breeding success of this SPA and 100% breeding failure of displaced birds, this would equate to 8 chicks being 'lost', which would result in a predicted reduction in breeding success at this SPA of 0.007%.

7.1.8.5. Puffin

Breeding success: Annual estimates of the number of chicks produced per nest on the Isle of May were used for the period 2007 - 2012 (http://www.ceh.ac.uk/sci_programmes/2012-seabird-breeding-isleofmay.html). The mean (and associated SD) was calculated for those years. No recent data were known to be available from other SPAs, or sites, within the region of interest.

Forth Islands SPA

It is estimated that approximately 5 adult breeding puffin will be displaced by the Kincardine site with a 1km buffer. This figure equates to 0.005% of the population of Fowlsheugh SPA. The number of chicks per pair per year for this SPA is 0.60. If 5 individual adult breeding birds are displaced there is the potential for 3 chicks to be 'lost' as a result of displacement. This figure equates to a predicted reduction in breeding success of 0.004%.

[25] Source of Data: Seabird Monitoring Project – JNCC - http://jncc.defra.gov.uk/smp/

7.2. In-Combination Assessment

For the in-combination assessment, it has been agreed with Marine Scotland and Scottish Natural Heritage that the potential impacts of seven offshore windfarms should be considered in-combination with Kincardine, based on their location and distance from Kincardine, the magnitude of their impacts on birds from SPAs along the coasts and the current stages in their consenting.

The cumulative impact Windfarm development sites to be included in the in-combination assessment are as follows (see ***Table 7-13*** below):

1. European Offshore Wind Development Centre (Aberdeen)
2. Firth of Forth – Seagreen Alpha and Bravo
3. Hywind Scotland Pilot Park
4. Inch Cape Offshore Windfarm
5. Neart na Gaoithe Offshore Windfarm
6. Moray Offshore Renewables Windfarm (eastern development area)
7. Beatrice Offshore Windfarm Ltd (BOWL)

The following sites were not considered necessary to assess in-combination with Kincardine, either due to their distance from Kincardine, the magnitude and scope of their impacts or the stage in their consenting process.

1. Fife Energy Park Offshore Demonstration Wind Turbine
2. 2B Energy Demonstrator
3. Dounreay Floating Offshore Wind Development Centre
4. All land based windfarm development

For a map of in-combination offshore windfarm developments see ***Figure 6-4*** above.

Table 7-13 Projects considered for in-combination impacts.

	Project name	Distance from Pilot Park	Project developer	High level description	Project status
Offshore windfarm projects					
1	European Offshore Wind Deployment Centre (EOWFL)	17km	Aberdeen Offshore Windfarm Ltd	Offshore wind turbine deployment centre for 11 turbines with up to 100 MW capacity.	Consented.
2	Firth of Forth Offshore Windfarm	34km	Seagreen Wind Energy Limited	Offshore windfarm and export cabling to be developed in three Phases with a total target capacity of 3.5 GW. • Phase 1: Alpha and Bravo. 1,050 MW, export cable to Carnoustie in Angus. • Phase 2: Charlie, Delta and Echo. Phase 3: Foxtrot and Golf.	Phase 1 – consented. Phase 2 & 3 – EIA Scoping Opinion issued.
3	Hywind Scotland Pilot Park	45km	Statoil	Pilot project for five 6mw floating wind turbines	Environmental Statement submitted April 2015
4	Inch Cape Offshore Windfarm	47km	Inch Cape Offshore Windfarm Ltd	Offshore windfarm up to 213 turbines, covering an area of up to 150 km^2 with capacity of approximately 1,000 MW.	Consented.
5	Neart na Gaoithe Offshore Windfarm	74km	Mainstream Renewable Power	Offshore windfarm, 75 - 125 turbines, 450 MW with 33 km export cable to shore.	Consented. Offshore construction due to begin in 2015 subject to consent.
6	Moray Offshore Renewables Windfarm (eastern development area)	125km	Moray Offshore Renewables Ltd (MORL)	A 1,500 MW windfarm over an area of 125 km2 in the outer Moray Firth. Includes an export cable approximately 105 km in length offshore to Fraserburgh and 30 km onshore to substation.	1.116 MW consented. Construction planned to begin Q3 2015 to full generation in Q3 2020.
7	Beatrice Offshore Windfarm Ltd (BOWL)	150km	SSE	An offshore windfarm with a maximum of 227 offshore turbines, generating up to 1,000 MW in the outer Moray Firth. Includes an electrical transmission cable along a 65 km corridor to the shore at Port gordon and 20 km of onshore cable to a new substation at Blackhill hock.	Consented.

Table 7-14 In-combination predicted annual collision mortality during the breeding season for SPA qualifying species requiring further information to inform an Appropriate Assessment.

Bird Species[5]	Avoidance Rate[1]	CRM Option	Development[3]								
			Inch Cape Offshore Windfarm	Neart na Gaoithe[2]	Firth of Forth Phase I (Project Alpha)	Firth of Forth Phase I (Project Bravo)	European Offshore Wind Deployment Centre	Beatrice Offshore Windfarm (BOWL)	Moray Firth R3, Zone 1 (MORL)	Hywind Scotland Pilot Park[4]	Kincardine Floating Offshore Windfarm (KOWL)
Gannet	99%	Option 3	313	294	438	270	3	54	62	6	2
Kittiwake	98%	Option 3	18	57	189	252	25	124	108	76	17
	98.9%	Option 3	10	32	104	139	14	68	59	23	9
	99%	Option 3	9	29	95	126	13	62	54	17	8

1. Where different avoidance rates were used in published Environmental Statements for developments, these have been adjusted to the avoidance rate given in the table.
2. Published collision estimate was adjusted for difference in definition of gannet breeding season.
3. The Beatrice Demonstrator Windfarm was in operation at the time that bird survey data for Inch Cape Offshore Windfarm were being collected, and is considered to be part of the baseline. For a map of all Offshore Windfarm Developments, see ***Figure 6-4*** above.

   Annual collision figures displayed for Kincardine are based on using the CRM Option 3 and a 98% and 99% avoidance rate (see ***Table 7-5*** above). This is to ensure an accurate comparison of impacts to other windfarm developments.
4. Collision Impacts to guillemot are considered to negligible in magnitude across all windfarms and therefore have not been considered as part of the in-combination collision assessment.

Table 7-15 Potential loss of foraging range due to in-combination displacement from offshore windfarms for SPA qualifying species requiring an Appropriate Assessment

Bird Species	SPA	Foraging Area (km^2)	Windfarms within foraging area – in addition to the project.	Overlap between Foraging Area and Windfarms plus 2km buffer as a % of foraging range (km^2)	Overlap between Foraging Area and Kincardine Site plus 2km[1] buffer as a % of foraging range (km^2)	Assumed Displacement of Bird Species	Predicted % of Foraging Area Lost from Windfarms	Predicted % of Foraging Area Lost from Kincardine
Kittiwake	Fowlsheugh	11,673	Inch Cape Offshore Windfarm; European Offshore Wind Deployment Centre; Firth of Forth Phase 1; Neart na Gaoithe	10.5% (1,228)	0.4% (49)	30%	3%	0.2%
	Buchan Ness to Collieston Coast	15,215	European Offshore Wind Deployment Centre; Firth of Forth Phase 1	0.9% (132)	0.3% (49)	30%	0.3%	0.16%
Guillemot	Fowlsheugh	33,938	Firth of Forth Phase 1; Neart na Gaoithe; European Offshore Wind Deployment Centre; Inch Cape Offshore Windfarm.	3.8% (1291)	0.1% (49)	50%	1.9%	0.07%
	Buchan Ness to Collieston Coast	42,148	Firth of Forth Phase 1; European Offshore Wind Deployment Centre; Beatrice Offshore Windfarm; Moray Firth R3 Zone 1 Eastern Development Area (EDA); Neart na Gaoithe; Inch Cape Offshore Windfarm;	5.1% (2156)	0.1% (49)	50%	2.6%	0.06%
	Troup, Pennan and Lion's Heads	37,041	European Offshore Wind Deployment Centre; Beatrice Offshore Windfarm; Moray Firth R3 Zone 1 Eastern Development Area (EDA); Hywind Buchan Deep Demonstration Site.	2.8% (1,049)	0.1% (49)	50%	1.4%	0.07%

Bird Species	SPA	Foraging Area (km^2)	Windfarms within foraging area – in addition to the project.	Overlap between Foraging Area and Windfarms plus 2km buffer as a % of foraging range (km^2)	Overlap between Foraging Area and Kincardine Site plus 2km[1] buffer as a % of foraging range (km^2)	Assumed Displacement of Bird Species	Predicted % of Foraging Area Lost from Windfarms	Predicted % of Foraging Area Lost from Kincardine
Razorbill	Fowlsheugh	11,743	Firth of Forth Phase 1; Neart na Gaoithe; European Offshore Wind Deployment Centre; Inch Cape Offshore Windfarm.	11% (1297)	0.4% (49)	50%	5.5%	0.2%
Puffin	Forth Islands	28,543	European Offshore Wind Deployment Centre; Firth of Forth Phase 1; Neart na Gaoithe; Blyth Offshore Wind Demonstration Site; Inch Cape Offshore Windfarm.	4.8% (1377)	0.2% (49)	50%	2.4%	0.09%
Note: gannet and fulmar are considered to be so wide-ranging as to not require further detail on overlap of relatively small impact area versus foraging areas. 1. To allow direct comparison for the in-combination assessment, a 2km buffer has been applied to the Kincardine site. Based on a site that is 3km x 3km, this equates to 7km x 7km, producing a site area with buffer of 49km^2.								

7.2.1. In-combination assessment

7.2.1.1. Kittiwake

Collision risk from 7 offshore windfarms in addition to Kincardine are presented in ***Table 7-14*** above. The in-combination impacts through breeding season collision estimates amount to 458 kittiwakes at a 98.9% avoidance rate and using option 3 of the Band model (the only option to allow direct comparison between all windfarms). Kincardine contributes approximately 9 adult breeding birds, 1.97% of the total.

It is predicted from ***Table 7-15*** above that in-combination displacement from offshore windfarms will result in the effective loss of 3% (0.2% from Kincardine) of the foraging area for kittiwakes at Fowlsheugh SPA and 0.3% (0.16% from Kincardine) at Buchan Ness to Collieston Coast SPA. This may require birds to travel further to feed, and the breeding success of kittiwakes may be reduced if they have to travel greater distances (see ***Table 7-12*** above). The overall proportion of foraging area predicted to be lost is small compared to the variation in mean maximum foraging distances for this species, which can vary from between 36.7km and a maximum of 120km[26].

7.2.1.2. Gannet

Collision risk from 7 offshore windfarms in addition to Kincardine are presented in ***Table 7-14*** above. The in-combination impacts through breeding season collision estimates amount to 1,442 gannets at a 99% avoidance rate (closest to the 98.9% recommended by the joint SNCB advice) and using option 3 of the Band model (the only option to allow direct comparison between all windfarms). Kincardine contributes approximately 2 adult breeding bird, 0.14% of the total.

The foraging range of gannet breeding on the Forth Islands SPA is extensive in comparison to the site footprints of all the offshore windfarms identified for the in-combination assessment (see ***Figure 6-3*** and ***Figure 6-4*** above) and the species has a very flexible foraging strategy. In-combination displacement from offshore windfarms is therefore not predicted to negatively affect the gannet population at the Forth Islands SPA.

7.2.1.3. Guillemot

The in-combination collision risk from all windfarms to guillemot is considered negligible, this is largely due to their flight height distributions and maximum flight heights. Guillemot generally have a very low flight height, often flying just a few metres above the water. Due to this, they are very rarely flying at turbine height and therefore have a very low number of predicted collisions. In addition to this, the numbers of individuals at each SPA are high and 4 out of the 6 SPAs supporting guillemot within foraging range of Kincardine are seeing increases in numbers of guillemot. In some cases quite significant increases (see ***Table 6-1*** above).

It is predicted from ***Table 7-15*** above that in-combination displacement from offshore windfarms will result in the effective loss of 1.9% (0.07% from Kincardine) of the foraging area for guillemot at Fowlsheugh SPA, 2.6% (0.06% from Kincardine) at Buchan Ness to Collieston Coast SPA and 1.4% (0.07% from Kincardine) at Troup, Pennan and Lion's Heads SPA. This may require birds to travel further to feed, and the breeding success of guillemots may be reduced if they have to travel greater distances (see ***Table 7-12*** above). Guillemot are able to dive to considerable depths and exploit prey throughout the water column (see ***Table 6-2*** above).The overall proportion of foraging area predicted to be lost is small compared to the variation in mean maximum foraging distances for this species, which can vary from between 34.1km and a maximum of 135km[22].

7.2.1.4. Razorbill

The in-combination collision risk from all windfarms to razorbill is considered negligible, this is largely due to their flight height distributions and maximum flight heights. Razorbill generally have a very low flight height, often flying just a few metres above the water. Due to this, they are very rarely flying at turbine height and therefore have a very low number of predicted collisions. In addition to this, the numbers of individuals at Forth Islands SPA have seen significant increases in numbers since designation (a 68% increase, see ***Table 6-1*** above). Fowlsheugh SPA has seen a 9% decrease in the Razorbill population since designation. This could however, be due to individuals joining the colony at Forth Islands SPA.

[26] Thaxter, C.B., Lascelles, B., Sugar, K., Cook, A.S.C.P., Roos, S., Bolton, M., Langston, R.H.W. and Burton, N.H.K. (2012) Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas. Biological Conservation 156: 53-61.

It is predicted from ***Table 7-15*** above that in-combination displacement from offshore windfarms will result in the effective loss of 5.5% (0.2% from Kincardine) of the foraging area for razorbill at Fowlsheugh SPA. This may require birds to travel further to feed, and the breeding success of razorbills may be reduced if they have to travel greater distances (see ***Table 7-12*** above). Like guillemot, razorbills are able to dive to considerable depths and exploit prey throughout the water column (see ***Table 6-2*** above). The overall proportion of foraging area predicted to be lost is small compared to the variation in mean maximum foraging distances for this species, which can vary from between 13.5km and a maximum of 95km[27].

7.2.1.5. Puffin

The in-combination collision risk from all windfarms to Puffin is considered negligible, this is largely due to their flight height distributions and maximum flight heights. Puffin generally have a very low flight height, often flying just a few metres above the water. Due to this, they are very rarely flying at turbine height and therefore have a very low number of predicted collisions. In addition to this, the numbers of individuals at Forth Islands SPA have seen a significant increase in numbers since designation (a 73% increase, see ***Table 6-1*** above).

It is predicted from ***Table 7-15*** above that in-combination displacement from offshore windfarms will result in the effective loss of 2.4% (0.09% from Kincardine) of the foraging area for Puffin at the Forth Islands SPA. This may require birds to travel further to feed, and the breeding success of puffins may be reduced if they have to travel greater distances (see ***Table 7-12*** above). Although not as deep as guillemots and razorbills, puffins are still able to dive to considerable depths and exploit prey throughout the water column (see ***Table 6-2*** above). The overall proportion of foraging area predicted to be lost is small compared to the variation in mean maximum foraging distances for this species, which can vary from between 59.4km and a maximum of 200km[23].

[27] Thaxter, C.B., Lascelles, B., Sugar, K., Cook, A.S.C.P., Roos, S., Bolton, M., Langston, R.H.W. and Burton, N.H.K. (2012) Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas. Biological Conservation 156: 53-61.

8. Summary and Conclusions

8.1. Special Protection Areas

8.1.1. Fowlsheugh

8.1.1.1. Kittiwake (*Rissa tridactyla*)

Collision Risk
The results of the collision risk modelling (using option 2 - see ***Table 7-5*** above) predict a total annual mortality of 34 kittiwake through collisions with turbine blades, based on NE3 survey area density estimates and 32 based on Kincardine survey area density estimates (NE3 area with 8km buffer). The predicted annual mortality during the breeding season is 28 kittiwake (see ***Table 7-9*** above). From this total figure of 28 birds, an annual mortality of 8 birds has been apportioned to Fowlsheugh SPA (see ***Table 7-10*** above). This figure equates to an increase in breeding adult mortality from collisions of 0.044% of Fowlsheugh SPA population.

Displacement
With regards to the displacement effects of Kincardine windfarm, precautionary assumptions were made for kittiwake of a 30% displacement from the Project wind turbine footprint. This footprint assumed that 8 turbines would be installed with a 1km buffer. The breeding failure of displaced birds was assumed to be 100% with 50% adult mortality.

A total of 19 adult breeding kittiwake from Fowlsheugh SPA (0.1% of the SPA population) were predicted to be displaced by the scheme (see ***Table 7-12*** above). Based on the annual breeding success of this SPA and 100% breeding failure of displaced birds, this would equate to 19 chicks being 'lost', which would result in a predicted reduction in breeding success at this SPA of 0.1%.

Disturbance
Disturbance resulting from the construction or operation of the scheme will be temporary and localised and is not predicted to negatively affect the population viability of kittiwakes, either alone or in-combination with other plans or projects.

Conclusion
Overall the potential impact of the Kincardine Windfarm on kittiwake from Fowlsheugh SPA is considered to be negligible, given the scale and magnitude of the proposal. It can therefore be concluded that this scheme will have no adverse effects on the integrity of Fowlsheugh SPA, alone or in-combination with other plans or projects.

8.1.1.2. Guillemot (*Uria aalge*)

Collision Risk
The results of the collision risk modelling (see ***Table 7-5*** above) predict that no guillemot will be lost through collisions with turbine blades, based on NE3 and Kincardine (NE3 area with 8km buffer) survey area density estimates.

Displacement
With regards to the displacement effects of Kincardine windfarm, precautionary assumptions were made for guillemot of a 50% displacement from the Project wind turbine footprint. This footprint assumed that 8 turbines would be installed with a 1km buffer. The breeding failure of displaced birds was assumed to be 100%.

A total of 130 adult breeding guillemot from Fowlsheugh (0.28% of the SPA population) were predicted to be displaced by the scheme (see ***Table 7-12*** above). Based on the annual breeding success of this SPA and 100% breeding failure of displaced birds, this would equate to 86 chicks being 'lost', which would result in a predicted reduction in breeding success at this SPA of 0.29%.

It could be the case however that the floating sub-structures, mooring anchor weights and lines act to encourage birds to use the area, rather than displacing them. This could particularly be the case for diving bird species, as the floating sub-structure, mooring anchor weighs and lines could act as artificial reefs and fish aggregation devices, increasing prey species in the immediate area of the turbines and the design of the triangular sub-structures is such that they would provide suitable resting and perching areas for birds. The triangular shape of the structures would also create a central area of open water that could help to provide shelter and protection to bird species during adverse weather and sea conditions (see ***Figure 2-2*** above).

Disturbance
Disturbance resulting from the construction or operation of the scheme will be temporary and localised and is not predicted to negatively affect the population viability of guillemots, either alone or in-combination with other plans or projects.

Conclusion
Overall the potential impact of the Kincardine Windfarm on guillemot from Fowlsheugh SPA is considered to be negligible, given the scale and magnitude of the proposal. It can therefore be concluded that this scheme will have no adverse affects on the integrity of Fowlsheigh SPA, alone or in-combination with other plans or projects.

8.1.1.3. Fulmar (*Fularus glacialis*)

Collision Risk
The results of the collision risk modelling (using option 3 - see ***Table 7-5*** above) predict no fulmar will be impacted from collision risk and as a result there will be no predicted increases to fulmar mortality rates.

Displacement
Foraging ranges for fulmar are very extensive in comparison to the surface area of Kincardine and the offshore windfarms identified for the in-combination displacement assessment (see ***Figure 6-3*** above). In addition, the species has a particularly flexible foraging strategy. Displacement from Kincardine, either alone or in-combination with other offshore windfarms, is therefore not predicted to negatively affect the fulmar population at any of the SPAs.

Disturbance
Disturbance resulting from the construction or operation of the scheme will be temporary and localised and is not predicted to negatively affect the population viability of fulmar, either alone or in-combination with other plans or projects.

Conclusion
Overall the potential impact of the Kincardine Windfarm on fulmar from Fowlsheugh SPA is considered to be negligible, given the scale and magnitude of the proposal. It can therefore be concluded that this scheme will have no adverse affects on the integrity of Fowlsheigh SPA, alone or in-combination with other plans or projects.

8.1.1.4. Herring Gull (*Larus argentatus*)

Collision Risk
The results of the collision risk modelling (using option 3 - see ***Table 7-5*** above) predict a total annual mortality of 1 herring gull through collisions with turbine blades.

Displacement
Kincardine would result in a loss of 0.1% of the foraging area for herring gull originating from Fowlsheugh SPA. This figure is substantially lower than other windfarms, which contribute to a total loss of 2% of the foraging area for herring gull originating from Fowlsheugh SPA. Herring Gulls are omnivorous and may feed onshore and offshore. Because they forage in a variety of terrestrial, coastal and offshore habitats, including taking discards from fishing vessels, any displacement impacts are not considered likely to cause negative impacts on herring gull populations at any of the SPAs.

Disturbance
Disturbance resulting from the construction or operation of the scheme will be temporary and localised and is not predicted to negatively affect the population viability of herring gull, either alone or in-combination with other plans or projects.

Conclusion

Overall the potential impact of the Kincardine Windfarm on herring gull from Fowlsheugh SPA is considered to be negligible, given the scale and magnitude of the proposal. It can therefore be concluded that this scheme will have no adverse affects on the integrity of Fowlsheigh SPA, alone or in-combination with other plans or projects.

8.1.1.5. Razorbill (*Alca torda*)

Collision Risk
The results of the collision risk modelling (see ***Table 7-5*** above) predict that no razorbill will be impacted through collisions with turbine blades.

Displacement
With regards to the displacement effects of Kincardine windfarm, precautionary assumptions were made for razorbill of a 50% displacement from the Project wind turbine footprint. This footprint assumed that 8 turbines would be installed with a 1km buffer. The breeding failure of displaced birds was assumed to be 100%.

It is estimated that approximately 8 adult breeding razorbill will be displaced by the Kincardine site with a 1km buffer (see ***Table 7-12*** above). This figure equates to 0.15% of the population of Fowlsheugh SPA. The number of chicks per pair per year for this SPA is 0.60. If 8 individual adult breeding birds are displaced there is the potential for 5 chicks to be 'lost' as a result of displacement. This figure equates to a predicted reduction in breeding success of 0.16%.

Kincardine would result in a loss of 0.2% of the foraging area for razorbill originating from Fowlsheugh SPA. This figure is substantially lower than other windfarms, which contribute to a total loss of 5.5% of the foraging area for razorbill originating from Fowlsheugh SPA (see ***Table 7-15*** above).

It could be the case however that the floating sub-structures, mooring anchor weights and lines act to encourage birds to use the area, rather than displacing them. This could particularly be the case for diving bird species, as the floating sub-structure, mooring anchor weighs and lines could act as artificial reefs and fish aggregation devices, increasing prey species in the immediate area of the turbines and the design of the triangular sub-structures is such that they would provide suitable resting and perching areas for birds. The triangular shape of the structures would also create a central area of open water that could help to provide shelter and protection to bird species during adverse weather and sea conditions (see ***Figure 2-2*** above).

Disturbance
Disturbance resulting from the construction or operation of the scheme will be temporary and localised and is not predicted to negatively affect the population viability of razorbill, either alone or in-combination with other plans or projects.

Conclusion
Overall the potential impact of the Kincardine Windfarm on razorbill from Fowlsheugh SPA is considered to be negligible, given the scale and magnitude of the proposal. It can therefore be concluded that this scheme will have no adverse affects on the integrity of Fowlsheigh SPA, alone or in-combination with other plans or projects.

8.1.2. Buchan to Collieston Coast; and Troup, Pennan and Lions Heads

8.1.2.1. Kittiwake (*Rissa tridactyla*)

Collision Risk

The results of the collision risk modelling (see ***Table 7-5*** above) predict a total annual mortality of 34 kittiwake through collisions with turbine blades, based on NE3 survey area density estimates and 32 based on Kincardine survey area density estimates (NE3 area with 8km buffer). The predicted annual mortality during the breeding season is 28 kittiwake (see ***Table 7-9*** above). From this total figure of 28 birds, an annual mortality of 3 bird has been apportioned to Buchan to Collieston Coast and 1 birds has been apportioned to Troup, Pennan and Lions Heads SPA (see ***Table 7-10*** above). These figures equate to an increase in breeding adult mortality from collisions of 0.013% of Buchan to Collieston Coasts and 0.002% of Troup, Pennan and Lions Heads SPA populations.

Displacement

With regards to the displacement effects of Kincardine windfarm, precautionary assumptions were made for kittiwake of a 30% displacement from the KOWL wind turbine footprint. This footprint assumed that 8 turbines would be installed with a 1km buffer. The breeding failure of displaced birds was assumed to be 100%.

A total of 8 adult breeding kittiwake from Buchan to Collieston Coast (0.03% of the SPA population) and 2 bird from Troup, Pennan and Lions Heads (0.006% of the SPA population) were predicted to be displaced by the scheme (see ***Table 7-12*** above). Based on the annual breeding success of this SPA and 100% breeding failure of displaced birds, this would equate to 6 chicks being 'lost' from Buchan to Collieston Coast SPA, which would result in a predicted reduction in breeding success of 0.03%. Two kittiwakes were apportioned to Troup, Pennan and Lions Heads SPA (0.006% SPA population) resulting in 2 chicks lost and a reduction in breeding success of 0.008%.

Disturbance

Disturbance resulting from the construction or operation of the scheme will be temporary and localised and is not predicted to negatively affect the population viability of kittiwakes, either alone or in-combination with other plans or projects.

Conclusion

Overall the potential impact of the Kincardine Windfarm on kittiwake from Buchan to Collieston Coast and Troup, Pennan and Lions Heads SPA is considered to be negligible, given the scale and magnitude of the proposal. It can therefore be concluded that this scheme will have no adverse affects on the integrity of Buchan to Collieston Coast and Troup, Pennan and Lions Heads SPA, alone or in-combination with other plans or projects.

8.1.2.2. Guillemot (*Uria aalge*)

Collision Risk

The results of the collision risk modelling (see ***Table 7-5*** above) predict that no guillemot will be lost through collisions with turbine blades, based on NE3 and Kincardine (NE3 area with 8km buffer) survey area density estimates.

Displacement

With regards to the displacement effects of Kincardine windfarm, precautionary assumptions were made for guillemot of a 50% displacement from the KOWL wind turbine footprint. This footprint assumed that 8 turbines would be installed with a 1km buffer. The breeding failure of displaced birds was assumed to be 100%.

A total of 16 adult breeding guillemot (0.08% of the SPA population) were predicted to be displaced by the scheme (see ***Table 7-12*** above) from Buchan to Collieston Coast SPA and 3 birds displaced from Troup, Pennan and Lions Heads SPA (0.02% of the SPA population). Based on the annual breeding success of this SPA and 100% breeding failure of displaced birds, this would equate to 11 chicks being 'lost' from Buchan to Collieston Coast SPA and 2 chicks being lost from Troup, Pennan and Lions Heads SPA. This would result in a predicted reduction in breeding success at Buchan to Collieston Coast SPA of 0.09% and a reduction from Troup, Pennan and Lions Heads SPA of 0.019%.

It could be the case however that the floating sub-structures, mooring anchor weights and lines act to encourage birds to use the area, rather than displacing them. This could particularly be the case for diving bird species, as the floating sub-structure, mooring anchor weighs and lines could act as artificial reefs and fish aggregation devices, increasing prey species in the immediate area of the turbines and the design of the triangular sub-structures is such that they would provide suitable resting and perching areas for birds. The triangular shape of the structures would also create a central area of open water that could help to provide shelter and protection to bird species during adverse weather and sea conditions (see Figure 2-2 in the HRA).

Disturbance
Disturbance resulting from the construction or operation of the scheme will be temporary and localised and is not predicted to negatively affect the population viability of guillemots, either alone or in-combination with other plans or projects.

Conclusion
Overall the potential impact of the Kincardine Windfarm on guillemot from Buchan to Collieston Coast and Troup, Pennan and Lions Heads SPA is considered to be negligible, given the scale and magnitude of the proposal. It can therefore be concluded that this scheme will have no adverse affects on the integrity of Buchan to Collieston Coast and Troup, Pennan and Lions Heads SPA, alone or in-combination with other plans or projects.

8.1.2.3. Fulmar (*Fularus glacialis*)

Collision Risk
The results of the collision risk modelling (using option 3 - see ***Table 7-5*** above) predict that no fulmar will be lost through collisions with turbine blades, based on NE3 and Kincardine (NE3 area with 8km buffer) survey area density estimates.

Displacement
Foraging ranges for fulmar are very extensive in comparison to the surface area of Kincardine and the offshore windfarms identified for the in-combination displacement assessment (see ***Figure 6-3*** above). In addition, the species has a particularly flexible foraging strategy. Displacement from Kincardine, either alone or in-combination with other offshore windfarms, is therefore not predicted to negatively affect the fulmar population at any of the SPAs.

Disturbance
Disturbance resulting from the construction or operation of the scheme will be temporary and localised and is not predicted to negatively affect the population viability of fulmar, either alone or in-combination with other plans or projects.

Conclusion
Overall the potential impact of the Kincardine Windfarm on fulmar from Buchan to Collieston Coast and Troup, Pennan and Lions Heads SPA is considered to be negligible, given the scale and magnitude of the proposal. It can therefore be concluded that this scheme will have no adverse affects on the integrity of Buchan to Collieston Coast and Troup, Pennan and Lions Heads SPA, alone or in-combination with other plans or projects.

8.1.2.4. Herring Gull (*Larus argentatus*)

Collision Risk
The results of the collision risk modelling (using option 3 - see ***Table 7-5*** above) predict a total annual mortality of 1 herring gull through collisions with turbine blades.

Displacement
Kincardine would result in a loss of 0.2% of the foraging area for herring gull originating from Buchan to Collieston Coast SPA. This figure is substantially lower than other windfarms, which contribute to a total loss of 2% of the foraging area for herring gull originating from Buchan to Collieston Coast SPA. Herring Gulls are omnivorous and may feed onshore and offshore. Because they forage in a variety of terrestrial, coastal and offshore habitats, including taking discards from fishing vessels, any displacement impacts are not considered likely to cause negative impacts on herring gull populations at any of the SPAs. No displaced

herring gull were apportioned to Troup, Pennan and Lions Heads SPA due to the distance of the SPA from the Kincardine site.

Disturbance
Disturbance resulting from the construction or operation of the scheme will be temporary and localised and is not predicted to negatively affect the population viability of herring gull, either alone or in-combination with other plans or projects.

Conclusion
Overall the potential impact of the Kincardine Windfarm on herring gull from Buchan to Collieston Coast and Troup, Pennan and Lions Heads SPA is considered to be negligible, given the scale and magnitude of the proposal. It can therefore be concluded that this scheme will have no adverse affects on the integrity of Buchan to Collieston Coast and Troup, Pennan and Lions Heads SPA, alone or in-combination with other plans or projects.

8.1.3. Forth Islands

8.1.3.1. Fulmar (*Fularus glacialis*)

Collision Risk

The results of the collision risk modelling (using option 3 - see ***Table 7-5*** above) predict that no fulmar will be lost through collisions with turbine blades, based on NE3 and Kincardine (NE3 area with 8km buffer) survey area density estimates.

Displacement

Foraging ranges for fulmar are very extensive in comparison to the surface area of Kincardine and the offshore windfarms identified for the in-combination displacement assessment (see ***Figure 6-3*** above). In addition, the species has a particularly flexible foraging strategy. Displacement from Kincardine, either alone or in-combination with other offshore windfarms, is therefore not predicted to negatively affect the fulmar population at any of the SPAs.

Disturbance

Disturbance resulting from the construction or operation of the scheme will be temporary and localised and is not predicted to negatively affect the population viability of fulmar, either alone or in-combination with other plans or projects.

Conclusion

Overall the potential impact of the Kincardine Windfarm on fulmar from Forth Islands SPA is considered to be negligible, given the scale and magnitude of the proposal. It can therefore be concluded that this scheme will have no adverse affects on the integrity of Forth Islands SPA, alone or in-combination with other plans or projects.

8.1.3.2. Gannet (*Morus bassanus*)

Collision Risk

The results of the collision risk modelling (see ***Table 7-5*** above) predict a total annual mortality of 6 gannet through collisions with turbine blades, based on NE3 survey area density estimates and 5 based on Kincardine survey area density estimates (NE3 area with 8km buffer). The predicted annual mortality during the breeding season is 6 gannets (see ***Table 7-9*** above). From this total figure of 6 birds, an annual mortality of 2 bird has been apportioned to Forth Islands SPA (see ***Table 7-10*** above). This figure equates to an increase in breeding adult mortality from collisions of 0.002% of Forth Islands SPA population.

Displacement

With regards to the displacement effects of Kincardine windfarm, precautionary assumptions were made for gannet of a 75% displacement from the KOWL wind turbine footprint. This footprint assumed that 8 turbines would be installed with a 1km buffer. The breeding failure of displaced birds was assumed to be 100%.

A total of 10 adult breeding gannet (0.006% of the SPA population) were predicted to be displaced by the scheme (see ***Table 7-12*** above). Based on the annual breeding success of this SPA and 100% breeding failure of displaced birds, this would equate to 8 chicks being ‘lost’, which would result in a predicted reduction in breeding success at this SPA of 0.007%.

Foraging ranges for gannet are very extensive in comparison to the surface area of Kincardine and the offshore windfarms identified for the in-combination displacement assessment (see ***Figure 6-3*** above). In addition, the species has a particularly flexible foraging strategy. Displacement from Kincardine, either alone or in-combination with other offshore windfarms, is therefore not predicted to negatively affect the gannet population at any of the SPAs.

Disturbance

Disturbance resulting from the construction or operation of the scheme will be temporary and localised and is not predicted to negatively affect the population viability of gannet, either alone or in-combination with other plans or projects.

Conclusion

Overall the potential impact of the Kincardine Windfarm on gannet from Forth Islands SPA is considered to be negligible, given the scale and magnitude of the proposal. It can therefore be concluded that this scheme will have no adverse affects on the integrity of Forth Islands SPA, alone or in-combination with other plans or projects.

8.1.3.3. Puffin (*Fratercula arctica*)

Collision Risk

The results of the collision risk modelling (using option 3 - see ***Table 7-5*** above) predict that no puffin will be impacted through collisions with turbine blades.

Displacement

With regards to the displacement effects of Kincardine windfarm, precautionary assumptions were made for puffin of a 50% displacement from the KOWL wind turbine footprint. This footprint assumed that 8 turbines would be installed with a 1km buffer. The breeding failure of displaced birds was assumed to be 100%.

It is estimated that approximately 5 adult breeding puffin will be displaced by the Kincardine site with a 1km buffer. This figure equates to 0.005% of the population of Fowlsheugh SPA. The number of chicks per pair per year for this SPA is 0.60. If 5 individual adult breeding birds are displaced there is the potential for 3 chicks to be 'lost' as a result of displacement. This figure equates to a predicted reduction in breeding success of 0.004%.

Kincardine would result in a loss of 0.09% of the foraging area for puffin originating from Forth Islands SPA. This figure is substantially lower than other windfarms, which contribute to a total loss of 2.4% of the foraging area for puffin originating from Forth Islands SPA (see ***Table 7-15*** above).

Disturbance

Disturbance resulting from the construction or operation of the scheme will be temporary and localised and is not predicted to negatively affect the population viability of puffin, either alone or in-combination with other plans or projects.

Conclusion

Overall the potential impact of the Kincardine Windfarm on puffin from Forth Islands SPA is considered to be negligible, given the scale and magnitude of the proposal. It can therefore be concluded that this scheme will have no adverse affects on the integrity of Forth Islands SPA, alone or in-combination with other plans or projects.

8.1.4. East Caithness Cliffs, North Caithness Cliffs, Copinsay, Hoy, Calf of Eday, West Westray, Sumburgh Head, Foula, and Noss

8.1.4.1. Fulmar (*Fularus glacialis*)

Collision Risk

The results of the collision risk modelling (using option 3 - see ***Table 7-5*** above) predict that no fulmar will be lost through collisions with turbine blades, based on NE3 and Kincardine (NE3 area with 8km buffer) survey area density estimates.

Displacement

Foraging ranges for fulmar are very extensive in comparison to the surface areas of Kincardine and the offshore windfarms identified for the in-combination displacement assessment (see ***Figure 6-3*** above). In addition, the species has a particularly flexible foraging strategy. Displacement from Kincardine, either alone or in-combination with other offshore windfarms, is therefore not predicted to negatively affect the fulmar population at any of the SPAs.

Disturbance

Disturbance resulting from the construction or operation of the scheme will be temporary and localised and is not predicted to negatively affect the population viability of fulmar, either alone or in-combination with other plans or projects.

Conclusion

Overall the potential impact of the Kincardine Windfarm on fulmar from East Caithness Cliffs, North Caithness Cliffs, Copinsay, Hoy, Calf of Eday, West Westray, Sumburgh Head, Foula, or Noss SPAs are considered to be negligible, given the scale and magnitude of the proposal. It can therefore be concluded that this scheme will have no adverse affects on the integrity of these SPAs, alone or in-combination with other plans or projects.

8.1.5. Fair Isle; and Flamborough Head and Bempton Cliffs

8.1.5.1. Gannet (*Morus bassanus*)

Collision Risk

The results of the collision risk modelling (see ***Table 7-5*** above) predict a total annual mortality of 6 gannet through collisions with turbine blades, based on NE3 survey area density estimates and 5 based on Kincardine survey area density estimates (NE3 area with 8km buffer). The predicted annual mortality during the breeding season is 6 gannets (see ***Table 7-9*** above). From this total figure of 6 birds, no birds have been apportioned to either Fair Isle or Flamborough Head and Bempton Cliffs SPAs (see ***Table 7-10*** above). This is due to the large population size of the Forth Islands SPA compared to the Fair Isle SPA and the distance of Flamborough Head and Bempton Cliffs SPA from the Kincardine site.

Displacement

No gannet originating from either Fair Isle or Flamborough Head and Bempton Cliffs SPAs were predicted to be displaced by Kincardine.

Foraging ranges for gannet are very extensive in comparison to the surface area of Kincardine and the offshore windfarms identified for the in-combination displacement assessment (see ***Figure 6-3*** above). In addition, the species has a particularly flexible foraging strategy. Displacement from Kincardine, either alone or in-combination with other offshore windfarms, is therefore not predicted to negatively affect the gannet population at any of the SPAs.

Disturbance

Disturbance resulting from the construction or operation of the scheme will be temporary and localised and is not predicted to negatively affect the population viability of gannet, either alone or in-combination with other plans or projects.

Conclusion

Overall the potential impact of the Kincardine Windfarm on gannet from Fair Isle and Flamborough Head and Bempton Cliffs SPAs is considered to be negligible, given the scale and magnitude of the proposal. It can therefore be concluded that this scheme will have no adverse affects on the integrity of Flamborough Head and Bempton Cliffs SPAs, alone or in-combination with other plans or projects.

8.2. Special Areas of Conservation

8.2.1. Bottlenose Dolphin

8.2.1.1. Moray Firth

A number of species such as the Bottlenose dolphin are placed at higher risks of collision or entanglement with mooring lines[28]. Almost of greater concern than the entanglement risk presented by moorings themselves is the entanglement in derelict fishing gear which has the potential to become caught or snagged among the mooring lines, this is commonly known as ghost fishing[29].

Bottlenose dolphins were the second most frequently sited cetacean species during the EOWDC surveys, with a total of 25 observations of 117 individuals being detected on effort. The majority of the sightings occurred in the spring and summer months. A higher number of bottlenose dolphins were in the vicinity of the entrance to Aberdeen Harbour, which is a known 'hotspot' for dolphin sightings. Bottlenose dolphins were frequently recorded in close proximity to the harbour entrance, with their presence being linked to salmon migration up the river.

Bottlenose Dolphins were however, not recorded during the High Definition (Hi-Def) aerial surveys.

The proposed development area is approximately 15km from the coast. Bottlenose dolphins tend to stay close inshore therefore it's conceivable that not many will use this area. However, they are observed along the coastline between Aberdeen and Stonehaven, so it cannot be excluded that they may use the development area (SNH HRA response).

<u>Disturbance Impacts</u>

The level of vessel traffic within the area is deemed as intermediate to moderately busy compared to other regions of UK waters. The current use of the Development Area varies throughout the year. An average of 55 vessels per day passed within 10nm of the Development Area. Of these, an average of five vessels per day passed through the site (Anatec Preliminary Hazard Analysis). The vessel types recorded passing within 10nm of the Development Area include cargo vessels, tugs, tankers, Emergency Response and Rescue Vessels (ERRVs), guard boats, survey vessels and workboats.

The precise nature of the vessels to be used is still to be determined. It is likely that a number of vessels will be used including barges, cable laying vessels and tugs. The additional windfarm related traffic will be confined to pre-defined traffic corridors.

It is unlikely that increased vessel activity will result in a barrier effect to marine mammals, as they are already used to a medium level of vessel traffic moving throughout the area.

Any displacement and behavioural changes of marine mammals due to increased vessel activity can be very broad, but appear to be short-term[30].

<u>Noise Impacts</u>

Traditional offshore windfarm developments have been the subject of significant underwater noise assessments and regulation due to the impact of piling noise and vessel noise during the extended period of construction (installation of the piles, installation of the monopoles / jackets and the installation of the WTG). 90dB_{ht} (dBs referenced to hearing threshold) is the level at which the perceived noise level is predicted to

[28] Bonar, P.A.J., Bryden, I.G. and Borthwick, A.G.L. (2015). Social and ecological impacts of marine energy development. Renewable and Sustainable Energy Reviews, Volume 47, Pages 486-495.
[29] Benjamins, S., Harnois, V., Smith, H.C.M., Johanning, L., Greenhill, L., Carter, C. and Wilson, B. (2014). Understanding the potential for marine megafauna entanglement risk from renewable marine energy developments. Scottish Natural Heritage Commissioned Report No. 791
[30] Wilhelmsson, D., Malm, T., Thompson, R., Tchou, J., Sarantakos, G., McCormick, N., Luitjens, S., Gullström, M., Patterson Edwards, j.K., Amir, O. and Dubi, A. (2010). Greening Blue Energy: Identifying and Managing the Biodiversity Risks and Opportunities of Offshore Renewable Energy. IUCN.

cause a strong avoidance reaction in virtually all marine mammal individuals[31]. It has been found that the majority of construction activities have very small ranges in which perceived noise reaches 90dB_{ht} levels (within 100m of activity), with the greatest levels of noise produced by impact piling[32] (see KOWL EIA ES Chapter 9 for noise assessment).

The construction phase of windfarms will inevitably generate increased noise from vessel traffic and installation activities; however, the installation of floating offshore structures removes nearly all site construction noise as the units are constructed in port, towed to the site then moored in position, with no piling activities required. Construction related noise is therefore either not generated or significantly reduced as a result of the following:

- No large construction vessels required for installation of WTG units
- The WTG installation vessels (tugs) spend a limited time on site during construction;
- There is no piling noise generated
- KOWL is a small scale development with a short on site construction phase.

From studies of windfarms to date, there is no evidence of marine mammals avoiding windfarms during operation due to noise, and any long-term avoidance behaviour is considered very local and small[33].

Generally, any noise generated during construction or decommissioning should be temporary. As the potential noise impact is very limited for offshore floating wind installations, it is not believed that a separate noise study is required during the consenting phase due to any potential impacts being very limited in time and space.

Collision / Vessel Strikes

The level of vessel traffic within the area is deemed as intermediate to moderately busy compared to other regions of UK waters. The current use of the Development Area varies throughout the year. An average of 55 vessels per day passed within 10nm of the Development Area. Of these, an average of five vessels per day passed through the site (Anatec Preliminary Hazard Analysis). The vessel types recorded passing within 10nm of the Development Area include cargo vessels, tugs, tankers, Emergency Response and Rescue Vessels (ERRVs), guard boats, survey vessels and workboats.

The number and severity of marine mammal strikes is likely to be influenced by vessel type, speed and underwater background noise. Vessels travelling at speeds of 14 knots or over appear to cause the most severe injuries[34].

The vessel types and construction ports to be used during the development of Kincardine Offshore Windfarm are still to be determined. It is likely that a number of vessels will be used including barges, cable laying vessels and tugs, and although the potential for impact on marine mammal species will be dependent on the vessel routes taken to the Development Area, the additional vessel traffic will be confined to pre-defined traffic corridors.

During the construction, operation and decommissioning phases of the project, vessels will be slow moving and predictable for safety and operational reasons, therefore it is likely that the vessels will pose little risk of collision to marine mammals.

In addition, there is already a medium level of vessel activity occurring in the area, with a high intensity of vessel movements to and from Aberdeen Harbour. Planned vessel activity relating to construction, operation and decommissioning activities will be discussed and detailed within the final Environmental

[31] Nedwell, J.R., Turnpenny, A.W.H., Lovell, J., Parvin, S.J., Workman, R., Spinks, J.A.L. and Howell, D. (2007). A validation of the dB_{ht} as a measure of the behavioural and auditory effects of underwater noise. Subacoustech Report Reference 534R1231. Department for Business, Enterprise and Regulatory Reform.
[32] Inch Cape Offshore Limited (ICOL) (2013). Inch Cape Offshore Limited Offshore Environmental Statement. [ONLINE] Available at: http://www.inchcapewind.com/publications/environmental-statement/introduction
[33] Wilhelmsson, D., Malm, T., Thompson, R., Tchou, J., Sarantakos, G., McCormick, N., Luitjens, S., Gullström, M., Patterson Edwards, j.K., Amir, O. and Dubi, A. (2010). Greening Blue Energy: Identifying and Managing the Biodiversity Risks and Opportunities of Offshore Renewable Energy. IUCN.
[34] Laist, D.W., Knowlton, A.R., Mead, J.G., Collet, A.S. and Podesta, M. (2001). Collisions between ships and whales. Marine Mammal Science, 17 (1): 35-75.

Management Plan (EMP). Defined navigational routes will be utilised by vessels to reduce the risk of collision with marine mammals.

Entanglement

Marine Renewable Energy (MRE) device moorings are unlikely to pose a major threat; however, entanglement risk among MRE arrays will likely vary substantially based on device spacing, mooring design and array layout. Some mooring designs present a greater risk than others, with the greater risks generated by catenary moorings, particularly those containing nylon. Taut systems represent the lowest risk, with the caveat that pre-tension should be designed to be high enough to prevent slack mooring lines[32].

As a result of 'ghost fishing', Benjamins *et al*. (2014)[35] recommend that Developers routinely monitor their development to check for entanglement, animal behaviour / presence around the site and trapped derelict fishing gear. Regular underwater visual inspection of the conditions of moorings, and subsea cables is likely to be required and planned for operational reasons at Kincardine Offshore Windfarm. Such inspections will also be used to detect derelict fishing gears and items with a potential risk of mammal entanglement.

The mooring lines will be routinely maintained and checked for debris with gear removal programmes put in place where necessary. Furthermore, load cells will be attached to the mooring devices and subsea cables. The load cells will alert the Developer if there is unexpected load on the devices which can then be examined.

There are no records of marine mammal entanglements in moorings or any other infrastructure associated with the offshore oil and gas industry, which is the closest parallel to moorings utilised for marine renewable energy devices[32], although it is likely that the Kincardine Offshore Windfarm will require less moorings than that utilised in oil and gas installations.

Disturbance to Prey Species

The main prey items for the majority of marine mammals recorded within the study area are fish, although some non-fish species such as cephalopods (e.g. Squid and Cuttlefish) will be eaten by marine mammals.

Construction surveys from existing windfarms have indicated that fish numbers present within operating windfarms are at least similar to those prior to construction and may be higher. Consequently no long term impacts on fish which marine mammals prey are predicted following cessation of construction and decommissioning activities.

Due to the nature of the proposed development as a floating windfarm, it has the potential to become a fish aggregation device, by growing algae, seaweed and kelp on the floating substructure, which in turn provides hiding places and habitat for juvenile fish and invertebrates, which attracts larger fish species. There is, therefore potential for the occurrence of increased numbers of fish such as sandeel in the Development Area which would provide a source of prey to marine mammals.

Geophysical Surveys

Pre installation geophysical surveys of the Development Area may be required and it is recognised that geophysical surveys have the potential to cause acoustic disturbance to marine mammals (JNCC, 2010).

Geophysical acoustic surveys in marine or coastal waters involve the collection of information on the physical environment by means of sound signal production, reception, analysis and interpretation, to analyse the structure and composition of the seabed substrate. Surveys involve the use of a vessels fitted with specialised equipment or from which such equipment can be deployed or towed.

Marine seismic surveys primarily use low-frequency sound to penetrate the sea floor, which can harm marine mammals. The level of environmental impact associated with this acoustic activity is variable depending on a

[35] Benjamins, S., Harnois, V., Smith, H.C.M., Johanning, L., Greenhill, L., Carter, C. and Wilson, B. (2014). Understanding the potential for marine megafauna entanglement risk from renewable marine energy developments. *Scottish Natural Heritage Commissioned Report No. 791*.

number of factors including the type of the equipment being used, its sound signal and propagation characteristics, and the depth in which it is operating.

Acoustic instruments and equipment used in targeted marine geophysical investigations can have very high sound pressure levels (e.g. air guns), however the instruments that are likely to be used for the Project survey (multibeam, single beam, side-scan sonar and sub-bottom profilers) emit energy at a significantly lower levels.

The details of the geophysical survey specification are not known yet, however it is anticipated that sub bottom profilers are likely to pose the greatest risk of disturbance to marine mammals. Based on our prior experience we would expect to employ a number of key mitigation measures, as outlined in the JNCC 2010 seismic guidelines, which will be discussed and agreed as part of the consultation prior to the surveys.

Similarly, but to a lesser extent, the use of acoustic deterrent devices (ADD), as a mitigation measure, represent the addition of a new sound source to the marine mammal environment designed to elicit a behavioural response. The use of such devices may not be required by the Project, but should they be suggested, they should be considered carefully to decide whether or not it is appropriate to deliberately add extra-noise to the sea as a precautionary measure.

Given the low penetration depth into the seabed required for the Project geophysical surveys, they are not anticipated to emit large amounts of noise. However, as the survey specifications have not yet been finalised, further consultation will be undertaken prior to the geophysical surveys, which are planned for the detailed design stage of the Project. The Geophysical surveys will be undertaken in line with the JNCC 2010 seismic guidelines and will include relevant mitigation measures. It is recognised that compliance with the JNCC seismic guidelines will reduce the risk of injury to EPS to negligible levels (JNCC, 2010). The Marine Scotland Licensing Operations Team (MS-LOT) would be consulted regarding the requirement for a European Protected Species (EPS) licence.

Conclusion

Due to the limited number of bottlenose dolphins observed within the vicinity of the Kincardine Site, the size and scale of the development and the fact that the location of the windfarm has been chosen in the area of least fishing effort, it can be concluded that no adverse effect on the integrity of the interest features of the Moray Firth SAC, alone or in-combination with other plans or projects.

8.2.2. Atlantic Salmon

8.2.2.1. River Dee, River South Esk and River Spey

The migratory nature of Atlantic salmon means that they are likely to be vulnerable to certain effects associated with the project, specifically the electromagnetic fields (EMF) produced by the subsea cables. Salmonids are likely to utilise EMF for behaviours such as navigation during long distance migrations which occur at certain stages of their life cycles[36].

Cables will be suitably buried to a depth of 1.5m as recommended by the UK Department of Energy and Climate Change (DECC) (2011)[37] in order to keep the cable below the most active biological layer. Where burial is not possible the cables will be protected by other means. The cables used are relatively small at 33kv and as they are buried at depth there will be little or no EMF at the surface of the seabed. Species monitoring at the Robin Rigg windfarm observed no significant difference in the difference in distribution of electro sensitive species along the cable corridor after two years of monitoring[38].

In addition the magnetic field generated from the cable is determined to be well below that of the earth's magnetic field which is between 30 and 70µT and may not be detectable by the diadromous fish species which are present in the area[39]. There is currently no clear evidence to suggest that either attraction or repulsion will have a detrimental impact on salmonid species. We can therefore conclude that there is no adverse effect on the integrity of the interest features of the River Dee, River South Esk and River Spey SACs, alone or in combination with other plans and projects.

8.2.3. Freshwater Pearl Mussel

Given the location of the Kincardine project relative to the habitat of the species it is not considered that freshwater pearl mussel SAC populations will be directly affected by the project. It is however recognised that populations maybe indirectly affected if there were significant effects on their host species (salmoinds). As it has been determined that there will be no adverse effect on the integrity of the interest features of the River Dee, River South Esk and River Spey SACs, alone or in combination with other plans and projects in relation to salmoinds, this can also be taken as the case for freshwater pearl mussel.

[36] Gill, A.B. & Bartlett, M. (2010). Literature review on the potential effects of electromagnetic fields and subsea noise from marine renewable energy developments on Atlantic salmon, sea trout and European eel. Scottish Natural Heritage Commissioned Report No.401

[37] DECC. (2011). National Policy Statement for renewable Energy Infrastructure (EN-3). Presented to Parliament pursuant to section 5(9) of the Planning Act 2008.

[38] Malcolm, I., Armstrong, J., Godfrey, J., Maclean, J. and Middlemas, S. (2013). The scope of research requirements for Atlantic Salmon, Sea Trout and European Eel in the context of offshore renewables. Marine Scotland Science Report 05/13. Available Online: http://www.gov.scot/Resource/0042/00426601.pdf [Accessed: July 2015]

[39] Moray Offshore Renewables Ltd (2012) Environmental Statement, Eastern Development Area and associated Transmission Infrastructure

8.3. Mitigation and Monitoring

A monitoring plan will be developed and agreed with the regulatory bodies after consent has been granted, and will be detailed in an Environmental Management Plan. Monitoring is required in order to demonstrate the environmental performance of the project.

8.3.1. SPA

While it is noted above that this scheme will not have any adverse affects on the integrity of SPA interest features, it is recognised that this scheme fits within the Scottish Governments "Survey, Deploy and Monitor" licensing policy for wave and tidal projects[40].

With this in mind there has been a lot of consultation with Marine Scotland, Scottish Natural Heritage and the RSPB about opportunities to use the Kincardine Wind Turbines and floating Sub-structures as platforms for monitoring of seabird populations and their interaction with the wind turbines.

Kincardine offers a unique platform for seabird monitoring due to the triangular shape of the floating sub-structure that not only provides a large surface area for monitoring to take place, but it also provides sufficient space to allow a good viewpoint looking back onto the turbine. The size of the substructure provides many opportunities for different seabird monitoring techniques to be undertaken, including mounting a bird radar system that can remotely monitor birds passing through the turbine blades, or monitoring in person by ornithologists from the platform itself.

8.3.2. SAC

Given the small scale of the impacts of the project on the interest features of the above SACs, no mitigation or monitoring is considered necessary. However, as this project fits in with the Scottish Governments "Survey, Deploy and Monitor" licensing policy for wave and tidal projects[31], some monitoring may be required as part of the scheme.

Such monitoring is likely to include checking mooring lines for any potential fishing gear entanglement. While this is recognised as a potential impact to marine mammals, it also presents an impact to the stability and condition of the mooring lines that hold the turbines in place. Any entangled fishing gear will be removed in order to avoid damaging the mooring lines.

This monitoring will have the added benefits of minimising impacts to marine mammals from fishing gear entanglement.

Furthermore, the assessment of effects on marine mammals and Atlantic salmon has taken account of the following embedded mitigation measures:

- Vessels and plant relating to the construction, operation and decommissioning phase will follow industry best practice and OSPAR, IMO and MARPOL guidance for pollution at sea, which will be detailed in the final Environment Management Plan (EMP) to reduce and coordinate response to pollution events. The EMP will also include provision for the storage of pollutants.

- Defined navigational routes will be utilised by vessels to reduce the risk of collision with marine mammals.

- Alternative mitigation techniques will be investigated prior to the final construction Method Statement and confirmed following consultation with regulatory organisations. It should be noted that the employment of mitigation measures will be subject to an assessment of technical and commercial feasibility.

- All materials utilised will be safe for use within the marine environment.

- Cables will be suitably buried or protected by other means where burial is not practicable, e.g. rock dumping or concrete mattressing, which will reduce potential for impacts relating to Electromagnetic Fields (EMF).

[40] http://www.scotland.gov.uk/Topics/marine/Licensing/marine/Applications/SDM

- Trained Marine Mammal Observers (MMO) will be present on the vessels when appropriate to advise on environmental best practice and to conduct searches for the presence of marine mammals prior to activities commencing. In addition, the use of acoustic deterrent devices (ADD) (scarers) and / or Passive Acoustic Monitoring (PAM) to detect marine mammals in the area will be considered if necessary and relevant to the species of concern. The use of acoustic warning equipment, if appropriately designed, could prove a valuable mitigation tool, however, any active acoustic warning also represents a new source of sound pollution, specifically intended to alter the behaviour of marine mammals. The use of such devices should therefore be considered carefully to decide whether or not it is appropriate to deliberately add extra-noise to the sea as a precautionary measure.

- It may be possible to programme the construction activities anticipated to result in the most impacts to marine mammals (cable laying / burial, rock placement) outside of the peak periods for marine mammals presence within the vicinity of Development Area (e.g. August and September).

Appendix A. Hi-Def Final Aerial Survey Report.

Appendix B. Kincardine Scoping Opinion

For the full scoping opinion, go to http://www.scotland.gov.uk/Resource/0045/00457478.pdf

APPENDIX D
KINCARDINE FLOATING OFFSHORE WIND DEMONSTRATOR PROJECT: HABITATS REGULATIONS APPRAISAL - SPECIAL PROTECTION AREAS

Introduction

In the following advice for HRA we set out the three steps that need to be considered in order to determine whether or not the proposal is likely to have a significant effect on qualifying interests of SPAs, and any possible adverse impact on site integrity – Appendix B provides more detail on the legislative framework. It is the competent authority (Marine Scotland) who will carry out the appropriate assessment, the final step of the HRA, based on our advice and using information and data collated by the applicant.

Under HRA, the potential impacts of this proposal will need to be considered alone and in combination with other plans and projects. At this stage, we would advise that the following projects may require further consideration:

- European Offshore Wind Deployment centre
- Moray Firth Offshore Windfarm applications
- Forth and Tay Offshore Windfarm applications
- NRIP (harbour and port applications)
- Cable works in the vicinity of Peterhead, including the proposed HVDC cable to NE England
- The Hywind proposed floating wind demonstrator project.

We also note that HRA should address all elements of the windfarm proposal – onshore works as well as offshore elements.

Special Protection Areas for inclusion in HRA
We strongly recommend at this stage of the assessment that an HRA screening report is provided by the applicant.

In order to assist with provision of the HRA screening report, we have identified SPAs and features that should be considered.

For birds, we use the mean maximum foraging ranges + 10% buffer to develop a long list of species of birds that are qualifying features from relevant SPAs within Scottish waters that may be affected by the project. Thaxter et al. 2012 provides the most up to date source of information for foraging ranges and assigns confidence levels (high, moderate and low) to the representative foraging ranges for each species. BirdLife International data from BirdLife International Seabird Wikispace has been used to provide mean maximum foraging ranges for species not included in Thaxter et al, (2012).

Although this initially produces a long list of SPAs, this will be refined through an iterative process as further results from baseline characterisation surveys are available. Surveys will help inform this process by identifying species present at the site, their abundance, seasonal patterns of use and behaviour and as species sensitivity to potential impacts from the proposal are defined. Furthermore, this process should reduce the likelihood of connectivity with Natura sites being missed early on, thus helping to ensure that the final ES / HRA is complete, appropriate and fully informed. In addition, for some seabird species, the meta-data is such that it is appropriate to use cumulative frequency plots to determine the foraging range at which 95% of the population will be included. Note that these ranges are subject to some variance and so are not used as a hard cut off (i.e. an SPA only a few kilometres further than the foraging range have not automatically been scoped out).

It is necessary to determine the connectivity and thus potential impacts to birds during the post-breeding period, migration and winter as well. The connectivity with all protected sites is conducted using biologically relevant information. We understand however, that outside the breeding season most species tend to range more widely, complicating the identification of connectivity with sites and the HRA process. The Statutory Nature Conservation Bodies (SNCB‟s) have been consulting on this topic but we do not expect to be able to provide detailed guidance to the applicant in near future.

List of SPAs for inclusion in HRA

We recommend that the following initial list of SPA sites and features are considered. We would suggest this indicative list is compiled in conjunction with a thorough review of relevant SPAs and features to insure inclusion of all relevant sites and species.

With the exception of non-breeding eider, a feature of Montrose Basin SPA, all features are breeding seabirds:

- Buchan Ness to Collieston Coast SPA: kittiwake, guillemot, fulmar herring gull
- Fowlsheugh SPA: kittiwake, guillemot, fulmar, herring gull, razorbill
- Troup, Pennan and Lions Heads SPA: kittiwake, fulmar, herring gull, guillemot
- Forth Islands SPA: fulmar, gannet, lesser black backed gull
- East Caithness Cliffs SPA: fulmar
- North Caithness Cliffs SPA: fulmar
- Ythan Estuary, Sands of Forvie and Meikle Loch SPA: sandwich tern
- Montrose Basin SPA: non-breeding eider
- Fair Isle SPA: gannet
- Flamborough head and Bempton Cliffs SPA: gannet
- The following non-breeding goose and swan features should be given consideration only during the migratory period:
- Montrose Basin SPA: pink-footed goose, greylag goose
- Loch of Strathbeg SPA: pink-footed goose, greylag goose, Svalbard barnacle goose, whooper swan.
- Loch of Skene SPA: greylag goose

The scope of HRA should be based on a consideration of the range of bird species that may be affected, their ecology and the types of impacts which may affect them.

We would also welcome further discussion on this initial list, upon receipt of the first year baseline survey report.

Further information on SPAs, including their conservation objectives, is available from SNH Sitelink web pages[31]. We recommend that the most recent, reliable population figures should be used when assessing potential effects on SPAs. These estimates must be interpreted with reference to the original baseline (site citation – see SNH Sitelink[32]) population figures to establish whether there have been any significant changes in numbers supported by the site since classification. Recent population figures may be gathered from the SNH Site Condition Monitoring and the Seabird Monitoring programmes. Further information may also be found in the Marine Scotland report – *Population sizes of seabirds breeding at Scottish SPAs* [33]. Importantly, site populations also need to be considered in the context of the wider population trends and the current conservation status of the species.

We are currently in the process of finalising a guidance note on how to apportion impacts on breeding seabird colonies, including SPAs, and recommend that this guidance note is incorporated into HRA process. We will provide the applicant with a copy of this as soon as it is available and would be happy to give further advice as the HRA progresses.

However, in the absence of this guidance we are content for the applicant to use a reasoned approach to apportioning, and recommend that colony size and distance from the proposed size are factored in to any calculation.

We advise that cumulative impact assessment will require to be discussed in sufficient detail. Early discussion with SNH will be important to establishing the sources of cumulative and in-combination impacts for discussion. We recommend providing a methodology for assessing which projects may have connectivity with the same populations that may be impacted by the proposed KOWL development. We can then provide comments on the methodology, without having to consider each potential cumulative impact individually. This should be informed by knowledge of foraging ranges during the breeding season, post-breeding dispersal patterns, known or estimated migration routes and known or estimated wintering areas.

Advice for HRA in respect of SPA qualifying interests

We provide advice on the legislative requirement for HRA in Appendix B. The steps of the process are as follows:

Step 1: Is the proposal directly connected with or necessary to the conservation management of the SPAs?

The proposal is not directly connected with or necessary to site management for the conservation the SPAs.

Step 2: Is the proposal likely to have a significant effect on the qualifying interests of the SPAs either alone or in combination with other plans or projects?

This step acts as a screening stage: it removes from the HRA those proposals (plans or projects) which clearly have no connectivity to SPA qualifying interests or where it is very obvious that the proposal will not undermine the conservation objectives for these the development process, it usually means that it takes the form of a desk-based appraisal. We advise that this is kept broad so that potentially significant impacts are not missed out, or discounted too early, in any HRA (or EIA). The SPA bird interests being considered in respect of OSWF are wide-ranging – many seabirds make long foraging trips, especially during the breeding season. This means that OSWF proposals may be „connected to" SPAs even at great distances. Although connectivity is thus established the fact that the proposal is located further away from the designated sites means that direct impacts are less likely on qualifying species while they are within the SPA. This presents challenges in determining from which SPA species on the site have arisen.

Expert agreement over species sensitivity should help to identify those SPA qualifying interests for which the conservation objectives are unlikely to be undermined by OSWF developments, despite any possible connection (e.g. SPA qualifiers which are recorded within a proposed OSWF site but where their flight behaviour and / or foraging ecology means that the OSWF will not have a likely significant effect).

Determination of „likely significant effect" is not just a record of presence or absence of bird species at a site, but also involves a judgement as to whether any of the SPA conservation objectives might be undermined. Such judgement is based on a simple consideration of the importance of the area in question for the relevant species. Understanding the behavioural ecology of the species, and the characteristics and context of the proposed OSWF site, will help in determining whether there are likely significant effects.

There are three possible conclusions for this step of HRA:

- The likely impacts are such that there is clear potential for the conservation objectives to be undermined – conclude likely significant effect;
- The likely impacts are so minimal (either because the affected area is not of sufficient value for the birds concerned or because the risk to them is so small) that the conservation objectives will not be undermined – conclude no likely significant effect;
- There is doubt about the scale of the likely impacts in terms of the conservation objectives – conclude likely significant effect.

Step 3: Can it be ascertained that the proposal will not adversely affect the integrity of the SPA, either alone or in combination with other plans or projects?

This stage of HRA is termed **appropriate assessment**, and it is undertaken by the competent authority based on information supplied by the developer, and with advice provided by the relevant nature conservation organisation.

Appropriate assessment considers the implications of the proposed development for the **conservation objectives** of the qualifying interests for which a likely significant effect has been determined. SNH‟s website provides details on the conservation objectives for each SPA. Based on these objectives, we discuss key questions relevant to each interest, to determine overall whether it can be ascertained that the proposal will not adversely affect the integrity of any of these SPAs.

Our advice on appropriate assessment, and how many of these questions may need to be answered, will become clearer when the development process is further advanced, when baseline data has been collected, and when construction methods, location of infrastructure, choice of port, and other aspects of the proposal have been finalised.

Conservation objectives for SPA bird species
To ensure that site integrity is maintained by:
(i) Avoiding deterioration of the habitats of the qualifying species.
(ii) Avoiding significant disturbance to the qualifying species.
To ensure for the qualifying species that the following are maintained in the long term:
(iii) Population of the bird species as a viable component of the SPA.
(iv) Distribution of the bird species within the SPA.
(v) Distribution and extent of habitats supporting the species.
(vi) Structure, function and supporting processes of habitats supporting the species.
repeat of (ii) No significant disturbance of the species.

It is important to recognise that the conservation objectives primarily offer site-based protection and that some of them will not directly apply to species when they are outwith the boundaries of the SPA. This is particularly true of objectives **(i)**, **(v)** and **(vi)** which relate to the supporting habitats within the SPA.

Objective **(iii)** however – maintenance of the population of the bird species as a viable component of the SPA – will be relevant in most cases because:

- It encompasses direct impacts to the species, such as significant disturbance to qualifying bird interests when they are outwith the SPA;
- It addresses indirect impacts such as the degradation or loss of supporting habitats which are outwith the SPA but which help to maintain the population of the bird species of the SPA in the long-term.

Finally, in rare circumstances, it is possible that factors / events outside site boundaries may have the capacity to affect the long term distribution of bird species within the SPA – see objective **(iv)**.

Issues to consider under appropriate assessment
The key question in any appropriate assessment for KOWL of development is whether it can be ascertained that this proposal, alone or in combination, will not adversely affect the population of any qualifying bird species as a viable component of the SPAs under consideration.

In considering this matter, there may be further issues to consider if the proposal is likely to affect the conservation objectives that relate to bird species while they are in an SPA or to the habitats in the SPA that support them.

- Will the offshore wind proposal(s) cause a deterioration in the habitats of any of the
- SPAs?
- Will the offshore wind proposal(s) cause any significant disturbance to bird interests
- while they are in any of the SPAs?
- Will the offshore wind proposal(s) alter the distribution of the birds within any of the
- SPAs?
- Will the offshore wind proposal(s) affect the distribution and extent of the habitats (that
- support the bird species) in any of the SPAs?
- Will the offshore wind proposal(s) in any way affect the structure, function and supporting processes of habitats in any of the SPAs?

Ongoing Liaison
We will continue to review our advice on HRA as the proposal progresses, as survey work and analyses are undertaken, and when construction / installation methods, location of infrastructure, and other aspects of this proposal have been finalised.

APPENDIX E
KINCARDINE FLOATING OFFSHORE WIND DEMONSTRATOR PROJECT: HABITATS REGULATIONS APPRAISAL - SPECIAL AREAS OF CONSERVATION

Introduction

In the following advice for HRA we set out the three steps that need to be considered in order to determine whether or not the proposal is likely to have a significant effect on qualifying interests of SPAs, and any possible adverse impact on site integrity – Appendix B provides more detail on the legislative framework. It is the competent authority (Marine Scotland) who will carry out the appropriate assessment, the final step of the HRA, based on our advice and using information and data collated by the applicant.

At this early stage in the process we do not have full details on the development being proposed or finalised locations of all elements of infrastructure. We can provide more focused advice for HRA once further project details and baseline survey reports are submitted.

We recognise that the HRA is set wide initially, but will become more focused as information is collected and we will continue to review our advice as the windfarm development progresses.

Under HRA, the potential impacts of this proposal will need to be considered alone and in combination with other plans and projects. At this stage, we would advise that the following projects may require further consideration:

- European Offshore Wind Deployment centre
- Moray Firth Offshore Windfarm applications
- Forth and Tay Offshore Windfarm applications
- NRIP (harbour and port applications)
- Cable works in the vicinity of Peterhead, including the proposed HVDC cable to NE England
- The Hywind proposed floating wind demonstrator project

We also advise that HRA should address all elements of the windfarm proposal – onshore works as well as offshore elements.

Special Areas of Conservation for Inclusion in HRA

We advise that the applicant will need to consider the following SACs for HRA, initially, due to potential connectivity between the development and the site:

- **Moray Firth SAC** designated for its Bottlenose dolphins (*Tursiops truncatus*).
- **River South Esk SAC** designated for its Atlantic salmon and freshwater pearl mussel.
- **River Dee SAC** designated for its Atlantic salmon and freshwater pearl mussel.
- **River Spey SAC** designated for its Atlantic salmon, sea lamprey and freshwater pearl mussel.

We have considered other qualifying features from the SACs above and other SACs in close proximity to the development site, and included only those that we consider relevant i.e. where there may be connectivity between the OSWF and the SAC.

Further information on SACs, including their conservation objectives, is available from http://www.snh.org.uk/snhi/.

SNH advice for HRA in respect of Special Areas of Conservation

We provide advice on the legislative requirement for HRA in Appendix B. The steps of the process are as follows, independently of the characteristics or size of the project:

Step 1: Is the proposal directly connected with or necessary for the conservation management of the SACs?
The proposal is not directly connected with or necessary for the conservation management of any of the SACs listed above.

Step 2: Is the proposal likely to have a significant effect on the qualifying interests of the SACs either alone or in combination with other plans or projects?
This step acts as a screening stage: it removes from the HRA those proposals which clearly have no connectivity to SAC qualifying interests or where it is very obvious that the proposal will not undermine the conservation objectives for these interests, despite a connection. When this screening step is undertaken at an early stage in the development process, it usually means that it takes the form of a desk-based appraisal.

Screening begins early in the development process (at scoping), at which point we advise that the scope of the HRA is kept broad so that potentially significant impacts are not missed out. The HRA will then be refined over time as further information arises, from the developer and experience elsewhere. The SAC interests listed here may therefore change as the HRA process progresses and we recommend early discussion to agree which qualifying interests can be scoped out of the HRA and at what stage.

There are three possible conclusions to this step of HRA:
a) The likely impacts are such that there is clear potential for the conservation objectives to be undermined – conclude likely significant effect.
b) The likely impacts are so minimal that the conservation objectives will not be undermined – conclude no likely significant effect.
c) There is doubt about the scale of the likely impacts in terms of the conservation objectives – conclude likely significant effect.
Until the proposal has been further progressed and more details are available, we will not be in a position to present definite conclusions for this step. Instead, we therefore provide a summary of our current advice for each qualifying interest.

- **Bottlenose dolphins** of Moray Firth SAC

The dolphins are not confined to this SAC and will range more widely within the Firth and along the East coast of Scotland. It is unclear whether noise from construction (and other sources) is likely to extend beyond the windfarm footprint and therefore overlap with dolphin use of the surrounding environment. Boat movements, cable-laying and other construction activity may give rise to disturbance. There may also be impacts to the prey species of dolphin – either from the placement of infrastructure or due to noise. We therefore advise that there is potential for the proposal to have likely significant effects on bottlenose dolphins and discuss below (under step 3) the issues that we think need to be considered.

Summary of our current advice: Potential likely significant effect, so impacts (including cumulative) will need to be considered in appropriate assessment (see step 3).

- **Atlantic salmon** of River South Esk SAC, River Dee SAC and River Spey SAC.

The development may be located within the migratory pathways of Atlantic salmon from these designated sites. Construction and operational noise/vibration may give rise to disturbance of Atlantic salmon. There is also the potential for disturbance from EMF. We advise that there is potential for the proposal to have likely significant effects on Atlantic salmon and we discuss below (under step 3) the issues that we think need to be considered.

Summary of our current advice: likely significant effect due to the potential disturbance to migrating Atlantic salmon, so impacts (including cumulative) will need to be considered in appropriate assessment (see step 3).

- **Freshwater pearl mussels** of River South Esk SAC, River Dee SAC and River Spey SAC.

Atlantic salmon (and other salmonids) are integral to the life cycle of freshwater pearl mussel (FWPM), therefore any impacts to Atlantic salmon that prevent them from returning to their natal rivers may have a resulting effect on FWPM populations. While we consider this matter needs discussion in any appropriate assessment we do not identify any survey or research requirements. The impacts are indirect, dependent on the impacts the proposal may have on Atlantic salmon.

Summary of our current advice: likely significant effect due to changes to the distribution and viability of the freshwater pearl mussel host species, so direct and indirect impacts (including cumulative) will need to be considered in appropriate assessment as part of the assessment of any direct impacts on host species (see step 3).

- **Sea lamprey** of the River Spey SAC.

The proposed OSWF may be located within the migratory pathways of sea lamprey from this designated site. Construction and operational noise/vibration may give rise to disturbance of sea lamprey. There is also the potential disturbance from EMF. We advise that there is potential for the proposal to have likely significant effects on sea lamprey and we discuss below (under step 3) the issues that we think need to be considered.

Summary of our current advice: likely significant effect due to the potential disturbance to migrating sea lamprey, so impacts (including cumulative) will need to be considered in appropriate assessment (see step 3).

Step 3: Can it be ascertained that the proposal will not adversely affect the integrity of the SAC, either alone or in combination with other plans or projects?

This stage of HRA is termed **appropriate assessment**, and it is undertaken by the competent authority based on information supplied by the developer, and with advice provided by the relevant nature conservation organisation.

Appropriate assessment considers the implications of the proposed development for the **conservation objectives** of the qualifying interests for which a likely significant effect has been determined. SNH‟s website provides details on the conservation objectives for each SAC. Based on these objectives, we discuss key questions relevant to each interest, to determine overall whether it can be ascertained that the proposal will not adversely affect the integrity of any of these SACs.

Our advice on appropriate assessment, and how many of these questions may need to be answered, will become clearer when the development process is further advanced, when baseline data has been collected, and when construction methods, location of infrastructure, choice of port, and other aspects of the proposal have been finalised.

Moray Firth SAC: advice on bottlenose dolphins
Advice for further consideration of the requirement for appropriate assessment in respect of bottlenose dolphin of the Moray Firth SAC.

The **conservation objectives** for bottlenose dolphin are:
(i) to avoid deterioration of the habitats of bottlenose dolphin or

(ii) significant disturbance to bottlenose dolphin, thus ensuring that the integrity of the Moray Firth SAC is maintained and that the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features.

And to ensure for bottlenose dolphin that the following are established then maintained in the long term:
(iii) Population of bottlenose dolphin as a viable component of the site.
(iv) Distribution of bottlenose dolphin within site.
(v) Distribution and extent of habitats supporting bottlenose dolphin.
(vi) Structure, function and supporting processes of habitats supporting bottlenose dolphin.
repeat of **(ii)** No significant disturbance of bottlenose dolphin.

Based on these conservation objectives the following questions may need to be addressed:

- Will the proposal cause any deterioration to habitats within the Moray Firth SAC which support bottlenose dolphin?
- Will it affect the extent or distribution of any of these habitats in the SAC?
- Will it affect the structure and function of these habitats or of any of their supporting processes?
- Will the proposal cause significant disturbance to bottlenose dolphin while they are in the SAC, and will it cause any change to their distribution within the site?
- Will the proposal cause significant disturbance to bottlenose dolphin while they are outwith the SAC such that the viability of this SAC population is affected?
- Will the proposal in any way affect the population viability of the bottlenose dolphins of the Moray Firth SAC?

The last question encompasses the indirect impacts that a windfarm development could have – such as the degradation or loss of supporting habitats or feeding grounds which are outwith the SAC but which help to maintain the population of bottlenose dolphin in the SAC in the long-term.

The risk of impacts, and how many of these questions may need answered, will become clearer when the development process is further advanced and construction methods, location of cable routes, choice of port, and other aspects are finalised.

We advise that noise impact assessment from vessels, anchoring and other operations is likely to be an important part of assessing any direct disturbance to bottlenose dolphin, including their potential displacement from feeding grounds and other supporting habitats. While we consider that the construction phase may give rise greatest risk of disturbance, we do highlight that impacts during the operational phase also need to be considered, as well as any repowering and decommissioning work. It will also be important for the applicant to consider impacts on prey species.

We highlight that cumulative impacts are a key concern and should be addressed.

River South Esk SAC, River Dee SAC and River Spey SAC: advice on Atlantic salmon Advice for further consideration of the requirement for appropriate assessment in respect of Atlantic salmon of River South Esk SAC, River Dee SAC and River Spey SAC

The SAC **conservation objectives** for Atlantic salmon are:
(i) to avoid deterioration of the habitats of the qualifying species or
(ii) significant disturbance to them, thus ensuring that the integrity of the SAC is maintained and that they make an appropriate contribution to achieving favourable conservation status for the qualifying species.

And to ensure for the qualifying species that the following are maintained in the long term:
(iii) Population of the species, including range of genetic types for salmon, as a viable component of the SACs.
(iv) Distribution of the species within sites.
(v) Distribution and extent of habitats supporting each species.
(vi) Structure, function and supporting processes of habitats supporting each species. repeat of **(ii)** No significant disturbance of the species.

The key question in any appropriate assessment is whether it can be ascertained that this proposal, alone or in-combination, will not adversely affect the population of the qualifying species as a viable component of these SACs.

Information to support the application should consider all aspects of the proposal with the potential to affect the conservation objectives of these sites and, through this, ascertain whether the proposal will not adversely affect the integrity of a Natura site.

We advise that a noise/vibration/EMF impact assessment is likely to be an important part of assessing any disturbance to Atlantic salmon while they are outwith these SACs. Further information on the installation, operation, maintenance and decommissioning of the array is required to assess whether there will be any direct disturbance to Atlantic salmon.

River South Esk SAC, River Dee SAC and River Spey SAC: advice on fresh water pearl mussels
Advice for further consideration of the requirement for appropriate assessment in respect of Freshwater pearl mussels of River South Esk SAC, River Dee SAC and River Spey SAC

The SAC **conservation objectives** for Atlantic salmon and freshwater pearl mussel (where appropriate) are:
(i) to avoid deterioration of the habitats of the qualifying species or
(ii) significant disturbance to them, thus ensuring that the integrity of the SAC is maintained and that they make an appropriate contribution to achieving favourable conservation status for each species.

And to ensure for each species that the following are maintained in the long term:
(iii) Population of the species, including range of genetic types for salmon (where relevant), as a viable component of the SACs.**(iv)** Distribution of the species within sites.
(v) Distribution and extent of habitats supporting each species.
(vi) Structure, function and supporting processes of habitats supporting each species. repeat of **(ii)** No significant disturbance of the species.
And in addition for freshwater pearl mussel in particular, to ensure that the following are maintained in the long term:
(vii) Distribution and viability of freshwater pearl mussel host species
(viii) Structure, function and supporting processes of habitats supporting freshwater pearl mussel host species

The key requirement will be to demonstrate that the distribution and viability of the freshwater pearl mussel host species are maintained in the long term - conservation objective **(vii)**. This is discussed above in the section for Atlantic salmon.

River Spey SAC: advice on sea lampreys.
The conservation objectives for the sea lamprey populations of this SAC are the same as those we have listed above for Atlantic salmon. Those requiring consideration – objectives **(ii)** and **(iii)** – as discussed in the section above for Atlantic salmon.

Ongoing Liaison

As noted above, we will continue to liaise with the developers and Marine Scotland in respect of this HRA process. Agreeing the scope of, and information required for, HRA will be an iterative process.

Appendix C. SNH and MS Response to Draft HRA

Scottish Natural Heritage
Dualchas Nàdair na h-Alba
All of nature for all of Scotland
Nàdair air fad airson Alba air fad

Joao Queiros
MS-LOT
Scottish Government
Marine Laboratory
PO Box 101
375 Victoria Road
Aberdeen
AB11 9DB

Your Ref:

Our Ref: CNS/REN/OSWF/DS/KINCARDINE/CPA138336

Date: 2 October 2015

By email only:
Joao.Queiros@gov.scot

Dear Joao,

KINCARDINE FLOATING OFFSHORE WINDFARM DEMONSTRATOR PROJECT DRAFT HABITATS REGULATIONS APPRAISAL – SNH COMMENTS

Thank you for your consultation of the 16 September 2015 requesting our advice on the document prepared by Atkins entitled '*Kincardine Floating Offshore Wind Demonstrator Project Habitats Regulations Appraisal – Appropriate Assessment (Revision 2)*'. We offer the following comments on the draft HRA report.

Advice summary

The draft HRA report is well written and is broadly appropriate to enable assessment of the proposal against the Habitats Regulations; however, clarification is required regarding some aspects of the report in order to fully inform our advice at formal consultation stage.

Birds

For birds, we are unable to fully appraise the impacts of the proposal and to conclude what our HRA advice will be until further information is provided.

We provide detailed advice below with respect to birds for each aspect that we consider requires further information, clarification or correction in order to fully inform our HRA advice. These are, in summary:

1. Clarification of turbine design details, including those parameters used for collision risk modelling.
2. Inconsistency between the areas given for the site, buffer and site + buffer and the implications for density estimates and therefore, as a consequence, displacement rates.

Scottish Natural Heritage, Great Glen House, Leachkin Road, Inverness, IV3 8NW
Tel: 01876 580236
e-mail: tracey.begg@snh.gov.uk
marinerenergy@snh.gov.uk
www.snh.org.uk

3. Clarification on the use of collision risk model (CRM) options, including the origin of flight height distribution data used in each model; presentation of flight height data.
4. Displacement: post-breeding auks should be excluded from the breeding season assessment; adult mortality impacts of displacement should be estimated.
5. Apportioning of impacts to include both SPA and non-SPA birds within mean-maximum foraging range.

Marine mammals – Bottlenose dolphin – Moray Firth SAC

We broadly agree with the conclusions of the HRA report with regard to bottlenose dolphin, a qualifying interest of the Moray Firth SAC – that the development will have no adverse effect on site integrity for this SAC, alone or in-combination with other plans or projects. We have previously advised that we consider the risk to this SAC population from this proposal is low, provided piling is not used during turbine installation.

We recommend further consideration is given to discussing the impacts of installation of the export cable to landfall. Installation along the export cable route will occur inshore from the development where interactions with bottlenose dolphins are more likely.

Although some impacts of cable laying are discussed, these are in relation to the potential impacts of EMF. There could also be disturbance during this phase of the construction (albeit temporary) from vessel noise and any potential rock dumping that may be required during cable installation.

Earlier documents refer to the potential for geophysical surveys of the cable route. This is not discussed in the HRA report. Geophysical surveys planned for both the survey area and the cable route could result in acoustic disturbance to cetaceans, including bottlenose dolphins of Moray Firth SAC. We recognise that details of these proposed surveys may not yet be available and we can provide separate advice specifically for geophysical surveys with regard to EPS (European Protected Species) and HRA, as required.

Diadromous fish and freshwater pearl mussel SAC features

We broadly agree with the conclusions of the HRA report for identified diadromous fish and freshwater pearl mussel features – that the development will have no adverse effect on site integrity for relevant SACs, alone or in-combination with other plans or projects.

Birds - Detailed advice

1. <u>Identification of designated sites and qualifying interests for HRA</u>
Internationally designated sites (SPAs and SACs) are listed in Tables 4.1 and 4.2. This list follows the list of sites recommended by us at scoping. We consider that the list of sites and species is complete. For birds, the list is based on the sites within mean-maximum foraging range of birds as listed in Thaxter et al (2012).

The long list of SPAs has been selected using criteria recommended by us at pre-application meetings i.e. mean-maximum foraging range (mmfr) from Thaxter et al (2012) plus 10%. Since those meetings our preference has moved to consider mmfr +/-1SD, as presented in Thaxter et al (2012).

We do not expect the long list to change to reflect our most recent advice on mmfr and we leave it to the discretion of the applicant to decide if they wish to make this amendment to reflect our most recent advice.

The difference resulting from this change in mmfr would not be substantial in most cases. The area of search for kittiwake and puffin would be increased a little and for gannet would increase from 252 km to 514 km. Increase in the area covered would mean that more colonies would be connected with the development. However, the influence of these more distant colonies would usually be small. In the case of gannet, where some significant other colonies would have been included, (e.g. Noss, Hermaness and Foula in Shetland) this may have influence apportioned numbers slightly, though is unlikely to alter conclusions reached.

Possible future designations

JNCC and SNH have recently published a draft SPA (dSPA) suite proposal, which is currently with the Scottish Ministers for consideration. Further information can be found at: http://www.snh.gov.uk/docs/A1350044.pdf

The two draft SPAs that the development proposal may need further assessment include:
i) Outer Firth of Forth and Tay Bay Complex dSPA. This site is being put forward for designation for a number of species including a number of wintering water fowl: red-throated diver, Slavonian grebe, common eider, long-tailed duck, common scoter, velvet scoter, goldeneye, red-breasted merganser and winter waterbird assemblage.

The site is also being put forward for wintering concentrations of little gull, black-headed gull, common gull, herring gull, common guillemot, breeding foraging concentrations of black-legged kittiwake, common tern, Arctic tern, northern gannet, Manx shearwater, European shag, razorbill, Atlantic puffin and foraging seabird assemblages during both breeding and winter.

ii) An extension to Ythan Estuary, Sands of Forvie and Meikle Loch SPA, which is being put forward for sandwich tern and little tern. The Ythan Estuary, Sands of Forvie and Meikle Loch SPA is already considered by inclusion in the long list.

Further assessment may be required for these sites if Scottish Ministers approve these for public consultation. If these sites do come forward for public consultation, we will liaise with both Marine Scotland and the developers as to how best to consider if this proposal would require any further HRA assessment.

2. Turbine details and collision risk calculations
The project overview provides details of the proposed construction within a Rochdale / design envelope. It is expected that there will be eight 6MW floating wind turbines with semi-submersible bases in an array up to 50MW total generation capacity. There is some confusion over the turbine dimensions and it is not clear what parameters have been used in the collision risk models. This needs clarified across all relevant sections of the report.

In Section 2 and Table 2-1 it states turbines will be 3-bladed and expected to be 107m to hub height, 85m radius (170m diameter), with an effective tip height of 192m (plus lowest astronomical tide). As the units will float, height above sea level will remain constant. Lowest level of rotor sweep on the 6MW unit is 22m above sea level. Table 6-4 records the bottom of the turbine sweep as 34m.

The alternative layout described is for six 8MW wind turbines, the dimensions of these are given in Table 7.2, along with description of a 4MW model, which is not discussed elsewhere.

In Table 7.2 the description of the 6MW turbine varies slightly from the description in Section 2. Hub height is listed as 100m, rotor radius as 73.5m (not 85m). For the 8MW turbine, the centre of hub is listed as 136.5m (overall hub is 7.5m tall), the maximum height is 220m. This would suggest a bottom of turbine sweep will to be 52.5m above sea level. This appears to be correct from the chart of flight heights in the appendix. The large difference between the lowest blade height of the two turbine options means that significant difference in collision impacts will be predicted. Even the small differences in the two descriptions of the 6MW unit would affect collision model outputs.

Floating bases for the turbines will be constructed of tubular steel 12m in diameter. The overall length of one side of the triangular base will be 67m. The deck level (on which the turbines are mounted) will be approximately 12m above the waterline. It is this additional 12m elevation that apparently increases the 'air gap' of the 6MW turbine to 34m, and that of the 8MW turbine to 52.5m. The chart of flight heights (Figure C1) indicates that the rotor swept area for the 6MW turbine extends from 27m to c.165m, whereas it probably extends from 34m to 180m. In Section 6.2.3., the area between maximum and minimum turbine height is given as 22 and 192m.

These differences will have significant implications for the number of birds considered to be at risk of collision. Clarification of the turbine design details is required to ensure that the collision estimates have been correctly calculated.

3. Survey area / density estimates

The approaches used for CRM and displacement are suitable, but some details require clarification. Uncertainty about these details means it is currently not possible for us to conclude our assessment.

There is inconsistency between the area used in density calculations and the areas given for the site, buffer and site + buffer. It would be helpful if they could provide densities for each of these areas so we can clearly see which values are being used and how they've been derived.

The total survey area is described as 991km^2 (which includes the project area of 110km^2 plus an 8km buffer). The total area to be occupied by turbines is expected to be 8km^2 (at a proposed 500m turbine spacing), which is equivalent of 0.8% of total survey area. However, density estimates and populations appear to be given for a 550km^2 area (back calculation from Table A-5), therefore the population estimates relate to an area considerably bigger than the 110km^2 project area. Clarification on the size of the total survey area presented is required. The implications for calculated bird densities and in turn, displacement rates will also need to be considered (see below – Impact pathways and connectivity – displacement).

The flight heights are estimated from HiDef data and therefore come directly from the survey area. This information is presented in the form of a summary graph. We recommend these data are presented as a table. This would allow data to be imported into the Band model spreadsheet.

4. Use of CRM options and flight height data

CRM results for options 1, 2 and 3 are presented. This is the approach agreed with consultants at pre-application meetings. The models presented follow the requirements of the joint SNCB advice on the revised BTO avoidance rates. The basic model with avoidance rate of 0.989 is used for both gannet and kittiwake assessments.

The inputs to the model are listed in a logical sequence at the beginning sections, including wind farm and turbine parameters, bird parameters and treatment of the bird survey data. However, some of the information presented is confusing and requires clarification, including turbine parameters (as previously discussed) and flight height distributions used for the models.

Table 7-2 (page 66 and 67) and information in 7.1.1 (page 62) are not clear with regard to the approaches used for the basic and extended models. To be clear, the basic model has two options: option 1 and 2. Option 1 utilises site specific derived flight height data, Option 2 uses the generic flight height data as presented in the corrigendum for Johnston et al. 2014. The extended model also has two options: option 3 and option 4. Option 3 uses the generic flight height data from the corrigendum for Johnston et al. 2014, while option 4 uses site specific data in the extended model. We have not used option 4 in any offshore wind farm assessment in Scotland, but are content that the applicant can present the option 4 figures alongside option 1, 2 and 3 if they wish to.

Table 7-2 needs revision so it clearly shows option 1 (and 4, if desired) under the site specific data and options 2 and 3 under the Johnston et al. 2014 data. We also recommend that this table only presents the collision risk outputs for species of collision risk concern: neither razorbill nor puffin require collision risk modelling. Option 3 has been used for some species, however, we highlight that SNCBs consider that option 3 should not be used for kittiwake and gannet at present.

As discussed previously, we recommend estimated flight heights are presented as a table as opposed to a graph. This will allow data to be imported into the Band model spreadsheet.

The collision risk modelling for migratory birds has been completed following SOSS methodology. The analyses suggests some large numbers of some species crossing the Kincardine site, however we do not consider that any of these populations are likely to be significantly impacted by collision with turbines during migration.

5. Impact pathways and connectivity

We agree that the main impact pathways for receptors have been included in the report. The method laid out here of the assessment of the pathway and severity of each impact is broadly appropriate, however, displacement and apportioning of impacts require further consideration as outlined below. We also provide additional comments on some impacts.

I. Displacement

The approach to displacement was agreed with us at meetings in March 2015. The initial assessment concentrated on kittiwake, but we recommended (e-mail 18th June 2015) that assessment of auks was also undertaken. We welcome that this advice has been followed in the HRA report.

A semi-quantitative assessment has been undertaken, given the current knowledge about displacement impacts and the size of this project. We agree this approach is appropriate. An area of $25km^2$ has been used as the basis for the 'displacement area'. This is calculated from the area covered by turbines ($9km^2$) plus a 1km all round buffer. This is equivalent of 23% of the total area of the KOWL site ($110km^2$), and 2.5% of the total survey area ($991\ km^2$). For displacement assessment the upper 95% confidence limits of population size were used, which is considered a precautionary step.

The estimated population size is given in Table 7-9, the values for which are taken from Table A-5 in the appendices. Whereas the estimated population is stated as relating to the $110km^2$ area, it appears that the original figures in A-5 are calculated on an area of $550km^2$ (this has been estimated by back calculating the density to the population figures in Table A-5). The number of birds estimated to be displaced has been therefore been over-estimated. If this is the case, the number of kittiwakes displaced from the Kincardine proposal is 12 adult breeding birds, rather than the 76 presented in Table 7-9. Other than clarification regarding the actual numbers of birds involved, the approach to the displacement calculation is suitable.

Large numbers of guillemots and razorbills occur in July to September surveys. The estimates of bird density (Table A-5) appear to include these counts, which are then used to assess displacement during breeding season. To be correct, the density estimate should remove these high influx periods and just be confined to the breeding season.

The assessment of displacement has concentrated on the loss of productivity that could results from birds having to fly extra distance to provision young. Adult mortality

Appendix D. SNH and MS comments on draft HRA with KOWL response.

Email chain and associated table addressing all SNH comments and the agreed approach to the HRA addendum.

From: Tracey Begg [mailto:Tracey.Begg@snh.gov.uk]
Sent: 16 December 2015 16:48
To: Maclennan, Will <Will.Maclennan@atkinsglobal.com>
Cc: Wakefield, Richard <Richard.Wakefield@atkinsglobal.com>; 'allan@macaskill-associates.com' <allan@macaskill-associates.com>; Erica Knott <Erica.Knott@snh.gov.uk>; Glen Tyler <Glen.Tyler@snh.gov.uk>; 'Jared.Wilson@gov.scot' <Jared.Wilson@gov.scot>; 'David.Bova@gov.scot' <David.Bova@gov.scot>; 'MS.MarineLicensing@gov.scot' <MS.MarineLicensing@gov.scot>
Subject: RE: Kincardine HRA comments and next steps.

Good Afternoon Will,

Following discussion between ourselves and Marine Scotland Science, I attach your HRA spreadsheet with an additional column containing our comments that should clarify any outstanding queries and allow you to progress the HRA report.

We agree with the identified issues to be scoped out. With regard to in-combination impacts, the list of developments to be considered by KOWL should be those we advised at scoping. To clarify, assessment of more distant sites referred to in our gate check advice (Blythe, Teeside, Dogger Bank) are not required to be undertaken by KOWL, but may be included in the final HRA stages of Appropriate Assessment undertaken by Marine Scotland, as required.

I hope this clarifies our advice and allows you to work towards the final draft of the HRA report.

Regards,

Tracey

Dr Tracey Begg
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Coastal and Marine Ecosystems Unit
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From: Maclennan, Will [mailto:Will.Maclennan@atkinsglobal.com]
Sent: 09 December 2015 10:32
To: Tracey Begg; Glen Tyler; 'Jared Wilson (Jared.Wilson@scotland.gsi.gov.uk)'; Jared.Wilson@gov.scot
Cc: Wakefield, Richard
Subject: Kincardine HRA comments and next steps.

Hello All,

Thank you for your comments on the Kincardine HRA.

Further to reading through all your comments, I would like to propose the next steps, so that they can be agreed up front prior to me carrying out any amendments to the HRA.

It is recognised that there are impacts that can, at this stage, be scoped out of further assessment, so rather than re-writing the HRA, I thought it might be more appropriate to do an addendum to the HRA, just focusing on impacts that are still of concern to the relevant species.

This will save me time (as I will need to collate quite a lot of additional data and re-run the Collision Risk Models) and hopefully address all of the outstanding concerns you have.

I have addressed each of your HRA comments in turn in the attached spreadsheet and I propose the following approach below:

I propose to **scope out any further work/analysis** on the following impacts (i.e. the information in the existing HRA is adequate to allow you to understand the potential impacts):

1. - Disturbance
2. - Habitat Loss
3. - Impacts to Migratory birds
4. - In-combination impacts

I propose to undertake further work (**scope in**) on the following impacts:

5. - Turbine details and collision risk calculations
    6. o Further assessment will be based on eight 6MW turbines, as it has now been decided that these are the most appropriate turbine models to go ahead with. The parameters I include in the addendum will be the ones used for the windfarm.
    7. o I will include the additional 12m height of the sub-structure in Collision risk modelling.
8. - Survey Area/Densities
    9. o I will include analysis of both the Kincardine area and the wider NE3 area (Kincardine with 8km buffer) bird density data
    10. o I will include the Hi-Def flight height data tables rather than the graph.
11. - CRM options and Flight height data
    12. o I propose to carry out CRM **on Kittiwake, Guillemot and Gannet only**. I consider impacts to all other species to be negligible.
    13. o I propose to carry out CRM on Adult birds only. I propose to use the Inch Cape PVA proportions on the bird densities to get an estimate figure for each species (see comment 4.1 in attached).
    14. o I propose to re-present the CRM results in the simpler manner, differentiating between the options, particularly options 3 and 4 (see comments 4.2, 4.3 and 4.4)
15. - Displacement
    16. o I propose to stick to the displacement methodology as agreed, using Inch Cape PVA proportions of breeding adults and displacement rates. These figures were considered adequate for the displacement assessment of a windfarm with 213 turbines covering an area of 150km2, I would therefore argue that they are considered adequate for a ‘back of envelope’ calculation for the potential displacement of a windfarm with 8 turbines covering an area of 9km2.
    17. o I will amend the bird densities in table 7-9 (see comment 5.1)
    18. o I will check the bird densities in table A-5 for guillemots and razorbills (see comments 5.3)
    19. o I will seek further clarification from SNH on adult mortality (see comment 5.4) and make the necessary changes.
20. - Apportioning impacts
    21. o I will include impacts to bird species outside of SPAs including the Kittiwake data (see comments 6.1, 6.2, 6.3).

The addendum to the HRA will only include the information scoped in as outlined above.

Would you all be able read through the above and let me know if you agree with my approach. If you do not agree, then please make any necessary amendments to any of the above until we are all in agreement with a way forward. This will allow me to carry out all the work in one go and ensure everyone is happy with the approach and methodology to inform consenting.

Many thanks and please feel free to call me to talk through any of the above. If it would be more appropriate to organise a telecall or webinar then I would be happy to arrange it.

Kind Regards,

Will

Will Maclennan BSc, MSc, CSci CMarSci MIMarEST

Senior Marine Environmental Scientist,

Water, Ground & Environment

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LinkedIn: http://www.linkedin.com/company/atkins | YouTube: http://www.youtube.com/wsatkinsplc

	Subject	Comment Reference	KOWL Response	Result	SNH comments 15 December 2015
1	**Identification of designated sites and qualifying interests for HRA**				
1.1	Internationally designated sites (SPAs and SACs) are listed in Tables 4.1 and 4.2. This list follows the list of sites recommended by us at scoping. We consider that the list of sites and species is complete. For birds, the list is based on the sites within mean-maximum foraging range of birds as listed in Thaxter et al (2012).	SNH	I agree that the list of site and species is complete		
1.2	The long list of SPAs has been selected using criteria recommended by us at pre-application meetings i.e. mean-maximum foraging range (mmfr) from Thaxter et al (2012) plus 10%. Since those meetings our preference has moved to consider mmfr +/-1SD, as presented in Thaxter et al (2012).	SNH	Noted		
1.3	We do not expect the long list to change to reflect our most recent advice on mmfr and we leave it to the discretion of the applicant to decide if they wish to make this amendment to reflect our most recent advice.	SNH	I propose to stick to the original list as previously agreed		
1.4	Further assessment may be required for these sites if Scottish Ministers approve these for public consultation. If these sites do come forward for public consultation, we will liaise with both Marine Scotland and the developers as to how best to consider if this proposal would require any further HRA assessment.	SNH	Noted		
2	**Turbine details and collision risk calculations**				
2.1	The project overview provides details of the proposed construction within a Rochdale / design envelope. It is expected that there will be eight 6MW floating wind turbines with semi-submersible bases in an array up to 50MW total generation capacity. There is some confusion over the turbine dimensions and it is not clear what parameters have been used in the collision risk models. This needs clarified across all relevant sections of the report.	SNH	When I wrote the HRA we were still uncertain as to which turbine model we needed to use, use I was required to present a selection to give an indication of potential impacts to a range of turbine models and to be as transparent as possible about potential impacts. We now know we are going to go ahead with a 6mw turbine, so I will use these parameters in all further assessments I carry out.	Use 6MW turbine parameters in all further assessment.	CRM Workbook / spreadsheets also to be updated to reflect 6MW parameters. Please supply with finalised HRA to inform our advice.
2.2	Floating bases for the turbines will be constructed of tubular steel 12m in diameter. The overall length of one side of the triangular base will be 67m. The deck level (on which the turbines are mounted) will be approximately 12m above the waterline. It is this additional 12m elevation that apparently increases the 'air gap' of the 6MW turbine to 34m, and that of the 8MW turbine to 52.5m. The chart of flight heights (Figure C1) indicates that the rotor swept area for the 6MW turbine extends from 27m to c.165m, whereas it probably extends from 34m to 180m. In Section 6.2.3., the area between maximum and minimum turbine height is given as 22 and 192m.	SNH	Noted. This additional 12m was omitted from CRM modelling results previously and will be included in further assessments	Add the additional 12m of the substructure into calculations.	CRM Workbook / spreadsheets also to be updated to reflect 6MW parameters. Please supply with finalised HRA to inform our advice.
3	**Survey Area/ Density Estimates**				
3.1	There is inconsistency between the area used in density calculations and the areas given for the site, buffer and site + buffer. It would be helpful if they could provide densities for each of these areas so we can clearly see which values are being used and how they've been derived.	SNH	Noted. We were waiting on the final report back from Hi-Def which meant we only had full data (including transect length) for one area. I will include densities from both areas (Kincardine and NE3) in further assessments	Include Kincardine and NE3 densities. To CRM for both sites.	
3.2	The flight heights are estimated from HiDef data and therefore come directly from the survey area. This information is presented in the form of a summary graph. We recommend these data are presented as a table. This would allow data to be imported into the Band model spreadsheet.	SNH	Noted. The tables of bird flight heights that are used in further CRM will be included in the report.	Include flight height tables.	

	Subject	Comment Reference	KOWL Response	Result	SNH comments 15 December 2015
4	**Use of CRM options and flight height data**				
4.1	It is unclear whether the density estimates used in the CRM are all birds, or just adults. If the former, the effect will be overestimated as the effect is compared to the SPA population that is adult breeding birds only. Survey data could be used to estimate the proportion of adult plumaged birds observed, or a stable age structure could be used (but see below).	MS	All birds were used in the modelling, this was due to a lack of confidence in the aerial data on whether the birds were adult or not – a lot of blanks in the raw data. It was considered best to be pre-cautionary and just use the density estimates for all birds. Following the CRM model outputs the data was split into breeding and non-breeding seasons – again it was assumed that all birds present during the breeding season were adults. It was only at the displacement assessment that the proportion of adults was estimated using age distributions from Inch Cape PVA. Is there an appropriate proportion estimate of the number of birds that are likely to be adults that could be applied to the density estimates to make them more realistic and avoid an excessive of precaution (e.g. 100% of all birds are adult)? Could the estimated age distributions from the Inch Cape PVA be used?	Only include adults in CRM modelling.	Suggest that the Inch Cape (ICOL) boat based surveys would provide age distributions that would be more appropriate to use than the PVA estimates for kittiwakes and gannets in particular. The boat-based ratio (97% adults for gannet, 87% adults for kittiwake) are in ICOL Appendix 15A. The ICOL appendix 15A - Offshore ornithology Technical report is available to download.
4.2	Table 7-2 (page 66 and 67) and information in 7.1.1 (page 62) are not clear with regard to the approaches used for the basic and extended models. To be clear, the basic model has two options: option 1 and 2. Option 1 utilises site specific derived flight height data, Option 2 uses the generic flight height data as presented in the corrigendum for Johnston et al. 2014. The extended model also has two options: option 3 and option 4. Option 3 uses the generic flight height data from the corrigendum for Johnston et al. 2014, while option 4 uses site specific data in the extended model. We have not used option 4 in any offshore windfarm assessment in Scotland, but are content that the applicant can present the option 4 figures alongside option 1, 2 and 3 if they wish to.	SNH	I was initially unaware of an option 4, and therefore presented an option 3 for the generic data and another 'option 3' for site specific data (aka option 4). Now I have been made aware I will re-present the CRM data making the distinction between options 3 and 4 clearer.	re-present the CRM result data to make the distinction between different options clearer.	A simplified revised table explaining the options presented would be welcome.
4.3	Table 7-2 presents collision estimates for Options 1, 2 and 3 for each species and WTG size but then two sets of results are presented, one for Kincardine flight height data and the other for Johnston et al data. [Option 1 is site specific data, Option 2 is generic data (i.e. Johnston et al 2014), and option 3 is the Extended version of the model with the generic data, and Option 4 would be the Extended version of the model with site specific data.] Option 1 and 2 estimates should be the same, but in the Table different numbers are presented for Option 2. I would suggest that one set of the results is deleted and a single set of (correct) estimates for Option 2 be presented. The subsequent tables may then also need updating.	MS	as above.		

	Subject	Comment Reference	KOWL Response	Result	SNH comments 15 December 2015
4.4	Table 7-2 needs revision so it clearly shows option 1 (and 4, if desired) under the site specific data and options 2 and 3 under the Johnston et al. 2014 data. We also recommend that this table only presents the collision risk outputs for species of collision risk concern: neither razorbill nor puffin require collision risk modelling. Option 3 has been used for some species, however, we highlight that SNCBs consider that option 3 should not be used for kittiwake and gannet at present.	SNH	as above.		
4.5	The collision risk modelling for migratory birds has been completed following SOSS methodology. The analyses suggests some large numbers of some species crossing the Kincardine site, however we do not consider that any of these populations are likely to be significantly impacted by collision with turbines during migration.	SNH	agreed.	Impacts to migratory birds to be scoped out.	
	Impact Pathways and connectivity				
5	**Displacement**				
5.1	The estimated population size is given in Table 7-9, the values for which are taken from Table A-5 in the appendices. Whereas the estimated population is stated as relating to the 110km2 area, it appears that the original figures in A-5 are calculated on an area of 550km2 (this has been estimated by back calculating the density to the population figures in Table A-5). The number of birds estimated to be displaced has been therefore been over-estimated. If this is the case, the number of kittiwakes displaced from the Kincardine proposal is 12 adult breeding birds, rather than the 76 presented in Table 7-9. Other than clarification regarding the actual numbers of birds involved, the approach to the displacement calculation is suitable.	SNH	Noted, the bird population numbers will be corrected. The approach to displacement will remain the same.	Make corrections regarding bird numbers. The displacement methodology will remain the same.	
5.2	Table 7-9 indicates that the proportion of adults is taken from the ICOL PVA stable age structure. This is not appropriate for kittiwake (or gannet) which disperse over much wider areas, and where the proportion of adult plumaged birds observed during surveys would be more appropriate (accepting that some ‘adult’ plumaged birds may not be part of the breeding population).	MS	This was used for kittiwake and gannet from Inch Cape to give an indication of the potential displacement impacts of Kincardine. Following consultation with SNH it was recognised that the potential displacement impacts from 8 turbines would be relatively minor and using data from another windfarm (in this case Inch Cape) in a proportional manner relating to the number of birds on the Kincardine site was agreed to be a sensible approach.	Given the scale and small displacement impacts of this windfarm (with only 8 turbines) I propose to stick to the displacement methodology agreed as above, using Inch Cape PVA proportions of breeding adults.	Inch Cape boat based surveys would provide age distributions that would be more appropriate to use than the PVA estimates from Inch Cape for kittiwakes and gannets.
5.3	Large numbers of guillemots and razorbills occur in July to September surveys. The estimates of bird density (Table A-5) appear to include these counts, which are then used to assess displacement during breeding season. To be correct, the density estimate should remove these high influx periods and just be confined to the breeding season.	SNH	Noted. I can look through the months by month Hi-Def data and do the math to work out whether or not these periods have been included. If they have, I will remove for guillemots and razorbills.	Check bird densities in Table A-5.	

	Subject	Comment Reference	KOWL Response	Result	SNH comments 15 December 2015
5.4	The assessment of displacement has concentrated on the loss of productivity that could results from birds having to fly extra distance to provision young. Adult mortality aspects have not been included and previously accepted levels of adult mortality for auks have been 50% for large windfarms. For each adult death a breeding attempt has been considered lost. While in some cases a proportion of apparent adult-type plumage birds do not breed (so called sabbatical birds) it is usually assumed that all adult plumage birds are breeding adults. If there is evidence otherwise then it should be presented and agreed with us and Marine Scotland Science.	SNH	I don't fully understand this comment. In the displacement assessment I have assumed that 100% of displaced adult breeding birds will fail to reproduce. See the note under table 7-10. Should this figure be 50%?	Seek clarification over comment. Change % displaced bird breeding failure figure from 100% to 50%.	100% is the correct figure to use for breeding failure as a consequence of displacement. In addition, 50% adult mortality should also be applied as the earlier draft only dealt with loss of productivity.
5.5	I do not recall the SNH advice that 50% of adult plumaged gannets should be assumed to be breeding, and the rationale for this is unclear.	MS	50% was not used for gannets. For Gannets it assumed 100% of adult plumaged birds were breeding. The wording under table 7-9 states the following: "For kittiwake (0.606), razorbill (0.712), guillemot (0.667) and puffin (0.677) the proportion of breeding adults is based on age distributions estimated from the Inch Cape PVA (Appendix 15B, Table 15B.6), for gannet it is assumed that all adult plumage birds are breeding (WWT Consulting, 2012); for other species it is assumed that 50% of adult plumage birds are breeding, based on advice from SNH."	No action	Inch Cape boat based surveys would provide age distributions that would be more appropriate to use than the PVA estimates from Inch Cape for kittiwakes and gannets.
5.6	Table 7-9 uses displacement rates that do not appear to follow those advised by the SNCBs e.g. 75% for gannet. Are they based on the ICOL ES or on SNCB advice?	MS	They were based on the Inch Cape ES, as outlined in point 2 below table 7-9.	No action?	75% for gannet is from the ICOL report. This is acceptable.
5.7	Table 7-12 assumes a 99% AR with the Extended version of the CRM. The BTO recommended ARs and model options should be used	MS	Noted, this will be amended to 98.9%.	Amend table 7-12.	
6	**Apportioning of impacts**				
6.1	The apportioning of impacts to the SPAs has been done between SPAs only and does not include any birds from areas outside of SPAs. This has therefore overestimated the impact to the SPAs. For gannet, this is likely to be less of an issue than for kittiwake, but for gannet, the population at Troup Head (1810 AON (3620 adults)) should have been included. Although this population is very small compared to Bass Rock, the proximity to Kincardine will mean that that contribution to the onsite population will still count.	SNH	Noted, the apportionment will include birds from outside of the SPA.	Look at bird pops from outside SPAs and include in apportionment.	
6.2	Appendix G gives the numbers of kittiwakes at all colonies within foraging range of the development, however this information does not appear to have been used in the apportioning of kittiwake impacts.	SNH	Noted, These figures will be included in the apportionment.	Include kittiwake in apportionment	
6.3	We would recommend apportioning of impacts are revaluated to include all breeding birds within mean-max foraging range, regardless of them being in designated sites or not.	SNH	Noted.	as above.	
7	**Disturbance**				

	Subject	Comment Reference	KOWL Response	Result	SNH comments 15 December 2015
7.1	Disturbance impacts are likely to be limited due to relatively little sea-based construction activity. Boat movements and activity associated with anchor deployment are considered the most important sources of disturbance and provided that these are restricted as far as possible to outwith the most sensitive time (when auks with dependent young are present in large number), the most damaging negative impacts will be avoided.	SNH	Noted.	Seek further advice on the time of year to avoid during sea based construction activity.	July to September would be recommended.
8	**Habitat loss**				
8.1	Habitat loss due to anchors and possibly cable laying and armouring will be very small. It is not likely to impact on the seabirds due to the depth of water. Only guillemot (200m), razorbill (140m) and possibly puffin (70m) would be expected to dive to this depth. The habitat will largely remain unaltered and seabed change will be fairly limited. Some anchor chain movement could also occur but would expect that this will also be minimal damage given the area of habitat available, and unlikely to have a significant effect on prey resource for the seabirds listed.	SNH	Noted	No action required.	
9	**Collision Risk**				
9.1	The collision impacts to migrating birds were assessed with an arbitrary threshold of 1% of passage population. As stated in the report, this does not have any biological basis. KOWL's own flight height data was gathered by Hi-Def aerial survey and the maximum recorded flight height (if it was above minimum rotor height) was used to indicate possibility of likely significant effect. This approach is appropriate although, as noted above, we require clarification of the turbine parameters used in the models. Underwater collision (with substructures and mooring structures) has also been considered, but is not likely to be of significance for birds. Detailed comments on CRM are provided above (see use of CRM and flight height data).	SNH	Noted	No action required.	
10	**Approach to in-combination effects**				
10.1	Section 6-6 considers the in-combination impacts of the proposal. The SPAs (and qualifying interests) identified as having likely significant effects are each considered as part of cumulative assessment, and the treatment follows recommendations from SNH in previous advice.	SNH	Noted	No action required.	
10.2	The list of other projects to be considered for in-combination effects includes not only all significant windfarm projects, but also associated NRIP and transmission links. Impacts of other offshore development (oil and gas) are not included, but we consider the list sufficiently complete.	SNH	Noted	No action required.	

Appendix E. SNH Advice on HRA addendum.

Scottish Natural Heritage
Dualchas Nàdair na h-Alba
All of nature for all of Scotland
Nàdar air fad airson Alba air fad

David Bova
Marine Scotland
Marine Laboratory
P. O. Box 101
375 Victoria Road
Aberdeen
AB11 9DB

Your Ref: Kincardine revised draft HRA

Our Ref: CNS/REN/OSWF/DS/Kincardine/CPA140009

Date: 04 February 2016

By email only:
ms.marinelicensing@scotland.gsi.gov.uk

Dear David,

KINCARDINE FLOATING OFFSHORE WIND DEMONSTRATOR PROJECT

DRAFT HRA – SNH ADVICE

We received a request for comments from Atkins on the Kincardine floating offshore wind demonstrator project draft Habitats Regulations Appraisal (HRA) on 15 January 2016. We provided comments on the original draft HRA and other documents submitted at gate check (letters to Marine Scotland of 2 October 2015 and 11 November 2015). This revised draft HRA was produced in response to our previous comments on earlier HRA drafts.

We welcome further revision of the HRA in advance of submission of the application for the proposal. We have now reviewed the Atkins document entitled 'Kincardine Floating Offshore Windfarm, HRA Addendum 12 January 2016' and the revised collision risk modelling spreadsheets and final HiDef aerial survey report accompanying the document and offer the following comments.

Advice summary

The outstanding issues identified with the HRA at time of gate check have largely been rectified. In particular, issues relating to density of birds on site and treatment of birds in collision risk modelling have been resolved satisfactorily.

We agree that the methods used and information provided to assess the impacts on ornithological receptors are broadly appropriate for submission of the proposal application, however, we advise that minor corrections are required for the displacement assessment.

We acknowledge the approach taken to calculate displacement is precautionary and has been conducted as previously advised, but the derivation of the figures used should be changed (see below - Detailed advice - displacement).

The collision modelling suggests that relatively small numbers of birds will suffer from collisions with the installed turbines.

Sufficient information is provided to enable SNH to undertake a review and provide advice to allow Marine Scotland to undertake an Appropriate Assessment, if an application is submitted.

Detailed advice - displacement

We agreed that a simple approach to displacement estimation was appropriate for this development. The approach that has been taken is suitable, although the details of the method require modification.

For the HRA, we advise the assessment concentrates on the breeding season impacts. For this proposal, the dilution effect of birds from outside the region in winter means impacts are likely to be small enough to be discounted for this development. This is suggested by the low densities of gannet and kittiwake recorded in winter, a time when birds are no longer central place foragers.

In line with our recommendations, the post-breeding dispersal period has been removed from the assessment period for auks (July - September for guillemot and razorbill and August for puffin). This has led to recalculations of the impacts and the proportions of adult breeding birds in the populations.

We previously discussed the method of calculating the figures presented in Table 7-9 with Atkins (on 21/01/2016). We understand the logic used, but would request the number of adult breeding birds present in the breeding season to be calculated by a different method.

To estimate the number of birds from colonies displaced in the breeding season, we recommend using the breeding season only counts (and not use the counts from dispersal / winter periods). For example, for guillemot if the counts made only between April and June are used then the mean density in NE3 is estimated at 21.46 birds / km^2. This is the equivalent to a population in the wind farm (turbine area plus 1km buffer) of 536 birds. Other species should also be treated the same way.

We hope these comments are helpful. If further information or advice is required please contact me in the first instance: tracey.begg@snh.gov.uk or 01876 580236.

Yours faithfully

Dr Tracey Begg
Marine Renewable Energy Casework Adviser

Appendix F. Kincardine Site Specific Flight Height Distributions.

Table F-1 Site Specific Flight Height Distributions derived from Hi-Def Aerial Survey data

Flight Height	Gannet	Guillemot	Kittiwake
0	0.430107527	0.638709677	0.480213090
1	0.010752688	0.006451613	0.008371385
2	0.010752688	0.006451613	0.018264840
3	0.008064516	0.012903226	0.009132420
4	0.021505376	0.012903226	0.009132420
5	0.005376344	0.006451613	0.013698630
6	0.016129032	0.012903226	0.013698630
7	0.016129032	0.019354839	0.009132420
8	0.013440860	0.009677419	0.013698630
9	0.010752688	0.012903226	0.013698630
10	0.013440860	0.003225806	0.009132420
11	0.002688172	0.019354839	0.018264840
12	0.024193548	0.012903226	0.012176560
13	0.008064516	0.009677419	0.014459665
14	0.010752688	0.003225806	0.011415525
15	0.016129032	0.009677419	0.013698630
16	0.010752688	0.012903226	0.013698630
17	0.008064516	0.012903226	0.011415525
18	0.010752688	0.009677419	0.011415525
19	0.008064516	0.009677419	0.009893455
20	0.016129032	0.009677419	0.010654490
21	0.005376344	0.000000000	0.009893455
22	0.013440860	0.000000000	0.009132420
23	0.005376344	0.009677419	0.011415525
24	0.005376344	0.012903226	0.013698630
25	0.010752688	0.006451613	0.012176560
26	0.005376344	0.003225806	0.009132420
27	0.002688172	0.003225806	0.012937595
28	0.013440860	0.003225806	0.008371385
29	0.005376344	0.003225806	0.012176560
30	0.013440860	0.006451613	0.007610350
31	0.002688172	0.003225806	0.010654490
32	0.002688172	0.006451613	0.010654490
33	0.000000000	0.009677419	0.007610350
34	0.013440860	0.003225806	0.009132420
35	0.021505376	0.003225806	0.006088280
36	0.000000000	0.000000000	0.007610350
37	0.002688172	0.006451613	0.006088280
38	0.005376344	0.000000000	0.002283105

39	0.008064516	0.000000000	0.006849315
40	0.002688172	0.006451613	0.005327245
41	0.002688172	0.003225806	0.004566210
42	0.000000000	0.000000000	0.004566210
43	0.018817204	0.000000000	0.003805175
44	0.002688172	0.003225806	0.006849315
45	0.008064516	0.000000000	0.002283105
46	0.005376344	0.000000000	0.002283105
47	0.008064516	0.003225806	0.002283105
48	0.000000000	0.003225806	0.003805175
49	0.000000000	0.009677419	0.004566210
50	0.002688172	0.000000000	0.003044140
51	0.000000000	0.003225806	0.002283105
52	0.002688172	0.003225806	0.000761035
53	0.008064516	0.000000000	0.001522070
54	0.000000000	0.000000000	0.001522070
55	0.002688172	0.003225806	0.000761035
56	0.005376344	0.003225806	0.001522070
57	0.002688172	0.003225806	0.000761035
58	0.000000000	0.000000000	0.001522070
59	0.005376344	0.003225806	0.001522070
60	0.005376344	0.000000000	0.001522070
61	0.000000000	0.000000000	0.000000000
62	0.002688172	0.000000000	0.001522070
63	0.010752688	0.000000000	0.000761035
64	0.002688172	0.003225806	0.002283105
65	0.005376344	0.000000000	0.000000000
66	0.002688172	0.003225806	0.001522070
67	0.000000000	0.000000000	0.001522070
68	0.000000000	0.000000000	0.001522070
69	0.002688172	0.003225806	0.000000000
70	0.005376344	0.000000000	0.000761035
71	0.002688172	0.000000000	0.002283105
72	0.000000000	0.000000000	0.001522070
73	0.005376344	0.000000000	0.000761035
74	0.002688172	0.000000000	0.000761035
75	0.000000000	0.000000000	0.000761035
76	0.002688172	0.000000000	0.000000000
77	0.005376344	0.000000000	0.000000000
78	0.000000000	0.000000000	0.000761035
79	0.000000000	0.000000000	0.000761035
80	0.002688172	0.000000000	0.001522070
81	0.000000000	0.000000000	0.000761035
82	0.000000000	0.000000000	0.000761035
83	0.005376344	0.000000000	0.000761035
84	0.000000000	0.000000000	0.000000000

85	0.002688172	0.000000000	0.002283105
86	0.002688172	0.000000000	0.000000000
87	0.002688172	0.000000000	0.000761035
88	0.000000000	0.000000000	0.000000000
89	0.000000000	0.000000000	0.000761035
90	0.000000000	0.000000000	0.000000000
91	0.000000000	0.000000000	0.000000000
92	0.000000000	0.000000000	0.000761035
93	0.000000000	0.000000000	0.000000000
94	0.002688172	0.000000000	0.000000000
95	0.000000000	0.000000000	0.000000000
96	0.000000000	0.000000000	0.000000000
97	0.000000000	0.000000000	0.000761035
98	0.000000000	0.000000000	0.001522070
99	0.000000000	0.000000000	0.001522070
100	0.000000000	0.000000000	0.000000000
101	0.000000000	0.000000000	0.000000000
102	0.000000000	0.000000000	0.000000000
103	0.000000000	0.000000000	0.000761035
104	0.002688172	0.000000000	0.000000000
105	0.000000000	0.000000000	0.000000000
106	0.005376344	0.000000000	0.000000000
107	0.000000000	0.000000000	0.000000000
108	0.000000000	0.000000000	0.000000000
109	0.002688172	0.000000000	0.000000000
110	0.002688172	0.000000000	0.000000000
111	0.000000000	0.000000000	0.000000000
112	0.000000000	0.000000000	0.000000000
113	0.000000000	0.000000000	0.000000000
114	0.000000000	0.000000000	0.000000000
115	0.000000000	0.000000000	0.000000000
116	0.000000000	0.000000000	0.000000000
117	0.005376344	0.000000000	0.000000000
118	0.000000000	0.000000000	0.000761035
119	0.000000000	0.000000000	0.000000000
120	0.000000000	0.000000000	0.000761035
121	0.000000000	0.000000000	0.000000000
122	0.000000000	0.000000000	0.000000000
123	0.000000000	0.000000000	0.000761035
124	0.000000000	0.000000000	0.000000000
125	0.000000000	0.000000000	0.000000000
126	0.000000000	0.000000000	0.000000000
127	0.000000000	0.000000000	0.000761035
128	0.000000000	0.000000000	0.000000000
129	0.000000000	0.000000000	0.000000000
130	0.000000000	0.000000000	0.000000000

131	0.000000000	0.000000000	0.000761035
132	0.000000000	0.000000000	0.000761035
133	0.000000000	0.000000000	0.000000000
134	0.002688172	0.000000000	0.000000000
135	0.000000000	0.000000000	0.000000000
136	0.000000000	0.000000000	0.000000000
137	0.000000000	0.000000000	0.000000000
138	0.000000000	0.000000000	0.000000000
139	0.000000000	0.000000000	0.000000000
140	0.002688172	0.000000000	0.000761035
141	0.000000000	0.000000000	0.000000000
142	0.000000000	0.000000000	0.000000000
143	0.000000000	0.000000000	0.000000000
144	0.000000000	0.000000000	0.000000000
145	0.000000000	0.000000000	0.000000000
146	0.000000000	0.000000000	0.000000000
147	0.000000000	0.000000000	0.000761035
148	0.000000000	0.000000000	0.000000000
149	0.000000000	0.000000000	0.000000000
150	0.000000000	0.000000000	0.000000000
151	0.000000000	0.000000000	0.000000000
152	0.000000000	0.000000000	0.000761035
153	0.000000000	0.000000000	0.000000000
154	0.000000000	0.000000000	0.000000000
155	0.000000000	0.000000000	0.000000000
156	0.000000000	0.000000000	0.000000000
157	0.000000000	0.000000000	0.000000000
158	0.000000000	0.000000000	0.000000000
159	0.000000000	0.000000000	0.000000000
160	0.000000000	0.000000000	0.000000000
161	0.000000000	0.000000000	0.000000000
162	0.000000000	0.000000000	0.000000000
163	0.000000000	0.000000000	0.000000000
164	0.000000000	0.000000000	0.000000000
165	0.000000000	0.000000000	0.000000000
166	0.000000000	0.000000000	0.000000000
167	0.000000000	0.000000000	0.000000000
168	0.000000000	0.000000000	0.000000000
169	0.000000000	0.000000000	0.000000000
170	0.000000000	0.000000000	0.000000000
171	0.000000000	0.000000000	0.000000000
172	0.000000000	0.000000000	0.000000000
173	0.000000000	0.000000000	0.000000000
174	0.000000000	0.000000000	0.000000000
175	0.000000000	0.000000000	0.000000000
176	0.000000000	0.000000000	0.000000000

177	0.000000000	0.000000000	0.000761035
178	0.000000000	0.000000000	0.000761035
179	0.000000000	0.000000000	0.000000000
180	0.000000000	0.000000000	0.000000000
181	0.000000000	0.000000000	0.000000000
182	0.000000000	0.000000000	0.000000000
183	0.000000000	0.000000000	0.000000000
184	0.000000000	0.000000000	0.000761035
185	0.000000000	0.000000000	0.000761035
186	0.000000000	0.000000000	0.000000000
187	0.000000000	0.000000000	0.000000000
188	0.000000000	0.000000000	0.000000000
189	0.000000000	0.000000000	0.001522070
190	0.000000000	0.000000000	0.000000000
191	0.000000000	0.000000000	0.000000000
192	0.000000000	0.000000000	0.000000000
193	0.000000000	0.000000000	0.000000000
194	0.000000000	0.000000000	0.000000000
195	0.000000000	0.000000000	0.000000000
196	0.000000000	0.000000000	0.000000000
197	0.000000000	0.000000000	0.000000000
198	0.000000000	0.000000000	0.000000000
199	0.000000000	0.000000000	0.000000000
200	0.000000000	0.000000000	0.000761035
201	0.000000000	0.000000000	0.000000000
202	0.000000000	0.000000000	0.000000000
203	0.000000000	0.000000000	0.000761035
204	0.000000000	0.000000000	0.000000000
205	0.000000000	0.000000000	0.000000000
206	0.000000000	0.000000000	0.000000000
207	0.000000000	0.000000000	0.000761035
208	0.000000000	0.000000000	0.000000000
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210	0.000000000	0.000000000	0.000000000
211	0.000000000	0.000000000	0.000000000
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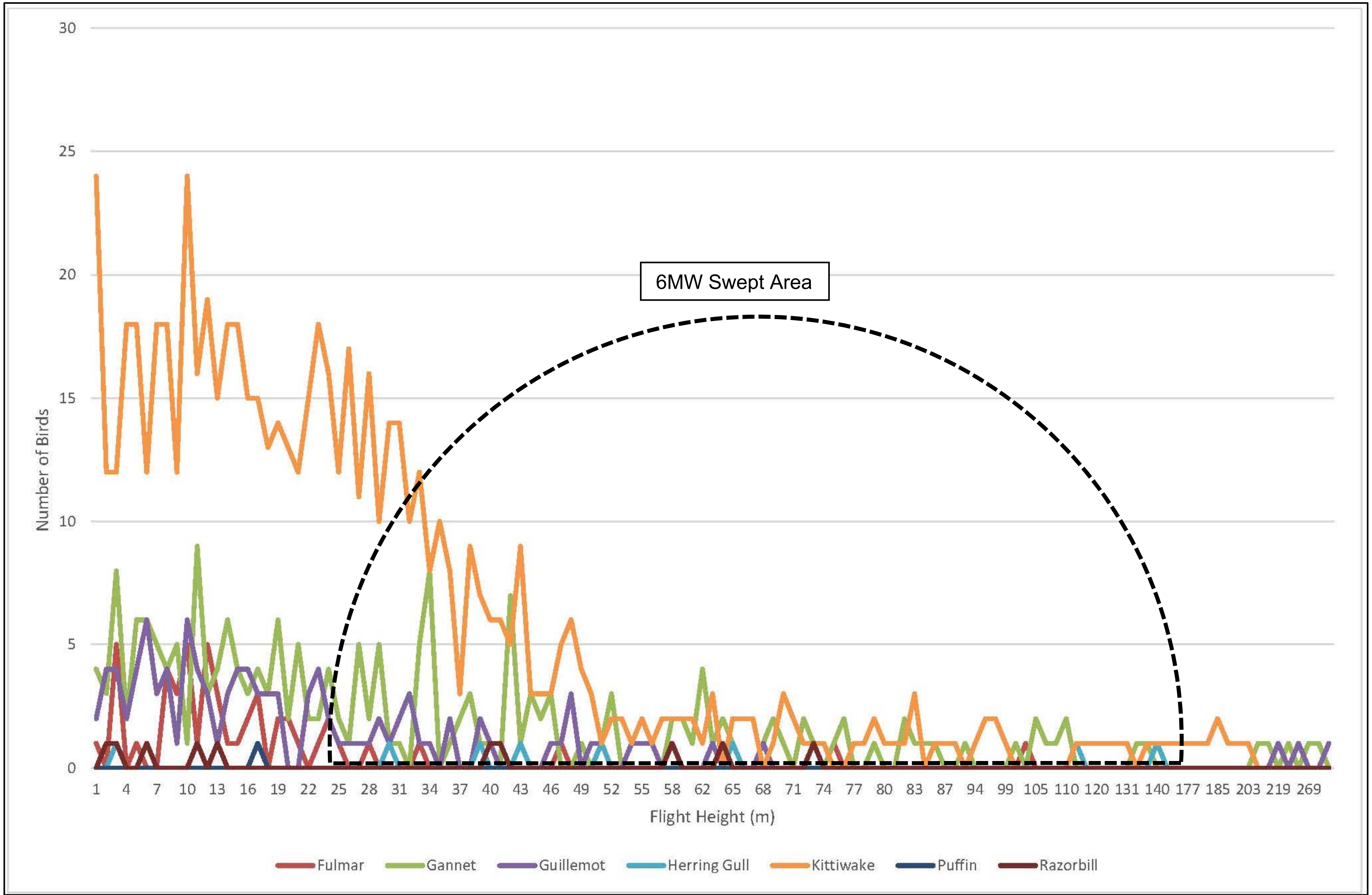
214	0.000000000	0.000000000	0.000000000
215	0.000000000	0.000000000	0.000000000
216	0.000000000	0.000000000	0.000000000
217	0.002688172	0.000000000	0.000000000
218	0.000000000	0.000000000	0.000000000
219	0.002688172	0.000000000	0.000000000
220	0.000000000	0.000000000	0.000000000

Figure F-1 Kincardine Bird Flight Height Distributions - derived from Hi-Def Aerial Surveys.



Appendix G. Results of Migratory risk assessment.

Table G-1 Strategic Ornithological Support Services (SOSS) Migratory SPA Bird Risk Assessment

	Species cross Kincardine on Migration? (Y/N)	Total Migratory Population Size	Population Correction Factor (percent of population estimated to be using relevant sea-crossings - %)	Proportion of Migratory Pop crossing Kincardine site.	Number of Migratory Pop crossing Kincardine site.
Whooper Swan *Cygnus cygnus*	Y	11,000	100	9.63%	1,060
Bean Goose *Anser fabalis*	Y	410	1	1.34%	0
Pink-footed Goose *Anser brachyrhynchus*	Y	360,000	100	16.11%	57,992
Greenland White-fronted Goose *Anser albifrons flavirostris*	Y	13,000	100	46.81%	6,085
Icelandic Greylag Goose *Anser anser*	Y	85,000	100	41.85%	35,573
Barnacle Goose (Greenland population) *Branta leucopsis*	Y	58,000	100	55.86%	32,402
Barnacle Goose (Svalbard population) *Branta leucopsis*	Y	33,000	100	5.93%	1,958
Light-bellied Brent Goose (Canadian population) *Branta bernicla hrota*	Y	710	100	19.17%	136
Shelduck *Tadorna tadorna*	Y	61,000	25	2.55%	389
Wigeon *Anas penelope*	Y	440,000	35	4.81%	7,402
Teal *Anas crecca*	Y	210,000	51	4.82%	5,166
Mallard *Anas platyrhynchos*	Y	680,000	16	2.55%	2,773
Pintail *Anas acuta*	Y	29,000	50	4.82%	699
Shoveler *Anas clypeata*	Y	18,000	51	3.45%	316

	Species cross Kincardine on Migration? (Y/N)	**Total Migratory Population Size**	**Population Correction Factor (percent of population estimated to be using relevant sea-crossings - %)**	**Proportion of Migratory Pop crossing Kincardine site.**	**Number of Migratory Pop crossing Kincardine site.**
Pochard *Aythya ferina*	Y	38,000	25	3.45%	328
Tufted Duck *Aythya fuligula*	Y	110,000	12	4.72%	623
Scaup *Aythya marila*	Y	5,200	3	7.25%	11
Eider *Somateria mollissima*	Y	55,000	92	3.68%	1,864
Long-tailed Duck *Clangula hyemalis*	Y	11,000	1	2.55%	2
Common Scoter *Melanitta nigra*	Y	100,000	22	4.82%	1,061
Velvet Scoter *Melanitta fusca*	Y	2,500	1	2.73%	0
Goldeneye *Bucephala clangula*	Y	20,000	3	2.55%	15
Red-breasted Merganser *Mergus serrator*	Y	8,400	7	6.89%	41
Goosander (non-breeding) *Mergus merganser*	Y	12,000	5	2.73%	16
Red-throated Diver *Gavia stellate* (breeding)	Y	1,500	12	4.66%	8
Red-throated Diver *Gavia stellate* (non-breeding)	Y	17,000	12	5.25%	107
Fulmar Fulmarus *glacialis*	Y	504,756	18	4.70%	4,266
Manx Shearwater *Puffinus puffinus*	Y	319,499	91	4.70%	13,651
Storm Petrel *Hydrobates pelagicus*	Y	33,434	8	4.70%	126
Leach’s Petrel *Oceanodroma leucorhoa*	Y	64,883	54	4.70%	1,645

	Species cross Kincardine on Migration? (Y/N)	Total Migratory Population Size	Population Correction Factor (percent of population estimated to be using relevant sea-crossings - %)	Proportion of Migratory Pop crossing Kincardine site.	Number of Migratory Pop crossing Kincardine site.
Gannet *Morus bassanus*	Y	218,546	73	4.70%	7,491
Cormorant *Phalacrocorax carbo*	Y	35,000	41	2.53%	364
Shag *Phalacrocorax aristotelis*	Y	110,000	55	5.54%	3,353
Great Crested Grebe *Podiceps cristatus*	Y	19,000	8	1.81%	28
Slavonian Grebe *Podiceps auritus*	Y	1,100	19	4.82%	10
Hen Harrier *Circus cyaneus* (breeding)	Y	570	1	5.63%	0
Hen Harrier *Circus cyaneus (non-breeding)*	Y	750	9	2.73%	2
Merlin *Falco columbarius*	Y	1,330	3	12.26%	5
Corncrake *Crex crex*	Y	589	0	6.13%	0
Oystercatcher *Haematopus ostralegus* (breeding)	Y	113,000	28	5.54%	1,753
Oystercatcher *Haematopus ostralegus* (non-breeding)	Y	67,620	47	4.82%	1,533
Ringed Plover *Charadrius hiaticula* (breeding)	Y	5,438	15	5.52%	45
Ringed Plover *Charadrius hiaticula* (non-breeding)	Y	34,000	67	2.54%	579
Golden Plover *Pluvialis apricaria* (breeding)	Y	22,600	26	5.52%	325
Golden Plover *Pluvialis apricaria* (non-breeding)	Y	400,000	36	8.36%	12,036
Grey Plover *Pluvialis squatarola*	Y	43,000	20	2.56%	220

	Species cross Kincardine on Migration? (Y/N)	**Total Migratory Population Size**	**Population Correction Factor (percent of population estimated to be using relevant sea-crossings - %)**	**Proportion of Migratory Pop crossing Kincardine site.**	**Number of Migratory Pop crossing Kincardine site.**
Lapwing *Vanellus vanellus*	Y	620,000	15	2.56%	2,381
Knot *Calidris canutus*	Y	320,000	75	4.85%	11,630
Sanderling *Calidris alba*	Y	16,000	19	4.85%	147
Purple Sandpiper *Calidris maritima*	Y	13,000	33	18.29%	785
Dunlin *Calidris alpina schinzii* & C.a.*arctica (passage)*	Y	9,900	100	4.93%	488
Dunlin *Calidris alpina alpine* (passage & winter)	Y	350,000	33	3.10%	3,583
Ruff *Philomachus pugnax*	Y	800	0	1.28%	0
Snipe *Gallinago gallinago*	Y	1,000,000	40	4.86%	19,437
Black-tailed Godwit *Limosa limosa islandica*	Y	43,000	100	6.79%	2,921
Bar-tailed Godwit *Limosa lapponica*	Y	38,000	45	2.69%	461
Whimbrel *Numenius phaeopus*	Y	3,840	0	5.21%	1
Curlew *Numenius arquata* (breeding)	Y	107,000	25	5.58%	1,493
Curlew *Numenius arquata* (non-breeding)	Y	140,000	28	2.72%	1,067
Greenshank *Tringa nebularia*	Y	4,790	2	2.89%	3
Wood Sandpiper *Tringa glareola*	Y	8	0	3.43%	0
Redshank *Tringa totanus Britannica (breeding)*	Y	135,000	100	3.59%	4,846

	Species cross Kincardine on Migration? (Y/N)	**Total Migratory Population Size**	**Population Correction Factor (percent of population estimated to be using relevant sea-crossings - %)**	**Proportion of Migratory Pop crossing Kincardine site.**	**Number of Migratory Pop crossing Kincardine site.**
Redshank Icelandic population *Tringa totanus robusta* (non-breeding)	Y	120,000	34	6.81%	2,779
Redshank mainland Europe population *Tringa totanus tetanus* (non-breeding)	Y	300,000	34	2.69%	2,747
Turnstone *Arenaria interpres*	Y	48,000	41	4.82%	948
Red-necked Phalarope *Phalaropus lobatus*	Y	16	0	5.33%	0
Arctic Skua *Stercorarius parasiticus*	Y	2,136	5	2.54%	3
Great Skua *Stercorarius skua*	Y	9,634	60	4.68%	270
Kittiwake *Rissa tridactyla*	Y	379,892	12	2.54%	1,158
Black-headed Gull *Chroicocephalus ridibundus*	Y	2,200,000	7	5.52%	8,508
Common Gull *Larus canus*	Y	700,000	29	4.78%	9,703
Lesser Black-backed Gull *Larus fuscus*	Y	120,000	42	6.80%	3,425
Herring Gull *Larus argentatus*	Y	730,000	28	3.59%	7,337
Great Black-backed Gull *Larus marinus*	Y	76,000	10	3.59%	273
Little Tern *Sternula albifrons*	Y	1,947	24	0.00%	0
Sandwich Tern *Sterna sandvicensis*	Y	12,490	15	3.77%	71
Common Tern *Sterna hirundo*	Y	11,838	15	3.30%	59
Arctic Tern *Sterna paradisaea*	Y	53,388	11	2.56%	150

	Species cross Kincardine on Migration? (Y/N)	Total Migratory Population Size	Population Correction Factor (percent of population estimated to be using relevant sea-crossings - %)	Proportion of Migratory Pop crossing Kincardine site.	Number of Migratory Pop crossing Kincardine site.
Guillemot *Uria aalge*	Y	1,420,900	36	4.70%	24,017
Razorbill *Alca torda*	Y	188,576	22	4.70%	1,948
Puffin *Fratercula arctica*	Y	579,189	10	4.70%	2,719
Short-eared *Owl Asio flammeus*	Y	3,500	2	4.70%	3

Source: http://www.bto.org/science/wetland-and-marine/soss/projects

SOSS-05: Assessing the risk of offshore windfarm development to migratory birds designated as features of UK Special Protection Areas (and other Annex 1 species)

This project has been completed, and the final report, Migration Assessment Tool, and both written instructions and a video tutorial describing how to use the Migration Assessment Tool can be downloaded below.

- SOSS-05 final report - assessing risk to migrants (pdf, 4 MB).
- SOSSMAT - the SOSS Migration Assessment Tool (zip, 12 MB).
- SOSSMAT written instructions (pdf, 1.6 MB) - note these instructions are also in an Annex to the final report, but can be downloaded separately here.
- SOSSMAT video tutorial, in two parts (youtube link, 18 minutes total length. We recommend using the highest quality setting and full screen view to make everything a legible as possible).
- Migration zone shapefiles for each species map used in the report can be downloaded, if required, though these are not needed for use of the SOSSMAT.

This project reviewed available information on over-sea migration routes, timings and the flight heights of migrating seabirds, waterbirds and terrestrial birds that are features of UK Special Protection Areas, and how these vary, for example in response to weather conditions. It has provided recommendations as to how this information should be used to assess the risks to migrants in the EIA process for offshore windfarm developments, and where further data collection would be required to assess the effects. It also recommends what further work could be conducted to fill key gaps in knowledge of migration routes and flight heights. This work was conducted by the BTO.

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aspects have not been included and previously accepted levels of adult mortality for auks have been 50% for large wind farms. For each adult death a breeding attempt has been considered lost. While in some cases a proportion of apparent adult-type plumage birds do not breed (so called sabbatical birds) it is usually assumed that all adult plumage birds are breeding adults. If there is evidence otherwise then it should be presented and agreed with us and Marine Scotland Science.

II. Apportioning of Impacts
The apportioning of impacts to the SPAs has been done between SPAs only and does not include any birds from areas outside of SPAs. This has therefore overestimated the impact to the SPAs. For gannet, this is likely to be less of an issue than for kittiwake, but for gannet, the population at Troup Head (1810 AON (3620 adults)) should have been included. Although this population is very small compared to Bass Rock, the proximity to Kincardine will mean that that contribution to the onsite population will still count.

Appendix G gives the numbers of kittiwakes at all colonies within foraging range of the development, however this information does not appear to have been used in the apportioning of kittiwake impacts.

We would recommend apportioning of impacts are revaluated to include all breeding birds within mean-max foraging range, regardless of them being in designated sites or not.

III. Disturbance
Disturbance impacts are likely to be limited due to relatively little sea-based construction activity. Boat movements and activity associated with anchor deployment are considered the most important sources of disturbance and provided that these are restricted as far as possible to outwith the most sensitive time (when auks with dependent young are present in large number), the most damaging negative impacts will be avoided.

IV. Habitat loss
Habitat loss due to anchors and possibly cable laying and armouring will be very small. It is not likely to impact on the seabirds due to the depth of water. Only guillemot (200m), razorbill (140m) and possibly puffin (70m) would be expected to dive to this depth. The habitat will largely remain unaltered and seabed change will be fairly limited. Some anchor chain movement could also occur but would expect that this will also be minimal damage given the area of habitat available, and unlikely to have a significant effect on prey resource for the seabirds listed.

V. Collision risk
The collision impacts to migrating birds were assessed with an arbitrary threshold of 1% of passage population. As stated in the report, this does not have any biological basis. KOWL's own flight height data was gathered by HiDef aerial survey and the maximum recorded flight height (if it was above minimum rotor height) was used to indicate possibility of likely significant effect. This approach is appropriate although, as noted above, we require clarification of the turbine parameters used in the models. Underwater collision (with substructures and mooring structures) has also been considered, but is not likely to be of significance for birds. Detailed comments on CRM are provided above (see use of CRM and flight height data).

6. Approach to in-combination effects
Section 6-6 considers the in-combination impacts of the proposal. The SPAs (and qualifying interests) identified as having likely significant effects are each considered as part of

cumulative assessment, and the treatment follows recommendations from SNH in previous advice.

The list of other projects to be considered for in-combination effects includes not only all significant wind farm projects, but also associated NRIP and transmission links. Impacts of other offshore development (oil and gas) are not included, but we consider the list sufficiently complete.

We hope these comments are helpful. If further information or advice is required please contact me in the first instance: tracey.begg@snh.gov.uk or 01876 580236.

Yours sincerely,

DR TRACEY BEGG
Marine Renewable Energy Casework Adviser