



**MAINSTREAM**  
RENEWABLE  
POWER

**Neart na Gaoithe Offshore Wind Farm  
Addendum of Supplementary Environmental  
Information**

**Ornithology Appendix 3: Habitats  
Regulations Appraisal - Special Protection  
Areas**

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## 1 Introduction

- 1 In July 2012 Neart na Gaoithe Offshore Wind Farm Limited (NnGOWL) submitted to Marine Scotland, an agency of the Scottish Government, an application to construct and operate an offshore wind farm, Neart na Gaoithe. In support of the application an Environmental Statement (ES) was published presenting the finding of an Environmental Impact Assessment (EIA) and the information to inform a Habitats Regulations Appraisal (HRA).
- 2 Following submission of the application, a public consultation was undertaken and responses received providing comment and advice specifically relating to issues concerning the HRA.
- 3 Advice received during consultation has been considered within this updated HRA document.
- 4 Information used to support the application included ornithological data obtained during two years of site-specific surveys. In order to verify that the two years of data used within the application was valid, NnGOWL continued to undertake boat-based ornithological and marine mammal surveys for a further 12 months. The data obtained during Year 3 surveys has been analysed and used in conjunction with the Year 1 and Year 2 survey data in this HRA document.

## 2 Scope of Document

- 5 This document presents a verification of information on potential impacts on sites of nature conservation importance as a result of the development or operation of the proposed Neart na Gaoithe offshore wind farm. This has been produced following the receipt of comments from stakeholders including an informal submission from SNH, feedback from Marine Scotland Licensing Operations Team (MS-LOT) and comments from RSPB. These are available on the MS-LOT website. This information has been used to verify the conclusions as presented in the project's original ES in particular Chapter 11: Nature Conservation, supported by an updated Ornithological Technical Report.
- 6 The information presented determined whether Neart na Gaoithe, either alone or in-combination with other plans and projects, was likely to have a significant effect on a European site based on the results from this screening assessment (Annex A). The Environmental Statement provided the necessary information to inform an Appropriate Assessment (AA) of whether, in view of the relevant European site's conservation objectives, Neart na Gaoithe would have an adverse effect (or risk of adverse effect) on the integrity of a European site.
- 7 The sites and species identified as being at risk of a likely significant effect is based on comments received during consultation (SNH, 2012) and revised approaches to assessment also advised during consultation or recently issued guidance documents (e.g. NE and JNCC, 2012). The use of Year three survey data provides greater confidence in the results and conclusions made.
- 8 This document provides clarification on a number of points to inform HRA and/or an Appropriate Assessment (AA) for Special Protection Areas (SPAs); a requirement for the project given the potential interaction between the project and SPAs. It supersedes the HRA information that was presented within Chapter 11: Nature Conservation, of the Neart na Gaoithe ES.

## 3 Legislative and Policy Context

- 9 As outlined in the ES, within the EU the key international legislative measures requiring the protection of rare and at-risk habitats and species are the Birds Directive (Directive 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds) and the Habitats Directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, as amended). These Directives are intended to fulfil the EU's commitment to international conventions and provide a framework for the designation of a network of protected sites for species and features across all EU member states, known as the 'Natura 2000 network'.

- 10 Species of nature conservation interest not benefitting from protection within the Natura 2000 network but listed within Annex IV of the Habitats Directive receive a different level of protection; these are known as European Protected Species (EPS).
- 11 Within Scottish territorial waters (STW) the transposing legislation for the Habitats and Birds Directives are the Wildlife and Countryside Act 1981 (as amended), the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (the Habitats Regulations) and the Nature Conservation (Scotland) Act 2004.
- 12 The Habitats Regulations allow for the designation of Natura 2000 areas: Special Areas of Conservation (SACs) which act to protect ecologically vulnerable or valuable habitats and Special Protection Areas (SPAs) for sites which are considered important for bird populations. Under these regulations, the Joint Nature Conservation Committee (JNCC) is responsible for the designation of marine SACs and SPAs beyond 12 nautical miles (NM) and SNH is responsible for marine sites within 12 NM as well as terrestrial sites.
- 13 The Habitats Regulations implement the Habitats Directive in Scottish Territorial Waters (STW). The Regulations require the competent authority to carry out an HRA if a project is likely to have a significant effect on a Natura 2000 site. If this is so, then it is required to assess the likelihood of a significant adverse effect on the site's ecological integrity occurring, by carrying out an AA. If the AA finds that such a significant adverse effect is likely to arise then consent for such a project must, other than in exceptional circumstances, be refused.
- 14 HRA applies to any plan or project with the potential to affect the qualifying interests of a Natura 2000 site, and subsequently, the conservation objectives and integrity of the site. The competent authority, Marine Scotland, has been advised by SNH that an HRA is required for the Neart na Gaoithe project (see SNH, 2010).
- 15 The requirement for HRA at a project level is further outlined in the Scottish Government's Plan for offshore wind development in territorial waters (*'Blue Seas - Green Energy: A Sectoral Marine Plan for Offshore Wind Energy in Scottish Territorial Waters'*, see Marine Scotland, 2011a; 2011b; and 2011c), which also had an accompanying plan-level HRA.
- 16 SNH (2010) advises that the Conservation (Natural Habitats &c.) Regulations 1994 (as amended) require the competent authority to (from SNH, 2010):
- Determine whether the proposal is directly connected with or necessary to site management for conservation;
  - Determine whether the proposal is likely to have a significant effect on the site either individually or in combination with other plans or projects; and
  - If so, then make an AA of the implications (of the proposal) for the site in view of that site's conservation objectives. A plan or project can only be consented if it can be ascertained that it will not adversely affect the integrity of a Natura 2000 site (subject to Regulation 49 considerations).
- 17 Although the proposal is not directly connected with, or necessary, to site management for conservation for any Natura 2000 sites, SNH has advised that as the project may have an LSE on certain site features Marine Scotland will therefore carry out an AA of the effects of the proposed development on potentially impacted Natura 2000 sites' features and conservation objectives.

### 3.1 Habitats Regulation Appraisal

- 18 The Habitats Regulations require that where a project (or plan) could affect a Natura 2000 site (or its qualifying interests) then the competent authority must consider whether the plan or project is likely to give rise to a significant effect, and if so, make an AA of the implications of the project in view of the site's conservation objectives. This process is known as HRA in the UK, or more widely as an Article 6 Assessment (European Commission (EC), 2002). Marine Scotland, as the competent authority for offshore wind farm developments in Scottish territorial waters (STW), and the Scottish Government's statutory nature conservation advisers - SNH - have confirmed that a project level HRA is required and provided guidance on the scope of such an HRA (Marine Scotland, 2011a; 2011b; SNH, 2012; 2010).

19 The potential significant impacts of the proposed Neart na Gaoithe offshore wind farm development upon these sites, qualifying features and nature conservation objectives have been assessed and information is summarised in this document as information to inform assessment by the competent authority.

## 4 The Proposed Development

20 It should be noted that the design envelope has been revised since the original ES submission and this is taken into account in this revised HRA document.

21 The proposed project will be located to the northeast of the Firth of Forth, 15.5 km east of Fife Ness. The proposed wind farm Agreement for Lease areas covers approximately 105 km<sup>2</sup>, with Indicative Layout 3 using 83 km<sup>2</sup> of this area for turbines. There will be between 73 and 90 turbines rated between 5MW to 6.15MW with a maximum site capacity of 450 MW.

22 For further details of the revised design envelope are available in the main addendum document and in Technical Appendix 1: Refined Design Envelope.

## 5 HRA Approach

### 5.1 Introduction

23 Regulation 61 of the Habitats Regulations sets out the procedure for the assessment of the implications of plans and projects on European sites. Under Regulation 61, if the proposed development is not directly connected with or necessary to the management of a European site and is likely to significantly affect the site, the competent authority must undertake an Appropriate Assessment (AA) of the implications for that site in view of that site's conservation objectives (Regulation 61(1)). The assessment is undertaken as a four stage process:

- Stage 1 Screening - Test of Likely Significance: Determining whether the plan or project "*either alone or in-combination with other plans and projects*" is likely to have a significant effect on a European site(s);
- Stage 2 Appropriate Assessment: Where likely significant effects are identified during screening, determining whether, in view of the European site's conservation objectives, the plan or project would have an adverse effect (or risk of adverse effect) on the integrity of the site. If not, the plan can proceed;
- Stage 3 Alternatives and Compensation: Where the plan or project cannot be shown to avoid an adverse effect on the integrity of a site, there should be an examination of compensation measures and alternative solutions; and
- Stage 4 Assessment of "*imperative reasons of overriding public interest*" (IROPI): If it is not possible to identify mitigation and alternatives that would avoid an adverse effect, it would be necessary to establish IROPI. This is not considered a standard part of the process and will only be carried out in exceptional circumstances.

24 The following section identifies the potential impacts that may arise on qualifying species from the proposed development. The potential impacts on birds arising from the project have been identified within the Ornithology Appendix 1: Ornithology Technical Report (May 2013).

### 5.2 Summary of Effects from the Proposed Development

#### 5.2.1 Introduction

25 Potential impacts on birds that could cause a likely significant effect include:

- Disturbance and Displacement
- Direct Habitat Loss
- Displacement Resulting in Effective Habitat Loss from an area around Turbines and Other Ancillary Structures during the Operational Phase of the Development

- Mortality as a result of Direct Collision with Turbines
- Barrier Effects caused by the Physical Presence of Turbines and Ancillary Structures Preventing Clear Transit of Birds

### 5.2.2 Disturbance and Displacement

- 26 Displacement modelling has been carried out using the whole Neart na Gaoithe site boundary (Agreement for Lease area), however the actual buildable area for the revised layout (layout 3) is less than this (Table 5.1, Figure 5.1 to Figure 5.3).
- 27 Disturbance and displacement can occur as a result of construction, maintenance and decommissioning activities including increased vessel traffic and construction activities, including impacts associated with noise.
- 28 Disturbance and displacement arising from construction, maintenance and decommissioning activities have the potential to cause birds to relocate to sites that might be less optimal and therefore cause increased energetic or behavioural costs to the birds and risk increasing mortality or reducing breeding success.
- 29 Evidence from existing wind farms and other marine activities suggest that this is potentially a significant effect to divers (e.g. red-throated diver; Norman and Ellis, 2005) and seaduck (e.g. common scoter; Kaiser, 2002). However, very few divers or seaduck have been recorded in the offshore site and they are not species of concern for NnGOWL.
- 30 Key species recorded within the offshore site that may be affected by vessel disturbance are the auks (guillemot, razorbill and puffin). Evidence from offshore activities indicate that these species are not significantly impacted by vessel disturbance with Wade and Furness (2012) indicating a moderate sensitivity for auks species. Theoretical modelling undertaken assessing potential disturbance effect from vessels over a range of distances concluded that *'the numbers of potentially affected and frequency that individuals would experience such active disturbance are both so low that it is not plausible that it could significantly affect populations'* (McDonald *et al.*, 2012).

Table 5.1: Area of Neart na Gaoithe site boundary and buildable areas for indicative layout 3 with buffers applied.

Area (also refer to Figure 5.1 to Figure 5.3)	Area Km <sup>2</sup>
Site Boundary for Neart na Gaoithe (or Agreement for Lease area)	105.1
Site Boundary for Neart na Gaoithe + 1 km Buffer	148.9
Site Boundary for Neart na Gaoithe + 2 km Buffer	199.1
Buildable Area for indicative layout 3	82.7
Buildable Area for indicative layout 3 + 1 km Buffer	126.3
Buildable Area for indicative layout 3 + 2 km Buffer	175.6

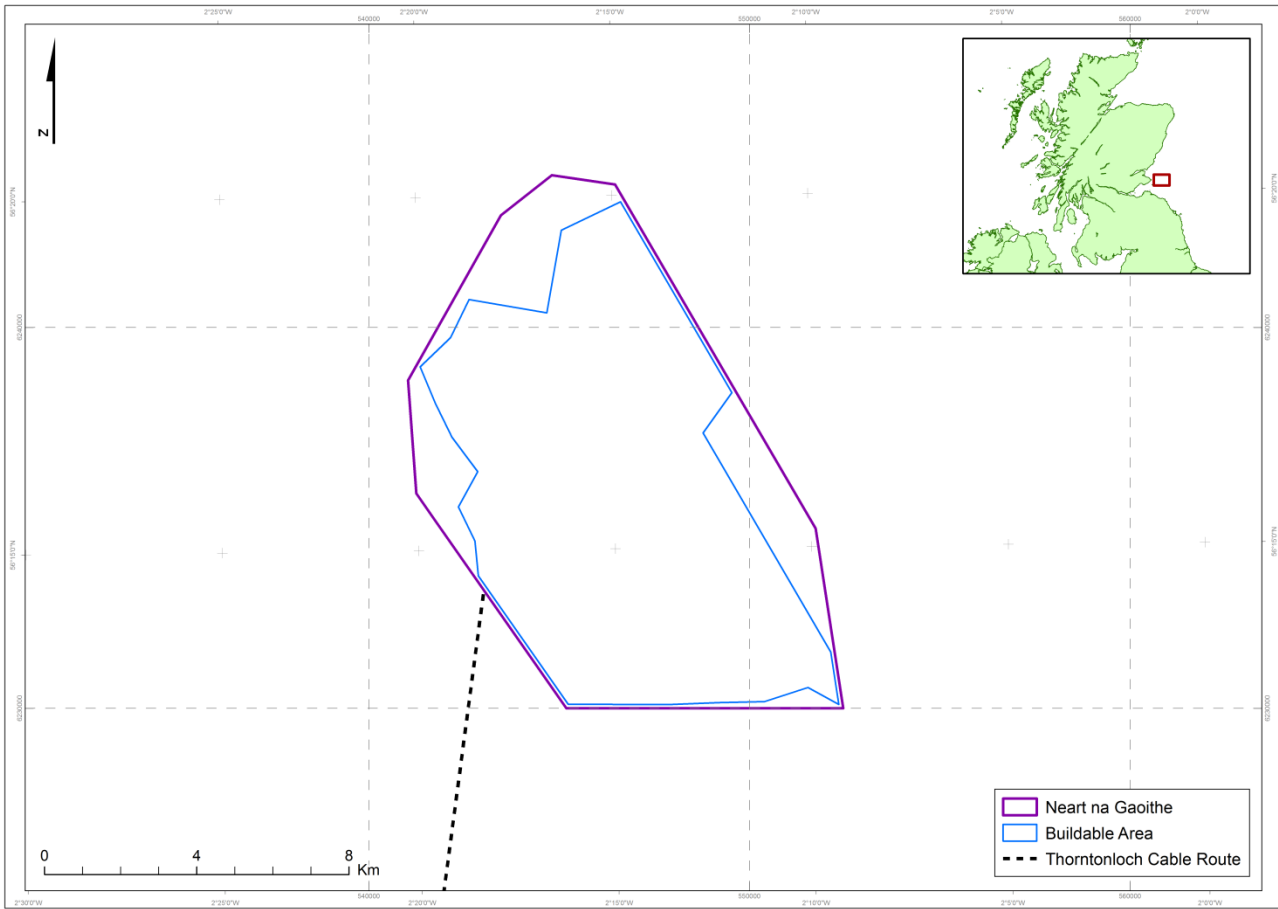


Figure 5.1: Neart na Gaoithe site boundary and buildable area for layout 3.

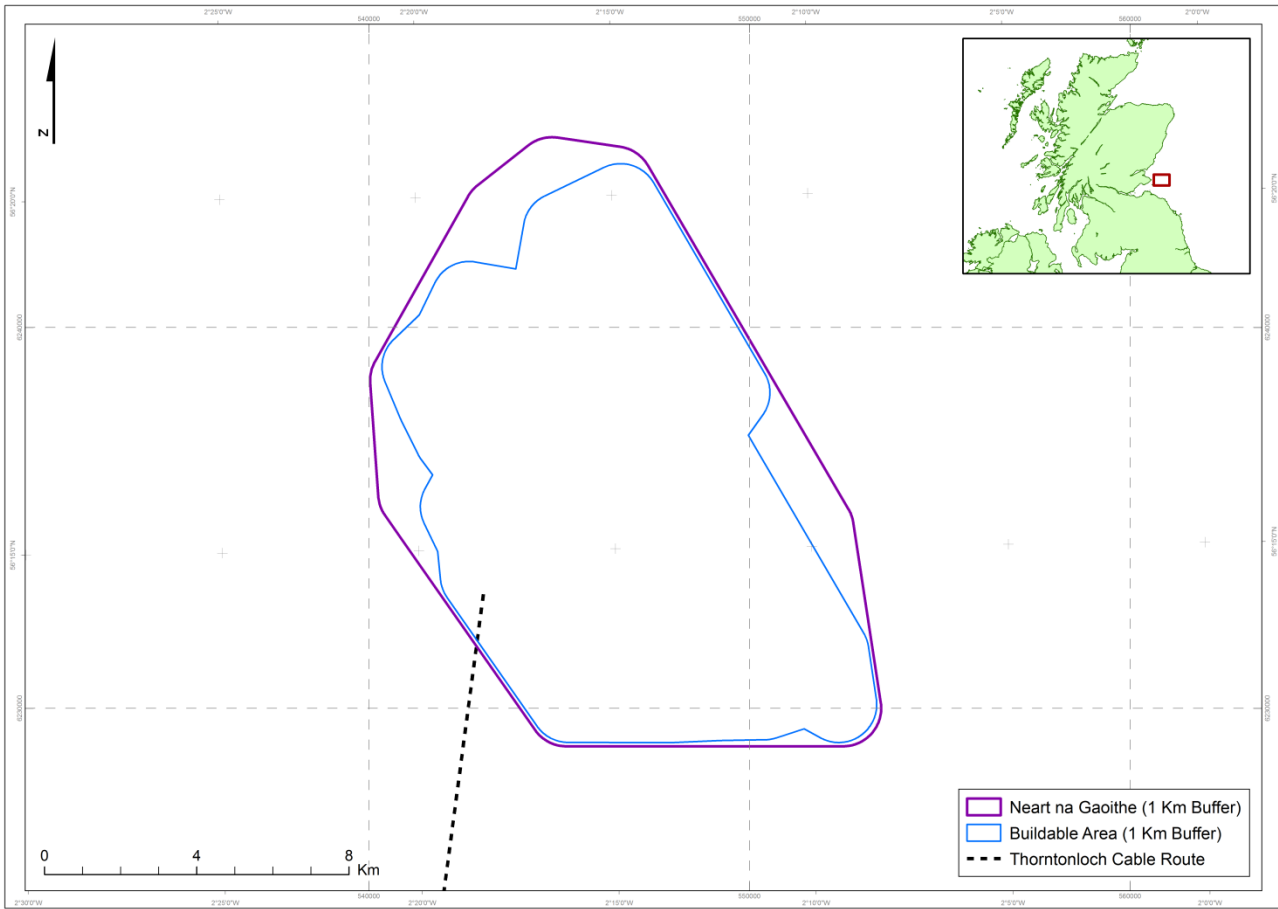


Figure 5.2: Neart na Gaoithe site boundary and buildable area for layout 3, both with 1 km buffer applied.



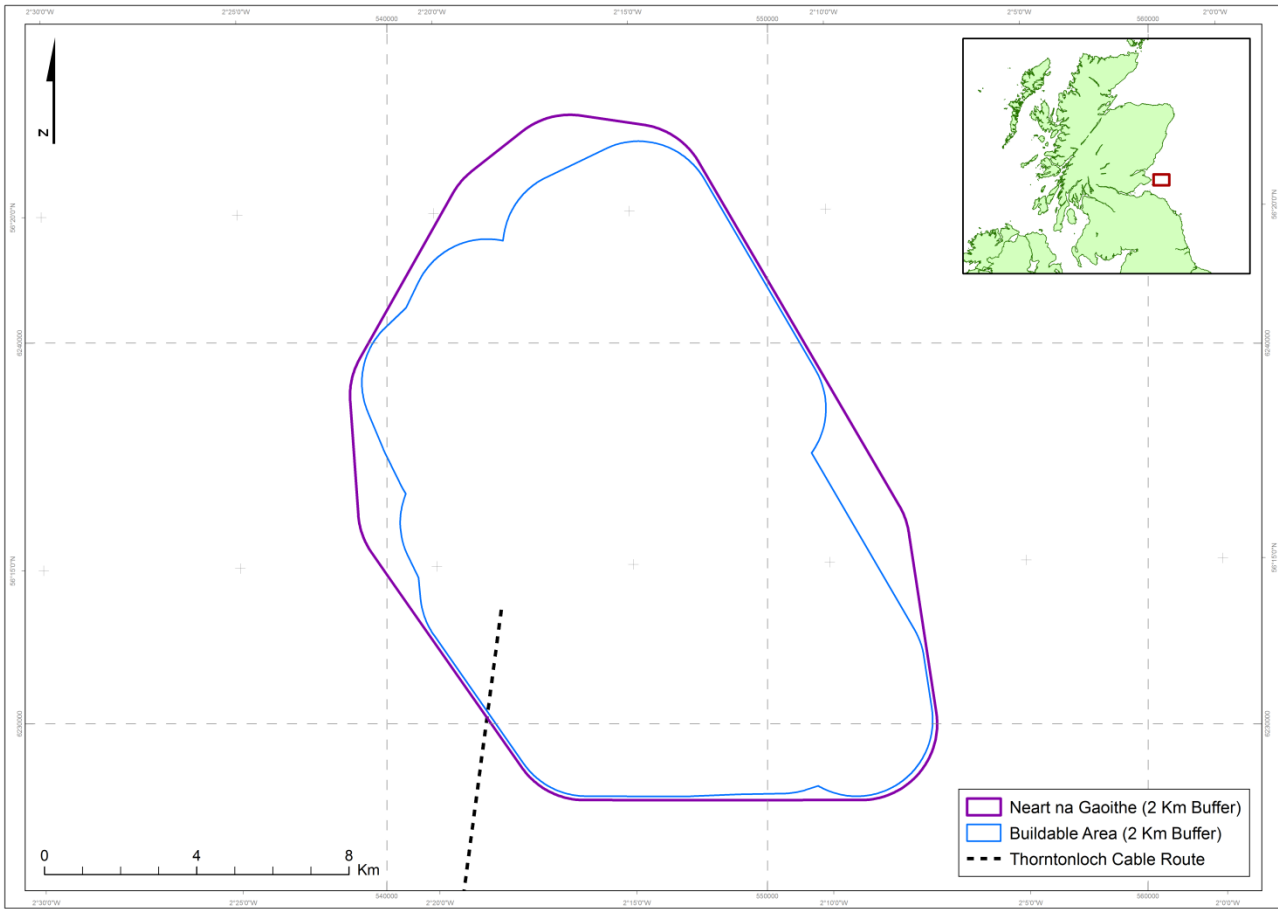


Figure 5.3: Neart na Gaoithe site boundary and buildable area for layout 3, both with 2 km buffer applied.

### 5.2.3 Direct Habitat Loss

31 The loss of seabed habitat due to installation and operational presence of the wind turbine foundations and associated infrastructure, e.g. cables, could cause a negative impact on birds if they require the seabed and associated fauna for prey. This may be particularly the case for seaduck feeding on bivalves (e.g. common scoter; Kaiser *et al.*, 2006). However, of the species regularly recorded within the offshore site, none regularly feed on bivalves or rely upon the seabed features. The area of seabed used in Indicative Layout 3 for Neart na Gaoithe is 83 km<sup>2</sup>. This is a very small area of seabed loss compared to the total foraging ranges for the seabirds associated with the regional SPAs.

### 5.2.4 Displacement Resulting in Effective Habitat Loss from an area around Turbines and Other Ancillary Structures during the Operational Phase of the Development

32 Seabirds may avoid entering operational wind farms and therefore effectively be displaced to a lesser or greater extent from suitable habitat (e.g. Diersche and Garthe, 2006). This effect arising from the development of the Neart na Gaoithe project is considered to have the potential to cause a likely significant or an adverse effect on seabirds (see the Ornithology Appendix 1: Technical Report).

### 5.2.5 Mortality as a result of Direct Collision with Turbines

33 It is widely recognised that there is potential for seabirds to collide with operating wind turbines, although the risk of collision varies across species depending on a number of factors, including the heights that they frequently fly at (e.g., gulls) and their avoidance behaviour (e.g., gannets). Collision risk modelling undertaken provides an indication as to the likely level impact on the species of concern based on site

specific data. It is considered that collision risk impacts have the potential to cause a likely significant or an adverse effect on seabirds (see the Ornithology Appendix 1: Technical Report).

### 5.2.6 Barrier Effects caused by the Physical Presence of Turbines and Ancillary Structures Preventing Clear Transit of Birds

34 Birds may avoid flying through wind farms and in doing so detour around a constructed wind farm causing it fly further than it may have otherwise have done so and expend additional energy. This incremental increase in energy expenditure, if great enough, could cause increase risk of mortality or reduced productivity. Within the application a detailed assessment of potential barrier effects has been undertaken on birds from the SPAs within the mean maximum foraging range of the offshore site. No barrier effects were identified as being significant for any qualifying species.

### 5.2.7 Attraction to Lights on Offshore Infrastructure

35 Attraction to lights offshore by migrating birds can cause disorientation, reduction in fitness and possible death. Most birds impacted by lit structures collide with the structure before exhaustion occurs. A review undertaken of the recorded birds from North Sea oil and gas platforms in the UK using data collected over five years and reported in the North Sea Bird Club records concluded that nocturnal migrants, specifically passerines, are most attracted to lights (Barton and Pollock, 2009).

### 5.2.8 In-Combination Impacts

36 Under the Habitats Regulations, it is necessary to consider the in-combination effects of development proposals on European Sites. These refer to effects, which may or may not interact with each other, but which could affect the same receptor or interest feature (i.e. a habitat or species for which a European Site is designated).

37 The in-combination assessment includes developments that are:

- Under construction;
- Permitted application(s), but not yet implemented;
- Submitted application(s) not yet determined;
- Projects identified in the relevant Development Plan (and emerging Development Plans); and
- Sites identified in other policy documents, as development reasonably likely to come forward.

38 For the purposes of this assessment, on-going impacts from current activities have not been included within the in-combination assessment where the influence of the projects upon a receptor, that may also be predicted to be significantly affected by the development, is considered to be captured within the baseline. For some on-going activities, e.g. fishing and shipping it is technically not possible to determine what the baseline conditions would be without the influence the impacts from these activities have on the current seabird populations. For example, many seabird species obtain a significant proportion of their food from fish discards from the fishing industry. The impact that this activity has on the seabird populations is not measurable but is likely to have allowed for greater adult survival and fecundity and the impacts from the fishing industry may have inflated the natural populations for some species. In addition to this, the increase in sandeel stocks (from which seabird populations have benefited during most of the 20th century) is due to the impacts the fishing industry has had on other fish species that would otherwise predate sandeels. Consequently, the 'natural baseline' population for seabirds is unknown and it is not possible to assess the impacts current fishing and other activities have on seabirds, nor is it possible to assess what future impacts any changes in fishing policy, e.g. banning discards, will have on these populations.

39 Although there is potential for some interaction with qualifying features of European Sites by the potential plans or projects identified, the ES concludes that the location, scale and nature of the potential impacts from all but offshore wind farms are such that they will not have a measurable impact on any of the sites. Therefore, no further in-combination assessment with other industry sectors has been undertaken (See Environmental Statement).

- 40 Impacts arising from existing or planned offshore wind farms that may cause and in-combination affect include:
- Collision mortality
  - Displacement effects
  - Barrier effects

### 5.2.9 In-Combination Collision Mortality

- 41 In order to assess potential in-combination impacts arising from collision, results from collision risk modelling have been used.
- 42 Data from Neart na Gaoithe is based on the results from modelling presented in the verification document.
- 43 Data from Seagreen is based on published figures within the submitted application documents.
- 44 Data from published Environmental Statements and associated documents have been used to predict potential in-combination assessments from existing developments for which planning applications have been made, e.g. Seagreen Projects Alpha and Bravo, Beatrice, Moray Firth and Aberdeen offshore wind farms. Data for the Inch Cape Offshore Limited (ICOL) project is unpublished and subject to change until the application is submitted.
- 45 Potential in-combination impacts from collision mortality across all developments is a total of all the predicted collisions.
- 46 In-combination displacement impacts may arise from any and all plans or projects. Disturbance from vessels associated with commerce, fishing, oil and gas, renewables, aggregates and other activities will all cause some level of displacement. However, such displacement is localised and temporary and cannot be quantified. The scale and temporary nature of the displacement impacts are such that any displacement caused from other activities will not be measurable in-combination with the proposed Neart na Gaoithe development.
- 47 It is possible that birds displaced from one wind farm may otherwise have occurred at another. This is largely unquantifiable as birds displaced from one development area may not always be the same as those displaced from another location. However, the predicted total number of birds displaced can be estimated based on applicants' site specific data.
- 48 Combining the results from developments in the Firth of Forth and Firth of Tay development area provides an estimate of the total number of birds that may be displaced by regional offshore wind farms. Auks and gannets are the main species considered to be at risk of an in-combination displacement and may show some degree of displacement.

### 5.2.10 Conclusions

- 49 Of the above predicted foreseeable impacts, only those potentially arising from collision and displacement and barrier effects have the potential to cause a likely significant effect and consequently only these impacts are considered within the HRA.

## 5.3 Habitats Regulations Appraisal Screening for Special Protected Area and Ramsar Sites

- 50 A likely significant effect is any effect that may be reasonably predicted as a consequence of a plan or project that may affect the conservation objectives of the features for which the European site was designated, but excluding trivial or inconsequential effects.
- 51 There are no recognised criteria as to what can be considered to be trivial or inconsequential impacts. The determination of whether a likely significant effect arising from Neart na Gaoithe is likely to undermine a site's conservation objectives is based on the available evidence.

- 52 SNH provided advice prior to the application on which SPA and Ramsar sites should be considered for HRA purposes (SNH, 2010). This list was expanded within the application to include sites noted for species recorded during site-specific surveys for the offshore site and its 8 km buffer and on the UK east coast between Hermaness (Shetland) and Spurn Point (Humberside).
- 53 The full list of sites that were considered to have connectivity with the project area are listed in Figure 5.4 and Figure 5.5 and Table 5.2.

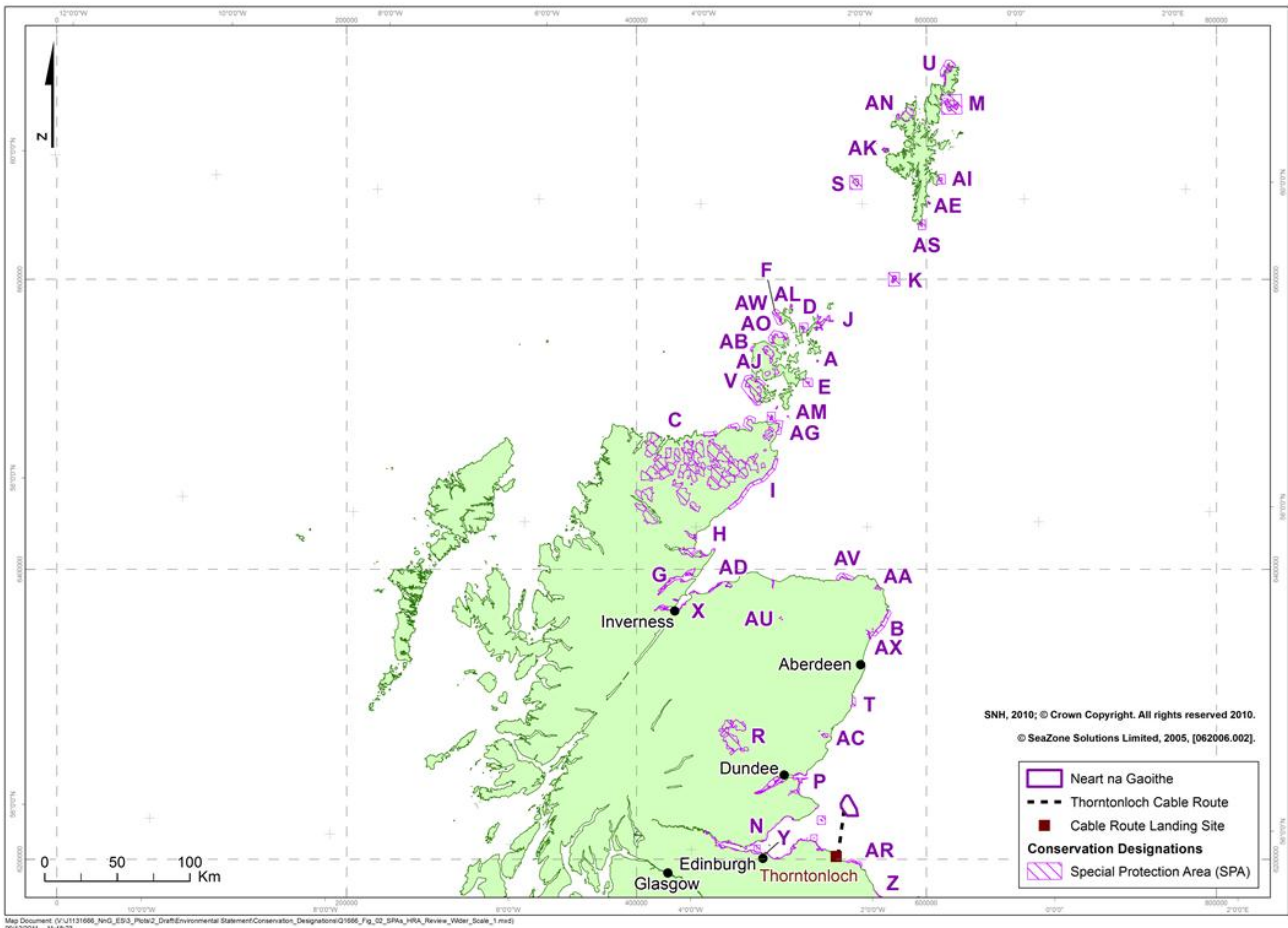


Figure 5.4: Special Protection Areas with potential connectivity to Neart na Gaoithe.

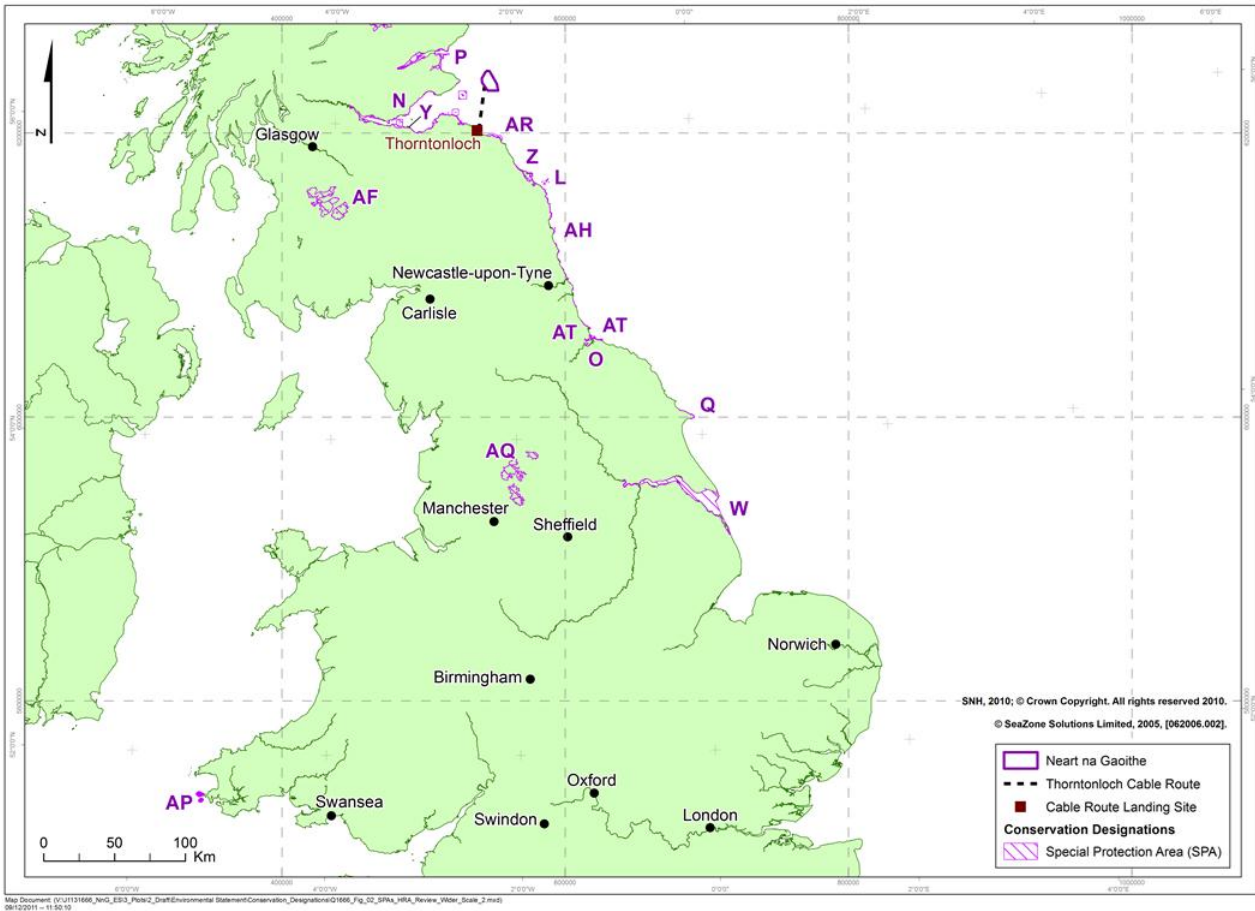


Figure 5.5: Special Protection Areas with potential connectivity to Neart na Gaoithe (continued).

Table 5.2: SPAs with potential connectivity to Neart na Gaoithe as summarised by SNH (2010).

Figure code and site			
A	Auskerry	AA	Loch of Strathbeg
B	Buchan Ness to Collieston Coast	AB	Marwick Head
C	Caithness and Sutherland Peatlands	AC	Montrose Basin
D	Calf of Eday	AD	Moray and Nairn Coast
E	Copinsay	AE	Mousa
F	Coquet Island	AF	Muirkirk and North Lowther Uplands
G	Cromarty Firth	AG	North Caithness Cliffs
H	Dornoch Firth and Loch Fleet	AH	Northumbria coast
I	East Caithness Cliffs	AI	Noss
J	East Sanday coast	AJ	Orkney Mainland Moors
K	Fair Isle	AK	Papa Stour
L	Farne Islands	AL	Papa Westray (North Hill and Holm)
M	Fetlar	AM	Pentland Firth Islands
N	Firth of Forth	AN	Ronas Hill - North Roe and Tingon
O	Firth of Forth Islands	AO	Rousay
P	Firth of Tay and Eden Estuary	AP	Skomer and Skokholm

Figure code and site			
<b>Q</b>	Flamborough Head and Bempton Cliffs	<b>AQ</b>	South Pennine Moors
<b>R</b>	Forest of Clunie	<b>AR</b>	St Abb's Head to Fast Castle
<b>S</b>	Foula	<b>AS</b>	Sumburgh Head
<b>T</b>	Fowlsheugh	<b>AT</b>	Teesmouth and Cleveland Coast
<b>U</b>	Hermaness, Saxa Vord and Valla Field	<b>AU</b>	Tips of Corsemaul & Tom Mor
<b>V</b>	Hoy	<b>AV</b>	Troup, Pennan and Lion Heads
<b>W</b>	Humber Estuary	<b>AW</b>	West Westray
<b>X</b>	Inner Moray Firth	<b>AX</b>	Ythan Estuary, Sands of Forvie & Meikle Loch
<b>Y</b>	Leith Docks/Imperial Docks Leith		
<b>N</b>	Firth of Forth		
<b>Z</b>	Lindisfarne		

54 Following the submission of the Neart na Gaoithe offshore wind farm application in July 2012, further guidance has been provided by SNH on species and sites to be included in the scope of an HRA (SNH, 2012). This guidance has been taken into account in the screening exercise below.

### 5.3.1 Screening Special Protection Areas

55 A list of SPAs and Ramsar sites with potential connectivity to Neart na Gaoithe has been set out above and subsequently refined following SNH guidance in 2012 (SNH, 2012).

56 Sites identified as being at risk of a likely significant effect are subject to a screening assessment presented in Annex A of this HRA. The sites selected are based on advice received from consultation on the ES (SNH, 2012).

57 The sites are:

- Buchan Ness to Collieston Coast SPA;
- Coquet Island SPA;
- Fala Flow SPA & Ramsar;
- Farne Islands SPA;
- Firth of Forth SPA & Ramsar;
- Firth of Tay and Eden Estuary SPA & Ramsar;
- Forth Islands SPA;
- Fowlsheugh SPA;
- Gladhouse Reservoir SPA & Ramsar;
- Imperial Leith Dock SPA;
- Lindisfarne SPA & Ramsar;
- Loch Leven SPA & Ramsar;
- Loch of Skene SPA & Ramsar;
- Montrose Basin SPA & Ramsar;
- Muir of Dinnet SPA & Ramsar,
- Slammanan Plateau SPA & Ramsar,
- South Tayside Goose Roosts SPA;
- St Abb's Head to Fast Castle SPA;
- Upper Solway Flats and Marshes SPA; and
- Ythan Estuary, Sands of Forvie and Meikle Loch SPA and Ramsar.

- 58 This screening assessment (Annex A) has been undertaken to determine whether the proposed development is likely to have a significant effect on the interest features of the European sites (listed above) alone or in-combination with other plans or projects.
- 59 Following this screening assessment, any European sites for which it has been determined that there is likely to be a significant effect from the proposed development of Neart na Gaoithe, either alone or in-combination, is further assessed to determine whether the proposal will adversely affect the integrity of the site in view of the conservation objectives of the site.
- 60 SNH (2012) have provided advice on the designated sites and qualifying species on which there will be a likely significant effect from Neart na Gaoithe alone and in-combination with other plans or projects (refer to Table 5.3).

Table 5.3: SPAs for which a likely significant effect has been identified alone and in-combination with other plans or projects (SNH, 2012).

SPA	Gannet	Fulmar	Herring gull	Lesser black-backed gull	Kittiwake	Guillemot	Razorbill	Puffin
Forth Islands	X	X	X	X	X	X	X	X
Fowlsheugh		X	X		X	X	X	
St Abb's Head to Fast Castle			X		X	X	X	
Buchan Ness to Collieston Coast		X			X	X		

X = likely significant effect identified

### 5.3.2 Summary of Sites and Species Screened into the Habitats Regulations Appraisal

- 61 Based on the results of the screening assessment presented in Annex A, a likely significant effect has been identified on the following sites and associated qualifying species presented in Table 5.4.

Table 5.4: Special Protection Areas and relevant qualifying species for which a likely significant effect has been identified from screening assessment (Annex A).

SPA	Impact	Gannet	Fulmar	Herring gull	Lesser black-backed gull	Kittiwake	Guillemot	Razorbill	Puffin
Forth Islands SPA	Collision with turbines	✓	X	✓	✓	✓	X	X	X
	Displacement effects from constructed wind farm	✓	✓	X	X	X	✓	✓	✓
Fowlsheugh SPA	Collision with turbines	-	X	✓	-	✓	X	-	-
	Displacement effects from constructed wind farm	-	✓	X	-	X	✓	-	-
St Abb's Head to Fast Castle SPA	Collision with turbines	-	-	✓	-	✓	X	X	-
	Displacement effects from constructed wind farm	-	-	X	-	X	✓	✓	-
Buchan Ness to Collieston Coast SPA	Collision with turbines	-	X	-	-	-	X	-	-
	Displacement effects from constructed wind farm	-	✓	-	-	-	✓	-	-

### 5.3.3 In-Combination Impacts

- 62 There are a number of projects, programmes, plans or activities that could have an impact on SPA qualifying species and therefore SPAs in-combination with impacts arising from Neart na Gaoithe.
- 63 Three other offshore wind farms are proposed in the Forth and Tay region: Inch Cape Offshore Limited (ICOL) and two in the Firth of Forth Round 3 Zone 2 (Seagreen Projects Alpha and Bravo). Information from the ES Submission for the Firth of Forth project, alongside their HRA submission (Seagreen 2012; Seagreen 2013) have been used. ICOL have not yet submitted their application however, alongside the Inch Cape



Offshore Wind Farm First Annual Ornithological Report (*pers. comm.*, ICOL, 2012) ICOL have also supplied updated ornithological data for key species (*pers. comm.*, ICOL, 2013).

- 64 Outside the Firth of Forth and Tay region there are two proposed offshore wind farms in the Moray Firth (Beatrice Offshore wind farm and the Moray Firth Zone wind farm). These proposed developments have been considered where applicable when assessing impacts on SPAs, as summarised below. In addition, an application has been approved for the Aberdeen offshore wind farm (AOWF) in Aberdeen Bay, approximately 100 km to the north of the proposed Neart na Gaoithe offshore site. Based on the proposed scale of AOWF (11 turbines) and the findings in the project's ES (Vattenfall, 2011), it was concluded that impacts from Aberdeen offshore wind farm would not significantly add to the cumulative impacts from Neart na Gaoithe, ICOL and the Seagreen, Firth of Forth Round 3 Zone developments and so AOWF is not considered in the assessment of cumulative impacts.
- 65 **In-combination impacts** – In-combination impacts are required to be assessed under the legislation and include those arising from existing and reasonably foreseeable activities including:
- Other offshore wind farms;
  - Aggregate extraction and dredging;
  - Navigation and shipping;
  - Established fishing activities;
  - Existing, and planned construction of, subsea cables and pipelines; and
  - Oil and gas installations.
- 66 Other offshore wind farms have the potential to cause a range of in-combination impacts similar to those arising from Project One alone, including collision mortality, displacement effects and cumulative noise sources. There are currently a number of offshore wind farms that may be constructed or operating at the same time as Neart na Gaoithe and these have been assessed within the in-combination assessment.
- In-combination oil and gas activities
- 67 Oil and gas activities occur widely across the North Sea and are long established. Consequently, any historical impacts on birds and marine mammals are incorporated into the baseline data obtained for Project One.
- 68 Main potential impacts from oil and gas activities include:
- Noise disturbance from exploration, production and decommissioning of fields;
  - Disturbance and displacement around platforms;
  - Accidental pollution events;
  - Atmospheric emissions; and
  - Seabed disturbance.
- 69 Although there are oil and gas developments in the central and northern North Sea, there is no oil and gas industry activity in the Firth of Forth and Firth of Tay areas. Although, there is the potential that future licence blocks may be licenced, there is currently no information on future oil and gas exploration activities in the area and it is therefore not possible to undertake an in-combination assessment.
- 70 There is potential for a localised displacement affect around the immediate vicinity of any new platform that may be installed in the future. Any impact will be localised to approximately a few hundred metres around each platform and therefore have a very small impact on displaced birds. The majority of new field developments in the Southern North Sea comprise of subsea tie-backs and therefore do not have any displacement effects. It is not known if, where or when any surface structures might be located and therefore it is not possible to undertake an in-combination assessment. However, should they occur the effect will be very localised and it is predicted that no likely significant effect will occur.
- 71 Accidental pollution events can occur. All the fields in the Southern North Sea are either gas or gas condensate fields. There are no oil fields and therefore the risk of a significant oil spill is negligible. Accidental spills from bunkering operations can and do occur but the impacts from the volume spilled is

relatively small, i.e. <1 tonnes and of diesel that rapidly evaporates and disperses. Therefore the impacts from such spills are localised. Being accidental events it is not known where or when they might occur. However, should they do so the effects will likely be very localised. The risk of one occurring in-combination with an accidental spill from Project One is extremely low.

72 Atmospheric emissions from the oil and gas industry come primarily from power generation and flare gas. Atmospheric emissions are not predicted to have any direct impact on any qualifying species or habitat and no in-combination impacts that will cause a likely significant effect will occur.

73 Seabed disturbance arising from oil and gas activities arises primarily during the construction period, particularly relating to subsea infrastructure, e.g. pipelines and subsea manifolds. Impacts from subsea construction activities typically impact an area of seabed within 10 m of the works being undertaken. Consequently, the impacts are very localised. It is not known, if, where or when any subsea activities will take place.

In-combination aggregates and dredging

74 No aggregate extraction areas occur within the Neart na Gaoithe development area.

75 Main potential impacts from aggregate and dredging activities include:

- Physical impacts and seabed disturbance; and
- Displacement and disturbance by vessels.

76 Physical impacts and seabed disturbance from aggregate and dredging activities will have a localised impact within 500 m and 1,500 m from the area of impact (Newell *et al.* 2002) and therefore any impacts will not affect any coastal SPAs and no in combination effect will occur.

77 Vessel activity arising from aggregate and dredging activities may disturb or displace seabirds. The affects arising from any activity will be localised (within a few hundred metres of the vessel) and temporarily as the vessel passes. The impacts have been on-going and are part of the baseline environment. Any effects arising from aggregates are localised, temporary and outwith the zone of effect from Neart na Gaoithe. No in-combination effect will occur and no likely significant effects.

In-combination navigation and shipping

78 Shipping activity can cause disturbance and displacement of seabirds. Impacts arising from on-going shipping activities will be part of the baseline environment. On-going shipping activity will have the same level of impact as historical levels. Future increases in shipping activity relating to other offshore developments will have localised impacts but the impacts will be temporary and affect an area in the immediate vicinity of the vessel. It is not known when or where future increases in shipping may occur and therefore no assessment can be undertaken but as any impacts are predicted to localised and temporary no likely significant effects will occur.

In-combination established fishing activities

79 Affects from existing fishing activities are part of the baseline environment. However, Neart na Gaoithe and other offshore wind farms could cause a change in the distribution of fishing vessels that could impact on qualifying species or habitats. Changes in fishing vessel location could change seabird distribution, particularly those that scavenge behind fishing vessels. However, studies have shown that seabird distribution is not significantly affected by fishing vessels (e.g. Camphuysen and Garthe 1997) and that the attraction of seabirds to fishing vessels is limited to about 10 km (Skov and Durinck 2001). Consequently, impacts on seabird distribution are very localised.

80 No restrictions to fishing vessels once Neart na Gaoithe is operational are planned. There may be localised displacement of vessels but no in-combination impacts that will cause a likely significant effect are predicted to occur.

In-combination with existing, and planned construction of, subsea cables and pipelines

- 81 Impacts arising from existing telecommunication cables and pipelines on the seabed will be part of the baseline environment.
- 82 There is no information available as to if, when or where future pipelines or subsea cables will be installed and no in-combination assessment can be undertaken.

## 6 Summary of Information to Support Appropriate Assessment

- 83 The decision as to whether an Appropriate Assessment is required will ultimately be undertaken by the competent authority, Marine Scotland, based upon advice received from Statutory Nature Conservation Bodies (SNH). The assessment will demonstrate whether or not there will be an adverse effect on the integrity of a European site, in light of its conservation objectives.
- 84 The following provides a summary of the relevant information that may be used by the competent authority to determine whether an adverse effect will occur on a qualifying site from the potential impacts identified as having a likely significant effect.

### 6.1 Conservation Objectives

- 85 Each SPA has its own conservation objective. However, for the sites considered in this HRA the conservation objectives are common to all breeding seabird SPAs. These are:

- To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and
- To ensure for the qualifying species that the following are maintained in the long term:
  - Population of the species as a viable component of the site;
  - Distribution of the species within site;
  - Distribution and extent of habitats supporting the species;
  - Structure, function and supporting processes of habitats supporting the species; and
  - No significant disturbance of the species.

### 6.2 Site Integrity

- 86 In order to meet the conservation objectives of a site, the integrity of the site must be maintained. The integrity of the site is the coherence of its ecological structure and function, across its whole area, which enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified. The integrity of the site can therefore be considered to be the structure and the functioning of its ecological systems, the features for which the site is designated (habitats and/or species) and the ability of the site to meet its conservation objectives. An adverse effect is defined as something that impacts the site features, either directly or indirectly, and results in disruption or harm to the ecological structure and functioning of the site and/or affects the ability of the site to meet its conservation objectives across all parts of the site (SNH, 2012a).

### 6.3 Determining Adverse Effect

- 87 Advice received from Marine Scotland following submission of the application is that only impacts arising during the breeding period should be considered on breeding seabirds (*pers. comm.*, MS, 2013). The advice received from SNH on HRA screening only considers impacts on breeding seabird species and identifies likely significant effects during the breeding season (SNH, 2012). This HRA document does, for reasons of completeness and information purposes, present potential impacts during the non-breeding period.

- 88 There is no guidance available on how to qualitatively assess an adverse effect as required by the Birds Directive. This HRA uses quantitative data obtained from three years of site specific surveys and detailed analysis often using models in order to obtain a measure of the potential impact.
- 89 One possible approach to determine whether there will be an adverse effect is to assess the predicted magnitude of impact against a population threshold below which it may be concluded that no adverse effect may occur or above which, it is considered that there may be an adverse effect. With respect to impacts on birds this often considered to be an impact measured against 1% of the breeding population or 1% of the baseline mortality rate. This latter threshold is based on a European Commission (EC) report on the application of the Birds Directive and although does not relate specifically to impacts from wind farms does provide suitable guidance against which an assessment can be made (EC, 2000). If there is an increase in the baseline mortality rate of more than 1% then there is the potential for an adverse effect. However, advice received on the application is that this approach is not acceptable (SNH, 2012). In the absence of further advice this HRA has not based any of its conclusions on the whether the potential effect is less or greater than the 1% baseline mortality of the population. However, for information purposes the relevant 1% baseline mortality are presented in (Table 7.2)
- 90 The assessment presents the relevant information to inform an HRA, including where appropriate the baseline mortality rate, the population trend and the status of the SPA population. This information can be used to determine whether an adverse effect will occur.

## 7 Designated Sites - SPAs

- 91 The screening assessment (Annex A of this HRA) identified the designated sites presented in Table 7.1 as having qualifying species for which there is the potential for likely significant effects from Neart na Gaoithe development both alone and in-combination with other plans or projects. These sites have been taken forward to the second stage in the HRA process, providing information to inform an AA.

Table 7.1: Designated SPA sites with potential for a likely significant effect.

Site	Species
<b>Forth Islands SPA</b>	Fulmar, gannet, herring gull, lesser black-backed gull, kittiwake, guillemot, razorbill, puffin.
<b>Fowlsheugh SPA</b>	Fulmar, herring gull, kittiwake, guillemot.
<b>St Abb's Head to Fast Castle SPA</b>	Herring gull, kittiwake, guillemot, razorbill
<b>Buchan Ness to Collieston Coast SPA</b>	Fulmar, guillemot

- 92 The following section presents the findings of the second stage in the HRA process to inform the competent authority should an AA be required (Table 7.2). An AA is required where likely significant effects on European site(s) exist, alone or in combination with other plans or projects.

Table 7.2: Qualifying species assessed within HRA, breeding population and 1% of breeding population and 1% baseline mortality.

Site	Species	Breeding Population (individuals)	1% of Breeding Population	Adult survival rate (%)	1% baseline mortality
Forth Islands SPA	Fulmar	8,490	85	97.2	2
	Gannet	110,964	1,109	94.0	66
	Herring gull	11,528	153	88.0	14
	Lesser black-backed gull	5,708	57	91.3	5
	Kittiwake	7,532	75	94.0	4
	Guillemot	22,553	225	94.6	12
	Razorbill	3,704	37	90.0	4
	Puffin	124,334	1,243	92.4	94
Fowlsheugh SPA	Fulmar	238	2	97.2	<1
	Herring gull	518	5	88.0	<1
	Kittiwake	18,674	186	94.0	11
	Guillemot	44,920	448	94.6	24
	Razorbill	5,260	53	90.0	5
St Abb's Head to Fast Castle SPA	Herring gull	1,210	12	88.0	1
	Kittiwake	10,818	108	94.0	6
	Guillemot	34,415	344	94.6	18
	Razorbill	2,406	24	90.0	2
Buchan Ness to Collieston Coast SPA	Fulmar	2,778	27	2.8	<1
	Guillemot	20,858	208	94.6	11.2

## 7.1 Forth Islands SPA

### 7.1.1 Forth Islands SPA - Site Information

Site overview information for the Forth Islands SPA is provided in Table 7.3 below.

Table 7.3: Site overview information for Forth Islands SPA.

Site Information	Details
Site overview	The Forth Islands SPA lies approximately 16 km to the west of Neart na Gaoithe. The site comprises a series of islands supporting the main seabird colonies in the Firth of Forth including the Isle of May, Bass Rock, Craigleith, Inchmickery, Fidre and The Lamb.
Site designation – qualifying species and features	<ul style="list-style-type: none"> <li>● Arctic tern <i>Sterna paradisaea</i>;</li> <li>● Common tern <i>Sterna hirundo</i>;</li> </ul>

Site Information	Details
(*indicates assemblage qualifier only)	<ul style="list-style-type: none"> <li>● Cormorant <i>Phalacrocorax carbo</i>*;</li> <li>● Fulmar <i>Fulmarus glacialis</i>*;</li> <li>● Gannet <i>Morus bassanus</i>;</li> <li>● Guillemot <i>Uria aalge</i>*;</li> <li>● Herring gull <i>Larus argentatus</i>*;</li> <li>● Kittiwake <i>Rissa tridactyla</i>*;</li> <li>● Lesser black-backed gull <i>Larus fuscus</i>;</li> <li>● Puffin <i>Fratercula arctica</i>;</li> <li>● Razorbill <i>Alca torda</i>*;</li> <li>● Roseate tern <i>Sterna dougallii</i>;</li> <li>● Sandwich tern <i>Sterna sandvicensis</i>;</li> <li>● Shag <i>Phalacrocorax aristotelis</i>; and</li> <li>● Seabird assemblage.</li> </ul>
Site conservation objectives	<p>To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and</p> <p>To ensure for the qualifying species that the following are maintained in the long term:</p> <ul style="list-style-type: none"> <li>● Population of the species as a viable component of the site;</li> <li>● Distribution of the species within site;</li> <li>● Distribution and extent of habitats supporting the species;</li> <li>● Structure, function and supporting processes of habitats supporting the species; and</li> <li>● No significant disturbance of the species.</li> </ul>

### 7.1.2 Forth Islands SPA - Screened in Species

The results from the screening exercise (Annex A) have identified the potential for likely significant effects on:

- Gannet;
- Fulmar;
- Herring gull;
- Lesser black-backed gull;
- Kittiwake;
- Guillemot;
- Razorbill; and
- Puffin.

93 Following the screening exercise undertaken above, the following species and effects have been screened into the HRA for this site (refer to Table 7.4):

Table 7.4: Species from Forth Islands SPA and summary of likely significant effects following screening.

Species	Likely Significant Effect
Fulmar	Displacement effects from physical presence of the wind turbines.
Gannet	Collision mortality during operational period, Displacement effects from physical presence of the wind turbines.
Herring Gull	Collision mortality during operational period.

Species	Likely Significant Effect
Kittiwake	Collision mortality during operational period.
Lesser Black Backed Gull	Collision mortality during operational period.
Guillemot	Displacement effects from physical presence of the wind turbines.
Razorbill	Displacement effects from physical presence of the wind turbines.
Puffin	Displacement effects from physical presence of the wind turbines.

### 7.1.3 Forth Islands SPA - Gannet

- 94 The Neart na Gaoithe HRA Screening Assessment, detailed in Annex A, has identified gannets at the Forth Islands SPA as being a qualifying species at risk of a likely significant effect from collision risk and displacement effects during operation. This also follows advice received from SNH (SNH, 2012).
- 95 Results from site specific monitoring indicate that gannets are widespread across the Neart na Gaoithe throughout the year, with highest numbers occurring from April through to October and peak numbers in September. The three year mean peak number of gannets recorded during the breeding (April to September) and non-breeding (October to March) periods are presented in Table 7.5. Across all three years, for which site specific data are available, a total of 4.8% of all sightings of flying birds were of birds flying greater than 27.5 m above sea surface. Consequently, gannets are at risk of collision with the proposed development.

Table 7.5: Three-year mean peak estimated numbers of gannets in the offshore site (plus 1 and 2 km buffer).

Data	Survey area	Breeding	Non-breeding
3-year mean peak	Offshore site	1,153	405
	Offshore site + 1 km	1,560	511
	Offshore site + 2 km	1,905	695

- 96 Tagging studies undertaken at the Bass Rock gannet colony within the Forth Islands SPA indicate that when feeding chicks, gannets from the SPA may forage widely across the North Sea, covering an area greater than 200,000 km<sup>2</sup> and extending as far as Bergen/Viking Bank (SW Norway) in the north and the Frisian Islands (NW Netherlands) in the south (Hamer *et al.*, 2011). During the winter gannets occur widely across their winter range. In recent years, increasing numbers of adult gannets winter further south than historically, with an increasing availability of discards from fishing vessels further south and a decreasing availability of discards in the North Sea (Garthe *et al.* 2012).
- 97 Gannets from the Bass Rock frequently forage over distinct bathymetric features including Buchan Deep and Halibut Bank to the north-east of the colony and to the area between Farne Deep, Outer Silver Pit and Dogger Bank to the south-east of the colony (Hamer *et al.*, 2011). A significant amount of foraging occurs over a tidal mixing front approximately 50 km offshore. However, there are also large inter-annual variations linked with the availability of food with significant differences in the maximum recorded foraging distance between years. For example in 2002 the maximum recorded foraging distance was 320 km but only 170 km in 2003 (Hamer *et al.*, 2011). Figure 7.1 presents the results of the tagging studies across three

years during the chick rearing period and shows the changes across years in the core areas for gannets (based on 50% kernel distribution<sup>1</sup>) and wider foraging areas (based on 90% kernel distribution).

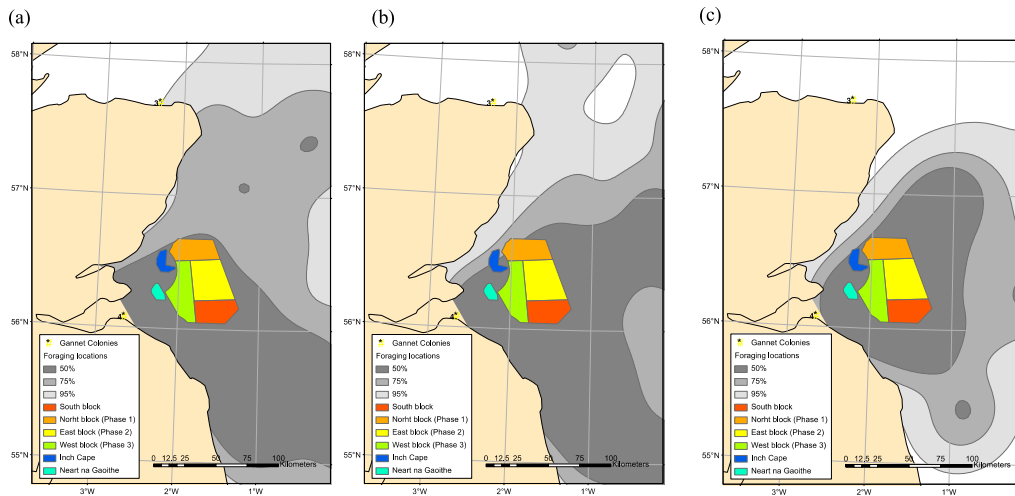


Figure 7.1: Distribution of chick rearing gannets tracked from the Bass Rock during three breeding seasons (Hamer *et al.*, 2011).

a) = 1998, b) = 2002, c) = 2003.

Grey scale indicates frequency of occurrence. 50% - dark grey, 75% - medium grey. 95% - light grey

98 Evidence from existing offshore wind farms (e.g. Egmond aan Zee), indicates that gannets avoid flying through wind farms with birds changing flight direction 500 m or more away from the turbines. Those that do not change flight direction have been reported to reduce flight height to be below rotor height and therefore are at very low risk of collision (Leopold *et al.*, 2011). This avoidance behaviour reduces the risk of potential collision and it is predicted that avoidance behaviour for gannet is significantly greater than 98% and an avoidance behaviour of 99% has been used for the basis of the assessment here, although impacts based on a 98% avoidance behaviour are presented for comparison. The significant far field avoidance rates reported indicate low risk of collision but a potentially larger risk of displacement from the constructed wind farm (Cook *et al.*, 2012; Walls *et al.*, 2013).

### 7.1.3.1 Neart na Gaoithe Site Specific Assessment

#### 7.1.3.1.1 Collision Mortality

99 The collision risk modelling undertaken is based on the revised turbine design where the minimum turbine tip height or air gap has been raised to mitigate against collision risk mortality and is now 27.5m MSL compared to the 22.5m assessed within the original ES. The collision risk modelling (Ornithological Appendix 2: Collision rates estimates of seabirds at Neart na Gaoithe) is based on three years site specific data and a worst-case scenario of 90 turbines rated at 5 MW. The results from both a 98% avoidance behaviour and 99% are presented.

100 The SPA population comprises breeding adults only and impacts on these have been considered further. Based on advice received from Marine Scotland (*pers. comm.*, Marine Scotland, 2013), impacts on SPAs that are designated for seabird breeding populations are only required to be assessed during the breeding period, i.e. between April and September and not during the non-breeding period. Potential number of impacts per year are presented for information.

101 The total predicted number of collisions per year (based on a 98% avoidance behaviour) is 473 birds with 387 occurring during the breeding period (April to September). If the avoidance behaviour is 99% then the

<sup>1</sup> The 'kernel distribution' is a means of presenting where a proportion of a population or a behavioural activity, occurs across a geographical area, e.g. the 50% kernel captures 50% of all gannet distribution, 90% kernel captures 90% of all gannet activity. Core areas are often variably considered to be 50% or 75% kernel areas.



predicted number of collisions per year decreases to 237 birds of which 193 will occur during the breeding period (Table 7.6).

**Table 7.6: Predicted number of gannet (adults and immature) collisions per year with Neart na Gaoithe.**

Years 1 to 3 mean	Annual	Breeding (Apr- Sept)
<b>98% avoidance</b>	473	387
<b>99% avoidance</b>	237	193

102 The proportion of adults within the population during this period is 97.4% and therefore of the 193 gannets predicted to collide during the breeding period (based on a 99% avoidance behaviour) an estimated 188 will be adults and therefore potentially part of the Forth Islands SPA gannet breeding population (Table 7.7).

**Table 7.7: Predicted mean number of adult gannet collisions per year with Neart na Gaoithe.**

Years 1 to 3 mean	Annual	Breeding (Apr- Sept)
<b>98% avoidance</b>	462	377
<b>99% avoidance</b>	231	188
<b>97.4% of all observations during breeding period were adults.</b>		
98.3% of all observations during non-breeding period were adults.		

103 In order to assess impacts of existing and consented wind farms on UK gannet populations and to determine a threshold 'harvesting rate' of gannets from current and future offshore wind farms developments a gannet population viability analysis (PVA) was commissioned by the Strategic Ornithological Support Services (SOSS) group. The SOSS group brought together expert stakeholders to identify key ornithological issues relating to the expansion of the UK offshore wind industry, due to the potential for offshore wind farms to impact bird populations. A steering group, comprising representatives of developers, regulators and advisory bodies, oversaw a program of work to address these issues and inform the planning and consenting process.

104 The gannet PVA was undertaken in combination with collision risk modelling and identified the potential number of gannets that could be impacted before a significant reduction on the breeding population might occur across the UK gannet colonies, including the breeding colony at the Bass Rock in the Forth Estuary SPA (WWT, 2011).

105 Results from the SOSS PVA indicate that a population decline at the Bass Rock gannet colony is predicted should there be an increase in mortality of more than 2,000 birds per year (WWT, 2011).

106 The PVA was based on a gannet population of 48,065 pairs (2003/2004) compared to the 2009 population of 55,482 pairs (WWT, 2011). There has therefore been a significant increase in the population of gannets at the Bass Rock colony within the Forth Islands SPA, since the time the data used in the PVA model were collected. Consequently, the results from the PVA model indicating a risk of population decline from an increase in mortality of 2,000 birds per year may be overly precautionary in terms of the latest population figures in 2009.

107 The increase in the Bass Rock gannet population over the five years from between 2003/04 and 2009 is 1,483 pairs per year; 2,966 individuals (WWT, 2011). This is equivalent to an annual increase in the adult breeding population of 3% per year. If the 3% increase in the annual breeding population is reflected in the

proportion of birds that can be impacted before a population decline occurs then, based on the results from the PVA modelling outputs of 2,000 mortalities (2003/04 population) (WWT, 2011), an estimated 2,420 adult gannets may be impacted before a population decline occurs based on an estimated 2011 population, which covers part of the period when the survey data were collected.

- 108 The potential loss of up to 188 adult gannets from collision impacts during the breeding period is significantly below the predicted level of impact the population will be able to withstand before a decline on the SPA gannet population occurs.
- 109 Gannets at the Forth Islands SPA are reported to be in favourable condition (SNH, 2013) and the loss of up to 188 additional adults during the breeding season will not adversely affect the integrity of the Forth Islands SPA, in light of the qualifying interests, their condition and vulnerabilities and the conservation objectives.

#### 7.1.3.1.2 Displacement

- 110 Studies undertaken at existing offshore wind farms indicate a potential for a high level of displacement by gannets. At the Egmond aan Zee offshore wind farm in the Netherlands it was estimated that up to 90% of all gannets were displaced and up to 50% were displaced from Robin Rigg. However, the data from Robin Rigg is based on only a single years post-construction monitoring and the report for the study recognises that not enough post-construction data have been collected yet to draw conclusions from it (Leopold *et al.*, 2011; Walls *et al.*, 2013).
- 111 Currently there is no guidance on how to assess displacement impacts for offshore wind farms in Scottish waters. Consequently, in order to assess the potential impacts from displacement, the approach presented in the interim guidance note on displacement issued by Natural England (NE) and the Joint Nature Conservation Committee (JNCC) has been used as guidance. The potential level of displacement is based on the evidence available on the scale of potential displacement and possible level of mortality (NE & JNCC, 2012).
- 112 The assessment is based on the empirical evidence obtained from the Egmond aan Zee offshore wind farm where gannets were regularly recorded flying around the wind farm and only occasionally crossing into the wind turbine area and when doing so not entering more than one turbine deep (Leopold *et al.*, 2011). The assessment is based on the potential of there being a high level displacement of 90%. It is recognised that the majority of gannets recorded at Egmond aan Zee were during the non-breeding period and the overall extent of the wind farm is smaller than Neart na Gaoithe but this is currently the best available data on gannet displacement behaviour.
- 113 The level of possible mortality arising from displacement (should it occur) is unknown. However, gannet are recognised to have a relatively low sensitivity to 'habitat flexibility', i.e. they are capable of using alternative locations should they be displaced (Furness & Wade, 2012). Consequently, the risk of displacement causing a mortality effect is considered to be low and a precautionary 2% potential mortality rate has been used in this assessment.
- 114 The results from the displacement assessment indicate that during the breeding period between 4 and 1,905 gannets may on average die during the breeding period due to displacement effects, depending on the level of displacement and mortality. The evidence suggests a high level of displacement will occur (90%) and a relatively low risk of mortality (2%) arising from displacement. Consequently, based on this up to 34 gannets may be impacted (Table 7.8). This is 0.03% of the breeding SPA population.
- 115 For information purposes the estimated displacement of gannets within Neart na Gaoithe offshore site and a 2 km buffer area from displacement during the non-breeding period are presented (Table 7.9). The results indicate that up to 13 gannets may be impacted during the non-breeding period. However, recognising that gannets are highly adaptable in their foraging locations (Garthe *et al.* 2012) during the non-breeding period and that they forage extensively on fishery discards that will not be affected by the proposed development, then it is expected that there will be no impacts on gannets during the non-breeding period.

Table 7.8: Estimated displacement of gannets by Neart na Gaoithe and a 2 km buffer during the breeding period.

Site		Mortality (%)													
Neart na Gaoithe	Displacement level (%)	0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
		10%	4	10	19	38	57	76	95	114	133	152	171	191	
		20%	8	19	38	76	114	152	191	229	267	305	343	381	
		30%	11	29	57	114	171	229	286	343	400	457	514	572	
		40%	15	38	76	152	229	305	381	457	533	610	686	762	
		50%	19	48	95	191	286	381	476	572	667	762	857	953	
		60%	23	57	114	229	343	457	572	686	800	914	1,029	1,143	
		70%	27	67	133	267	400	533	667	800	933	1,067	1,200	1,334	
		80%	30	76	152	305	457	610	762	914	1,067	1,219	1,372	1,524	
		90%	34	86	171	343	514	686	857	1,029	1,200	1,372	1,543	1,715	
		100%	38	95	191	381	572	762	953	1,143	1,334	1,524	1,715	1,905	

\* Green Shading indicates the estimated level of displacement level assessed in HRA and 10% either side. 90% displacement and 2% Mortality are considered as possible displacement/mortality for HRA purposes.

Table 7.9: Estimated displacement of gannets by Neart na Gaoithe and a 2 km buffer during the non-breeding period.

Site		Mortality (%)												
Neart na Gaoithe	Displacement level (%)	0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
		10%	1	3	7	14	21	28	35	42	49	56	63	70
		20%	3	7	14	28	42	56	70	83	97	111	125	139
		30%	4	10	21	42	63	83	104	125	146	167	188	209
		40%	6	14	28	56	83	111	139	167	195	222	250	278
		50%	7	17	35	70	104	139	174	209	243	278	313	348
		60%	8	21	42	83	125	167	209	250	292	334	375	417
		70%	10	24	49	97	146	195	243	292	341	389	438	487
		80%	11	28	56	111	167	222	278	334	389	445	500	556
		90%	13	31	63	125	188	250	313	375	438	500	563	626
		100%	14	35	70	139	209	278	348	417	487	556	626	695

\* Green Shading indicates the estimated level of displacement level assessed in HRA and 10% either side. 90% displacement and 2% Mortality are considered as possible displacement/mortality for HRA purposes.

- 116 The foraging area for gannets from the Bass Rock varies across years ranging from between 45,890 km<sup>2</sup> and 211,120 km<sup>2</sup> (Hamer *et al.* 2011). The agreement for lease area for the offshore site plus a 2 km buffer is 199 km<sup>2</sup>. Should the whole of the area of the proposed wind farm become unavailable to gannets due to displacement impacts then between 0.09% and 0.43% of the total foraging range may be lost through displacement.
- 117 The assumption that a proportion of displaced birds die is precautionary. Results from tagging studies undertaken on gannets breeding at the Forth Islands SPA demonstrates that not only do gannets forage over an extensive area but the areas in which they do forage change across years indicating that gannets are able to successfully adapt to changes in feeding locations depending on prey availability. This inter-annual adaptability shows that gannets are not confined to foraging in restricted areas and any displacement will only cause them to forage elsewhere within an extensive foraging range. The total area lost is small compared to the total foraging range during breeding period and there will not be adverse effect on gannets from displacement effects. Tagging studies indicate that Neart na Gaoithe is within a much larger core area used by gannets and that Neart na Gaoithe is not an area specially favoured by gannets for foraging (Hamer *et al.*, 2011).
- 118 The displaced area used in this assessment is also conservative. The Neart na Gaoithe agreement for lease area of the proposed offshore wind farm is 105 km<sup>2</sup> as compared to the actual area used for turbines of 83 km<sup>2</sup> shown in Indicative Layout 3. (See Table 5.1).
- 119 An estimated increase in breeding gannet mortality of 0.03% caused by displacement will not adversely affect the integrity of the Forth Islands SPA, in light of the qualifying interests, their condition and vulnerabilities and the conservation objectives.

### 7.1.3.2 Cumulative and In-Combination Impact Assessment

#### 7.1.3.2.1 Collision Mortality

- 120 The potential collision risk effect to gannets in-combination with other plans or projects is higher than with Neart na Gaoithe alone.
- 121 Gannets are a highly pelagic species and only come ashore to breed. During the breeding period, the foraging range is restricted by the necessity to return to the breeding sites. However, the foraging range for gannet during the breeding period is extensive with a mean maximum foraging range reported to be 229.4 km (Thaxter *et al.*, 2012) and site specific mean maximum foraging range of 238 km (Hamer *et al.*, 2011).
- 122 Projects identified during consultation and the undertaking of the EIA for which there is a potential for an in-combination collision risk impact during the breeding period are:
- ICOL – offshore wind farm;
  - Seagreen Project Alpha offshore wind farm; and
  - Seagreen Project Bravo offshore wind farm.
- 123 Data on the number of predicted collisions arising from the Seagreen Projects Alpha and Bravo offshore wind farms are presented within the applicant's Environmental Statement (Seagreen, 2012) and HRA (Seagreen, 2013). The proposed Seagreen Round 3 Zone development comprises of a three phase programme of six separate developments. Projects Alpha and Bravo are the first developments and the only Seagreen projects for which applications have been made.
- 124 ICOL have not yet submitted their application however, alongside the Inch Cape Offshore Wind Farm First Annual Ornithological Report (*pers. comm.*, ICOL, 2012) ICOL have also supplied updated ornithological data for key species (*pers. comm.*, ICOL, 2013).
- 125 The predicted in-combination impacts on gannets from Neart na Gaoithe, Seagreen and ICOL are presented in Table 7.10 and Table 7.11.

Table 7.10: Predicted number of gannet (adult and immature) mortality in-combination with other plans or projects.

Wind farm	Season	
	Annual	Breeding (Apr- Sept)
Neart na Gaoithe <sup>-1</sup>		
98% avoidance	473	387
99% avoidance	237	193
Seagreen (Project Alpha) <sup>-2</sup>		
98% avoidance	1,004	904
99% avoidance	502	452
Seagreen (Project Bravo) <sup>-2</sup>		
98% avoidance	661 <sup>-2</sup>	552
99% avoidance	331	276
ICOL <sup>-3</sup>		
98% avoidance	n/a	630
99% avoidance	n/a	315
<b>Total</b>		
98% avoidance	2,138+	2,473
99% avoidance	1,070+	1,236
<p><b>1 = Based on 3 years data.</b></p> <p><b>2 = based on 2 years data presented in Seagreen (2012).</b></p> <p><b>3 = based on 2 years data (adults only) pers. comm., ICOL, 2013.</b></p>		

126 Using a 99% avoidance behavioural rate, a total of 1,236 gannets are predicted to collide with Neart na Gaoithe, ICOL and Seagreen Projects Alpha and Bravo offshore wind farms during the breeding period.

127 Of those that were aged during the breeding period 2.6% of gannets recorded at Neart na Gaoithe, Data for ICOL and Seagreen projects Alpha and Bravo have been provided as adults only (*pers. comm.*, ICOL, 2013; Seagreen, 2013) and may be subject to change.

Table 7.11: Total number of adult gannets predicted to collide each breeding period in-combination with other plans or projects.

Wind farm	Season
	Adults only (Apr- Sept)
Neart na Gaoithe <sup>-1</sup>	
98% avoidance	377
99% avoidance	188
Seagreen (Project Alpha) <sup>-2</sup>	
98% avoidance	833
99% avoidance	416
Seagreen (Project Bravo) <sup>-2</sup>	
98% avoidance	514
99% avoidance	257
ICOL <sup>-3</sup>	
98% avoidance	630
99% avoidance	315
<b>Total</b>	
98% avoidance	2,352
99% avoidance	1,176
1 = Based on 3 years data.	
2 = based on 2 years data presented in Seagreen (2012).	
3 = based on 2 years data (adults only) <i>pers. comm.</i> , ICOL (2013).	

- 128 Using an avoidance rate of 99%, the potential in-combination impact of NnGOWL, ICOL and Seagreen Projects Alpha and Bravo is 1,176 adult gannets during breeding period, which is below the 2,000 birds per year predicted by PVA modelling to cause a decrease in the breeding population (WWT, 2011).
- 129 The results from the collision model indicate that the number of adult gannets predicted to be impacted each breeding period with Neart na Gaoithe in-combination with three other proposed offshore wind farms is similar to the estimated number of adult gannets the population may be able to withstand before a decrease occurs.
- 130 An estimated increase in breeding gannet mortality of 1,176 adult gannets, 1.1% of the breeding population, from in-combination collision mortality will not adversely affect the integrity of the Forth Islands SPA, in light of the qualifying interests, their condition and vulnerabilities and the conservation objectives.

7.1.3.2.2 Displacement

131 Data presented in the Seagreen HRA (Seagreen, 2013) report peak numbers of gannets in the Seagreen Project Alpha site boundary during the breeding period. In 2010 the peak number within the site boundary was during June with 2,716 birds and in 2011 peak numbers occurred in May with 1,841 birds. This provides a peak mean across two years, of 2,279 gannets during the breeding period within the Seagreen Project Alpha boundary.

132 Data presented in the Seagreen Environmental Statement (Seagreen, 2012) report peak numbers of gannets in the Seagreen Project Bravo during the breeding period. In 2010 the peak number within the site boundary was during August with 1,141 birds and in 2011 peak numbers occurred in June with 854 birds. This provides a peak mean of 998 gannets during the breeding period within the Seagreen Project Bravo boundary.

133 The predicted number of adult gannets from the Bass Rock (Forth Islands SPA) displaced from ICOL during the breeding season is 968 birds (*pers. comm.*, ICOL, 2013).

The total number of gannets (adults and immatures) predicted to be 100% displaced is 6,150 birds (See Table 7.14). Based on the peak mean densities reported from within the four proposed development areas, a total of 5,402 adult gannets may be displaced during the breeding period, should there be 90% displacement (refer to Table 7.12).

Table 7.12: Peak mean estimated gannet numbers across four proposed wind farm developments in the Firth of Forth.

	Offshore wind farm Site			
	Neart na Gaoithe <sup>-1</sup>	Seagreen Project Alpha <sup>-2</sup>	Seagreen Project Bravo <sup>-2</sup>	ICOL <sup>-3</sup>
Peak mean adults and immature (90% displacement/avoidance behaviour) (See Table 7.14)	1,715	2,051	898	871
% immature during breeding period	2.6	3.3	2.2	n/a
Peak mean adults (90% displacement/avoidance behaviour)	1,670	1,983	878	871
<b>Total peak mean adult gannets during breeding period April to September = 5,402 gannets</b>				
1 = Peak mean based on three year data and 2 km buffer.				
2 = Peak mean based on 2 years data and site boundary.				
3 = Peak mean figure from ICOL, <i>pers. comm.</i> , ICOL, 2013				

134 Evidence from existing offshore wind farms support the potential for a high, but not total, level of displacement behaviour (e.g. Leopold *et al.*, 2011) and a predicted 90% displacement effect has been used.

135 Assuming that there is the potential for up to 2% rate of mortality during the breeding period then up to 110 adult gannets may be impacted in-combination with the four proposed offshore wind farms (Table 7.14).

136 Data on the potential numbers of gannets that may be displaced during the non-breeding period is not available from all the potential future developments being considered here. Consequently, it is not possible to undertake a cumulative displacement assessment during the non-breeding periods.



- 137 The total area, including a 2 km buffer, of the proposed Seagreen offshore wind farm Project Alpha is 356 km<sup>2</sup> and Project Bravo 349 km<sup>2</sup> (Seagreen, 2012). The total area of ICOL is approximately 279 km<sup>2</sup>, also including a 2 km buffer (Table 7.13) (*pers. comm.*, ICOL, 2012).
- 138 The combined total area of Seagreen Projects Alpha and Bravo and ICOL is approximately 1,183 km<sup>2</sup> including a 2 km buffer.
- 139 Based on an average foraging range of 117,767 km<sup>2</sup>, obtained from three years of tagging data, the total area potentially lost to gannets through displacement is approximately 1% when all proposed plans or projects are considered in-combination (Table 7.13). This includes a 2 km buffer around the adjacent Seagreen Projects Alpha and Bravo and depending on their exact final locations there is potential for an overlap of the 2 km buffer areas. The displaced area used for Neart na Gaoithe in this assessment is also conservative. The Neart na Gaoithe agreement for lease area of the proposed offshore wind farm + 2 km buffer is 199 km<sup>2</sup> as compared to the actual area used for turbines of 83 km<sup>2</sup>, that with a 2 km buffer is 175 km<sup>2</sup>; shown in Indicative Layout 3. Consequently, the area of impact (including a 2 km buffer) will be approximately 12% smaller than has been used in the assessment here.
- 140 The potential loss of up to 1% of foraging area is based on the largest potential impact.

Table 7.13: Percentage of area potentially lost to foraging breeding gannets from the Bass Rock through displacement from in-combination offshore wind farms.

Offshore site	Area km <sup>2</sup>	Total Area km <sup>2</sup>	Average Area covered by foraging gannets (95% FKD within this area) <sup>1</sup>	Available area remaining after construction	Area lost through displacement as a % of total estimated foraging area
Neart na Gaoithe	199	1,183	117,767 km <sup>2</sup>	116,584 km <sup>2</sup>	1.0%
Seagreen Project Alpha	356				
Seagreen Project Bravo	349				
ICOL	279				

1 Data from Hamer *et al.* (2011). FKD – Fixed Kernal Density estimate

- 141 The loss of up to 1% of potential foraging area is low and indicates that there is a low risk of mortality arising from displacement as displaced birds will be able to relocate elsewhere, as they do naturally across years.
- 142 The potential loss of up to 110 gannets during the breeding period due to a 2% mortality rate arising from displacement is conservative.
- 143 An estimated increase in breeding gannet mortality of 108 adult gannets, 0.1% of the SPA population, from in-combination displacement mortality will not adversely affect the integrity of the Forth Islands SPA, in light of the qualifying interests, their condition and vulnerabilities and the conservation objectives.

### 7.1.3.2.3 Impact Assessment (Neart na Gaoithe Specific)

- 144 The total number of predicted collisions arising from Neart na Gaoithe on its own is 188 adult gannets during the breeding period based on a 99% avoidance behaviour. In addition to this a further 34 adult gannets per year may be impacted due to displacement effects, based on peak numbers during the

breeding period, a 2 km buffer area and 2% rate of mortality. The total impacts combined indicate a possible level of mortality of 221 adult gannets.

- 145 The gannet breeding population in the Forth Islands SPA is 110,964 individuals. The additional loss of up to 221 adult gannets from that population is relatively small and 0.2% of the breeding population.
- 146 The population of gannet at the Forth Islands SPA is of favourable conservation status and the potential increase in mortality arising from collision and displacement impacts from Neart na Gaoithe on gannets from Forth Islands SPA is relatively small compared to the total breeding population of 110,964 individuals. The level of impact predicted will not adversely affect the conservation status of the species, nor the conservation objectives of the site and there will be no adverse effect on the integrity of the SPA.
- 147 An estimated increase in breeding gannet mortality from Neart na Gaoithe of 221 adult gannets, 0.2% of the population, from collision mortality and displacement impacts will not adversely affect the integrity of the Forth Islands SPA, in light of the qualifying interests, their condition and vulnerabilities and the conservation objectives.

#### 7.1.3.2.4 Cumulative and In-Combination Impact Assessment

- 148 Based on the data inputs available at this time (Seagreen 2012; Seagreen 2013; *pers. comm.*, ICOL, 2012; *pers. comm.*, ICOL, 2013) the total number of predicted collisions arising from Neart na Gaoithe in-combination with Seagreen Project Alpha, Seagreen Project Bravo and ICOL is 1,176 adult gannets during the breeding period based on a 99% avoidance behaviour. In addition to this a further 110 adult gannets per year may be impacted due to displacement effects, based on peak numbers during the breeding period, a 2 km buffer area and 2% rate of mortality. The total impacts combined indicate a possible level of mortality of 1,284 adult gannets.
- 149 Based on the results from the PVA modelling undertaken and an estimated increase in the gannet breeding population within the Forth Islands SPA since the data used in the PVA modelling were collected. The additional loss of up to 1,284 adult gannets from the population is below that which may cause a decrease in the gannet population that would affect the conservation status of the species and the conservation objectives of the site. Consequently, there is the potential for an effect to occur on the breeding gannet population in the Forth Islands SPA due to combined collision and displacement impacts in-combination with three other proposed offshore wind farms.

Table 7.14: Estimated potential mortality of gannet (including immatures) from displacement effects in-combination with other offshore wind farm developments within the Firth of Forth area.

Site		Mortality (%)													
		0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
Neart na Gaoithe	Displacement level (%)	0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
		10%	4	10	19	38	57	76	95	114	133	152	171	191	
		20%	8	19	38	76	114	152	191	229	267	305	343	381	
		30%	11	29	57	114	171	229	286	343	400	457	514	572	
		40%	15	38	76	152	229	305	381	457	533	610	686	762	
		50%	19	48	95	191	286	381	476	572	667	762	857	953	
		60%	23	57	114	229	343	457	572	686	800	914	1,029	1,143	
		70%	27	67	133	267	400	533	667	800	933	1,067	1,200	1,334	
		80%	30	76	152	305	457	610	762	914	1,067	1,219	1,372	1,524	
		90%	34	86	171	343	514	686	857	1,029	1,200	1,372	1,543	1,715	
	100%	38	95	191	381	572	762	953	1,143	1,334	1,524	1,715	1,905		
Seagreen Project Alpha	Displacement level (%)	0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
		10%	5	11	23	46	68	91	114	137	159	182	205	228	
		20%	9	23	46	91	137	182	228	273	319	364	410	456	
		30%	14	34	68	137	205	273	342	410	478	547	615	683	
		40%	18	46	91	182	273	364	456	547	638	729	820	911	

Site		Mortality (%)												
		50%	23	57	114	228	342	456	570	683	797	911	1,025	1,139
		60%	27	68	137	273	410	547	683	820	957	1,093	1,230	1,367
		70%	32	80	159	319	478	638	797	957	1,116	1,276	1,435	1,595
		80%	36	91	182	364	547	729	911	1,093	1,276	1,458	1,640	1,822
		90%	41	103	205	410	615	820	1,025	1,230	1,435	1,640	1,845	2,051
		100%	46	114	228	456	683	911	1,139	1,367	1,595	1,822	2,050	2,279
Seagreen Project Bravo	Displacement level (%)	0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
		10%	2	5	10	20	30	40	50	60	70	80	90	100
		20%	4	10	20	40	60	80	100	120	140	160	180	200
		30%	6	15	30	60	90	120	150	180	210	240	269	299
		40%	8	20	40	80	120	160	200	240	279	319	359	399
		50%	10	25	50	100	150	200	250	299	349	399	449	499
		60%	12	30	60	120	180	240	299	359	419	479	539	599
		70%	14	35	70	140	210	279	349	419	489	559	629	699
		80%	16	40	80	160	240	319	399	479	559	639	719	798
		90%	18	45	90	180	269	359	449	539	629	719	808	898
ICOL		0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
		100%	20	50	100	200	299	399	499	599	699	798	898	998

Site		Mortality (%)												
Displacement level (%)	10%	2	5	10	19	29	39	48	58	68	77	87	97	
	20%	4	10	19	39	58	77	97	116	136	155	174	194	
	30%	6	15	29	58	87	116	145	174	203	232	261	290	
	40%	8	19	39	77	116	155	194	232	271	310	348	387	
	50%	10	24	48	97	145	194	242	290	339	387	436	484	
	60%	12	29	58	116	174	232	290	348	407	465	523	581	
	70%	14	34	68	136	203	271	339	407	474	542	610	678	
	80%	15	39	77	155	232	310	387	465	542	620	697	774	
	90%	17	44	87	174	261	348	436	523	610	697	784	871	
	100%	19	48	97	194	290	387	484	581	678	774	871	968	
Seagreen Project Alpha and Bravo = Peak estimate from two years within project boundary areas (Source Seagreen EIA)														
ICOL = Peak estimate of adult gannets displaced provided by ICOL ( <i>pers. comm.</i> ICOL, 2013).														

\*Green Shading indicates displacement level assessed in HRA 90% displacement and 2% Mortality. These are considered most likely displacement/mortality for HRA purposes

**7.1.4 Forth Islands SPA - Fulmar**

- 150 The Neart na Gaoithe HRA Screening Assessment, presented in Annex A has not identified Neart na Gaoithe as causing a likely significant effect on fulmars breeding at the Forth Islands SPA. SNH has advised that there is a likely significant effect on fulmar from the Forth Islands SPA (SNH, 2012).
- 151 Site specific surveys indicate that fulmar occur throughout the year in the offshore site with peak numbers at the end of the breeding season in September and also during the winter months of December and January. Relatively low numbers generally occurred between during the summer months. During the breeding period (April to September) peak numbers occurred in September with a peak of up to 252 fulmars in the offshore site and a 2 km buffer. The three year mean peak in the offshore site and 2 km buffer during the breeding period was 154 individuals (Table 7.15).

Table 7.15: Three-year mean peak estimated numbers of fulmar in the offshore site plus 1 and 2 km buffer.

Data	Survey Area	Breeding	Non-breeding
3-year mean peak	Offshore site	61	59
	Offshore site + 1 km	105	89
	Offshore site + 2 km	154	118

- 152 Results from site specific monitoring indicate that 0.1% of all flights will be above turbine height. Consequently, there is a very low risk of a collision impact.
- 153 Fulmars are known to have extensive foraging ranges during the breeding period (See Figure 7.2), with a mean maximum foraging range of 400 km (Thaxter *et al.*, 2012). The potential increase in flight distance around Neart na Gaoithe will be negligible compared to the overall distance that fulmars fly during a single foraging trip.

**7.1.4.1 Neart na Gaoithe Site Specific Assessment**

**7.1.4.1.1 Displacement**

- 154 There is limited evidence on the potential displacement impacts on fulmars from operating offshore wind farms. At Egmond aan Zee, the only survey at an operating offshore wind farm with a large enough sample size to draw conclusions, no clear displacement effects were detected. Elsewhere, fulmars have been reported flying around wind farms and reduced numbers have been recorded within them (Diersche and Garthe, 2006; Barton *et al.*, 2009). Consequently, there may be a displacement effect on fulmars.
- 155 The evidence from existing offshore wind farms suggests that fulmars may not be significantly displaced with the most robust of the limited available data indicating no clear influence on fulmars (Leopold *et al.*, 2010). For the purposes of this assessment a 10% displacement effect has been used.
- 156 There is little evidence of what the consequences of displacement on fulmars may be. If displacement does occur, there may be an increase in intra-specific competition or an increase in energetic expenditure but displacement will not necessarily cause an increase in mortality. It is possible that the effects of displacement will cause reduced breeding success for those individuals affected, which could have an overall effect on the breeding population.
- 157 As fulmars have a very large foraging range and a broad diet, the majority of displaced birds would be able to find other suitable foraging locations, and therefore there will be very low risk of mortality due to displacement affects. For the purposes of this assessment level of 2% mortality has been used..
- 158 The results from the displacement assessment undertaken indicate that based on three years data and assuming a 10% displacement effect out to 2 km buffer around the agreement for lease area (as opposed to

the 12% smaller Indicative Layout 3 plus 2 km buffer) and a precautionary assumption of 2% mortality rate during the colony attendance period no fulmars are predicted to die due to being displaced during the breeding season (Table 7.16). If there is a higher level of displacement or mortality then a higher number of birds will be impacted.

Table 7.16: Estimated number of fulmars at risk of mortality following displacement from Neart na Gaoithe plus 2 km buffer in breeding period.

		Mortality (%)												
		0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Displacement level (%)	0%	0	1	2	3	5	6	8	9	11	12	14	15	
	10%	1	2	3	6	9	12	15	18	22	25	28	31	
	20%	1	2	5	9	14	18	23	28	32	37	42	46	
	30%	1	3	6	12	18	25	31	37	43	49	55	62	
	40%	2	4	8	15	23	31	39	46	54	62	69	77	
	50%	2	5	9	18	28	37	46	55	65	74	83	92	
	60%	2	5	11	22	32	43	54	65	75	86	97	108	
	70%	2	6	12	25	37	49	62	74	86	99	111	123	
	80%	3	7	14	28	42	55	69	83	97	111	125	139	
	90%	3	8	15	31	46	62	77	92	108	123	139	154	
Three-year mean peak of 154 fulmars in the offshore site & 2 km buffer in the breeding season (April to Sept)														

\*Green Shading indicates displacement level assessed in HRA and 10% either side. 10% displacement and 2% Mortality are considered most likely displacement/mortality rates for HRA purposes.

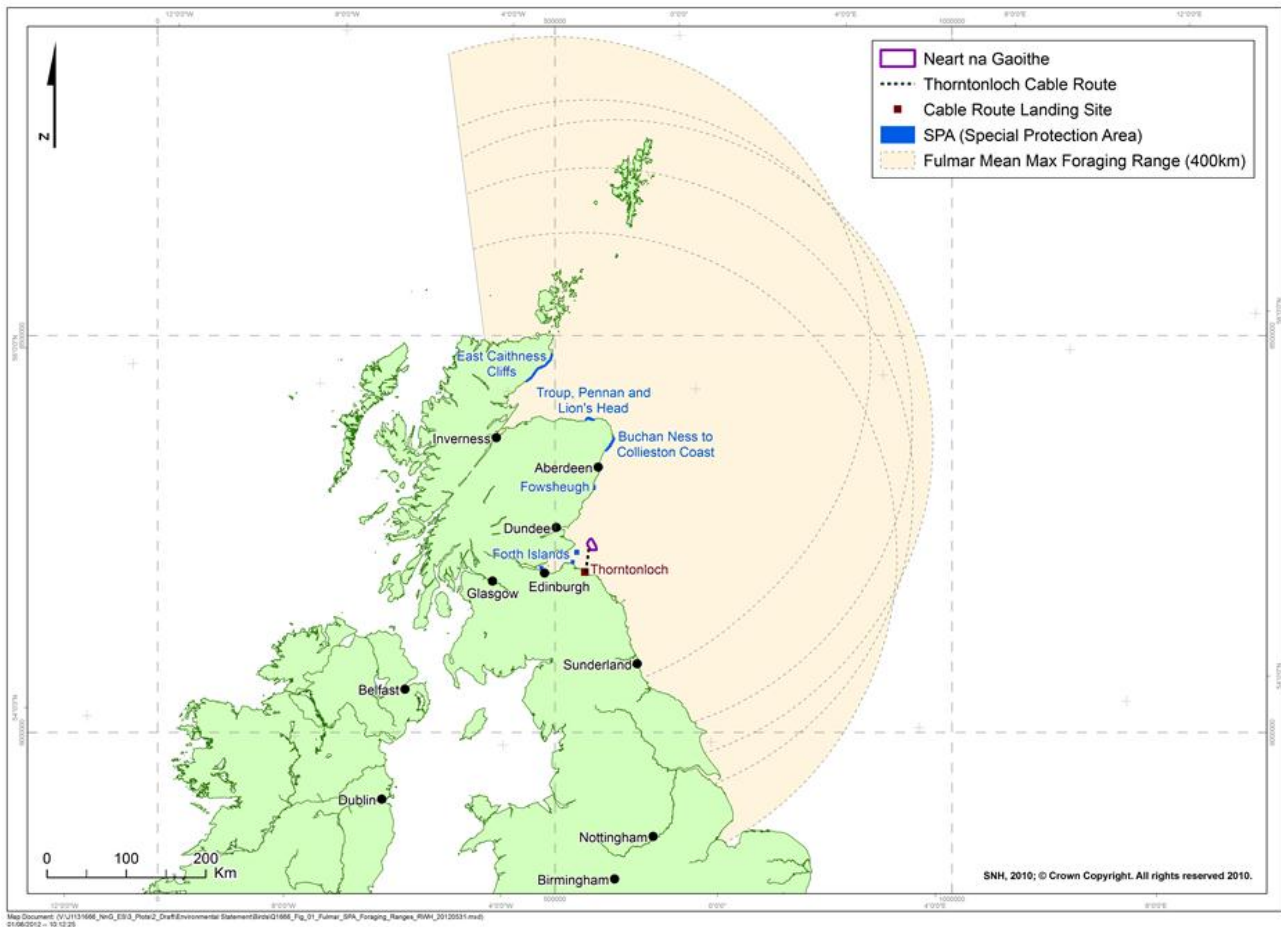


Figure 7.2: Fulmar mean maximum foraging range from breeding SPAs in relation to Neart na Gaoithe.

159 The regional fulmar SPA breeding population size occurring within the mean maximum foraging range is 217,446 individuals and therefore the breeding population of fulmars at Forth Islands SPA is 3.9% of the regional SPA population within the mean maximum foraging range. Therefore a low proportion of fulmars occurring in the offshore site may be from the Forth Islands SPA. However, this is the closest colony so a larger proportion of the site’s fulmar population may occur than from other SPA colonies.

160 The results indicate that no fulmars are predicted to die due to displacement effects and there will therefore be no impacts on any SPA population.

161 The level of impact predicted will not affect the conservation status of the species, nor the conservation objectives of the site and therefore there will be no adverse effect on the integrity of the Forth Islands SPA from displacement impacts on fulmars.

#### 7.1.4.2 Cumulative and In-Combination Impact Assessment

##### 7.1.4.2.1 Displacement

162 The potential displacement effect to fulmar in-combination with other plans or projects is higher than Neart na Gaoithe alone. However, no fulmars are predicted to be lost due to displacement effects and there will therefore be no in-combination impact.

#### 7.1.5 Forth Islands SPA - Herring Gull

163 The Neart na Gaoithe HRA Screening Assessment, detailed in Annex A, has identified herring gull at the Forth Islands SPA as being a qualifying species at risk of a likely significant effect from collisions during operation. This follows advice received from SNH (SNH, 2012).



164 Since designation, the breeding population of herring gulls at the Forth Islands SPA has decreased slightly from 6,600 pairs (13,200 individuals) to 5,764 pairs (11,528 individuals). The distance between the offshore site and the Forth Islands SPA is within the mean maximum foraging range of 61.1 km for herring gull during the breeding period and therefore breeding birds from the SPA may occur within the offshore site and be at risk of collision impacts (Figure 7.3) (Thaxter *et al.*, 2012).

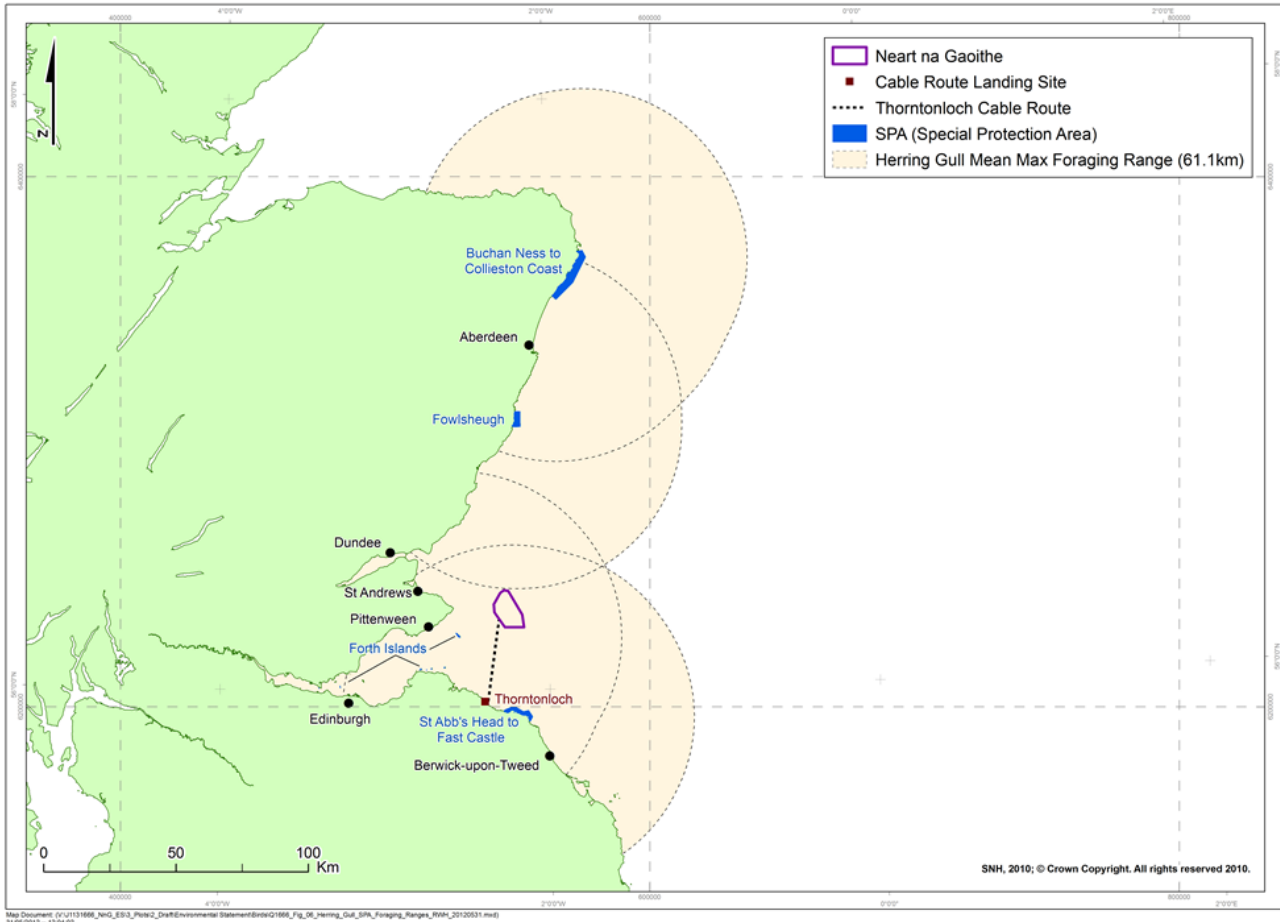


Figure 7.3: Predicted mean maximum foraging ranges for breeding herring gulls from regional SPAs.

- 165 Results from site specific monitoring indicate that herring gulls occur in the Neart na Gaoithe offshore site throughout the year. Peak numbers occurred within the offshore site and a 2 km buffer during the winter and early spring periods with an estimated 784 during January in Year 1 surveys, 116 in January in Year 2 and 252 in March during Year 3.
- 166 During the breeding period from April to August numbers were generally lower than the rest of the year. In Year 1 the peak count was of an estimated 28 herring gulls in June, in Year 2 of 146 birds in April and 82 in June during Year 3.
- 167 The three year mean peak during the breeding period within the offshore site was 40 herring gulls, this increased to 85 birds when including a 2 km buffer area (Table 7.17).

Table 7.17: Three-year mean peak estimated numbers of herring gulls in the offshore site (plus 1 & 2 km buffer).

Data	Survey area	Breeding	Non-breeding
3-year mean peak	Offshore site	40	31
	Offshore site + 1 km	40	279
	Offshore site + 2 km	85	384

- 168 Across all three years, for which site specific data are available, a total of 21.7% of all sightings of flying birds were of birds flying greater than 27.5 m above sea surface. Consequently, herring gulls are at risk of collision with the proposed development.
- 169 Evidence from existing offshore wind farms indicate that herring gulls are not displaced by offshore wind farms (e.g. Leopold *et al.*, 2011; Vattenfall, 2009) and therefore no further assessment has been undertaken on displacement effects. Herring gulls are at potential risk of collision mortality (e.g. Everaert and Kuijken, 2007; Diersche and Garthe, 2006) and the impacts from potential collision could cause a likely significant effect.

7.1.5.1 Neart na Gaoithe Site Specific Assessment

7.1.5.1.1 Collision Mortality

- 170 Collision modelling has been undertaken based on the revised turbine design where the minimum turbine tip height has been raised to mitigate against collision risk mortality and is now 27.5 m compared to the previously assessed 22.5 m. The modelling is based on three years of site specific data and a worst-case scenario of 90 x 5 MW turbines. The results from both 98% avoidance behaviour and 99% are presented.
- 171 Based on advice received from Marine Scotland (*pers. comm.*, Marine Scotland, 2013) impacts on SPAs for which breeding seabirds are qualifying species should only be assessed during the breeding period, i.e. between April and August. The potential annual numbers impacted are presented for information.
- 172 The total predicted number of collisions per year is 85 birds, of which 26 are predicted to occur during the breeding period (April to August). If the avoidance behaviour is 99% then the predicted number of collisions per breeding period decreases to less than 13 birds (Table 7.18).

Table 7.18: Predicted number of herring gull (adults and immature) collisions per year with Neart na Gaoithe.

Years 1 to 3 mean	Annual	Breeding (Apr- Aug)
98% avoidance	85	26
99% avoidance	42	13

- 173 During the breeding period (April to August) of those that were aged 22% were immature birds and therefore not breeding birds associated with the SPA.
- 174 The total number of adult herring gulls predicted to collide with Neart na Gaoithe during the breeding period is 20 birds (Table 7.19).

Table 7.19: Predicted mean number of adult herring gull collisions per year with Neart na Gaoithe.

Years 1 to 3 mean	Annual	Breeding (Apr- Aug)
98% avoidance	66	20
99% avoidance	33	10
<b>77.4% of all observations during breeding period were adults.</b>		

175 Based on the latest available counts the herring gull breeding population at the Forth Islands SPA of 5,764 pairs. The loss of 20 herring gulls during the breeding period is less than 0.2% of the breeding population. The herring gull population has decreased slightly since the time of designation but is in a maintained and favourable condition (SNH, 2013). However, this figure is based on all impacts being on birds from a single SPA and it is possible that some of the birds being impacted will be from non SPA colonies and SPAs other than the Forth Islands. This is explored further in the in-combination assessment below.

176 An increase in breeding herring gull mortality of less than 0.2% will not adversely affect the integrity of the Forth Islands SPA, in light of the qualifying interests, their condition and vulnerabilities and the conservation objectives.

### 7.1.5.2 Cumulative and In-Combination Impact Assessment

#### 7.1.5.2.1 Collision Mortality

177 The potential collision risk to herring gulls in-combination with other plans or projects is higher than with Neart na Gaoithe alone.

178 Projects identified during consultation and the undertaking of the EIA for which there is a potential for an in-combination collision risk impact during the breeding period are:

- ICOL offshore wind farm;
- Seagreen Project Alpha offshore wind farm; and
- Seagreen Project Bravo offshore wind farm.

179 Data on the number of predicted collisions arising from the two Seagreen offshore wind farms are presented within the applicant’s Environmental Statement (Seagreen, 2012). Projects Alpha and Bravo are the first developments and the only Seagreen projects for which separate applications have been made.

180 The results from two years of site specific surveys at Projects Alpha and Bravo indicate that herring gulls occur throughout the year with generally higher numbers during the winter period. However, peak numbers occurred in June with a peak count in Project Alpha survey area of 121 birds in June 2010 and 193 in Project Bravo in June 2011 (Seagreen, 2012).

181 Collision risk modelling undertaken for Project Alpha predicts an annual collision mortality of 76 herring gulls per year and 25 will be adults during the breeding period (Seagreen, 2012). Of those impacted during the breeding period, four are predicted to be from the Forth Islands SPA based on a 98% avoidance behaviour (Seagreen, 2013).

182 Collision risk modelling undertaken for Project Bravo predicts an annual collision mortality of 48 adult herring gulls per year and 16 will be during the breeding period (Seagreen, 2012). Of those impacted during the breeding period, three are predicted to be from the Forth Islands SPA based on a 98% avoidance behaviour (Seagreen, 2013).

183 Data presented in the Inch Cape Offshore Wind Farm First Annual Ornithological Report (*pers. comm.*, ICOL, 2012) indicate that peak counts of herring gulls within the ICOL development area occur during the winter

period, with a peak of 93 birds in January. During the breeding period numbers recorded were lower with a peak in June of 43 birds.

- 184 Results from collision risk modelling indicates that up to 84 herring gulls during the breeding period may be impacted by ICOL based on the worse-case scenario of maximum rotor speed and a minimum rotor height of 20 m above sea surface (*pers. comm.*, ICOL, 2012).
- 185 The predicted in-combination impacts on herring gull from Neart na Gaoithe, Seagreen (Projects Alpha and Bravo) and ICOL are presented in Table 7.20.

Table 7.20: Predicted number of herring gull (adult and immature) mortality in-combination with other plans or projects.

Wind farm	Season	
	Annual	Breeding (Apr - Aug)
<b>Neart na Gaoithe<sup>-1</sup></b>		
98% avoidance	85	26
99% avoidance	43	13
<b>Seagreen (Project Alpha)<sup>-2</sup></b>		
98% avoidance	76	25
99% avoidance	38	13
<b>Seagreen (Project Bravo)<sup>-2</sup></b>		
98% avoidance	48	16
99% avoidance	24	8
<b>ICOL<sup>-3</sup></b>		
98% avoidance	-	84
99% avoidance	-	42
<b>Total</b>		
<b>98% avoidance</b>	<b>209+</b>	<b>151</b>
<b>99% avoidance</b>	<b>104+</b>	<b>76</b>
<b>1 = Based on 3 year's data.</b>		
<b>2 = based on two year's data presented in Seagreen (2012).</b>		
<b>3 = based on one year's data presented by ICOL (<i>pers. comm.</i> ICOL, 2012) and worse case of minimum rotor height of 20 m and maximum rotor speed.</b>		

- 186 Using a 98% avoidance behavioural rate, a total of 151 herring gulls are predicted to collide with Neart na Gaoithe, ICOL and Seagreen Projects Alpha and Bravo offshore wind farms during the breeding period.
- 187 Of those that were aged at Neart na Gaoithe a total of 22.6% were immature. Collision estimates provided by Seagreen and ICOL were of adult birds only (Seagreen 2012; *pers. comm.*, ICOL 2012).

188 Accounting for the proportion of non-breeding immature birds recorded during the breeding period the total number of adult herring gulls at risk of collision during the breeding period is estimated to be 65 birds (Table 7.21).

Table 7.21: Total number of adult herring gulls predicted to collide each breeding period in-combination with other plans or projects.

Wind farm	Breeding Season	Adjusted for regional SPA proportion of population (38%)
	Adults only (Apr- Sept)	
<b>Neart na Gaoithe</b>		
98% avoidance	20	8
99% avoidance	10	4
<b>Seagreen (Project Alpha)</b>		
98% avoidance	25	9
99% avoidance	13	5
<b>Seagreen (Project Bravo)</b>		
98% avoidance	16	6
99% avoidance	8	3
<b>ICOL</b>		
98% avoidance	84	32
99% avoidance	42	16
<b>Total</b>		
<b>98% avoidance</b>	<b>145</b>	<b>55</b>
<b>99% avoidance</b>	<b>73</b>	<b>28</b>

189 Using an avoidance rate of 98%, the potential in-combination impact of Neart na Gaoithe, ICOL and Seagreen Projects Alpha and Bravo is 145 adult herring gulls during the breeding period.

190 If all the herring gulls predicted to be impacted, originate from the Forth Islands SPA then the loss of 145 adult herring gulls per year will be 1.2% of the breeding population. However, not all herring gulls predicted to be impacted will be from an SPA population. Assessments undertaken by Seagreen indicate that of the regional herring gull breeding population within the mean maximum foraging range no more than 38% of all breeding herring gulls within the mean maximum foraging range of the Seagreen projects are qualifying components of an SPA and therefore the majority of herring gulls predicted to be impacted will not be from the Forth Islands SPA (Seagreen, 2012). On this basis, of the 145 adult herring gulls predicted to be impacted across all four proposed developments an estimated 55 individuals will be from an SPA breeding population (Table 7.21).

- 191 Not all of the estimated 55 adult herring gulls that are from an SPA that are predicted to be impacted will be from the Forth Islands SPA and a proportion of them will be from Fowlsheugh SPA and potentially St Abb’s Head to Fast Castle SPA..
- 192 The mean maximum foraging range for herring gull is 61.1 km and the proposed Seagreen Project Alpha and Bravo projects, ICOL and Neart na Gaoithe lie within (or only marginally outwith) the reported mean maximum foraging for herring gulls breeding at Fowlsheugh and St Abb’s Head to Fast Castle SPAs (Thaxter *et al.*, 2012).
- 193 Estimated collision impacts arising at these four developments have been apportioned between the Forth Islands SPA, Fowlsheugh SPA and St Abb’s to Fast Castle SPA taking into account the size of the breeding population and their relative distances from the SPAs.
- 194 The potential number of fatalities arising from Neart na Gaoithe and ICOL have been apportioned based on relative breeding population size and the distance from relevant project(s). Figures from Seagreen Project Alpha and Project Bravo have been obtained from Seagreen HRA document, where a similar approach to apportioning impacts in the breeding period has been used (Seagreen, 2013).
- 195 The results indicate that up to 45 adult herring gulls from the Forth Islands SPA are predicted to be impacted in-combination with other plans or projects each breeding period based on a 98% avoidance behaviour (Table 7.22).

Table 7.22: Estimated number of in-combination collision impacts of adult herring gulls from SPA colonies during breeding period (April – August).

	SPA colony						Total predicted mortality
	Forth Islands		Fowlsheugh		St Abb’s Head		
SPA population (individuals)	11,528		518		1,210		
Development	Distance (km)	Predicted mortality	Distance (km)	Predicted mortality	Distance (km)	Predicted mortality	
Neart na Gaoithe	16	8	62	0	31	0	8
Seagreen Project Alpha <sup>-1</sup>	53	4	29	1	68	0	5
Seagreen Project Bravo <sup>-1</sup>	53	3	29	1	68	0	4
ICOL <sup>-2</sup>	31	30	33	1	54	1	32
<b>Total no. of collisions</b>	45		3		1		49

-1 = Data on impacts from Seagreen Projects Alpha and Bravo are those provided by Seagreen (2013).  
-2 = Data from draft year 1 report and will change following completion of impact assessment ICOL (*pers. comm.*, ICOL, 2012)

196 The results from the collision model indicate that the number of adult herring gulls predicted to be impacted each breeding period with Neart na Gaoithe in-combination with three other proposed offshore wind farms is 45 adult birds and is relatively small compared to the total breeding population of 11,528 individuals. The estimated increase in mortality of 0.4% during the breeding period will not adversely affect the integrity of the Forth Islands SPA, in light of the qualifying interest, their condition and the sites conservation objectives.

### 7.1.6 Forth Islands SPA - Lesser Black-Backed Gull

197 The Neart na Gaoithe HRA Screening Assessment, detailed in Annex A, has identified lesser black-backed gull at the Forth Islands SPA as being a qualifying species at risk of a likely significant effect from collisions during operation. This follows advice received from SNH (SNH, 2012).

198 Since designation, the breeding population at the Forth Islands SPA has decreased slightly from 2,920 pairs (5,840 individuals) to approximately 2,854 pairs (5,708 individuals) during Seabird 2000 (SMP, 2013). The distance between the offshore site and the Forth Islands SPA is within the mean maximum foraging range of 141 km for lesser black-backed gull during the breeding period and therefore breeding birds from the SPA may occur within the offshore site and be at risk of collision impacts (Figure 7.4) (Thaxter *et al.*, 2012).

199 Results from site specific monitoring indicate that lesser black-backed gulls occur in the Neart na Gaoithe offshore site throughout the year, with peak numbers occurring between July and September. Within the offshore site relatively few lesser black-backed gulls were recorded on surveys with nine birds in Year 1, 11 in Year 2 and 37 in Year 3.

200 Across all three years, for which site specific data are available, a total of 9.2% of all sightings of flying birds were of birds flying greater than 27.5 m above sea surface. Consequently, lesser black-backed gulls are at risk of collision with the proposed development.

201 Evidence from existing offshore wind farms indicate that lesser black-backed gulls are not displaced by offshore wind farms and therefore no further assessment has been undertaken on displacement effects (Leopold *et al.*, 2011). Lesser black-backed gulls are at potential risk of collision mortality (e.g. Everaert & Kuijken, 2007; Diersche and Garthe, 2006) and the impacts from potential collision could cause a likely significant effect.

#### 7.1.6.1 Neart na Gaoithe Site Specific Assessment

##### 7.1.6.1.1 Collision Mortality

202 Collision risk modelling has been undertaken based on the revised turbine design where the minimum turbine tip height has been raised to mitigate against collision risk mortality and is now 27.5 m MSL compared to the previously assessed 22.5 m MSL. The modelling is based on three years site specific data and a worst-case scenario of 90 x 5 MW turbines. The results from both 98% avoidance behaviour and 99% are presented.

The total predicted number of collisions per year is three birds with all of them occurring during the breeding period (April to August) based on 98% avoidance behaviour. If the avoidance behaviour is 99% then the predicted number of collisions per year decreases to less than two birds per year. (

203 Table 7.23).

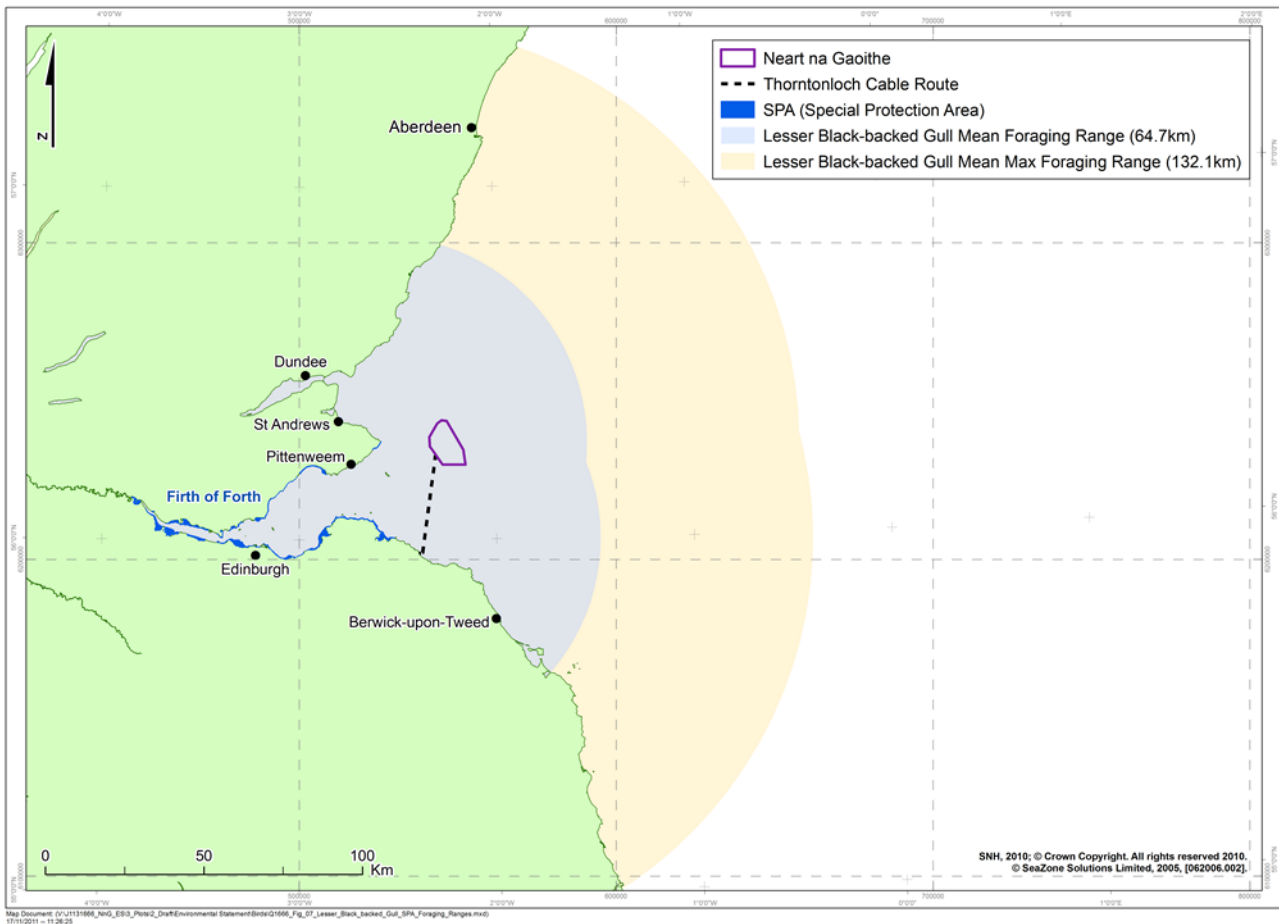


Figure 7.4: Predicted maximum and mean maximum foraging ranges for lesser black-backed gulls from the Forth Islands SPA.

Table 7.23: Predicted number of lesser black-backed gull (adults and immature) collisions per year with Neart na Gaoithe.

Years 1 to 3 mean	Annual	Breeding (Apr- Aug)
98% avoidance	3	3
99% avoidance	2	2

204 The lesser black-backed gull population has decreased slightly since the time of designation and is 2,890 pairs (5,780 individuals) (SMP, 2013). The potential loss of up to 3 lesser black-backed gulls per year from the population is 0.05% of the breeding population.

205 An increase in breeding lesser black-backed gull mortality of 0.05% will not adversely affect the integrity of the Forth Islands SPA, in light of the qualifying interests, their condition and vulnerabilities and the conservation objectives.



7.1.6.2 Cumulative and In-Combination Impact Assessment

7.1.6.2.1 Collision Mortality

- 206 The potential collision risk to lesser black-backed gull in-combination with other plans or projects is higher than with Neart na Gaoithe alone.
- 207 Projects identified during consultation and the undertaking of the EIA for which there is a potential for an in-combination collision risk impact during the breeding period are:
  - ICOL - offshore wind farm;
  - Seagreen Project Alpha; and
  - Seagreen Project Bravo.
- 208 Data on the number of predicted collisions arising from the Seagreen Phase 1 offshore wind farms Alpha and Bravo, are presented within the applicant’s Environmental Statement (Seagreen, 2012).
- 209 The results from two years of site specific surveys at Projects Alpha and Bravo indicate that lesser black-backed gulls occur between February and October with peak numbers during June when six lesser black-backed gulls were recorded at Project Alpha and seven in Bravo. Densities were relatively low ranging from between 0.01 and 0.4 birds/km<sup>2</sup> (Seagreen, 2012).
- 210 ICOL data obtained from first year’s surveys indicate that few lesser black-backed gulls occur within the proposed ICOL development area. All records were between April and August with densities of between 0.03 and 0.1 birds/km<sup>2</sup>. Preliminary results from collision risk modelling indicates that up to 118 lesser black-backed gulls during the breeding period may be impacted by ICOL, based on the maximum rotor speed and a minimum rotor height of 20 m above sea surface (*pers. comm.*, ICOL, 2012).
- 211 The predicted in-combination collision mortality on lesser black-backed gull from Neart na Gaoithe, Seagreen (Projects Alpha and Bravo) and ICOL are presented in Table 7.24.

Table 7.24: Predicted number of lesser black-backed gull mortality in-combination with other plans or projects.

Wind farm	Season	
	Annual	Breeding (Apr - Aug)
<b>Neart na Gaoithe<sup>-1</sup></b>		
98% avoidance	3	3
99% avoidance	2	2
<b>Seagreen (Project Alpha)<sup>-2</sup></b>		
98% avoidance	13	7
99% avoidance	7	4
<b>Seagreen (Project Bravo)<sup>-2</sup></b>		
98% avoidance	29	27
99% avoidance	15	14
<b>ICOL<sup>-3</sup></b>		
98% avoidance	-	76

Wind farm	Season	
	Annual	Breeding (Apr - Aug)
99% avoidance	-	38
<b>Total</b>		
<b>98% avoidance</b>	55+	113
<b>99% avoidance</b>	24+	57
<p><b>1 = Based on 3 year's data.</b></p> <p><b>2 = based on two year's data presented in Seagreen (2012). Figure is for adult birds only</b></p> <p><b>3 = based on one year's data presented in ICOL (<i>pers. comm.</i>, ICOL, 2012), and worse case of minimum rotor height of 20 m and maximum rotor speed. Figure is for adult birds only.</b></p>		

- 212 Using a 98% avoidance behavioural rate, a total of 113 lesser black-backed gulls are predicted to collide with Neart na Gaoithe, ICOL and Seagreen Projects Alpha and Bravo offshore wind farms during the breeding period.
- 213 Not all birds recorded were adults and therefore a proportion of immature birds will not be from the SPA breeding population.
- 214 Seagreen have assessed the number of adult lesser black-backed gulls predicted to be impacted by Projects Alpha and Bravo, taking into account the proportion of immature birds (Seagreen, 2013). The number of collision mortalities predicted by Seagreen has been used in this assessment.
- 215 The number of adult lesser black-backed gulls predicted to be impacted are presented in the Inch Cape Offshore Wind Farm First Annual Ornithological Report (*pers. comm.*, ICOL, 2012) and these have been used in this assessment.
- 216 Accounting for the proportion of non-breeding immature birds recorded during the breeding period the total number of adult lesser black-backed gulls at risk of collision during the breeding period is estimated to be 85 birds (Table 7.25).

Table 7.25: Total number of adult lesser black-backed gulls predicted to collide each breeding period in-combination with other plans or projects.

Wind farm	Season
	Adults only (Apr- Sept)
Neart na Gaoithe <sup>-1</sup>	
<b>98% avoidance</b>	2
<b>99% avoidance</b>	1
Seagreen (Project Alpha) <sup>-2</sup>	
<b>98% avoidance</b>	2

Wind farm	Season
	Adults only (Apr- Sept)
99% avoidance	1
Seagreen (Project Bravo) <sup>-2</sup>	
98% avoidance	5
99% avoidance	3
ICOL <sup>-3</sup>	
98% avoidance	76 <sup>3</sup>
99% avoidance	38 <sup>3</sup>
<b>Total</b>	
98% avoidance	85
99% avoidance	43
<b>1 = 28.6% immature.</b> <b>2 = from Seagreen HRA Report (Seagreen 2013) and are of adult birds from Forth Islands SPA.</b> <b>3 = from ICOL (<i>pers. comm.</i>, ICOL, 2012)</b>	

- 217 Using an avoidance rate of 98%, the potential in-combination impact with ICOL and Seagreen Projects Alpha and Bravo is 85 adult lesser black-backed gulls during the breeding period.
- 218 If all the lesser black-backed gulls predicted to be impacted originate from the Forth Islands SPA then the loss of 85 adult lesser black-backed gulls per year will be 1.4% of the breeding population. However, not all lesser black-backed gulls recorded will be from the SPA and a proportion of them will be from non-SPA colonies. Assessments undertaken by Seagreen indicate that of the regional breeding population within the mean maximum foraging range, 38.7% of all breeding lesser black-backed gulls within the mean maximum foraging range of the Seagreen projects are not part of an SPA and therefore the majority of gulls predicted to be impacted will not be from the Forth Islands SPA (Seagreen, 2012). On this basis, of the 85 adult lesser black-backed gulls predicted to be impacted across all four proposed developments an estimated 53 individuals will be from the Forth Islands SPA. This is equivalent to 0.9% of the Forth Islands SPA breeding population.
- 219 There is uncertainty in the results relating to the proposed ICOL development which are based on one year's data but the figures used are based on the worse-case turbine design giving and rotor speed and therefore provide a potential maximum level of predicted impacts based on the available data.
- 220 The results from the collision model indicate that the number of adult lesser black-backed gulls predicted to be impacted each breeding period with Neart na Gaoithe in-combination with three other proposed offshore wind farms is small compared to the total breeding population of 5,708 individuals but near 1% of the breeding population. However, this conclusion is based on incomplete data results and analysis from the proposed ICOL development and it is predicted that the final assessment of the potential impacts on lesser black backed gull will be considerably lower than the current figures suggest. On this basis it is

concluded that there will not be adverse effect the integrity of the Forth Islands SPA, in light of the qualifying interests, their condition and vulnerabilities and the conservation objectives.

**7.1.7 Forth Islands SPA - Kittiwake**

- 221 The Neart na Gaoithe HRA Screening Assessment, detailed in Annex A, has identified Kittiwakes at the Forth Islands SPA as being a qualifying species at risk of a likely significant effect from collision mortality effects during the operational period of the project.
- 222 Results from site specific monitoring indicate that kittiwakes are widespread across the Neart na Gaoithe throughout the year, with highest numbers occurring in September and October. During the breeding period (April to August) in Year 1 peak numbers occurred in June with an estimated 55 birds within the development site and 151 when including a 2 km buffer. Numbers of kittiwakes were significantly greater during the same period in Year 2, with 1,451 birds within the development site and 1,708 within the site and 2 km buffer. Year 3 data recorded peak numbers in August with 3,783 kittiwakes within the development site and 4,165 individuals in the site plus 2 km buffer.
- 223 The three year mean peak during the breeding period within the offshore site was 1,772 kittiwakes, this increased to 2,164 birds when including a 2 km buffer area (Table 7.26).

Table 7.26: Three-year mean peak estimated numbers of kittiwakes in the offshore site (plus 1 & 2 km buffer).

Estimated Kittiwake numbers	Location	Breeding	Post-breeding	Non-breeding
<b>3-year mean peak</b>	Offshore site	1,772	778	340
	Offshore site + 1 km	1,984	890	373
	Offshore site + 2 km	2,164	1,833	483

- 224 Across all three years, for which site specific data are available, a total of 4.8% of all sightings of flying birds were of birds flying greater than 27.5 m above sea surface. Consequently, kittiwakes are at risk of collision with the proposed development.
- 225 The offshore distribution of kittiwakes breeding within the Forth Islands SPA has been studied via the use of tracking devices for a period of four years between 1999 and 2003 and again in 2010. The results indicate that kittiwakes forage in St Andrew’s Bay and in offshore waters with maximum foraging range recorded of c. 120 km (Daunt *et al.*, 2011a). Although there is seasonal and inter-annual variation with maximum foraging ranges during most years been less than 100 km (Daunt *et al.*, 2010; 2011). Data from studies undertaken in 2010 reported a foraging area of 3,993 km<sup>2</sup> (Daunt *et al.*, 2011a).
- 226 The overlap in foraging range with Neart na Gaoithe varies across years. In 2010 there was a very small overlap in both the core foraging area (based on 50% kernel distribution) and the wider area (based on 90% kernel distribution). This contrasts with data collected in 2002 where a third of the core area activity overlapped with Neart na Gaoithe (Table 7.27).

Table 7.27: Results from kittiwake tracking studies from the Forth Islands SPA between 1999 and 2010.

Outputs from tagging studies	Year of kittiwake tracking study				
	1999	2000	2001	2002	2010

<b>Maximum foraging range (km)</b>	80 – 100	80 – 100	100 – 120	80 – 100	60 - 80
<b>% of overlap with Neart na Gaoithe based on 50% kernel range</b>	-	-	7.7	33.4	0.003
<b>% of overlap with Neart na Gaoithe based on 90% kernel range</b>	-	-	4.7	17.3	1.5
<b>% of trips crossing Neart na Gaoithe</b>	-	-	-	50	23.3

227 Tagging studies undertaken in 2011 on kittiwakes at St Abb’s Head and Fast Castle SPA and Fowlsheugh SPA, two colonies adjacent to the Forth Islands SPA recorded no kittiwakes from either of these colonies at Neart na Gaoithe (Daunt *et al.*, 2012). This suggests that there is relatively little overlap between the foraging ranges of birds from these colonies and Neart na Gaoithe.

228 Evidence from existing offshore wind farms (e.g. Egmond aan Zee, Horns Rev and Arklow Bank), indicates that kittiwakes are not displaced from offshore wind farms and do not avoid flying through wind farms with some sites showing no significant attraction or displacement and others indicating a potential for attraction (Leopold *et al.*, 2011; Diersche and Garthe, 2006; Barton *et al.*, 2009). The proportion of birds recorded flying at rotor height varies from between 5% (Arklow Bank) and 26% (Gwynt y Mor) depending on the study Barton *et al.*, 2009; ERM, 2005). Cook *et al.* (2011) reported a mean flight height of 7.4 m and 13% of all flight heights at risk of collision based on a sample of 14,140 birds.

7.1.7.1 Neart na Gaoithe Site Specific Assessment

7.1.7.1.1 Collision Mortality

229 The collision risk modelling undertaken is based on the revised turbine design where the minimum turbine tip height has been raised to mitigate against collision risk mortality and is now 27.5 m MSL compared to the previously assessed 22.5 m MSL. The modelling is based on three years site specific data and a worst-case scenario of 90 x 5 MW turbines. The results from both 98% avoidance behaviour and 99% are presented.

230 The SPA population comprises breeding adults only and impacts on these have been considered further. Based on advice received from Marine Scotland (*pers. comm.*, Marine Scotland, 2013) impacts on breeding seabird populations are only assessed during the breeding period, i.e. between April and August. Potential impacts across the whole year are presented for information.

231 The total predicted number of collisions per year, based on avoidance behaviour of 98%, is 86 birds with 26 occurring during the breeding period (April to August) (Table 7.28).

Table 7.28: Predicted number of kittiwake (adults and immature) collisions per year and per breeding period with Neart na Gaoithe alone.

Years 1 to 3 mean	Annual	Breeding (Apr- Aug)
98% avoidance	86	26
99% avoidance	43	13

232 The proportion of adults within the population during this period is 93.6% and therefore of the 26 kittiwakes estimated to collide during the breeding period, 24 will be adults and therefore potentially part of the Forth Islands SPA kittiwake breeding population Table 7.29).

Table 7.29: Predicted mean number of adult kittiwake collisions per year and per breeding period with Neart na Gaoithe.

Years 1 to 3 mean	Annual	Breeding (Apr- Sept)
98% avoidance	80	24
99% avoidance	40	12
93.6% of kittiwakes were recorded as adults.		

233 The kittiwake breeding population on the Forth Islands SPAs in 2012 was 3,766 pairs (7,532 breeding adults). The loss of up to 24 adults is 0.3% of the breeding population.

234 The kittiwake population at the Forth Islands SPA is in an unfavourable and declining condition (SNH, 2013) having declined from 9,380 pairs at the time of SPA review undertaken in 2001 (Stroud *et al.*, 2001). This is an annual decline of 1,020 breeding adults per year over an 11 year period and a decline of 60% since the SPA review.

235 The loss of an estimated additional 24 adult kittiwakes per year due to collision mortality is equivalent to loss of 2.4% of the current population that, on average, is decreasing by over a 1,000 birds per year. The current population is in decline and it is not believed that this additional mortality will change this trend significantly. Population Viability Analysis is currently being undertaken by Marine Scotland to inform this conclusion.

7.1.7.2 Cumulative and In-Combination Impact Assessment

7.1.7.2.1 Collision Mortality

236 The potential collision risk to kittiwake in-combination with other plans or projects is higher than with Neart na Gaoithe alone.

237 Projects identified during consultation and the undertaking of the EIA for which there is a potential for an in-combination collision risk impact during the breeding period are:

- ICOL - offshore wind farm,
- Seagreen Project Alpha,
- Seagreen Project Bravo.

238 Data on the number of predicted collisions arising from the Seagreen offshore wind farm are presented within the applicant’s Environmental Statement (Seagreen, 2012). Projects Alpha and Bravo are the first developments and the only Seagreen projects for which applications have been made. Data for Projects Alpha and Bravo obtained from the application are presented in Table 7.30 below.

239 Peak numbers of kittiwakes occurred during the non-breeding period with peak numbers of 4,510 in November in Project Alpha and 2,813 in Project Bravo. During the breeding period peak numbers occurred in June with 1,925 in both Project Alpha and 2,813 in Bravo.

240 Of those that were aged during the breeding period, 94.2% were adults within the Project Alpha development area and 95.8% for Project Bravo.

- 241 No application has yet been made for the proposed ICOL development. Unpublished outputs from collision risk modelling supplied by ICOL, indicate that one collision by an adult kittiwake per year may be from the Forth Islands SPA (*pers. comm.*, ICOL, 2013).
- 242 Results from collision risk modelling undertaken for Neart na Gaoithe, Seagreen (Seagreen, 2012) and ICOL (*pers. comm.*, ICOL, 2013) are presented in Table 7.30.

Table 7.30: Predicted kittiwake (adult and immature) mortality in-combination with other plans or projects.

Wind farm	Season	
	Annual	Breeding (Apr- Aug)
<b>Neart na Gaoithe<sup>-1</sup></b>		
98% avoidance	86	26
99% avoidance	43	13
<b>Seagreen (Project Alpha)<sup>-2</sup></b>		
98% avoidance	675	201
99% avoidance	337	100
<b>Seagreen (Project Bravo)<sup>-2</sup></b>		
98% avoidance	624	263
99% avoidance	312	132
<b>ICOL<sup>-3</sup></b>		
98% avoidance	-	18 <sup>-4</sup>
99% avoidance	-	9 <sup>-4</sup>
<b>Total<sup>-4</sup></b>		
98% avoidance	1,385+	508
99% avoidance	693+	254
<p>1 = Based on 3 year's data.</p> <p>2 = based on two year's data presented in Seagreen (2012).</p> <p>3 = based on two year's data, supplied by ICOL (<i>pers. comm.</i>, ICOL, 2013).</p> <p>4 = does not include immature birds.</p>		

- 243 Using a 98% avoidance behavioural rate, a total of 508 kittiwakes are predicted to collide with Neart na Gaoithe, ICOL and Seagreen Projects Alpha and Bravo offshore wind farms during the breeding period.
- 244 Of those that were aged during the breeding period 6.4% of kittiwakes recorded at Neart na Gaoithe were immature birds. Predicted number of collisions of adult kittiwakes per breeding period for Seagreen Project Alpha and Bravo are available from the Seagreen HRA report and these have been used in this assessment (Seagreen, 2013).
- 245 Predicted number of collisions per breeding period from the proposed ICOL development have been supplied as adults only and these have been used in this assessment.
- 246 Accounting for the proportion of non-breeding immature birds recorded during the breeding period the total number of adult kittiwakes at risk of collision during the breeding period is 1,152 birds (Table 7.31).

**Table 7.31: Total number of adult kittiwakes predicted to collide each breeding period in-combination with other plans or projects.**

Wind farm	Season
	Adults only (Apr- Sept)
<b>Neart na Gaoithe <sup>1</sup></b>	
98% avoidance	24
99% avoidance	12
<b>Seagreen (Project Alpha)</b>	
98% avoidance	125 <sup>2</sup>
99% avoidance	63 <sup>2</sup>
<b>Seagreen (Project Bravo)</b>	
98% avoidance	167 <sup>2</sup>
99% avoidance	84 <sup>2</sup>
<b>ICOL <sup>3</sup></b>	
98% avoidance	18
99% avoidance	4
<b>Total <sup>4</sup></b>	
<b>98% avoidance</b>	<b>334</b>



Wind farm	Season
	Adults only (Apr- Sept)
99% avoidance	167
<b>1 = 6.4% immature.</b> <b>2 = Data from Seagreen HRA report (Seagreen 2013)</b> <b>3 = Data supplied by ICOL (<i>pers. comm.</i>, ICOL, 2013)</b>	

- 247 The results indicate that up to 334 adult kittiwakes may be impacted during the breeding period across all four proposed offshore wind farms. However, not all kittiwakes predicted to be impacted during this period will be from the Forth Islands SPA and some of the estimated mortality will be to birds from other colonies.
- 248 Results from kittiwake tagging studies undertaken at three colonies in the region indicate that few, if any, kittiwakes from colonies at the Fowlsheugh SPA or St Abb's Head to Fast Castle SPA will occur within the Neart na Gaoithe offshore site during the breeding period (Daunt *et al.*, 2011b). Consequently, for the purposes of this assessment, no apportioning of impacts arising from Neart na Gaoithe has been made with any other colony, i.e. all 24 predicted collision impacts from Neart na Gaoithe are on birds from the Forth Islands SPA. This provides the worst-case scenario for impacts on the SPA from this project.
- 249 Results from tagging studies indicate that kittiwakes from Fowlsheugh occur during the breeding period in both ICOL and Seagreen Projects Alpha and Bravo development areas (Daunt *et al.*, 2011b). The results also indicate that no kittiwakes breeding at St Abb's Head will be impacted by Project Alpha and ten from Project Bravo.
- 250 Seagreen (2013) present two sets of results for the potential number of collision impacts across the regional SPAs depending on whether results from site specific tagging studies are used to calculate the proportion of kittiwakes from each site within Project Alpha and Bravo developments, or the results are from the use of an apportioning tool.
- 251 The results based on site specific surveys and apportioned across sites based on foraging range indicate that up to 39 adult kittiwakes from the Forth Islands SPA are predicted to be impacted in-combination with other plans or projects each breeding period based on a 98% avoidance behaviour (Table 7.32). Only the results based on foraging range are used here as data based on tagging studies is not available from all developments.

Table 7.32: Total number of fatalities of adult kittiwakes predicted to be impacted per breeding period across regional SPAs (based on 98% avoidance behaviour).

Colony	Proposed wind farm			Total	
	Neart na Gaoithe	Seagreen Project Alpha <sup>-1</sup>	Seagreen Project Bravo <sup>-1</sup>		ICOL <sup>-2</sup>
Forth Islands	24	6 (28)	8 (66)	1	39 (123)
Fowlsheugh	0	96 (97)	128 (10)	4	228 (118)

Colony	Proposed wind farm				Total
	Neart na Gaoithe	Seagreen Project Alpha <sup>-1</sup>	Seagreen Project Bravo <sup>-1</sup>	ICOL <sup>-2</sup>	
St Abb's Head to Fast Castle	0	12 (0)	17 (10)	1	30 (12)
Buchan Ness to Collieston Coast	0	11 (0)	14 (0)	<1	25 (<1)
1	Numbers in parenthesis based on results from tagging data results.				
2	Buchan Ness to Collieston Coast SPA beyond mean maximum foraging range for kittiwakes				

- 252 The potential loss of 39 adult kittiwakes from in-combination impacts out of a population of 7,532 individuals is 0.5% of the breeding adult population.
- 253 The loss of an estimated additional 39 adult kittiwakes per year due to in-combination collision mortality is equivalent to loss of 0.5% of the current population that, on average, is decreasing by over a 1,000 birds per year. The current population is in decline and it is not believed that this additional mortality will change this trend significantly.
- 254 The potential loss of up to 0.5% of the breeding population would not cause an adverse effect on the integrity of the Forth Islands SPA, in light of the qualifying interests, their condition and vulnerabilities and the conservation objectives. Population Viability Analysis is currently being undertaken by Marine Scotland to inform this conclusion.

### 7.1.8 Forth Islands SPA – Guillemot

#### 7.1.8.1 Neart na Gaoithe Site Specific Assessment

- 255 Neart na Gaoithe HRA Screening Assessment, presented in Annex A, has identified guillemots from the Forth Islands SPA as being a qualifying species at risk of a likely significant effect from displacement effects during the operational period of the wind farm but not from displacement effects during construction or decommissioning, nor barrier effects or collision mortality.

##### 7.1.8.1.1 Displacement

- 256 Results from site specific monitoring indicate that peak numbers of guillemots occurred during the post-breeding period, particularly during September and October. During the colony attendance period (April to June) the peak estimated number of guillemots in Year 1 occurred in June, with 387 birds in the offshore site but when including a 2 km buffer peak numbers occurred in April with 924 individuals. In Year 2, estimated numbers of guillemots in the offshore site peaked in April (3,789 birds), with 4,323 birds including a 2 km buffer. In Year 3, peak estimated numbers of guillemots in the offshore site peaked in May (1,477 birds), while estimated numbers including a 2 km buffer area peaked in April (2,965 birds).
- 257 The three year mean peak during the breeding period within the offshore site was 1,896 guillemots, this increased to 2,737 birds when including a 2 km buffer area (Table 7.33). The area used for displacement calculations is conservative as the agreement for lease area of the proposed offshore wind farm is 105 km<sup>2</sup> as compared to the actual area used for turbines of 83 km<sup>2</sup> shown in Indicative Layout 3 (refer to Table 5.1).

Table 7.33: Three-year mean peak estimated numbers of guillemots in the offshore site (plus 1 & 2 km buffer).

Data	Survey Area	At colony	Chicks at sea	Post-breeding	Non-breeding
3-year mean peak	Offshore site	1,896	2,044	3,783	1,060
	Offshore site + 1 km	2,295	2,840	5,356	1,544
	Offshore site + 2 km	2,737	3,717	7,308	2,040

- 258 The maximum reported foraging range for guillemot during the colony attendance period is 135 km, although the mean maximum is 84 km and the mean foraging range 37.8 km (Thaxter *et al.*, 2012). Therefore, guillemots recorded within the Neart na Gaoithe offshore site during the breeding season are within the mean maximum reported foraging range for this species from the Forth Islands SPA.
- 259 Tagging studies on guillemots breeding on the Isle of May (part of Forth Islands SPA) has been undertaken over eight years between 1986 and 2005 (Daunt *et al.*, 2010) and again in 2010 (Daunt *et al.*, 2011a). The results indicate that guillemots may forage predominantly north-east and south-east of the Isle of May. Foraging ranges vary across years with the maximum foraging range in some years less than 25 km and in others greater than 50 km (Daunt *et al.*, 2010). Data obtained in 2010 indicated the mean maximum foraging range of guillemot during the colony attendance period was 18 km ± 14 km with a maximum of 61 km (Daunt *et al.*, 2011a).
- 260 For the three years prior to 2010 for which suitable data are available (1999, 2002 and 2003) the total overlap with Neart na Gaoithe (90% kernel) ranged from 0% and 4%. In 2010 there was 0.1% overlap with the core area used by guillemots (50% kernel) and 3.3% over the wider area (90% kernel) (Daunt *et al.*, 2011a). The results indicate that the core areas for guillemot foraging are to the west and east of Neart na Gaoithe and the site is relatively little used compared to other locations (Figure 7.5). This is supported by the number of recorded trips made by guillemots from the Isle of May across the offshore site with 18.4% of all trips recorded flying across the zone (Daunt *et al.*, 2011a).
- 261 Post-construction monitoring undertaken at Horns Rev offshore wind farm has indicated that displacement of guillemots can occur (Petersen *et al.*, 2006). However, more recent results from operating wind farms have not shown a total displacement of guillemots. Guillemots have been recorded at the constructed Kentish Flats offshore wind farm and Robin Rigg offshore wind farm but in reduced numbers (Gill *et al.*, 2008; Walls *et al.*, 2013). No displacement effects have been recorded from Egmond aan Zee offshore wind farm or Bligh Bank (Lindeboom *et al.*, 2011; Vanermen *et al.*, 2011).
- 262 Based on the most recent studies, it is now thought that displacement of guillemots may not be as significant as previously supposed and that a displacement level of around 40% may be a more realistic, but still precautionary, estimate rather than an assumption of 50% or over. For the purposes of this assessment it is assumed that up to 40% of guillemots may be displaced from an offshore wind farm. Based on this, the estimated number of displaced guillemots from the Neart na Gaoithe site and a 2 km buffer is 1,095 birds (Table 7.34).
- 263 Data from studies undertaken on guillemots estimate that during April, when birds first return to the colony and egg laying commences, few birds present in the colonies are immature. However, during the majority of the breeding period and when peak numbers occurred during the 'at colony' period, 30% of all guillemots present may be immature birds and therefore not part of the SPA breeding population (Wanless *et al.*, 1998). Consequently of the estimated number of 1,095 guillemots present within the offshore site during the colony period, 766 birds may be breeding adults.

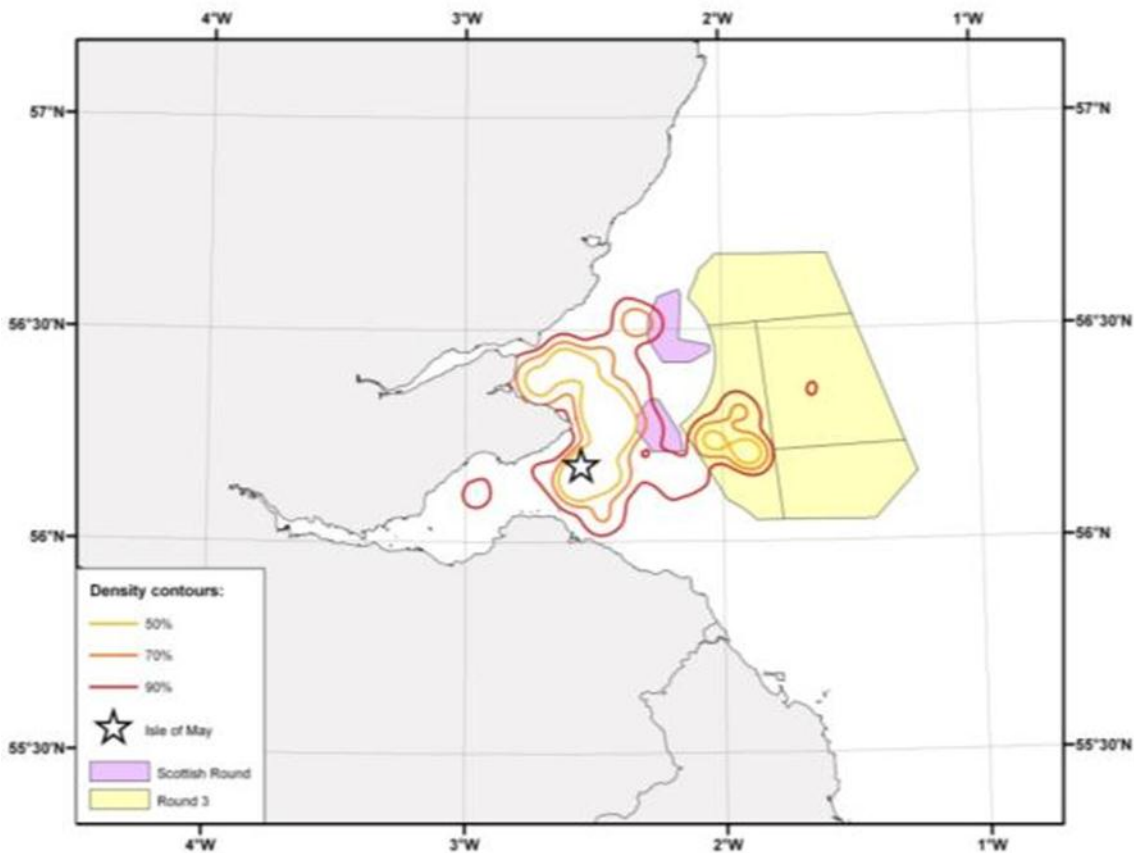


Figure 7.5: Kernel density distributions (50%, 70% and 90%) for guillemots from the Isle of May for non-flight fixes in relation to three offshore wind farm offshore sites in the Firth of Forth (Daunt *et al.*, 2011a).

- 264 There is little evidence of what the consequences of displacement on guillemots may be. Recent studies being developed using time/energy budgets of breeding guillemots and the impacts of a proposed offshore wind farm indicate an increase in energy expenditure will occur should a wind farm impact on breeding guillemots by either displacing birds to other areas or increasing their flight demands (McDonald *et al.*, 2012).
- 265 If displacement does occur, there may be an increase in intra-specific competition or an increase in energetic expenditure but displacement will not necessarily cause an increase in mortality. It is possible that the effects of displacement will cause reduced breeding success for those individuals affected, which could have an overall effect on the breeding population (McDonald *et al.*, 2012). Therefore this HRA assumes a potential mortality rate of 10% during the colony attendance period however the authors believe this is highly precautionary and conceivably unrealistic.
- 266 The results from the displacement assessment undertaken indicate that based on three years data and assuming a 40% displacement effect out to 2 km and a precautionary assumption of 10% mortality rate during the colony attendance period, a total of 109 guillemots may die due to being displaced during the breeding season (Table 7.34). Applying the correction for immature birds being present in the breeding season (Wanless *et al.*, 1998), gives an estimated mortality of up to 76 breeding adults. The potential loss of up to 76 guillemots is 0.3% of the current breeding guillemot population of 22,553 individuals. This assumes that all guillemots impacted by displacement are from the one colony when, in reality, birds from other colonies, e.g. St Abb's Head, Fowlsheugh and the Farne Islands are within the mean maximum foraging range of this species during the colony attendance period (Figure 7.6) and may therefore occur within the Neart na Gaoithe offshore sites during this period.

Table 7.34: Estimated number of guillemots at risk of mortality following displacement from Neart na Gaoithe plus 2 km buffer in colony attendance period.

		Mortality (%)												
		0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Displacement level (%)	10%	5	14	27	55	82	109	137	164	192	219	246	274	
	20%	11	27	55	109	164	219	274	328	383	438	493	547	
	30%	16	41	82	164	246	328	411	493	575	657	739	821	
	40%	22	55	109	219	328	438	547	657	766	876	985	1,095	
	50%	27	68	137	274	411	547	684	821	958	1,095	1,232	1,369	
	60%	33	82	164	328	493	657	821	985	1,150	1,314	1,478	1,642	
	70%	38	96	192	383	575	766	958	1,150	1,341	1,533	1,724	1,916	
	80%	44	109	219	438	657	876	1,095	1,314	1,533	1,752	1,971	2,190	
	90%	49	123	246	493	739	985	1,232	1,478	1,724	1,971	2,217	2,463	
	100%	55	137	274	547	821	1,095	1,369	1,642	1,916	2,190	2,463	2,737	

\* Green Shading indicates displacement level assessed in HRA and 10% either side. 40% displacement and 10% Mortality are considered most likely displacement/mortality for HRA purposes.

- 267 Studies undertaken on guillemots breeding at Fowlsheugh in 2011 (Daunt, 2012b) indicate that although Neart na Gaoithe is within the reported mean maximum foraging range for guillemot (Thaxter *et al.*, 2012) no guillemots from this colony are predicted to occur within the offshore site (Figure 7.7). Mean maximum foraging range for guillemots from Fowlsheugh in 2011 was estimated at 12.2 km, with a maximum foraging range of 55.6 km. The majority of birds flew east from the colony. This is based on data extrapolated from a limited number of foraging observations in a single year and comprises only of birds foraging to and from the colony within a single day (Daunt *et al.*, 2011b). Therefore, although the data presents evidence of the lack of widespread usage by guillemots from Fowlsheugh within Neart na Gaoithe, it does not preclude them from occurring there.
- 268 Studies undertaken on guillemots at St Abb’s Head (part of the St. Abb’s Head to Fast Castle Head SPA) indicate that guillemots from this colony could occur within the Neart na Gaoithe offshore site (Figure 7.8) (Daunt *et al.* 2012b). Mean maximum foraging range for guillemots from St Abb’s Head in 2011 was estimated at 16.6 km, with a maximum foraging range of 55.0 km. The majority of birds flew north-east from the colony.
- 269 Buchan Ness to Collieston SPA is 113 km away and 29 km beyond the reported mean maximum foraging range and therefore guillemots from this SPA are not predicted to occur regularly within the offshore site during the colony attendance period.
- 270 No tagging studies have been undertaken on guillemots from the Farne Islands. However, observations of guillemots offshore that are carrying prey during the colony attendance period indicate that guillemots from the Farne Islands SPA occur less frequently over the Wee Bankie (to the east of Neart na Gaoithe) but occur regularly over the Marr Bank area to the north and are therefore less likely to occur in the Neart na Gaoithe offshore site (Camphuysen, Scott & Wanless, 2007).

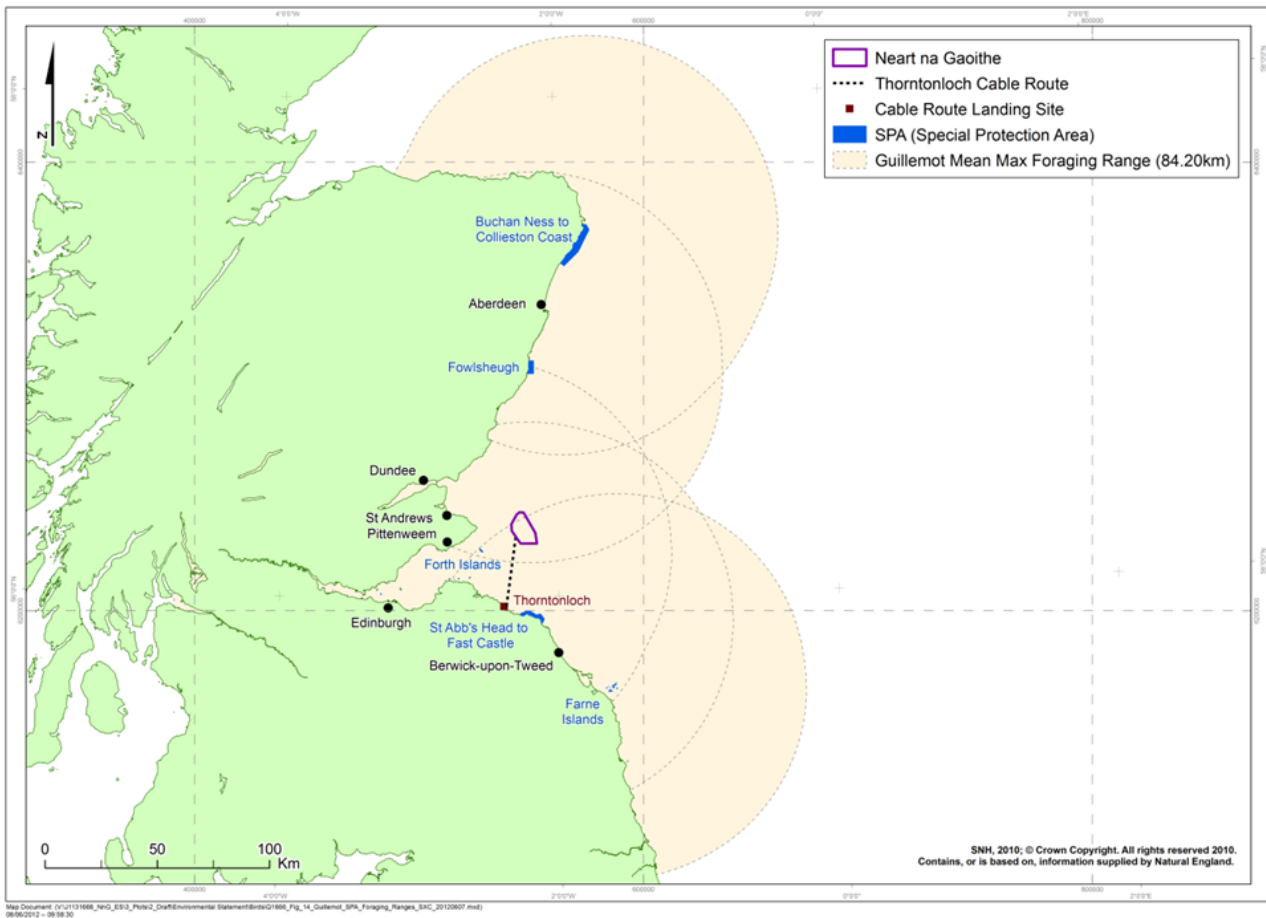


Figure 7.6: Guillemot mean maximum foraging range from breeding SPAs in relation to Neart na Gaoithe.

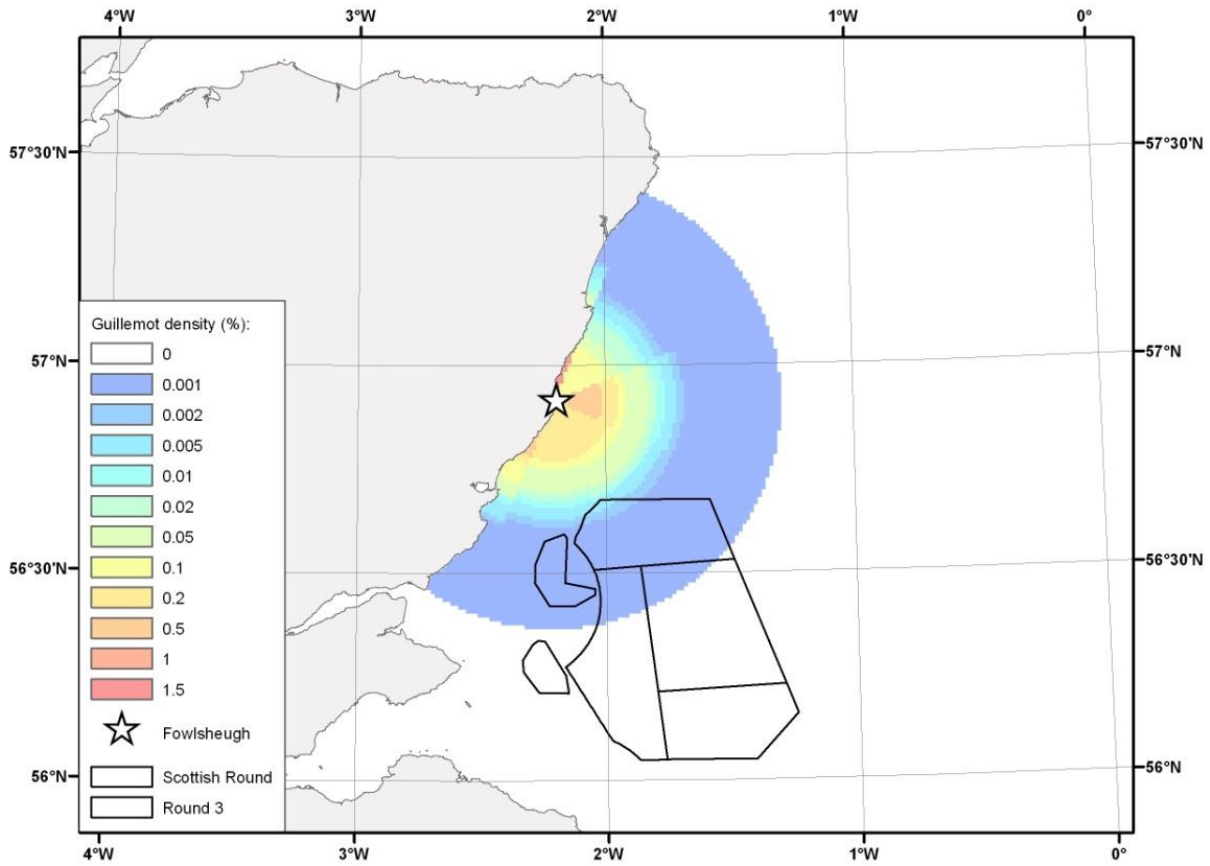


Figure 7.7: Guillemot distribution for Fowlsheugh determined from integrating trip durations with flight directions (Daunt *et al.*, 2011b).

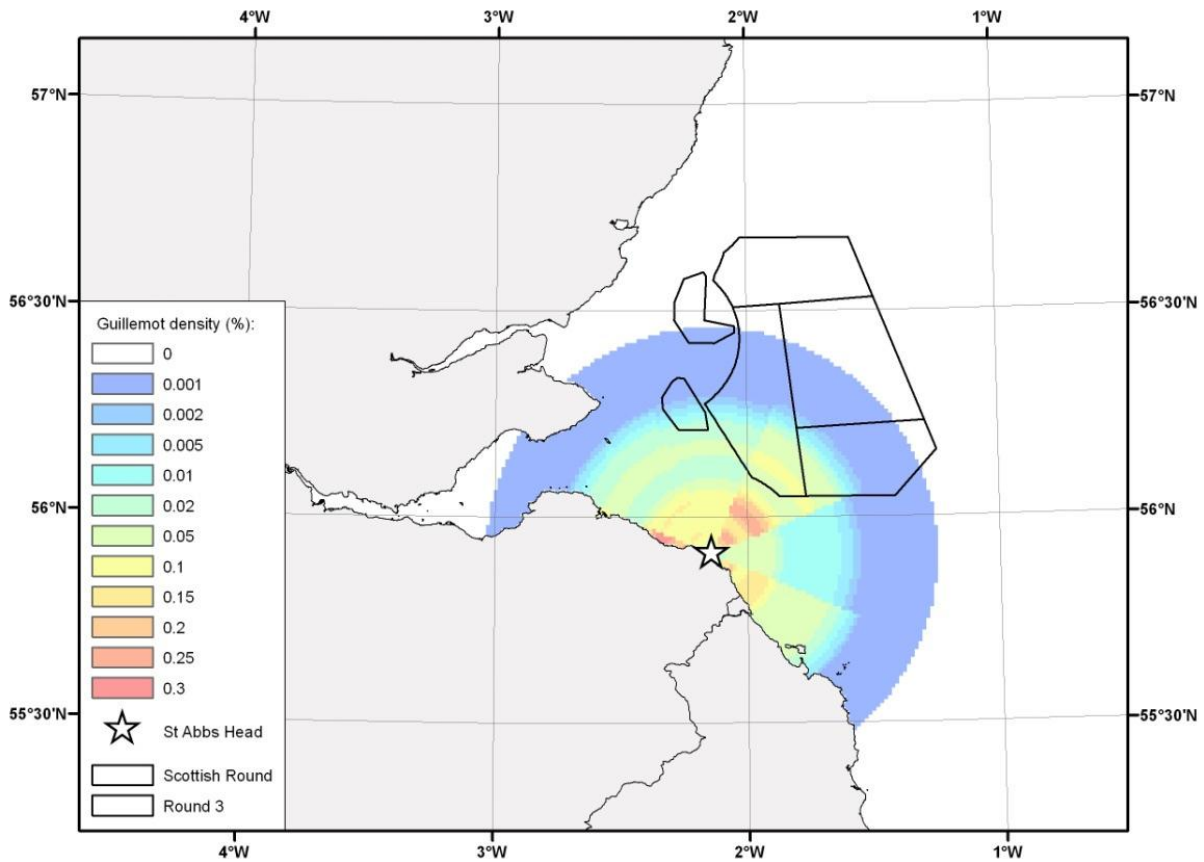


Figure 7.8: Guillemot distribution for St Abb’s determined from integrating trip durations with flight directions (Daunt *et al.*, 2011b).

271 Based on the above evidence obtained from tagging studies and visual observations, there are likely to be guillemots present within the Neart na Gaoithe offshore site during the colony attendance period from colonies aside from the Forth Islands SPA. The potential number of mortalities arising from displacement impacts can be apportioned between the colonies that are within the mean maximum foraging range of 82.4 km (or 134.3 km if mean maximum foraging range plus 1 standard deviation (SD) based on colony size and the distance from Neart na Gaoithe (Table 7.35).

Table 7.35: Possible number of adult guillemot fatalities arising from displacement impacts from Neart na Gaoithe across regional SPAs during the colony attendance period.

SPA colony	Guillemot			
	Potential number of fatalities = 76			
	SPA breeding population (individuals)	Distance from Neart na Gaoithe (km)	Possible number of fatalities	% of breeding Pop <sup>n</sup>
Forth Islands	22,553	16	46	0.2
St Abb’s Head	34,415	31	17	0.05
Fowlsheugh	44,920	62	8	0.01
Farne Islands	49,076	72	5	0.01
Buchan Ness to Collieston Coast	20,858	113	<1	<0.00



- 272 The results indicate that during the colony attendance period up to 46 adult guillemots may be impacted from displacement effects based on the peak mean numbers recorded within 2 km of the Neart na Gaoithe offshore site and a 10% rate of mortality.
- 273 The 2012 breeding population estimate for the Isle of May is 22,553 individuals (SMP, 2013) and the SPA is recognised to be in a favourable maintained status (SNH, 2013). The potential loss of 46 individuals is 0.2% of the SPA breeding population and will not cause an adverse effect.
- 274 The potential increase in mortality arising from displacement effects from Neart na Gaoithe on guillemots from Forth Islands SPA is 0.2% of the total breeding population. The level of impact predicted will not affect the conservation status of the species, nor the conservation objectives of the site and therefore there will be no adverse effect on the integrity of the SPA.

### 7.1.8.2 Cumulative and In-Combination Impact Assessment

#### 7.1.8.2.1 Displacement

- 275 The potential displacement of guillemots from other plans or projects may cause an in-combination impact.
- 276 During the colony attendance period, there are three projects that have the potential to cause an in-combination impact with Neart na Gaoithe:
- ICOL - offshore wind farm.
  - Seagreen Offshore wind farm Project Alpha;
  - Seagreen Offshore wind farm Project Bravo; and
- 277 In September 2012 Seagreen Alpha Wind Energy and Seagreen Bravo Wind Energy submitted an application for the construction of two offshore wind farms in the Firth of Forth Round 3 Zone. The Round 3 zone lies 53 km from the Forth Islands SPA.
- 278 Peak estimates occurred during the colony attendance period with highest counts and densities in Project Alpha during June with 5,502 individuals in 2010 and 10,811 in 2011 (peak mean of 8,156 individuals). In Project Bravo the peak number of guillemots also occurred during June 2011 with an estimated 10,569 individuals (no peak numbers for 2010 are presented in the ES and so calculating a peak mean is not possible for Project Bravo) (Seagreen, 2012).
- 279 Assuming that 30% of the population present are immature birds (Wanless *et al.*, 1998) then of the peak mean of 8,156 individuals at project Alpha 5,709 may be breeding adults and 7,398 at Project Bravo.
- 280 Based on the peak mean number of guillemots recorded within Seagreen Project Alpha development area and a potential impact of 40% displacement and 10% mortality an estimated 228 breeding guillemots may be impacted (Table 7.36).
- 281 Based on the peak estimated number of guillemots recorded within Seagreen Project Bravo development area, up to 296 guillemots may be impacted during the colony attendance period (Table 7.38) (Seagreen, 2012).
- 282 ICOL have not yet submitted their application. Unpublished, pre-application data supplied by the developer, reports a total displacement of 1,411 breeding adults from SPAs by the proposed ICOL development of which 208 are apportioned to the Forth Islands SPA (*pers. comm.*, ICOL, 2013).
- 283 The results indicate that, based on a 40% displacement level and a 10% mortality rate during the colony attendance period then of the 208 guillemots apportioned to the SPA, up to 8 adult guillemots may die due to displacement level impacts arising from the proposed ICOL development (Table 7.36).
- 284 In total across all four developments up to 609 guillemots may be impacted during the colony attendance period in-combination with other plans or projects (Table 7.36).
- 285 The locations of each of the projects are such that their potential impact on guillemots from the Forth Islands SPA will differ depending in part on their proximity to the SPA and the preferred foraging locations for guillemots associated with the SPA colonies. Those further away from the SPA e.g. Seagreen Projects Alpha and Bravo, may have a lower level of connectivity than those in closer proximity. Although this is not

always the case as birds may preferentially forage in areas further offshore than nearshore depending on food availability. For example, tagging studies indicate guillemots preferentially forage over the Wee Bankie than in adjacent waters to the west, which are closer to the breeding colonies (Daunt 2011a) (Figure 7.5).

- 286 The results of the tagging studies undertaken on guillemots from the Forth Islands SPA indicate that few, if any guillemots from the SPA use the Seagreen Project Alpha and Bravo wind farm offshore site (Figure 7.5) (Daunt *et al.*, 2011a).
- 287 Although, there is always the possibility that a few birds from the Forth Islands SPA may occur within the proposed Seagreen offshore sites, it is predicted that very few, if any of the possible mortalities from these two wind farms will be of guillemots from the Forth Islands SPA and there is very low risk of anything more than a negligible in-combination impact between Neart na Gaoithe and Seagreen Projects Alpha and Bravo. Seagreen Phase 1 HRA (Seagreen, 2013) confirms that there is low likelihood of guillemots from the Forth Islands SPA occurring within the proposed development sites of Projects Alpha and Bravo. Therefore no in-combination assessment with these projects and guillemots from the Forth Islands SPA is required.
- 288 The results from the tagging studies undertaken indicate that there is potential for some overlap with guillemots from the Forth Islands SPA and the proposed ICOL development; although the site is not identified as a core foraging area for them during the colony attendance period (Figure 7.5) (Daunt *et al.* 2011a). However, there is potential for variation in the distribution of guillemots across years and therefore some guillemots recorded within the proposed ICOL development area will likely be from the Forth Islands SPA.
- 289 Based on the information provided by ICOL (*pers. comm.*, ICOL, 2013) up to 208 guillemots from the Forth Islands SPA may be impacted by the proposed ICOL development and this total is the number used within the estimated number of fatalities from the proposed ICOL development presented in Table 7.36 from which it is estimated that eight guillemots may be lost from the Forth Islands SPA during the breeding period.
- 290 The loss of 8 guillemots per breeding period from the proposed ICOL development is 0.03 % of the breeding population.
- 291 Combining the estimated number of impacts arising from Neart na Gaoithe (46 individuals) and ICOL (8 individuals) proposed offshore wind farms, a total of 54 guillemots from the Forth Islands SPA may be impacted by displacement effects.
- 292 The 2012 breeding population estimate for the Forth Islands SPA is 22,553 individuals (SMP, 2013) and the SPA is recognised to be in a favourable maintained status (SNH, 2013). The potential in-combination loss of 54 individuals is 0.2% of the breeding population.
- 293 This is based on a worst-case scenario on peak mean populations out to 2 km from the offshore sites and a 10% rate of mortality to birds that are displaced for both Neart na Gaoithe and ICOL.
- 294 The potential increase in mortality arising from displacement effects from Neart na Gaoithe in-combination with other plans or projects on guillemots from Forth Islands SPA is predicted to be considerably lower than 10% of the total SPA breeding population and based on initial results from studies being undertaken to specifically assess impacts from displacement on guillemots from the Forth Islands (McDonald *et al.*, 2012), the possible mortality is likely to be less than 1%.
- 295 The level of impact predicted in-combination based on a 10% level of mortality will not affect the conservation status of the species, nor the conservation objectives of the site and therefore there will be no adverse effect on the integrity of the Forth Islands SPA from displacement impacts from guillemots.

Table 7.36: Cumulative levels of displacement and potential mortality on adult guillemot for four offshore wind farms within the Firth of Forth area.

Site		Mortality (%)													
		0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
Neart na Gaoithe	Displacement level (%)	0%													
		10%	4	10	19	38	57	77	96	115	134	153	172	192	
		20%	8	19	38	77	115	153	192	230	268	307	345	383	
		30%	11	29	57	115	172	230	287	345	402	460	517	575	
		40%	15	38	77	153	230	307	383	460	536	613	690	766	
		50%	19	48	96	192	287	383	479	575	671	766	862	958	
		60%	23	57	115	230	345	460	575	690	805	920	1,035	1,150	
		70%	27	67	134	268	402	536	671	805	939	1,073	1,207	1,341	
		80%	31	77	153	307	460	613	766	920	1,073	1,226	1,380	1,533	
		90%	34	86	172	345	517	690	862	1,035	1,207	1,380	1,552	1,724	
	100%	38	96	192	383	575	766	958	1,150	1,341	1,533	1,724	1,916		
Seagreen Project Alpha	Displacement level (%)	0%													
		10%	11	29	57	114	171	228	285	343	400	457	514	571	
		20%	23	57	114	228	343	457	571	685	799	913	1,028	1,142	
		30%	34	86	171	343	514	685	856	1,028	1,199	1,370	1,541	1,713	
		40%	46	114	228	457	685	913	1,142	1,370	1,599	1,827	2,055	2,284	
		50%	57	143	285	571	856	1,142	1,427	1,713	1,998	2,284	2,569	2,855	

Site		Mortality (%)												
		60%	69	171	343	685	1,028	1,370	1,713	2,055	2,398	2,740	3,083	3,425
		70%	80	200	400	799	1,199	1,599	1,998	2,398	2,797	3,197	3,597	3,996
		80%	91	228	457	913	1,370	1,827	2,284	2,740	3,197	3,654	4,110	4,567
		90%	103	257	514	1,028	1,541	2,055	2,569	3,083	3,597	4,110	4,624	5,138
		100%	114	285	571	1,142	1,713	2,284	2,855	3,425	3,996	4,567	5,138	5,709
Seagreen Project Bravo	Displacement level (%)	0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
		10%	15	37	74	148	222	296	370	444	518	592	666	740
		20%	30	74	148	296	444	592	740	888	1,036	1,184	1,332	1,480
		30%	44	111	222	444	666	888	1,110	1,332	1,554	1,776	1,997	2,219
		40%	59	148	296	592	888	1,184	1,480	1,776	2,071	2,367	2,663	2,959
		50%	74	185	370	740	1,110	1,480	1,850	2,219	2,589	2,959	3,329	3,699
		60%	89	222	444	888	1,332	1,776	2,219	2,663	3,107	3,551	3,995	4,439
		70%	104	259	518	1,036	1,554	2,071	2,589	3,107	3,625	4,143	4,661	5,179
		80%	118	296	592	1,184	1,776	2,367	2,959	3,551	4,143	4,735	5,327	5,918
		90%	133	333	666	1,332	1,997	2,663	3,329	3,995	4,661	5,327	5,992	6,658
ICOL	Displacement level (%)	0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
		10%	0	1	2	4	6	8	10	12	15	17	19	21

Site		Mortality (%)												
		20%	1	2	4	8	12	17	21	25	29	33	37	42
	30%	1	3	6	12	19	25	31	37	44	50	56	62	
	40%	2	4	8	17	25	33	42	50	58	67	75	83	
	50%	2	5	10	21	31	42	52	62	73	83	94	104	
	60%	2	6	12	25	37	50	62	75	87	100	112	125	
	70%	3	7	15	29	44	58	73	87	102	116	131	146	
	80%	3	8	17	33	50	67	83	100	116	133	150	166	
	90%	4	9	19	37	56	75	94	112	131	150	168	187	
	100%	4	10	21	42	62	83	104	125	146	166	187	208	

**Neart na Gaoithe = is an un-apportioned peak mean densities during colony attendance period from two year’s survey data for offshore site + 2 km buffer**

**Seagreen Project Alpha = is an un-apportioned peak mean estimate from two year’s data within project boundary areas (Source: Seagreen, 2012)**

**Seagreen Project Bravo = is an un-apportioned peak estimate from two year’s data within project boundary areas (Source: Seagreen, 2012)**

**ICOL = is Forth Islands specific as it is based on a total of 208 adult guillemots apportioned to Forth Islands SPA (Source: *pers. comm.*, ICOL, 2013)**

Green Shading indicates displacement level assessed in HRA and 10% either side. 40% displacement and 10% Mortality are considered most likely displacement/mortality for HRA purposes.

**7.1.9 Forth Islands SPA - Razorbill**

**7.1.9.1 Neart na Gaoithe Site Specific Assessment**

296 The Neart na Gaoithe HRA Screening Assessment, detailed in Annex A, has identified razorbills from the Forth Islands SPA as being a qualifying species at risk of a likely significant effect from displacement effects during the operational period of the wind farm but not from displacement effects during construction or decommissioning, nor barrier effects or collision mortality.

**7.1.9.1.1 Displacement**

297 Advice from SNH is that there will be a likely significant effect on razorbills from the Forth Islands SPA during the breeding period (SNH, 2012).

298 Results from site specific monitoring indicate that peak numbers of razorbills occurred during the post-breeding period, particularly between August and October with a peak estimate of 4,664 razorbills in October Year 1 surveys within the site and a 2 km buffer.

299 During the colony attendance period (April to June) the peak estimated number of razorbills in the offshore site during Year 1 occurred in June, with 44 birds in the offshore site and 65 birds in the offshore site and a 2 km buffer. In Year 2, estimated numbers of razorbills in the offshore site peaked in May with 364 birds and 472 birds when including a 2 km buffer. In Year 3, peak estimated numbers of razorbills in the offshore site peaked in May with an estimated 227 birds in the offshore site and 341 birds including a 2 km buffer.

300 The three year mean peak during the breeding period within the offshore site was 212 razorbills, this increased to 293 birds when including a 2 km buffer area (Table 7.37). It should be noted that this figure is conservative as 105 km<sup>2</sup> refers to the area of the Neart na Gaoithe agreement for lease as compared to the actual area used for turbines of 83 km<sup>2</sup> shown in Indicative Layout 3 (refer to Figure 5.1).

Table 7.37: Three-year mean peak estimated numbers of razorbills in the offshore site (plus 1 & 2 km buffer).

Data	Survey Area	At colony	Chicks at sea	Post-breeding	Non-breeding
3-year mean peak	Offshore site	212	1,103	1,359	227
	Offshore site + 1 km	237	1,771	1,967	365
	Offshore site + 2 km	293	2,299	2,946	384

301 Data from studies undertaken on razorbills estimate that during April, when birds first return to the colony and egg laying commences, few birds present in the colonies are immature. However, during the majority of the breeding period and when peak numbers occurred during the at colony period 30% of all razorbills present are immature birds and therefore not part of the SPA breeding population (Wanless *et al.*, 1998). Taking this into account then of the 3-year mean peak count of razorbills within the offshore and 2 km buffer of 293 birds, 205 will be adults and therefore part of the SPA population.

302 The maximum reported foraging range for razorbill during the colony attendance period is 90 km, although the mean maximum is 48.5 km and the mean foraging range 23.7 km (Thaxter *et al.*, 2012). Therefore, razorbills recorded within the Neart na Gaoithe offshore site during the breeding period are within the mean maximum reported foraging range for this species from the Forth Islands SPA.

303 Tagging studies on razorbills breeding on the Isle of May (part of Forth Islands SPA) has been undertaken over four years between 1987 and 2006 (Daunt *et al.*, 2010) and again in 2010 (Daunt *et al.*, 2011a). The results indicate that razorbills may forage predominantly north and east of the Isle of May. Foraging ranges may vary across years but the three years for which suitable data are available, the maximum foraging ranges recorded are similar: 50 km in 1999, 48 km in 2006 and 69 km in (Daunt *et al.*, 2010; Daunt *et al.*, 2011a). However, within the maximum foraging range there were differences in the distances razorbills

foraged with 20% of recorded locations within 20 km of the colony in 1999. 55% within 20 km of the colony in 2006 and 51% in 2010 (Daunt *et al.*, 2010; 2011a). Indicating that in 2006 and 2009 the majority of trips were within relatively nearshore waters compared to 1999. Data obtained in 2010 indicated the mean maximum foraging range of razorbill during the colony attendance period was 14 km ± 15 km with a maximum of 69 km (Daunt *et al.*, 2011a).

- 304 For the three years for which suitable data are available (1999, 2006 and 2010), the total overlap with Neart na Gaoithe (90% kernel) ranged from 0% and 5.2% (Table 7.38). In 2010, the total foraging area (90% kernel) range was 1,947 km<sup>2</sup>. There was no overlap with Neart na Gaoithe and the core area used by razorbills (50% kernel) nor the wider area based on (90% kernel) (Daunt *et al.*, 2011a) (Figure 7.9). The results indicate that the core areas for razorbill foraging are to the north and east of Neart na Gaoithe and the site is relatively little used for foraging compared to other areas.
- 305 The number of razorbills recorded crossing the site varies significantly across years with 85.7% of all trips crossing the site in 1999 and 6.4% in 2010 (Daunt *et al.*, 2011).

Table 7.38: Results from razorbill tracking studies from the Isle of May between 1999 and 2010.

Outputs from razorbill tracking studies	Year of tracking study		
	1999	2006	2010
Maximum foraging range (km)	50	48	69
% of overlap with Neart na Gaoithe based on 90% kernel range	4.2	5.2	0
% of tracking fixes within 20 km of breeding colony	20	55	51
% of trips crossing Neart na Gaoithe	85.7	14.0	6.4

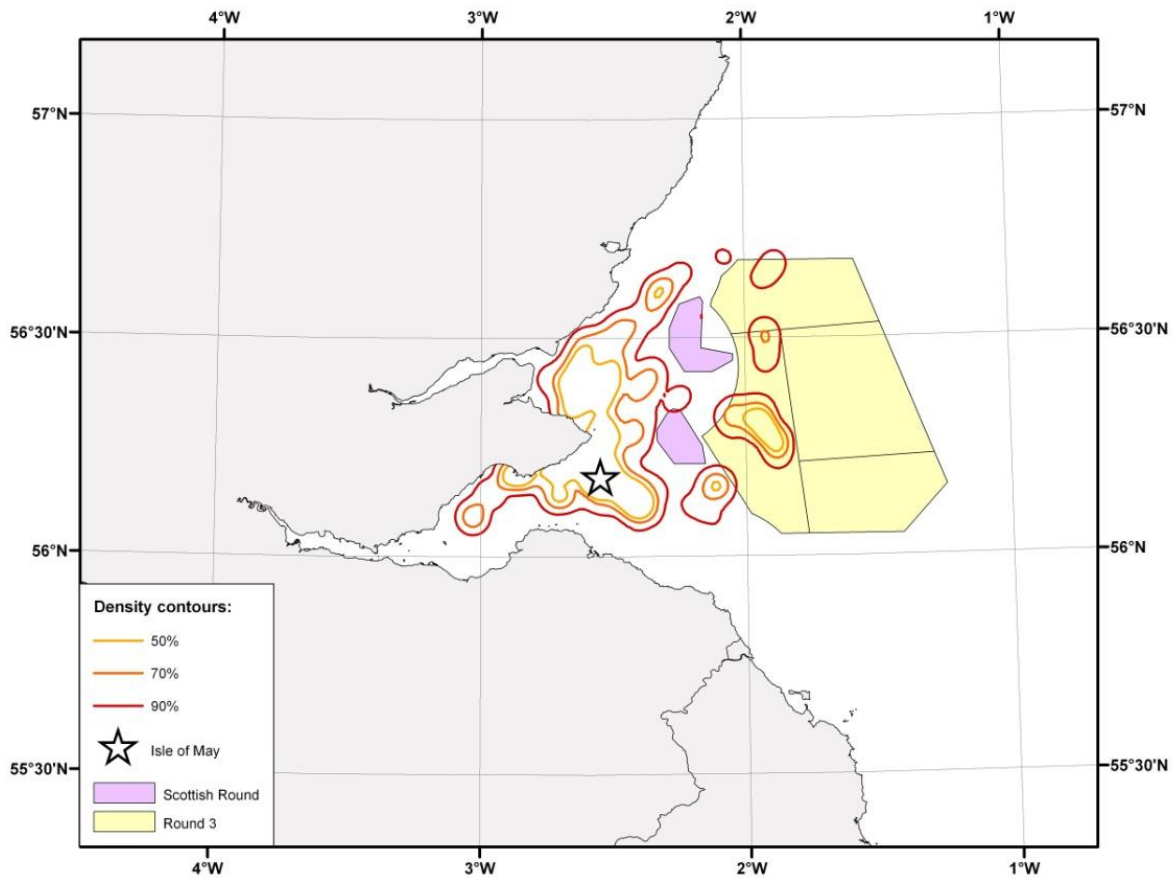


Figure 7.9: Kernel density distributions (50%, 70% and 90%) for razorbills from the Isle of May for non-flight and flight fixes in relation to three offshore wind farm offshore sites in the Firth of Forth (Daunt *et al.*, 2011a).

- 306 Post-construction monitoring undertaken at two Dutch offshore wind farms has indicated that displacement of razorbills can occur and that the level of displacement may differ depending on the density of turbines with no records of razorbills from within the Princess Amalia wind farm and partial displacement from within Egmond aan Zee, where turbine density was lower (Leopold *et al.*, 2011). The study concluded that the magnitude of the displacement effect for razorbills was less than 50%. Other studies at Arklow Bank, where large numbers of razorbills occur at a smaller wind farm, recorded razorbills within the wind farm area (Barton *et al.*, 2009).
- 307 Data based on a single year of post-construction monitoring undertaken at Robin Rigg indicates a decrease in the number of razorbills during construction period compared to pre-construction numbers and a slight increase during the post-construction, although numbers were still lower than prior to construction (Walls *et al.*, 2012).
- 308 Based on post-construction monitoring results, it is thought that displacement of razorbill may be less than 50% and a displacement level of around 40% may be a more realistic, but still precautionary estimate. For the purposes of this assessment it is assumed that up to 40% of razorbills may be displaced from an offshore wind farm.
- 309 There is little evidence of what the consequences of displacement on razorbills may be. Recent studies being developed using time/energy budgets of breeding guillemots (a similar Auk species to the razorbill) and the impacts of a proposed offshore wind farm indicate an increase in energy expenditure will occur should a wind farm impact on breeding birds by either displacing birds to other areas or increasing their flight demands (McDonald *et al.*, 2012).



- 310 If displacement does occur, there may be an increase in intra-specific competition or an increase in energetic expenditure but displacement will not necessarily cause an increase in mortality. It is possible that the effects of displacement will cause reduced breeding success for those individuals affected, which could have an overall effect on the breeding population (McDonald *et al.*, 2012). Therefore for the purposes of this HRA a potential mortality rate of 10% has been assumed during the colony attendance period however, the authors believe this is highly precautionary and conceivably unrealistic.
- 311 The results from the displacement assessment undertaken indicate that based on three years data and assuming a 40% displacement effect out to 2 km and a precautionary assumption of 10% mortality rate during the colony attendance period, a total of 8 adult razorbills may die due to being displaced during the breeding season (Table 7.39). The potential loss of up to 8 razorbills is 0.2% of the current breeding razorbill population of 3,704 individuals. This assumes that all razorbills impacted by displacement are from the one colony when in reality birds from other colonies, e.g. St Abb's Head are within the mean maximum foraging range of this species during the colony attendance period (Figure 7.10) and may therefore occur within the Neart na Gaoithe offshore site. It also assumes the area birds are displaced from is 105 km<sup>2</sup> as compared to the actual buildable area 83 km<sup>2</sup> shown in Indicative Layout 3.

Table 7.39: Estimated number of razorbills at risk of mortality following displacement from Neart na Gaoithe plus 2 km buffer in colony attendance period.

		Mortality (%)												
		0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Displacement level (%)	10%	0	1	2	4	6	8	10	12	14	16	18	21	
	20%	1	2	4	8	12	16	21	25	29	33	37	41	
	30%	1	3	6	12	18	25	31	37	43	49	55	62	
	40%	2	4	8	16	25	33	41	49	57	66	74	82	
	50%	2	5	10	21	31	41	51	62	72	82	92	103	
	60%	2	6	12	25	37	49	62	74	86	98	111	123	
	70%	3	7	14	29	43	57	72	86	100	115	129	144	
	80%	3	8	16	33	49	66	82	98	115	131	148	164	
	90%	4	9	18	37	55	74	92	111	129	148	166	185	
	100%	4	10	21	41	62	82	103	123	144	164	185	205	

\* Green Shading indicates displacement level assessed in HRA and 10% either side. 40% displacement and 10% Mortality are considered most likely displacement/mortality for HRA purposes.

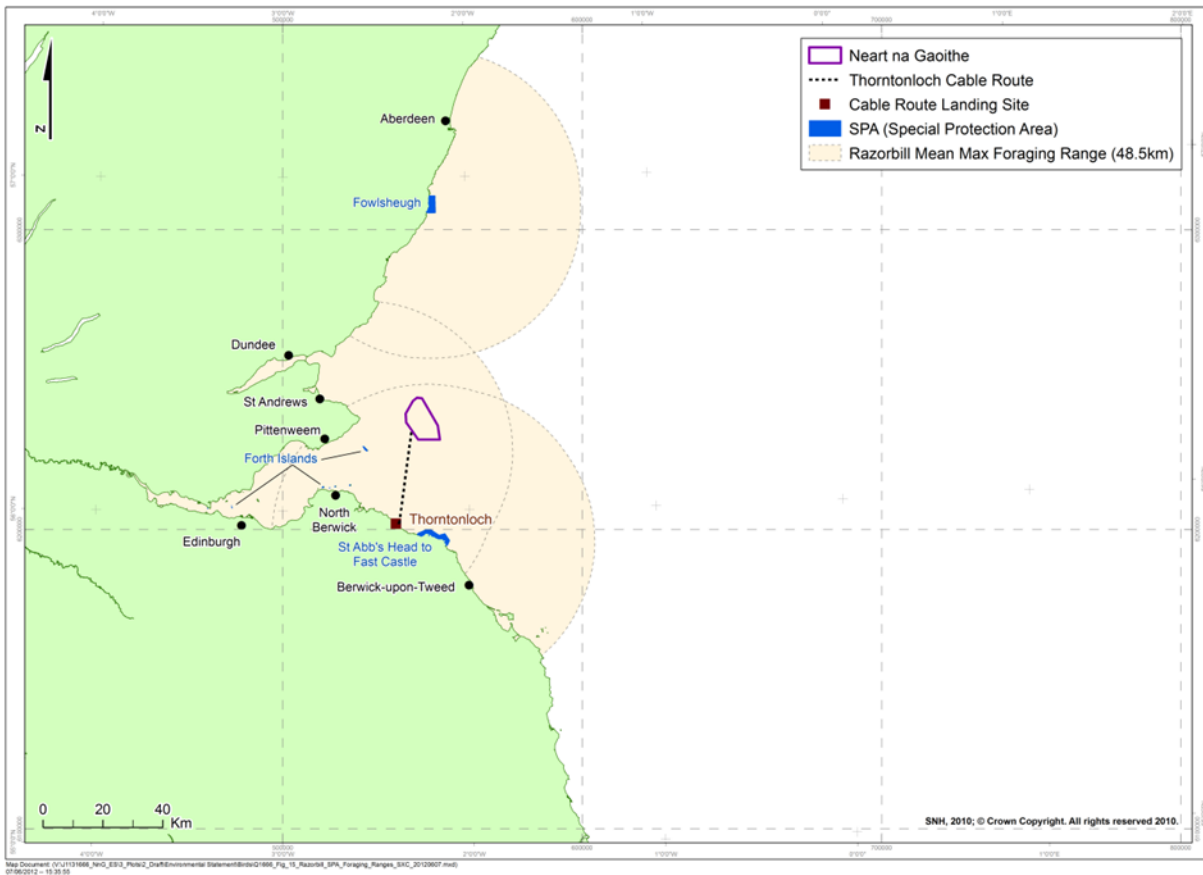


Figure 7.10: Razorbill mean maximum foraging range from breeding SPAs in relation to Neart na Gaoithe.

- 312 No tagging studies have been undertaken on razorbills from the St Abb’s Head to Fast Castle SPA and colony specific data are not available to identify where razorbills from the breeding colonies at St Abb’s forage. St Abb’s Head to Fast Castle SPA lies 31 km to the south of Neart na Gaoithe and therefore within the mean maximum foraging range for razorbill and there are likely to be razorbills present within the Neart na Gaoithe offshore site during the colony attendance period from St Abb’s Head to Fast Castle SPA.
- 313 No tagging studies have been undertaken on razorbills from Fowlsheugh SPA. However, the site is 62 km from Neart na Gaoithe and beyond the mean maximum foraging of 48.5 km for this species (Figure 7.10). It is within the mean maximum foraging range (+1 SD) of 83.5 km. Therefore, there will be few, if any, razorbills from Fowlsheugh in the offshore site during the breeding period and no impacts on this colony are predicted to occur.
- 314 The potential number of mortalities arising from displacement impacts can be apportioned between colonies that are within the mean maximum foraging range (plus Fowlsheugh) based on colony size and the distance from Neart na Gaoithe (Table 7.40).

Table 7.40: Possible number of razorbill fatalities arising from displacement impacts from Neart na Gaoithe across regional SPAs within the mean maximum foraging range during the colony attendance period.

SPA colony	Razorbill			
	Potential number of fatalities = 8			
	SPA breeding population (individuals)	Distance from Neart na Gaoithe (km)	Possible number of fatalities	% of breeding Pop <sup>n</sup>
Forth Islands	3,704	16	7	0.2
St Abb's Head to Fast Castle	2,406	31	1	0.04
Fowlsheugh	5,260	64	<1	0.01

315 The results indicate that during the colony attendance period up to 7 razorbills may be impacted from displacement effects based on the peak mean numbers recorded within 2 km of the Neart na Gaoithe offshore site and a 10% rate of mortality.

316 The 2012 razorbill breeding population estimate for the Isle of May was 3,740 individuals (SMP, 2013) and the SPA is recognised to be in a favourable maintained status (SNH, 2013). The potential loss of 7 individuals is 0.2% of the SPA breeding population.

317 The potential increase in mortality arising from displacement effects from Neart na Gaoithe on razorbills from Forth Islands SPA is 0.2% of the total breeding population. This is based on a highly precautionary impact of 10% mortality. The preliminary results from displacement modelling indicates a negligible, if any, mortality from displacement to the similar guillemot (McDonald *et al.*, 2012). The level of impact predicted will not adversely affect the integrity of the Forth Islands SPA, in light of the qualifying interest, their condition and the sites conservation objectives.

### 7.1.9.2 Cumulative and In-Combination Impact Assessment

#### 7.1.9.2.1 Displacement

318 The potential displacement effect on razorbills in-combination with other plans or projects is higher than with Neart na Gaoithe alone

319 During the colony attendance period, there are three projects that have the potential to cause an in-combination impact with Neart na Gaoithe:

- ICOL - offshore wind farm.
- Seagreen Offshore wind farm Project Alpha; and
- Seagreen Offshore wind farm Project Bravo;

320 Data on the number of displacement of razorbills arising from the Seagreen Projects Alpha and Bravo offshore wind farms are presented within the applicant's Environmental Statement (Seagreen, 2012) and HRA (Seagreen, 2013). The proposed Seagreen Round 3 Zone development comprises of a three phase programme of six separate developments. Projects Alpha and Bravo are the first developments and the only Seagreen projects for which applications have been made.

321 The Seagreen HRA Assessment (Seagreen, 2013) apportions the number of adult razorbills during the breeding period across SPAs for which razorbill is a qualifying species and within the mean maximum foraging range (+1SD). The results of the assessment indicate that up to 59 razorbills at risk of potential impact from Seagreen Project Alpha will be from the Forth Islands SPA. Similarly, 17 razorbills potentially impacted by Seagreen Project Bravo will be from the Forth Islands SPA (Seagreen 2013). (Refer to Table 7.44)

322 Assuming that there is a 40% displacement level and a 10% mortality during the colony attendance period then up to two razorbills may die due to displacement level impacts arising from the Seagreen Project Alpha offshore wind farm (Table Table 7.41 and Table 7.44).

Table 7.41: Estimated number of razorbill fatalities arising from displacement effects from the proposed Seagreen Project Alpha wind farm across regional SPAs.

SPA colony	Razorbill			
	Potential number of fatalities = 30			
	SPA breeding population (individuals)	Distance from Project Alpha (km)	Possible number of fatalities	% of breeding Pop <sup>n</sup>
Forth Islands	3,740	53	2	0.05
Fowlsheugh	5,800	29	23	0.4
St Abb's Head to Fast Castle	2,406	68	5	0.2

Note – Seagreen Project Alpha is marginally beyond the mean maximum foraging range of 48.5 km for razorbills breeding at Forth Islands SPA and St Abb's Head to Fast Castle SPA.

323 Assuming there is a 40% displacement level and a 10% mortality rate during the colony attendance period then up to one razorbill may die due to displacement level impacts arising from the Seagreen Project Bravo offshore wind farm (Table 7.42 and Table 7.44).

Table 7.42: Estimated number of razorbill fatalities arising from displacement effects from the proposed Seagreen Project Bravo wind farm across regional SPAs.

SPA colony	Razorbill			
	Potential number of fatalities = 9			
	SPA breeding population (individuals)	Estimated distance from Project Bravo (km)	Possible number of fatalities	% of breeding Pop <sup>n</sup>
Forth Islands	3,740	53	1	0.02
Fowlsheugh	5,800	29	7	0.1
St Abb's Head to Fast Castle	2,406	68	1	0.04

Note – Seagreen Project Bravo is marginally beyond the mean maximum foraging range of 48.5 km for razorbills breeding at Forth Islands SPA and St Abb's Head to Fast Castle SPA.

324 ICOL have not yet submitted their application. However, alongside the Inch Cape Offshore Wind Farm First Annual Ornithological Report (*pers. comm.*, ICOL, 2012) ICOL have also supplied updated ornithological data for key species (*pers. comm.*, ICOL, 2013).

325 ICOL have provided unpublished data on the predicted number of adult razorbills being displaced by the proposed ICOL development (*pers. comm.*, ICOL, 2013). Of the 295 adult razorbills estimated to be displaced during the breeding period 70 may be from the Forth Islands SPA.

326 The results indicate that based on a 40% displacement level and a 10% mortality rate during the colony attendance period then of the 70 razorbills estimated to be displaced by the proposed ICOL development during the breeding period up to three razorbills may die due to displacement level impacts arising from the proposed ICOL development (Table 7.43 and Table 7.44).

327 In total up to 13 razorbills (7 from NNG, 2 from Seagreen Project Alpha, 1 from Seagreen Project Bravo and 3 from ICOL) may be impacted during the colony attendance period in-combination with other plans or projects (Table 7.44).

Table 7.43: Estimated number of razorbill fatalities arising from displacement effects from the proposed ICOL developemnt across regional SPAs.

SPA colony	Razorbill			
	Potential number of fatalities = 13			
	SPA breeding population (individuals)	Estimated distance from ICOL (km)	Possible number of fatalities	% of breeding Pop <sup>n</sup>
Forth Islands	3,740	31	3	0.08
Fowlsheugh	5,800	33	9	0.1
St Abb's Head to Fast Castle	2,406	54	1	0.04

Note – ICOL is marginally beyond the mean maximum foraging range of 48.5 km for razorbills breeding at St Abb's Head to Fast Castle SPA.

328 Combining the estimated number of impacts arising from Neart na Gaoithe and the three other proposed offshore wind farms, a total of 13 razorbills from the Forth Islands SPA may be impacted by displacement effects during the colony attendance period.

329 The 2012 razorbill breeding population estimate for the Forth Islands SPA was 3,704 individuals (SMP, 2013) and the SPA is recognised to be in a favourable maintained status (SNH, 2013). The potential loss of 13 individuals during the colony attendance period is 0.35% of the breeding population.

330 The assessment is based on a worst-case scenario on peak mean populations from the offshore sites and a 10% rate of mortality to birds that are displaced (refer to Table 7.44). This assumption is considered highly precautionary and based on the preliminary studies undertaken (McDonald *et al.*, 2012) the level of impact that might cause a mortality effect is likely to be less than 1%. On this basis no more than 2 razorbill fatalities per breeding period may occur from displacement effects. This is 0.05% of the breeding population.

331 The potential mortality likely to arise from displacement effects from Neart na Gaoithe in-combination with other plans or projects on razorbills from Forth Islands SPA is predicted to be considerably lower than 0.3% of the breeding population and preliminary evidence suggest less than 0.05% of the breeding population may be impacted. The level of impact predicted will not affect the conservation status of the species, nor the conservation objectives of the site and therefore there will be no adverse effect on the integrity of the Forth Islands SPA from displacement impacts of razorbills.

Table 7.44: Possible levels of displacement on adult razorbills during breeding period and potential mortality for four offshore wind farms within the Firth of Forth area.

Site		Mortality (%)												
Neart na Gaoithe	Displacement level (%)	0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
		10%	0	1	2	4	6	8	10	12	14	16	18	21
		20%	1	2	4	8	12	16	21	25	29	33	37	41
		30%	1	3	6	12	18	25	31	37	43	49	55	62
		40%	2	4	7	16	25	33	41	49	57	66	74	82
		50%	2	5	10	21	31	41	51	62	72	82	92	103
		60%	2	6	12	25	37	49	62	74	86	98	111	123
		70%	3	7	14	29	43	57	72	86	100	115	129	144
		80%	3	8	16	33	49	66	82	98	115	131	148	164
		90%	4	9	18	37	55	74	92	111	129	148	166	185
		100%	4	10	21	41	62	82	103	123	144	164	185	205
Seagreen Project Alpha	Displacement level (%)	0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
		10%	0	0	1	1	2	2	3	4	4	5	5	6
		20%	0	1	1	2	4	5	6	7	8	9	11	12
		30%	0	1	2	4	5	7	9	11	12	14	16	18
		40%	0	1	2	5	7	9	12	14	17	19	21	24
		50%	1	1	3	6	9	12	15	18	21	24	27	30

Site		Mortality (%)												
		60%	1	2	4	7	11	14	18	21	25	28	32	35
		70%	1	2	4	8	12	17	21	25	29	33	37	41
		80%	1	2	5	9	14	19	24	28	33	38	42	47
		90%	1	3	5	11	16	21	27	32	37	42	48	53
		100%	1	3	6	12	18	24	30	35	41	47	53	59
Seagreen Project Bravo	Displacement level (%)	0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
		10%	0	0	0	0	1	1	1	1	1	1	2	2
		20%	0	0	0	1	1	1	2	2	2	3	3	3
		30%	0	0	1	1	2	2	3	3	4	4	5	5
		40%	0	0	1	1	2	3	3	4	5	5	6	7
		50%	0	0	1	2	3	3	4	5	6	7	8	9
		60%	0	1	1	2	3	4	5	6	7	8	9	10
		70%	0	1	1	2	4	5	6	7	8	10	11	12
		80%	0	1	1	3	4	5	7	8	10	11	12	14
		90%	0	1	2	3	5	6	8	9	11	12	14	15
		100%	0	1	2	3	5	7	9	10	12	14	15	17
ICOL	Displacement level (%)	0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
		10%	0	0	1	1	2	3	4	4	5	6	6	7

Site	Mortality (%)													
	20%	0	1	1	3	4	6	7	8	10	11	13	14	
	30%	0	1	2	4	6	8	11	13	15	17	19	21	
	40%	1	1	3	6	8	11	14	17	20	22	25	28	
	50%	1	2	4	7	11	14	18	21	25	28	32	35	
	60%	1	2	4	8	13	17	21	25	29	34	38	42	
	70%	1	2	5	10	15	20	25	29	34	39	44	49	
	80%	1	3	6	11	17	22	28	34	39	45	50	56	
	90%	1	3	6	13	19	25	32	38	44	50	57	63	
	100%	1	4	7	14	21	28	35	42	49	56	63	70	

Neart na Gaoithe = peak mean densities during colony attendance period from two year's survey data for offshore site + 2 km buffer  
 Seagreen Project Alpha and Bravo = Peak estimate from two years within project boundary areas (Source: Seagreen 2012)  
 ICOL = Data provided by ICOL report 70 affected razorbills from Forth Islands SPA (Source: *pers. comm.*, ICOL, 2013)

\* Green Shading indicates displacement level assessed in HRA and 10% either side. 40% displacement and 10% Mortality are considered most likely displacement/mortality for HRA purposes



### 7.1.10 Forth Islands SPA – Puffin

#### 7.1.10.1 Neart na Gaoithe Site Specific Assessment

332 The Neart na Gaoithe HRA Screening Assessment, detailed in Annex A, has identified puffins from the Forth Islands SPA as being a qualifying species at risk of a likely significant effect from displacement effects during the operational period of the wind farm but not from displacement effects during construction or decommissioning, nor barrier effects or collision mortality.

##### 7.1.10.1.1 Displacement

333 Advice from SNH is that there will be a likely significant effect on puffins from the Forth Islands SPA during the breeding period (SNH, 2012).

334 Results from site specific monitoring indicate that peak numbers of puffins occurred during the breeding period (April to August). In Year 1 surveys peak estimates of puffin occurred in August with 3,507 in the offshore site and 15,016 in the offshore site and 2 km buffer. In Year 2 surveys, peak numbers occurred in July with 2,481 puffins in the offshore site and 3,288 including a 2 km buffer area. Year 3 surveys recorded peak numbers in April with 3,719 birds estimated in the offshore site and a total of 6,175 including the 2 km buffer.

335 The three year mean peak during the breeding period within the offshore site was 3,267 puffins, this increased to 8,624 birds when including a 2 km buffer area (Table 7.45).

Table 7.45: Three-year mean peak estimated numbers of puffins in the offshore site (plus 1 & 2 km buffer).

		Breeding	Post-breeding	Non-breeding
<b>3-year mean peak</b>	Offshore site	3,267	1,511	404
	Offshore site + 1 km	5,007	2,313	573
	Offshore site + 2 km	8,624	3,614	796

336 During the colony attendance period the proportion of immature birds present within the population attending the colony varies with few immature birds present during April but with increasing numbers during May and June. An estimated 30% of the population present during this period are immature birds (Wanless *et al.*, 1998). Based on this assumption, then the peak mean number of adult puffins present in the offshore site plus 2 km buffer was 6,037 individuals. This is also a conservative assessment of numbers as the actual area used for turbines of 83 km<sup>2</sup> shown in Indicative Layout 3 as opposed to the Neart na Gaoithe agreement for lease area of the proposed offshore wind farm of 105 km<sup>2</sup> used here.

337 The maximum reported foraging range for puffin during the breeding period is 200 km, although the mean maximum is 105.4 km and the mean foraging range 4 km (Thaxter *et al.*, 2012). Therefore, puffins recorded within the Neart na Gaoithe offshore site during the breeding season are within the mean maximum reported foraging range for this species from the Forth Islands SPA.

338 Tagging studies on puffins breeding on the Isle of May (part of Forth Islands SPA) has been undertaken on a limited number of puffins and of the ten that have been tagged, data are available from only seven birds. The results indicate that puffins range widely over the Firth of Forth including Neart na Gaoithe.

339 Elsewhere tagging studies have been undertaken on the Farne Islands where data from twelve tagged puffins indicate that the majority of the foraging trips occur within approximately 30 km of the colony, foraging extensively over the Farne Deep (BBC, 2013).

- 340 There is very little post-construction monitoring data from wind farms where puffins occur. Few studies have recorded many puffins and those that have, have not recorded them in sufficient numbers to draw any conclusions as to whether or not puffins may be displaced by operating wind farms.
- 341 Based on post-construction monitoring results from other Auk species, it is thought that displacement may be less than 50% and a displacement level of around 40% may be more realistic. For the purposes of this assessment it is presumed that up to 40% of puffins may be displaced from an offshore wind farm, consistent with other Auk species.
- 342 There is no evidence of what the consequences of displacement on puffins may be. Recent studies being developed using time/energy budgets of breeding guillemots (another Auk species) and the impacts of a proposed offshore wind farm, indicate an increase in energy expenditure will occur should a wind farm impact on breeding birds by either displacing birds to other areas or increasing their flight demands (McDonald *et al.*, 2012).
- 343 If displacement does occur, there may be an increase in intra-specific competition or an increase in energetic expenditure but displacement will not necessarily cause an increase in mortality. It is possible that the effects of displacement will cause reduced breeding success for those individuals affected, which could have an overall effect on the breeding population (McDonald *et al.*, 2012). Puffins have extensive foraging ranges during the breeding period and therefore are potentially capable of finding alternative areas to forage within their extensive foraging areas should displacement occur. Therefore, a potential mortality rate of 10% during the colony attendance period has been assumed for the HRA however, the authors predict this to be precautionary and conceivably unrealistic.
- 344 The results from the displacement assessment undertaken indicate that based on three years data and assuming a 40% displacement effect out to 2 km and an assumption of 10% mortality rate during the breeding period, a total of 241 adult puffins may die due to being displaced during the breeding season (Table 7.46). The potential loss of up to 241 puffins is 0.2% of the current breeding puffin population of 124,334 individuals (62,167 pairs, 2009 count). This assumes that all puffins impacted by displacement are from the one colony when in reality birds from other colonies, e.g. the Farne Islands are within the mean maximum foraging range of this species during the colony attendance period (Figure 7.11) and may, in theory, occur within the Neart na Gaoithe offshore site.

Table 7.46: Estimated number of adult puffins at risk of mortality following displacement from Neart na Gaoithe plus 2 km buffer in breeding period (April to August).

		Mortality (%)												
		0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Displacement level (%)	10%	12	30	60	121	181	241	302	362	423	483	543	604	
	20%	24	60	121	241	362	483	604	724	845	966	1,087	1,207	
	30%	36	91	181	362	543	724	906	1,087	1,268	1,449	1,630	1,811	
	40%	48	121	<b>241</b>	483	724	966	1,207	1,449	1,690	1,932	2,173	2,415	
	50%	60	151	302	604	906	1,207	1,509	1,811	2,113	2,415	2,717	3,019	
	60%	72	181	362	724	1,087	1,449	1,811	2,173	2,536	2,898	3,260	3,622	
	70%	85	211	423	845	1,268	1,690	2,113	2,536	2,958	3,381	3,803	4,226	
	80%	97	241	483	966	1,449	1,932	2,415	2,898	3,381	3,864	4,347	4,830	
	90%	109	272	543	1,087	1,630	2,173	2,717	3,260	3,803	4,347	4,890	5,433	
	100%	121	302	604	1,207	1,811	2,415	3,019	3,622	4,226	4,830	5,433	6,037	

\* Green Shading indicates displacement level assessed in HRA and 10% either side. 40% displacement and 10% Mortality are considered most likely displacement/mortality for HRA purposes.

- 345 Tagging studies undertaken on puffins from the Farne Islands SPA indicate that puffins forage mainly within 30 km of the colony (BBC, 2013). The number of birds tagged is relatively small and the results are based on data obtained over a single breeding season and therefore there may be a large inter-annual variation in foraging ranges, as there is with other Auk species, which have not been detected. Although, puffins from the Farne Islands could forage within Neart na Gaoithe, the evidence suggests that it will not be a core foraging area and the majority of puffins predicted to be impacted will be from the Forth Islands SPA. Consequently, no apportioning of impacts between the two SPA colonies has been undertaken for this assessment.
- 346 The 2009 puffin breeding population estimate for the Forth Islands SPA was 124,334 individuals (SMP, 2013) and the puffin is recognised to be in a favourable maintained status (SNH, 2013). The potential loss of 241 individuals is 0.2% of the SPA breeding population.
- 347 The potential increase in mortality arising from displacement effects from Neart na Gaoithe on puffins from Forth Islands SPA is 0.2% of the total breeding population. This is based on there being 10% mortality of birds displaced, which for a species with a large foraging area is considered precautionary. The level of impact predicted will not adversely affect the integrity of the Forth Islands SPA, in light of the qualifying interest, their condition and the sites conservation objectives.

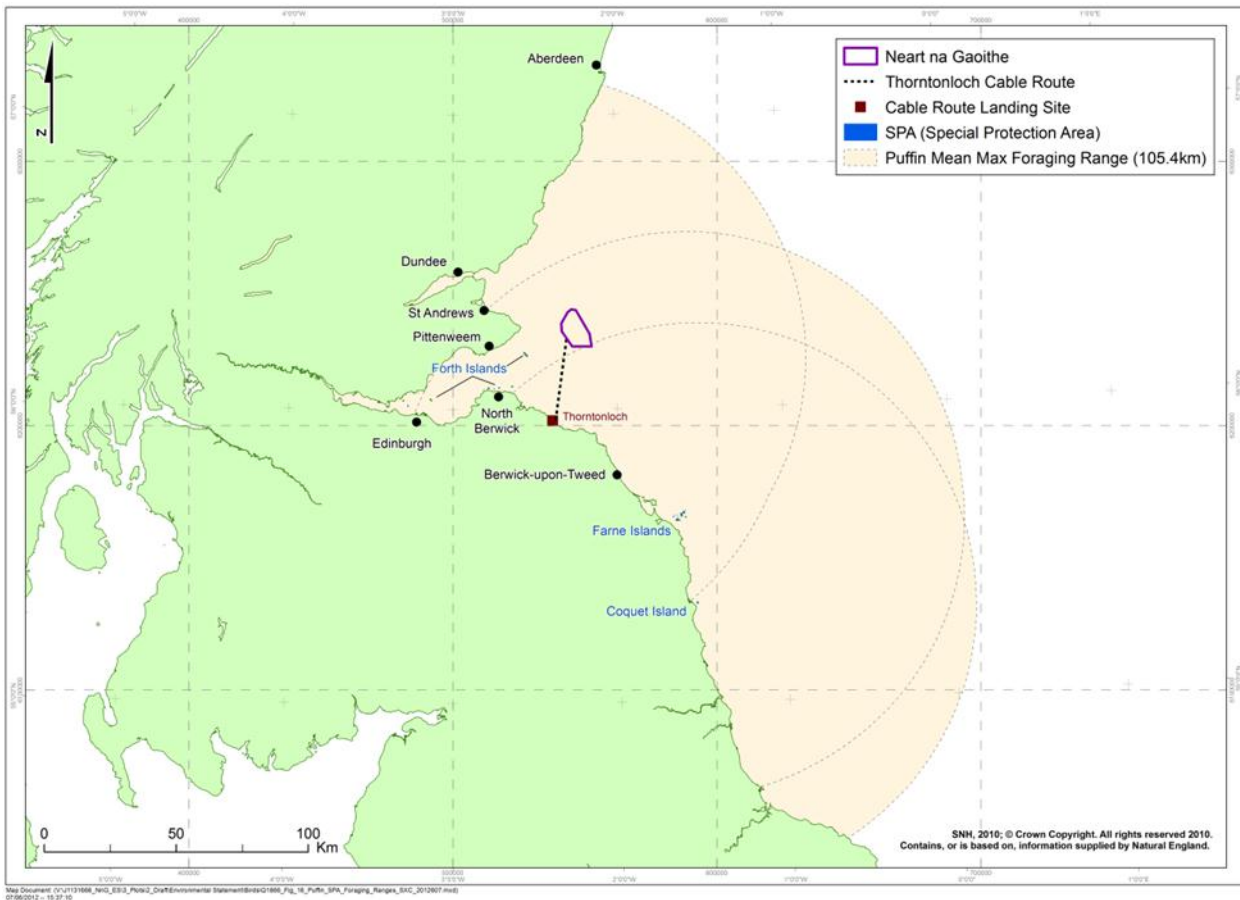


Figure 7.11: Puffin mean maximum foraging range from breeding SPAs in relation to Neart na Gaoithe.

### 7.1.10.2 Cumulative and In-Combination Impact Assessment

#### 7.1.10.2.1 Displacement

- 348 The potential displacement of puffins from other plans or projects may cause an in-combination impact.
- 349 Projects identified during consultation and the undertaking of the EIA for which there is a potential for an in-combination collision risk impact during the breeding period are:
- ICOL - offshore wind farm;
  - Seagreen Project Alpha offshore wind farm; and
  - Seagreen Project Bravo offshore wind farm.
- 350 Data on the number of predicted collisions arising from the Seagreen Projects Alpha and Bravo offshore wind farms are presented within the applicant’s Environmental Statement (Seagreen, 2012) and HRA (Seagreen, 2013). The proposed Seagreen Round 3 Zone development comprises of a three phase programme of six separate developments. Projects Alpha and Bravo are the first developments and the only Seagreen projects for which applications have been made.
- 351 Site-specific surveys undertaken for Seagreen Project Alpha recorded peak numbers of puffins during the breeding period with a peak 2,787 individuals, of which 1,967 were aged as adults (Seagreen, 2013).
- 352 The results indicate that, based on a 40% displacement level and a 10% mortality rate during the breeding period, then up to 79 adult puffins may die due to displacement level impacts arising from the Seagreen Project Alpha offshore wind farm (Table 7.50).

- 353 Peak numbers of puffins within the Project Bravo study area also occurred during breeding period but in higher numbers compared to Project Alpha with 5,439 individuals, of which 3,411 were considered to be adults (Seagreen, 2013).
- 354 The results indicate that based on a 40% displacement level and a 10% mortality rate during the colony attendance period then up to 136 adult puffins may die due to displacement level impacts arising from the Seagreen Project Bravo offshore wind farm (Table 7.47).
- 355 ICOL have not yet submitted their application however, they have provided provisional information (*pers. comm.*, ICOL, 2013). The results indicate that up to 1,292 adult puffins from the Forth Islands SPA may be displaced.
- 356 Based on the peak number of puffins recorded and a 40% displacement level with a 10% mortality rate during the colony attendance period then up to 52 adult puffins may die due to displacement level impacts arising from the proposed ICOL development (Table 7.47).
- 357 In total up to 508 puffins may be impacted during the colony attendance period in-combination with other plans or projects (Table 7.47).
- 358 The locations of each of the projects are such that their potential impact on puffins from the Forth Islands SPA will differ depending in part on their proximity to the SPA and the preferred foraging locations for puffins associated with the SPA colony. Those further away from the SPA, e.g. Seagreen Projects Alpha and Bravo, may have a lower level of connectivity than those in closer proximity. Although this is not always the case as birds may preferentially forage in areas further offshore than nearshore depending food availability and there may be inter-annual variations meaning that some years the proportion of birds at each site will differ between years.
- 359 Aside from the breeding puffins within the Forth Islands SPA, there are few other colonies within the mean maximum foraging range of 105.4 km from which puffins are predicted to occur. As previously discussed, evidence from tagged puffins at the Farne Islands suggests that birds from the colony will not regularly occur within the area. Further south, Coquet Island has a large breeding colony of 15,800 pairs but as 106 km is at the cusp of the mean maximum foraging range for puffin, it is predicted that birds from this colony will be unlikely to occur regularly in the area. There are small numbers breeding at St Abb's Head (4 individuals in 2012; NTS, 2013) and at Fowlsheugh (30 individuals in 2006). Therefore, a very significant majority of puffins will be from the Forth Islands SPA.
- 360 Assuming that all 508 adult puffins predicted to be impacted by displacement by the four proposed developments during the breeding period are from the Forth Islands SPA then 0.4% of the population may be impacted.
- 361 The puffin breeding population for the Forth Islands SPA is 124,344 individuals (SMP, 2013) and the SPA puffin population is recognised to be in a favourable maintained status (SNH, 2013). The estimated loss of 508 individuals during the breeding period is 0.4% of the breeding population.
- 362 The assessment is based on a worst-case scenario using peak mean populations from the offshore sites and an assumption that 10% of those displaced will die. As puffins may have a large foraging area, the proportion of the area lost to puffins from displacement is predicted to be relatively small and so the assumption that up to 10% of birds displaced die is considered highly precautionary.
- 363 The potential increase in mortality likely to arise from displacement effects from Neart na Gaoithe in-combination with other plans or projects on puffins from Forth Islands SPA is predicted to be considerably lower than 0.4% of the total SPA breeding population. The level of impact predicted will not affect the conservation status of the species, nor the conservation objectives of the site and therefore there will be no adverse effect on the integrity of the Forth Islands SPA from displacement impacts on puffins.

Table 7.47: Cumulative levels of puffin displacement and potential mortality for four offshore wind farms within the Firth of Forth area.

Site		Mortality (%)													
Neart na Gaoithe	Displacement level (%)	0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
		10%	12	30	60	121	181	241	302	362	423	483	543	604	
		20%	24	60	121	241	362	483	604	724	845	966	1,087	1,207	
		30%	36	91	181	362	543	724	906	1,087	1,268	1,449	1,630	1,811	
		40%	48	121	241	483	724	966	1,207	1,449	1,690	1,932	2,173	2,415	
		50%	60	151	302	604	906	1,207	1,509	1,811	2,113	2,415	2,717	3,019	
		60%	72	181	362	724	1,087	1,449	1,811	2,173	2,536	2,898	3,260	3,622	
		70%	85	211	423	845	1,268	1,690	2,113	2,536	2,958	3,381	3,803	4,226	
		80%	97	241	483	966	1,449	1,932	2,415	2,898	3,381	3,864	4,347	4,830	
		90%	109	272	543	1,087	1,630	2,173	2,717	3,260	3,803	4,347	4,890	5,433	
100%	121	302	604	1,207	1,811	2,415	3,019	3,622	4,226	4,830	5,433	6,037			
Seagreen Project Alpha	Displacement level (%)	0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
		10%	4	10	20	39	59	79	98	118	138	157	177	197	
		20%	8	20	39	79	118	157	197	236	275	315	354	393	
		30%	12	30	59	118	177	236	295	354	413	472	531	590	
		40%	16	39	79	157	236	315	393	472	551	629	708	787	
		50%	20	49	98	197	295	393	492	590	688	787	885	984	

Site		Mortality (%)												
		60%	24	59	118	236	354	472	590	708	826	944	1,062	1,180
		70%	28	69	138	275	413	551	688	826	964	1,102	1,239	1,377
		80%	31	79	157	315	472	629	787	944	1,102	1,259	1,416	1,574
		90%	35	89	177	354	531	708	885	1,062	1,239	1,416	1,593	1,770
		100%	39	98	197	393	590	787	984	1,180	1,377	1,574	1,770	1,967
Seagreen Project Bravo		0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
		10%	7	17	34	68	102	136	171	205	239	273	307	341
		20%	14	34	68	136	205	273	341	409	478	546	614	682
		30%	20	51	102	205	307	409	512	614	716	819	921	1,023
		40%	27	68	136	273	409	546	682	819	955	1,092	1,228	1,364
		50%	34	85	171	341	512	682	853	1,023	1,194	1,364	1,535	1,706
		60%	41	102	205	409	614	819	1,023	1,228	1,433	1,637	1,842	2,047
		70%	48	119	239	478	716	955	1,194	1,433	1,671	1,910	2,149	2,388
		80%	55	136	273	546	819	1,092	1,364	1,637	1,910	2,183	2,456	2,729
		90%	61	153	307	614	921	1,228	1,535	1,842	2,149	2,456	2,763	3,070
ICOL		0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
		10%	3	6	13	26	39	52	65	78	90	103	116	129

Site	Mortality (%)													
	20%	5	13	26	52	78	103	129	155	181	207	233	258	
	30%	8	19	39	78	116	155	194	233	271	310	349	388	
	40%	10	26	52	103	155	207	258	310	362	413	465	517	
	50%	13	32	65	129	194	258	323	388	452	517	581	646	
	60%	16	39	78	155	233	310	388	465	543	620	698	775	
	70%	18	45	90	181	271	362	452	543	633	724	814	904	
	80%	21	52	103	207	310	413	517	620	724	827	930	1,034	
	90%	23	58	116	233	349	465	581	698	814	930	1,047	1,163	
	100%	26	65	129	258	388	517	646	775	904	1,034	1,163	1,292	

Neart na Gaoithe = peak mean densities during colony attendance period from two year’s survey data for offshore site + 2 km buffer,  
 Seagreen Project Alpha and Bravo = Peak estimate from two years within project boundary areas (Source Seagreen 2012: Seagreen ES)  
 ICOL = Unpublished data provided by ICOL (*pers. comm.*, ICOL, 2013) estimated total number of puffins displaced from forth Islands SPA to 1,492 individuals

\* Green Shading indicates displacement level assessed in HRA and 10% either side. 40% displacement and 10% Mortality are considered most likely displacement/mortality for HRA purposes.



### 7.1.11 Forth Islands SPA - Conclusions

#### 7.1.11.1 Neart na Gaoithe Site Specific Assessment

364 Based on information previously presented in the application, the reassessment of impacts using alternative model parameters and approaches and three years of site-specific data. It is concluded that the level of impact predicted from Neart na Gaoithe alone will not affect the conservation status of any of the qualifying species, nor the conservation objectives of the site and therefore there will be no adverse effect on the integrity of the Forth Islands SPA.

#### 7.1.11.2 Cumulative and In-Combination Impact Assessment

365 Based on the data inputs available at this time; Seagreen ES (Seagreen, 2012), Seagreen HRA (Seagreen, 2013), Inch Cape Offshore Wind Farm First Annual Ornithological Report (*pers. comm.*, ICOL, 2012), additional ICOL supplied data (*pers. comm.*, ICOL, 2013) and information previously presented in the Neart na Gaoithe application, the reassessment of impacts using alternative model parameters and approaches, three years of site specific data, it is concluded that the level of impact predicted from Neart na Gaoithe in-combination with the other proposed projects will not affect the conservation status of any of the qualifying species of the site and therefore there will not be an adverse effect on the integrity of the Forth Islands SPA.

## 7.2 Fowlsheugh SPA

### 7.2.1 Fowlsheugh SPA - Site Information

366 Site overview information for the Forth Islands SPA is provided in Table 7.48 below.

Table 7.48: Site information for Fowlsheugh SPA.

Site Information	Details
<b>Site overview</b>	Fowlsheugh SPA lies approximately 62 km to the north of Neart na Gaoithe. The site comprises of sheer cliffs, between 30 m and 60 m high, located 4 km south of Stonehaven on the east coast of Aberdeenshire in north-east Scotland.
<b>Site designation – qualifying species and features</b> (* = indicates assemblage qualifier only)	<ul style="list-style-type: none"> <li>● Fulmar (<i>Fulmarus glacialis</i>)*;</li> <li>● Herring gull (<i>Larus argentatus</i>)*;</li> <li>● Kittiwake (<i>Rissa tridactyla</i>)*;</li> <li>● Guillemot (<i>Uria aalge</i>);</li> <li>● Razorbill (<i>Alca torda</i>); and</li> <li>● Seabird assemblage.</li> </ul>
<b>Site conservation objectives</b>	<p>To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and</p> <p>To ensure for the qualifying species that the following are maintained in the long term:</p> <ul style="list-style-type: none"> <li>● Population of the species as a viable component of the site;</li> <li>● Distribution of the species within site;</li> <li>● Distribution and extent of habitats supporting the species;</li> <li>● Structure, function and supporting processes of habitats supporting the species; and</li> </ul> <p>No significant disturbance of the species.</p>

### 7.2.2 Fowlsheugh SPA - Screened in Species

367 The results from the screening exercise and advice provided by SNH during consultation (SNH, 2012) have identified the potential for likely significant effects on:

- Fulmar;
- Herring gull;
- Kittiwake; and
- Guillemot.

368 Following the screening exercise undertaken above, the following species and effects have been screened into the HRA for this site (Table 7.49):

Table 7.49: Species and effects screened in for Fowlsheugh SPA.

Species	Likely Significant Effect
Fulmar	Displacement effects from physical presence of the wind turbines.
Herring Gull	Collision mortality during operational period.
Kittiwake	Displacement effects from physical presence of the wind turbines.
Guillemot	Displacement effects from physical presence of the wind turbines.
Razorbill	Displacement effects from physical presence of the wind turbines.

### 7.2.3 Fowlsheugh SPA - Fulmar

#### 7.2.3.1 Neart na Gaoithe Site Specific Assessment

369 The Neart na Gaoithe HRA Screening Assessment, presented in Annex A has not identified Neart na Gaoithe as causing a likely significant effect on fulmars breeding at the Fowlsheugh SPA. SNH has advised that there is a likely significant effect on fulmar from Fowlsheugh (SNH, 2012).

370 Site specific surveys indicate that fulmar occur throughout the year in the offshore site with peak numbers at the end of the breeding season in September and also during the winter months of December and January. Relatively low numbers generally occurred between during the summer months. During the breeding period (April to September) peak numbers occurred in September with a peak of up to 252 fulmars in the offshore site and a 2 km buffer. The three year mean peak in the offshore site and 2 km buffer during the breeding period was 154 individuals (Table 7.50).

Table 7.50: The estimated three-year mean peak numbers of fulmar in the offshore site plus 1 and 2 km buffer.

	Neart na Goithe and buffers	Breeding	Non-breeding
3-year mean peak	Offshore site	61	59
	Offshore site + 1 km	105	89
	Offshore site + 2 km	154	118

#### 7.2.3.1.1 Displacement

371 The results from the displacement assessment undertaken indicate that based on three years data and assuming a 2% displacement effect out to 2 km and a precautionary assumption of 2% mortality rate during the colony attendance period, no fulmars are predicted to die due to being displaced during the breeding season (Table 7.51).

Table 7.51: The estimated number of fulmars at risk of mortality following displacement from Neart na Gaoithe (plus 2 km buffer in breeding period).

Displacement level (%)	Mortality (%)												
	0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
10%	0	1	2	3	5	6	8	9	11	12	14	15	
20%	1	2	3	6	9	12	15	18	22	25	28	31	
30%	1	2	5	9	14	18	23	28	32	37	42	46	
40%	1	3	6	12	18	25	31	37	43	49	55	62	
50%	2	4	8	15	23	31	39	46	54	62	69	77	
60%	2	5	9	18	28	37	46	55	65	74	83	92	
70%	2	5	11	22	32	43	54	65	75	86	97	108	
80%	2	6	12	25	37	49	62	74	86	99	111	123	
90%	3	7	14	28	42	55	69	83	97	111	125	139	
100%	3	8	15	31	46	62	77	92	108	123	139	154	

**Three-year mean peak of 154 fulmars in the offshore site & 2 km buffer in the breeding season (April to Sept)**

\*Green Shading indicates displacement level assessed in HRA and 10% either side. 10% displacement and 2% Mortality are considered most likely displacement/mortality rates for HRA purposes.

372 As no impacts are predicted on fulmars from displacement effects arising from Neart na Gaoithe there will be no adverse effect on the integrity of Fowlsheugh SPA.

### 7.2.3.2 Cumulative and In-Combination Impact Assessment

#### 7.2.3.2.1 Displacement

373 The potential displacement of fulmars from other plans or projects could cause an in-combination impact. However, as no impacts are predicted to occur from Neart na Gaoithe on the fulmar breeding population at Fowlsheugh SPA no in-combination impact with Neart na Gaoithe will occur.

## 7.2.4 Fowlsheugh SPA - Herring Gull

### 7.2.4.1 Neart na Gaoithe Site Specific Assessment

374 Advice received during consultation from SNH is that there is a likely significant effect on breeding herring gulls from Fowlsheugh SPA alone and in-combination (SNH, 2012).

375 Since designation, the breeding population of herring gulls at Fowlsheugh SPA has decreased significantly from 3,190 pairs (6,380 individuals) at the time of designation to 259 pairs (518 individuals) in 2012. The distance between the offshore site and the Fowlsheugh SPA is marginally beyond the mean maximum foraging range of 61.1 km for herring gull during the breeding period but within the maximum reported foraging range of 92 km and therefore breeding birds from the SPA may occur within the offshore site (Thaxter *et al.*, 2012).

#### 7.2.4.1.1 Collision

376 The collision risk assessment undertaken for herring gull and presented in Section 7.1.5, estimates that during the breeding period up to 20 adult herring gulls may be impacted each breeding period (Table 7.52).

Table 7.52: The number of herring gull (adults and immature) collisions predicted to occur per year with Neart na Gaoithe.

Years 1 to 3 mean	Annual	Breeding (Apr- Aug)
98% avoidance	66	20
99% avoidance	33	10

377 Assessments undertaken by Seagreen indicate that of the regional herring gull breeding population within the mean maximum foraging range no more than 38% of all breeding herring gulls within the mean maximum foraging range of the Seagreen projects are qualifying components of an SPA and therefore the majority of herring gulls predicted to be impacted will not be from the Fowlsheugh SPA (Seagreen, 2012). On this basis, of the 20 adult herring gulls predicted to be impacted across all four proposed developments an estimated 8 individuals will be from an SPA breeding population.

378 Neart na Gaoithe is within (or close to) three SPAs for which herring gull is a qualifying species and may overlap during the breeding period based on the mean maximum foraging range:

- Forth Islands SPA,
- Fowlsheugh SPA,
- St Abb’s Head and Fast Castle SPA.

379 It is therefore likely that not all collision mortality will be on birds from Fowlsheugh, and a proportion of them will be from other SPAs or non-SPA colonies.

380 Apportioning the predicted impacts across the three SPAs relative to the size of the breeding population and the distance from Neart na Gaoithe, no herring gulls from Fowlsheugh are predicted to be impacted during each breeding period by Neart na Gaoithe on its own (Table 7.53).

Table 7.53: Estimated number of collision impacts by herring gulls from SPA colonies from Neart na Gaoithe alone.

Development	SPA colony						
	Forth Islands		Fowlsheugh		St Abb’s Head		Total predicted mortality
	Distance (km)	Predicted mortality	Distance (km)	Predicted mortality	Distance (km)	Predicted mortality	
SPA population (Individuals)	11,528		518		605		
Neart na Gaoithe	16	8	62	0	31	0	8

381 The loss of no adult herring gulls during the breeding season will not adversely affect the integrity of the Fowlsheugh SPA, in light of the qualifying interests, their condition and vulnerabilities and the conservation objectives.

#### 7.2.4.2 Cumulative and In-Combination Impact Assessment

##### 7.2.4.2.1 Collision

382 The potential collision impact on herring gulls from other plans or projects could cause an in-combination impact. However, as no impacts are predicted to occur from Neart na Gaoithe on the herring gull breeding population at Fowlsheugh SPA, no in-combination impact with Neart na Gaoithe will occur.

### 7.2.5 Fowlsheugh SPA - Kittiwake

#### 7.2.5.1 Neart na Gaoithe Site Specific Assessment

383 The Neart na Gaoithe HRA Screening Assessment, detailed in Annex A, has identified Kittiwakes at the Fowlsheugh SPA as being a qualifying species at risk of a likely significant effect from collision mortality effects during the operational period of the project.

384 A summary of the number of kittiwakes recorded during three years of site specific surveys and the results of tagging studies on kittiwakes are presented in Section 7.1.7.

385 Tagging studies undertaken in 2011 on kittiwakes at St Abb's Head and Fast Castle SPA and Fowlsheugh SPA, recorded no kittiwakes from either of these colonies at Neart na Gaoithe (Daunt *et al.*, 2012). Although, this is based on a small sample size and a single seasons data, the results do suggest that there is relatively little overlap between the foraging ranges of birds from these colonies and Neart na Gaoithe.

##### 7.2.5.1.1 Collision

386 The results from the collision risk modelling undertaken on the revised turbine rotor tip height of 27.5 m MSL as opposed to the previous assessment of 22.5 m MSL predicts up to 86 kittiwakes per year to be at risk of collision, of which 26 will be during the breeding period (Table 7.54). Taking into account the proportion of adults recorded during the breeding period a total of 24 adult kittiwakes are predicted to collide with Neart na Gaoithe each breeding period based on a 98% avoidance behaviour (Table 7.55).

Table 7.54: The predicted number of kittiwake collisions, with Neart na Gaoithe alone, per year and per breeding period (adults and immature).

Years 1 to 3 mean	Annual	Breeding (Apr- Aug)
98% avoidance	86	26
99% avoidance	43	13

Table 7.55: Predicted mean number of adult kittiwake collisions per year and per breeding period with Neart na Gaoithe.

Years 1 to 3 mean	Annual	Breeding (Apr- Sept)
98% avoidance	80	24
99% avoidance	40	12
93.6% of kittiwakes were recorded as adults.		

- 387 The kittiwake breeding population Fowlsheugh SPA in 2012 was 18,674 individuals. If all the predicted impacts were on kittiwakes from this SPA then the loss of up to 24 adults is 0.1% of the breeding population.
- 388 The kittiwake population at Fowlsheugh SPA is in a favourable and maintained (SNH, 2013). However, the population has undergone a large decline since the time of designation when the population was 69,740 individuals (Stroud *et al.*, 2001).
- 389 Tagging studies undertaken indicate little or no use of kittiwakes from Fowlsheugh SPA occur in the offshore site and the assessment undertaken for the Forth Islands SPA presumed that all kittiwakes originated from the single SPA (Daunt *et al.* 2010; Daunt *et al.* 2011a). However If, contrary to the tagging data results, it is assumed that there may be some impact on kittiwakes from Fowlsheugh SPA and St Abb’s Head to Fast Castle SPA and the impacts are in proportion to colony size and distance then an estimated three kittiwakes are predicted to be impacted (Table 7.56).
- 390 The kittiwake breeding population at Fowlsheugh SPA in 2012 was 18,674 individuals, the loss of up to three adults is <0.01% of the breeding population.
- 391 The loss of up to three adults during the breeding season (0.01% of the breeding population) will not adversely affect the integrity of the Fowlsheugh SPA, in light of the qualifying interests, their condition and vulnerabilities and the conservation objectives.

7.2.5.2 Cumulative and In-Combination Impact Assessment

7.2.5.2.1 Collision

- 392 Tagging studies indicate little or no overlap with kittiwakes from Fowlsheugh and Neart na Gaoithe (Daunt *et al.*, 2012), and collision modelling indicates that even if there is some degree of overlap that the impact from Neart na Gaoithe would be on 0.01% of the breeding population.
- 393 By apportioning impacts from other proposed offshore wind farms across all relevant SPAs based on the relative distance each site is from the respective offshore wind farm and irrespective of the results obtained from the tagging studies indicates that up to 231 adult kittiwakes may be impacted (Table 7.56).

Table 7.56: The total number of fatalities of adult kittiwakes predicted to be impacted per breeding period across regional SPAs (based on 98% avoidance behaviour).

Colony	Proposed wind farm				Total
	Neart na Gaoithe	Seagreen Project Alpha <sup>-1</sup>	Seagreen Project Bravo <sup>-1</sup>	ICOL <sup>-2</sup>	
Forth Islands	21	6 (28)	8 (66)	1	36 (94)
Fowlsheugh	3	96 (97)	128 (10)	4	231 (107)
St Abb’s Head to Fast Castle	0	12 (0)	17 (10)	1	30 (10)
Buchan Ness to Collieston Coast	0	11 (0)	14 (0)	<1	25 (<1)
1	Numbers in parenthesis based on results from tagging data results.				
2	Buchan Ness to Collieston Coast SPA beyond mean maximum foraging range for kittiwakes				

- 394 The predicted in-combination impact from all proposed offshore wind farms is 231 collisions per breeding season. This is 1.2% of the breeding population.
- 395 Of the 231 predicted collisions per year, Neart na Gaoithe contributes a small proportion (1.3%) of the total in-combination collision impact on kittiwake from Fowlsheugh SPA.
- 396 Consequently, Neart na Gaoithe on its own will not adversely affect the integrity of the Fowlsheugh SPA, in light of the qualifying interests, their condition and vulnerabilities and the conservation objectives and will not add anything other than a relatively small (3 birds per year) in-combination collision impact on kittiwakes from Fowlsheugh SPA.

## 7.2.6 Fowlsheugh SPA - Guillemot

### 7.2.6.1 Neart na Gaoithe Site Specific Assessment

- 397 The Neart na Gaoithe HRA Screening Assessment, presented in Annex A, has identified guillemots from the Fowlsheugh SPA as being a qualifying species at risk of a likely significant effect from displacement effects during the operational period of the wind farm but not from displacement effects during construction or operation, nor barrier effects or collision mortality.
- 398 The maximum reported foraging range for guillemot during the colony attendance period is 135 km, although the mean maximum is 84 km and the mean foraging range 37.8 km (Thaxter *et al.*, 2012). Therefore, guillemots recorded within the Neart na Gaoithe offshore site during the breeding season are within the mean maximum reported foraging range for this species from the Fowlsheugh SPA.
- 399 A summary of the results from tagging studies undertaken on guillemots nesting on the Isle of May are presented in Section 7.1.8.
- 400 Studies undertaken by observation of guillemots at Fowlsheugh in 2011 estimated potential foraging range based on flight direction and duration of trip (Daunt *et al.*, 2012). The results indicate that there is little or no overlap with guillemots from Fowlsheugh SPA and Neart na Gaoithe (Figure 7.7). However, the study used a number of assumptions that may have caused an underestimation of flight distance.

#### 7.2.6.1.1 Displacement

- 401 The assessment of the impacts from displacement on guillemots by Neart na Gaoithe are presented in Section 7.1.8.
- 402 The results of the assessment indicate that up to 109 guillemots per breeding period may be impacted by Neart na Gaoithe alone. This is based on a predicted displacement impact of 40% and an estimated 10% mortality rate (Table 7.57). Assuming that 30% of displaced birds are immature birds (Wanless *et al.*, 1998), then 76 adult guillemots are displaced.



Table 7.57: The number of guillemots estimated to be at risk of mortality following displacement from Neart na Gaoithe plus 2 km buffer in colony attendance period.

Displacement level (%)	Mortality (%)												
	0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
10%	5	14	27	55	82	109	137	164	192	219	246	274	
20%	11	27	55	109	164	219	274	328	383	438	493	547	
30%	16	41	82	164	246	328	411	493	575	657	739	821	
40%	22	55	109	219	328	438	547	657	766	876	985	1,095	
50%	27	68	137	274	411	547	684	821	958	1,095	1,232	1,369	
60%	33	82	164	328	493	657	821	985	1,150	1,314	1,478	1,642	
70%	38	96	192	383	575	766	958	1,150	1,341	1,533	1,724	1,916	
80%	44	109	219	438	657	876	1,095	1,314	1,533	1,752	1,971	2,190	
90%	49	123	246	493	739	985	1,232	1,478	1,724	1,971	2,217	2,463	
100%	55	137	274	547	821	1,095	1,369	1,642	1,916	2,190	2,463	2,737	

\*Green Shading indicates displacement level assessed in HRA and 10% either side. 40% displacement and 10% Mortality are considered most likely displacement/mortality for HRA purposes

403 Based on the evidence summarised in Section 7.1.8 there are likely to be guillemots present within the Neart na Gaoithe offshore site during the colony attendance period from colonies aside from Fowlsheugh SPA. The potential number of mortalities arising from displacement impacts can be apportioned between the colonies that are within the mean maximum foraging range based on colony size and the distance from Neart na Gaoithe and are presented in Table 7.58. The results indicate that of the 76 estimated mortalities, eight will be of birds from Fowlsheugh. This is 0.01% of the breeding population.

Table 7.58: The possible number of adult guillemot fatalities during the colony attendance period arising from displacement impacts from Neart na Gaoithe across regional SPAs.

SPA colony	Guillemot			
	SPA breeding population (individuals)	Distance from Neart na Gaoithe (km)	Possible number of fatalities	% of breeding Pop <sup>n</sup>
Forth Islands	22,553	16	46	0.2
St Abb's Head	34,415	31	17	0.05
Fowlsheugh	44,920	62	8	0.01
Farne Islands	49,076	72	5	0.01
Buchan Ness to Collieston Coast	20,858	113	<1	<0.00

404 The potential increase in mortality of 8 birds, arising from displacement effects from Neart na Gaoithe on guillemots from Fowlsheugh SPA, is 0.01% of the total breeding population. The level of impact predicted

will not affect the conservation status of the species, nor the conservation objectives of the site and therefore there will be no adverse effect on the integrity of the SPA.

### 7.2.6.2 Cumulative and In-Combination Impact Assessment

#### 7.2.6.2.1 Displacement

- 405 The potential displacement effect on guillemots in-combination with other plans or projects is higher than with Neart na Gaoithe alone
- 406 Projects identified during consultation and the undertaking of the EIA for which there is a potential for an in-combination displacement risk impact are:
- ICOL - offshore wind farm;
  - Seagreen Project Alpha offshore wind farm; and
  - Seagreen Project Bravo offshore wind farm.
- 407 Data on the number of predicted collisions arising from the Seagreen Projects Alpha and Bravo offshore wind farms are presented within the applicant's Environmental Statement (Seagreen, 2012) and HRA (Seagreen, 2013). The proposed Seagreen Round 3 Zone development comprises of a three phase programme of six separate developments. Projects Alpha and Bravo are the first developments and the only Seagreen projects for which applications have been made.
- 408 ICOL have not yet submitted their application however, alongside the Inch Cape Offshore Wind Farm First Annual Ornithological Report (*pers. comm.*, ICOL, 2012) ICOL have also supplied updated ornithological data for key species (*pers. comm.*, ICOL, 2013) including the estimated number of guillemots from Fowlsheugh that may be displaced by the proposed ICOL development.
- 409 The results of the displacement assessment indicate that a total of 656 adult guillemots may be impacted from displacement by all four proposed developments (Table 7.59) based on a 10% mortality and 40% displacement.
- 410 Results from visual observations undertaken indicate that guillemots from Fowlsheugh can occur across all four developments. Birds from other colonies may not occur in all the proposed offshore wind farm sites and therefore the proportion of impacts across each of the sites will vary depending on the distance the site is from Fowlsheugh SPA and the potential number of other colonies that may interact with, based on results from tagging studies (Daunt *et al.*, 2011b) and mean maximum foraging range .
- 411 The results of the assessment indicate that up to 546 adult guillemots from Fowlsheugh SPA may be impacted during the breeding period; this is 1.1% of the breeding population. Neart na Gaoithe contributes a small proportion, i.e. 1.4% of the estimated impact on guillemots from Fowlsheugh. The contribution to the overall impact is therefore proportionally very small and Neart na Gaoithe will not contribute significantly to the in-combination impacts.

Table 7.59: Estimated number of guillemots potentially impacted from regional SPAs based on 10% mortality arising from 40% displacement effect.

SPA colony	Neart na Gaoithe			
	Estimated number of fatalities = 76			
	SPA breeding population (individuals)	Distance from Neart na Gaoithe (km)	Possible number of fatalities	% of breeding Pop <sup>n</sup>
Fowlsheugh	49,920	62	8	0.01
Forth Islands	22,553	16	46	0.2
St Abb's Head	34,415	31	17	0.05
Farne Islands	49,076	72	5	0.01

Neart na Gaoithe				
SPA colony	Estimated number of fatalities = 76			
	SPA breeding population (individuals)	Distance from Neart na Gaoithe (km)	Possible number of fatalities	% of breeding Pop <sup>n</sup>
Buchan Ness to Collieston Coast	20,858	113	<1	<0.00
<b>Seagreen Project Alpha</b>				
Estimated number of fatalities = 228				
SPA colony	SPA breeding population (individuals)	Estimated distance from Seagreen Project Alpha (km)	Possible number of fatalities	% of breeding Pop <sup>n</sup>
Fowlsheugh	49,920	29	217	0.4
Buchan Ness to Collieston	20,858	84	11	0.05
<b>Seagreen Project Bravo</b>				
Estimated number of fatalities = 296				
SPA colony	SPA breeding population (individuals)	Estimated distance from Seagreen Project Bravo (km)	Possible number of fatalities	% of breeding Pop <sup>n</sup>
Fowlsheugh	49,920	29	282	0.5
Buchan Ness to Collieston	20,858	84	14	0.06
<b>ICOL</b>				
Estimated number of fatalities = 56				
SPA colony	SPA breeding population (individuals)	Estimated distance from Inch Cape (km)	Possible number of fatalities	% of breeding Pop <sup>n</sup>
Fowlsheugh	49,920	33	39	0.07
Forth Islands	22,553	31	8	0.03
St Abb's Head	34,415	54	8	0.02
Buchan Ness to Collieston	20,858	82	1	1.2

Note: See Table 7.36 except for figures for ICOL development which are based on the estimated number of displaced birds from each site as supplied by ICOL (*pers. comm.*, ICOL, 2013) and then assessed based on 40% displacement and 10% mortality.

## 7.2.7 Fowlsheugh SPA - Razorbill

### 7.2.7.1 Neart na Gaoithe Site Specific Assessment

412 The Neart na Gaoithe HRA Screening Assessment, detailed in Annex A, has identified razorbills from the Fowlsheugh SPA as being a qualifying species at risk of a likely significant effect from displacement effects

during the operational period of the wind farm but not from displacement effects during construction or decommissioning, nor barrier effects or collision mortality.

7.2.7.1.1 Displacement

- 413 Advice from SNH is that there will be a likely significant effect on razorbills from the Fowlsheugh SPA during the breeding period (SNH, 2012).
- 414 The maximum reported foraging range for razorbill during the colony attendance period is 90 km, although the mean maximum is 48.5 km and the mean foraging range 23.7 km (Thaxter *et al.*, 2012). Therefore, razorbills recorded within the Neart na Gaoithe offshore site during the breeding period are within the mean maximum reported foraging range for this species from the Fowlsheugh SPA.
- 415 The results from the displacement assessment undertaken indicate that based on three years data and assuming a 40% displacement effect out to 2 km and a precautionary assumption of 10% mortality rate during the colony attendance period, a total of 8 razorbills may die due to being displaced during the breeding season (Table 7.60).

Table 7.60: Estimated number of razorbills at risk of mortality following displacement from Neart na Gaoithe plus 2 km buffer in colony attendance period.

	Mortality (%)												
	0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
10%	0	1	2	4	6	8	10	12	14	16	18	21	
20%	1	2	4	8	12	16	21	25	29	33	37	41	
30%	1	3	6	12	18	25	31	37	43	49	55	62	
40%	2	4	8	16	25	33	41	49	57	66	74	82	
50%	2	5	10	21	31	41	51	62	72	82	92	103	
60%	2	6	12	25	37	49	62	74	86	98	111	123	
70%	3	7	14	29	43	57	72	86	100	115	129	144	
80%	3	8	16	33	49	66	82	98	115	131	148	164	
90%	4	9	18	37	55	74	92	111	129	148	166	185	
100%	4	10	21	41	62	82	103	123	144	164	185	205	

\* Green Shading indicates displacement level assessed in HRA and 10% either side. 40% displacement and 10% Mortality are considered most likely displacement/mortality for HRA purposes

- 416 The potential loss of up to 8 razorbills is 0.15% of the current breeding razorbill population of 5,260 individuals. This assumes that all razorbills impacted by displacement are from the one colony when in reality birds from other colonies, e.g. St Abb’s Head and the Forth Islands are within the mean maximum foraging range of this species during the colony attendance period (Figure 7.10) and may therefore occur within the Neart na Gaoithe offshore site. It also assumes the area birds are displaced from is 105 km<sup>2</sup> as compared to the actual buildable area of 83 km<sup>2</sup> shown in Indicative Layout 3.
- 417 The potential number of mortalities arising from displacement impacts can be apportioned between colonies that are within the mean maximum foraging range, based on colony size and the distance from Neart na Gaoithe (Table 7.61).

Table 7.61: Possible number of razorbill fatalities arising from displacement impacts from Neart na Gaoithe across regional SPAs within the mean maximum foraging range during the colony attendance period.

SPA colony	Razorbill			
	Potential number of fatalities = 8			
	SPA breeding population (individuals)	Distance from Neart na Gaoithe (km)	Possible number of fatalities	% of breeding Pop <sup>n</sup>
Fowlsheugh	5,260	64	<1	0.02
Forth Islands	3,704	16	7	0.2
St Abb's Head to Fast Castle	2,406	31	1	0.04

418 The results indicate that during the colony attendance period less than 1 razorbills may be impacted from displacement effects based on the peak mean numbers recorded within 2 km of the Neart na Gaoithe offshore site and a 10% rate of mortality.

419 The razorbill breeding population estimate for Fowlsheugh was 5,260 individuals (SMP, 2013) and the SPA is recognised to be in a favourable maintained status (SNH, 2013). The potential loss of less than 1 individual is less than 0.02% of the SPA breeding population.

420 The potential increase in mortality arising from displacement effects from Neart na Gaoithe on razorbills from Fowlsheugh SPA is less than 0.02% of the total breeding population. This is based on a highly precautionary impact of 10% mortality.

421 The level of impact predicted will not adversely affect the integrity of the Fowlsheugh SPA, in light of the qualifying interest, their condition and the sites conservation objectives.

### 7.2.7.2 Cumulative and In-Combination Impact Assessment

#### 7.2.7.2.1 Displacement

422 The potential displacement effect on razorbills in-combination with other plans or projects is higher than with Neart na Gaoithe alone.

423 The level of impact predicted from Neart na Gaoithe alone is less than one bird and 0.02% of the population. Therefore, any contribution Neart na Gaoithe may have in-combination with other projects will be insignificant and no in-combination impacts are predicted.

## 7.2.8 Fowlsheugh SPA - Conclusions

### 7.2.8.1 Neart na Gaoithe Specific Assessment

424 Based on information previously presented in the application, the reassessment of impacts using alternative model parameters and approaches and three years of site-specific data. It is concluded that the level of impact predicted from Neart na Gaoithe alone will not affect the conservation status of any of the qualifying species, nor the conservation objectives of the site and therefore there will be no adverse effect on the integrity of the Fowlsheugh SPA.

### 7.2.8.2 Cumulative and In-Combination Impact Assessment

425 Based on the very low number of estimated impacts arising from Neart na Gaoithe alone of less than one bird it is predicted that no in-combination impact will occur that would cause an adverse effect and it is concluded that the level of impact predicted from Neart na Gaoithe in-combination will not affect the conservation status of any of the qualifying species, nor the conservation objectives of the site and therefore there will be no adverse effect on the integrity of the Fowlsheugh SPA.

### 7.3 St Abb’s Head to Fast Castle SPA

#### 7.3.1 St Abb’s Head to Fast Castle SPA - Site Information

426 Site overview information for the Forth Islands SPA is provided in Table 7.62 below.

Table 7.62: Site Overview for St Abb's Had to Fast Castle SPA.

Site Information	Details
<b>Site overview</b>	St Abb’s Head to Fast Castle SPA lies approximately 31 km to the south of Neart na Gaoithe. The site comprises an area of sea cliffs and coastal strip stretching over 10 km along the Berwickshire coast, north of St Abb’s.
<b>Site designation – qualifying species and features</b> <b>* Indicates assemblage qualifier only</b>	<ul style="list-style-type: none"> <li>● Guillemot (<i>Uria aalge</i>)*</li> <li>● Herring gull (<i>Larus argentatus</i>)*</li> <li>● Kittiwake (<i>Rissa tridactyla</i>)*</li> <li>● Razorbill (<i>Alca torda</i>)*</li> <li>● Shag (<i>Phalacrocorax aristotelis</i>)*</li> <li>● Seabird assemblage</li> </ul>
<b>Site conservation objectives</b>	<p>To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and</p> <p>To ensure for the qualifying species that the following are maintained in the long term:</p> <ul style="list-style-type: none"> <li>● Population of the species as a viable component of the site;</li> <li>● Distribution of the species within site;</li> <li>● Distribution and extent of habitats supporting the species;</li> <li>● Structure, function and supporting processes of habitats supporting the species; and</li> <li>● No significant disturbance of the species.</li> </ul>

#### 7.3.2 St Abb’s Head to Fast Castle SPA - Screened in Species

427 The results from the screening exercise and advice provided by SNH during consultation (SNH, 2012) have identified the potential for likely significant effects on:

- Herring gull;
- Kittiwake;
- Guillemot; and
- Razorbill.

428 Species and effects screened in for the St.Abb’s Head to Fast Castle SPA are presented in Table 7.63.

Table 7.63: Species and effects screened in for St Abb’s Head to Fast Castle SPA.

Species	Likely Significant Effect
Herring Gull	Collision mortality during operational period.
Kittiwake	Collision mortality during operational period.
Guillemot	Displacement effects from physical presence of the wind turbines.
Razorbill	Displacement effects from physical presence of the wind turbines.

### 7.3.3 St Abb’s Head to Fast Castle SPA - Herring Gull

#### 7.3.3.1 Neart na Gaoithe Site Specific Assessment

- 429 Advice received during consultation from SNH is that there is a likely significant effect on breeding herring gulls from St Abb’s Head to Fast Castle SPA alone and in-combination (SNH, 2012).
- 430 Since designation, the breeding population of herring gulls at St Abb’s Head to Fast Castle SPA has decreased from 1,160 pairs (2,320 individuals) at the time of designation to 605 pairs (1,210 individuals) in 2000 (the latest available figures). The distance between the offshore site and St Abb’s Head to Fast Castle SPA is 31 km and therefore within the mean maximum foraging range of 61.1 km for herring gull during the breeding period (Thaxter *et al.*, 2012).

##### 7.3.3.1.1 Collision

- 431 The collision risk assessment undertaken for herring gull and presented in Section 7.1.5, estimates that up to 20 adult herring gulls may be impacted each breeding period (See Table 7.64).

Table 7.64: The number of collisions predicted to occur per year with Neart na Gaoithe for herring gull (adults and immature).

Years 1 to 3 mean	Annual	Breeding (Apr- Aug)
98% avoidance	66	20
99% avoidance	33	10

- 432 Assessments undertaken by Seagreen indicate that of the regional herring gull breeding population within the mean maximum foraging range no more than 38% of all breeding herring gulls within the mean maximum foraging range of the Seagreen projects are qualifying components of an SPA and therefore the majority of herring gulls predicted to be impacted will not be from the St Abb’s Head to Fast Castle SPA (Seagreen, 2012). On this basis, of the 20 adult herring gulls predicted to be impacted across all four proposed developments an estimated 8 individuals will be from an SPA breeding population.
- 433 Neart na Gaoithe is within (or close to) three SPAs for which herring gull is a qualifying species and may overlap during the breeding period based on the mean maximum foraging range:
- Forth Islands SPA;
  - Fowlsheugh SPA; and
  - St Abb’s Head and Fast Castle SPA.
- 434 It is therefore likely that not all collision mortality will be on birds from a St Abb’s Head to Fast Castle SPA and a proportion of them will be from other SPAs or non-SPA colonies.

435 By apportioning the predicted impacts across the three SPAs relative to the size of the breeding population and the distance from Neart na Gaoithe, no herring gulls from St Abb’s Head to Fast Castle SPA are predicted to be impacted during the breeding period by Neart na Gaoithe on its own (Table 7.65).

Table 7.65: Estimated number of collision impacts by adult herring gulls from SPA colonies from Neart na Gaoithe alone.

	SPA colony						
	Forth Islands		Fowlsheugh		St Abb’s Head to Fast Castle		
<b>SPA population (Individuals)</b>	11,528		518		605		
<b>Development</b>	Distance (km)	Predicted mortality	Distance (km)	Predicted mortality	Distance (km)	Predicted mortality	Total predicted mortality
<b>Neart na Gaoithe</b>	16	8	62	0	31	0	8

436 The loss of no adult herring gulls during the breeding season will not adversely affect the integrity of the St Abb’s Head to Fast Castle SPA, in light of the qualifying interests, their condition and vulnerabilities and the conservation objectives.

7.3.3.2 Cumulative and In-Combination Impact Assessment

7.3.3.2.1 Collision

437 The potential collision impact on herring gulls from other plans or projects could cause an in-combination impact. However, as no impacts are predicted to occur from Neart na Gaoithe on the herring gull breeding population at St Abb’s Head to Fast Castle SPA, no in-combination impact with Neart na Gaoithe will occur.

7.3.4 St Abb’s Head to Fast Castle SPA - Kittiwake

7.3.4.1 Neart na Gaoithe Site Specific Assessment

438 The Neart na Gaoithe HRA Screening Assessment, detailed in Annex A, has identified Kittiwakes at the St Abb’s Head to Fast Castle SPA as being a qualifying species at risk of a likely significant effect from collision mortality impacts during the operational period of the project.

439 A summary of the number of kittiwakes recorded during three years of site specific surveys and the results of tagging studies on kittiwakes are presented in Section 7.1.7.

440 Tagging studies undertaken in 2011 on kittiwakes at St Abb’s Head and Fast Castle SPA and Fowlsheugh SPA, recorded no kittiwakes from either of these colonies at Neart na Gaoithe (Daunt *et al.*, 2012). Although, this is based on a small sample size and a single seasons data the results do suggest that there is relatively little overlap between the foraging ranges of kittiwakes from these colonies and Neart na Gaoithe.



### 7.3.4.1.1 Collision

- 441 Results from the tagging studies (indicate that apportioning the predicted number of kittiwake collisions across SPA colonies based on mean maximum foraging range, the population size and distance from the colony is not appropriate as this will underestimate the number of potential collisions at some colonies, e.g. Forth Islands and overestimate the potential number of collisions at others e.g. St Abb’s Head. (Daunt *et al* 2011a, 2011b) However, as Neart na Gaoithe is the closest of the four proposed wind farm developments it is likely that any collision impacts on kittiwakes from St Abb’s Head to Fast Castle SPA will more likely be associated with this project as opposed to other developments further away, where there is predicted to be very little or no overlap with kittiwakes foraging from St Abb’s Head to fast Castle SPA.
- 442 For the purposes of this assessment for St Abb’s Head to Fast Castle SPA and contrary to the results of the tagging study that showed no overlap in kittiwake foraging ranges during the breeding period and the offshore site (Daunt *et al.*, 2011b), the potential collision mortality of 24 adult kittiwakes predicted by collision modelling (Table 7.66) have been apportioned across all three SPA colonies that Neart na Gaoithe is within the mean maximum foraging range of.
- 443 The results indicate that up to 6 adult kittiwakes from St Abb’s Head to Fast Castle SPA per breeding period may be impacted (Table 7.66).

Table 7.66: Estimated number of collision impacts of adult kittiwakes from SPA colonies from Neart na Gaoithe alone apportioned across three SPA colonies.

	SPA colony						Total predicted mortality
	Forth Islands		Fowlsheugh		St Abb’s Head to Fast Castle		
<b>SPA population (individuals)</b>	7,532		18,674		10,818		
<b>Development</b>	Distance (km)	Predicted mortality	Distance (km)	Predicted mortality	Distance (km)	Predicted mortality	
<b>Neart na Gaoithe</b>	16	16	62	2	31	6	24

- 444 The kittiwake breeding population at St Abb’s Head to Fast Castle SPA in 2012 was estimated as 10,818 individuals. (For details see Ornithological Appendix 1: Technical Report). The loss of up to 6 adult kittiwakes is 0.05% of the breeding population.
- 445 The kittiwake population at St Abb’s head to Fast Castle SPA is in an unfavourable and declining condition (SNH, 2013). However, the loss of 0.05% of the breeding population is a very small incremental increase in mortality compared to the overall decline in the population from 19,600 pairs at the time of designation to 5,409 pairs in 2012. The loss of up to six adults during the breeding season will not adversely affect the integrity of the St Abb’s Head to Fast Castle SPA, in light of the qualifying interests, their condition and vulnerabilities and the conservation objectives.

### 7.3.4.2 Cumulative and In-Combination Impact Assessment

#### 7.3.4.2.1 Collision

- 446 Tagging studies indicate little or no overlap with kittiwakes breeding at St Abb’s Head to Fast Castle SPA and Neart na Gaoithe (Daunt *et al.*, 2012), and collision modelling indicates that even if there is some degree of overlap that the impact would be relatively very small, equivalent to 0.05% of the breeding population.
- 447 Results from tagging studies indicate that kittiwakes from St Abb’s Head to Fast Castle SPA do not occur during the breeding period at the proposed ICOL development and Seagreen Projects Alpha and Bravo development areas (Daunt *et al.*, 2011b). Apportioning impacts across all three SPA colonies based on colony size and distance from colony may not be appropriate. However, there may be some inter-annual variation in kittiwake distribution and the results from apportioning impacts based on colony distance and size are presented in Table 7.67.
- 448 By apportioning impacts from other proposed offshore wind farms across all relevant SPAs based on the relative distance each site is from the respective offshore wind farm and irrespective of the results obtained from the tagging studies indicates that up to 36 adult kittiwakes may be impacted (Table 7.67).

Table 7.67: The total number of fatalities of adult kittiwakes predicted to be impacted per breeding period across regional SPAs (based on 98% avoidance behaviour).

Colony	Proposed wind farm				Total
	Neart na Gaoithe	Seagreen Project Alpha <sup>-1</sup>	Seagreen Project Bravo <sup>-1</sup>	ICOL <sup>-2</sup>	
St Abb’s Head to Fast Castle	6	12 (0)	17 (10)	1	36 (10)
Forth Islands	16	6 (28)	8 (66)	1	31 (94)
Fowlsheugh	2	96 (97)	128 (10)	4	230 (107)
Buchan Ness to Collieston Coast	0	11 (0)	14 (0)	<1	25 (<1)
1	Numbers in parenthesis based on results from tagging data results.				
2	Buchan Ness to Collieston Coast SPA beyond mean maximum foraging range for kittiwakes				

Note: Table 7.56 and Table 7.67 differ as populations apportioned according to advice

- 449 The kittiwake breeding population at St Abb’s Head to Fast Castle SPA is estimated to be 10,818 individuals and the loss of 36 adult kittiwakes each breeding season is 0.3% of the breeding population.
- 450 Based on the evidence from tagging studies it is concluded that there will be no, or very little, collision mortality arising from the ICOL, Seagreen Project Alpha and Seagreen Project Bravo developments and no in-combination impacts will occur. Apportioning impacts across SPAs based on distance and colony size indicate a low level of mortality arising from collision mortality and at levels that will not cause an adverse effect on the integrity of the St Abb’s Head to Fast Castle SPA will occur.

### 7.3.5 St Abb’s Head to Fast Castle SPA - Guillemot

#### 7.3.5.1 Neart na Gaoithe Site Specific Assessment

- 451 The Neart na Gaoithe HRA Screening Assessment, presented in Annex A, has identified guillemots from the St Abb’s Head to Fast Castle SPA as being a qualifying species at risk of a likely significant effect from

displacement effects during the operational period of the wind farm but not from displacement effects during construction or decommissioning, nor barrier effects or collision mortality.

- 452 The maximum reported foraging range for guillemot during the colony attendance period is 135 km, although the mean maximum is 84 km and the mean foraging range 37.8 km (Thaxter *et al.*, 2012). Therefore, guillemots recorded within the Neart na Gaoithe offshore site during the breeding season are within the mean maximum reported foraging range for this species from the St Abb’s Head to Fast Castle SPA.
- 453 A summary of the results from tagging studies undertaken on guillemots nesting on the Isle of May and the visual observations undertaken at Fowlsheugh and St Abb’s Head are presented in Section 7.1.8. The results indicate that guillemots may forage predominantly north-east and south-east of the Isle of May.
- 454 Studies undertaken by observation of guillemots at St Abb’s Head in 2011 estimated potential foraging range based on flight direction and duration of trip (Daunt *et al.*, 2012). The results indicate that there is overlap with guillemots from St Abb’s Head to Fast Castle SPA and Neart na Gaoithe and ICOL offshore farms, but not with Seagreen Projects Alpha and Bravo (Figure 7.8).

7.3.5.1.1 Displacement

- 455 The assessment of the impacts from displacement on guillemots by Neart na Gaoithe are presented in Section 7.1.8.
- 456 The results of the assessment indicate that up to 109 guillemots per breeding period may be impacted by Neart na Gaoithe alone. This is based on a predicted displacement impact of 40% and an estimated 10% mortality rate (Table 7.68). Assuming that 30% of displaced birds are immature birds (Wanless *et al.*, 1998), then 76 adult guillemots are displaced.

Table 7.68: The number of guillemots estimated to be at risk of mortality following displacement from Neart na Gaoithe (with a 2 km buffer in colony attendance period).

		Mortality (%)												
		0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Displacement level (%)	10%	5	14	27	55	82	109	137	164	192	219	246	274	
	20%	11	27	55	109	164	219	274	328	383	438	493	547	
	30%	16	41	82	164	246	328	411	493	575	657	739	821	
	40%	22	55	109	219	328	438	547	657	766	876	985	1,095	
	50%	27	68	137	274	411	547	684	821	958	1,095	1,232	1,369	
	60%	33	82	164	328	493	657	821	985	1,150	1,314	1,478	1,642	
	70%	38	96	192	383	575	766	958	1,150	1,341	1,533	1,724	1,916	
	80%	44	109	219	438	657	876	1,095	1,314	1,533	1,752	1,971	2,190	
	90%	49	123	246	493	739	985	1,232	1,478	1,724	1,971	2,217	2,463	
	100%	55	137	274	547	821	1,095	1,369	1,642	1,916	2,190	2,463	2,737	

\* Green Shading indicates displacement level assessed in HRA and 10% either side. 40% displacement and 10% Mortality are considered most likely displacement/mortality for HRA purposes

- 457 Based on the evidence summarised in Section 7.1.8 there are likely to be guillemots present within the Neart na Gaoithe offshore site during the colony attendance period from colonies aside from St Abb’s Head

to Fast Castle SPA. The potential number of mortalities arising from displacement impacts can be apportioned between the colonies that are within the mean maximum foraging range based on colony size and the distance from Neart na Gaoithe and are presented in Table 7.69. The results indicate that of the 76 estimated mortalities, 17 will be of birds from St Abb’s Head to Fast Castle SPA. This is 0.05% of the breeding population.

Table 7.69: The possible number of adult guillemot fatalities during the colony attendance period arising from displacement impacts from Neart na Gaoithe across regional SPAs.

SPA colony	Guillemot			
	SPA breeding population (individuals)	Distance from Neart na Gaoithe (km)	Possible number of fatalities	% of breeding Pop <sup>n</sup>
St Abb’s Head to Fast Castle	34,415	31	17	0.05
Forth Islands	22,553	16	46	0.2
Fowlsheugh	44,920	62	8	0.01
Farne Islands	49,076	72	5	0.01
Buchan Ness to Collieston Coast	20,858	113	<1	<0.00

458 The potential increase in mortality arising from displacement effects from Neart na Gaoithe on guillemots from St Abb’s Head to Fast Castle SPA is 0.05% of the total breeding population. The level of impact predicted will not affect the conservation status of the species, nor the conservation objectives of the site and therefore there will be no adverse effect on the integrity of the SPA.

### 7.3.5.2 Cumulative and In-Combination Impact Assessment

#### 7.3.5.2.1 Displacement

459 The potential displacement effect on guillemots in-combination with other plans or projects is higher than with Neart na Gaoithe alone.

460 Results from visual observations undertaken indicate that guillemots from St Abb’s Head to Fast Castle SPA may occur across Neart na Gaoithe and ICOL development areas but not from either Seagreen Project Alpha or Project Bravo (Figure 7.8).

461 The results of the displacement assessment indicate that a total of 132 adult guillemots may be impacted from displacement by all four proposed developments based on 10% mortality and 40% displacement. Table 7.70.

Table 7.70: The estimated number of guillemots potentially impacted from regional SPAs based on 10% mortality arising from 40% displacement effect.

SPA colony	Neart na Gaoithe			
	Estimated number of fatalities = 76			
	SPA breeding population (individuals)	Distance from Neart na Gaoithe (km)	Possible number of fatalities	% of breeding Pop <sup>n</sup>
St Abb's Head to Fast Castle	34,415	31	17	0.05
Fowlsheugh	49,920	62	8	0.01
Forth Islands	22,553	16	46	0.2
Farne Islands	49,076	72	5	0.01
Buchan Ness to Collieston Coast	20,858	113	<1	<0.00
SPA colony	ICOL			
	Estimated number of fatalities = 56			
	SPA breeding population (individuals)	Estimated distance from ICOL (km)	Possible number of fatalities	% of breeding Pop <sup>n</sup>
St Abb's Head to Fast Castle	34,415	54	8	0.02
Fowlsheugh	49,920	33	39	0.07
Forth Islands	22,553	31	8	0.03
Buchan Ness to Collieston	20,858	82	1	1.2

462 The results from the estimated number of potential impacts from the proposed ICOL and Neart na Gaoithe, developments (presented in Table 7.70) indicate that a total of 25 guillemots from St Abb's Head to Fast Castle SPA may be impacted during the breeding period by displacement based on 10% mortality of the 40% of birds predicted to be displaced.

463 The potential in-combination loss of up to 25 birds from a population of 34,415 individuals is 0.07% of the population.

464 The guillemot population at the SPA is in a favourable and maintained condition. The potential increase in mortality arising from displacement effects from Neart na Gaoithe in-combination with ICOL on guillemots from St Abb's Head to Fast Castle SPA will not adversely affect the integrity of the Fowlsheugh SPA, in light of the qualifying interests, their condition and vulnerabilities and the conservation objectives.

### 7.3.6 St Abb's Head to Fast Castle SPA - Razorbill

#### 7.3.6.1 Neart na Gaoithe Site Specific Assessment

465 The Neart na Gaoithe HRA Screening Assessment, detailed in Annex A, has identified razorbills from the St Abb's Head to Fast Castle SPA as being a qualifying species at risk of a likely significant effect from displacement effects during the operational period of the wind farm but not from displacement effects during construction or decommissioning, nor barrier effects or collision mortality.

### 7.3.6.1.1 Displacement

- 466 Advice from SNH is that there will be a likely significant effect on razorbills from the St Abb's Head to Fast Castle SPA during the breeding period (SNH, 2013).
- 467 A summary of the survey results and tagging studies undertaken on razorbills from the Forth Islands SPA are presented in Section 7.1.9. The results indicate that razorbills may forage predominantly north and east of the Isle of May (part of the Forth Islands SPA).
- 468 No tagging studies have been undertaken on razorbills from the St Abb's Head to Fast Castle SPA and colony specific data are not available to identify where razorbills from the breeding colonies at St Abb's Head forage. St Abb's Head to Fast Castle SPA lies 31 km to the south of Neart na Gaoithe and therefore within the mean maximum foraging range for razorbill and there are likely to be razorbills present within the Neart na Gaoithe offshore site during the colony attendance period from St Abb's Head to Fast Castle SPA.
- 469 The results from the displacement assessment undertaken indicate that based on three years data and assuming a 40% displacement effect out to 2 km and a precautionary estimate of 10% mortality rate during the colony attendance period, a total of 8 razorbills may die due to being displaced during the breeding season (Table 7.71).

Table 7.71: The estimated number of razorbills at risk of mortality following displacement from Neart na Gaoithe (with 2 km buffer in colony attendance period).

		Mortality (%)												
		0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Displacement level (%)	0%	0	1	2	4	6	8	10	12	14	16	18	21	
	10%	1	2	4	8	12	16	21	25	29	33	37	41	
	20%	1	3	6	12	18	25	31	37	43	49	55	62	
	30%	2	4	8	16	25	33	41	49	57	66	74	82	
	40%	2	5	10	21	31	41	51	62	72	82	92	103	
	50%	2	6	12	25	37	49	62	74	86	98	111	123	
	60%	3	7	14	29	43	57	72	86	100	115	129	144	
	70%	3	8	16	33	49	66	82	98	115	131	148	164	
	80%	4	9	18	37	55	74	92	111	129	148	166	185	
	90%	4	10	21	41	62	82	103	123	144	164	185	205	

\* Green Shading indicates displacement level assessed in HRA and 10% either side. 40% displacement and 10% Mortality are considered most likely displacement/mortality for HRA purposes

- 470 The potential number of mortalities arising from displacement impacts can be apportioned between colonies that are within the mean maximum foraging range based on colony size and the distance from Neart na Gaoithe. The results indicate that of the estimated number of 8 fatalities per breeding period one will be from the St Abb's Head to Fast Castle SPA (Table 7.72).

Table 7.72: The possible number of razorbill fatalities across regional SPAs within the mean maximum foraging range during the colony attendance period, arising from displacement impacts from Neart na Gaoithe.

SPA colony	Razorbill			
	Potential number of fatalities = 8			
	SPA breeding population (individuals)	Distance from Neart na Gaoithe (km)	Possible number of fatalities	% of breeding Pop <sup>n</sup>
St Abb's Head to Fast Castle	2,406	31	1	0.04
Forth Islands	3,704	16	7	0.2
Fowlsheugh	5,260	64	<1	0.01

471 The 2009 razorbill breeding population estimate for the St Abb's Head to Fast Castle SPA was 2,406 individuals (SMP, 2013) and the SPA is recognised to be in a favourable maintained status (SNH, 2013). The potential loss of 1 razorbill is 0.04% of the SPA breeding population.

472 The potential increase in mortality arising from displacement effects from Neart na Gaoithe on razorbills from St Abb's Head to Fast Castle SPA is 0.04% of the total breeding population. The level of impact predicted will not adversely affect the integrity of the St Abb's Head to Fast Castle SPA, in light of the qualifying interest, their condition and the sites conservation objectives.

### 7.3.6.2 Cumulative and In-Combination Impact Assessment

#### 7.3.6.2.1 Displacement

473 The potential displacement effect on razorbills in-combination with other plans or projects is higher than with Neart na Gaoithe alone.

474 The only other offshore wind farm site within the mean maximum foraging range of razorbills breeding at St Abb's Head to Fast Castle SPA is the proposed ICOL development.

475 Up to 27 razorbills may be displaced by the proposed the proposed ICOL development (*pers. comm.*, ICOL, 2013). Based on a 40% displacement and 10% mortality an estimated one razorbill from St Abb's Head to Fast Castle SPA may be lost due to displacement effects from Inch Cape Offshore Wind Farm (Table 7.73).

Table 7.73: The estimated number of razorbill fatalities from the proposed Inch Cape Offshore Wind Farm across regional SPAs, arising from displacement effects.

SPA colony	Razorbill			
	Potential number of fatalities = 13			
	SPA breeding population (individuals)	Estimated distance from ICOL (km)	Possible number of fatalities	% of breeding Pop <sup>n</sup>
St Abb's Head to Fast Castle	2,406	54	1	0.04
Forth Islands	3,704	31	3	0.08
Fowlsheugh	5,260	33	9	0.1

476 Combining the estimated number of impacts arising from Neart na Gaoithe and ICOL, a total of two razorbills from the St Abb's Head to Fast Castle SPA may be impacted by displacement effects during the colony attendance period.

- 477 The razorbill breeding population estimate for the SPA was 2,406 individuals and the SPA population is recognised to be in a favourable maintained status (SNH, 2013). The potential loss of two individuals during the colony attendance period is 0.1% of the breeding population.
- 478 The potential increase in mortality estimated from displacement effects from Neart na Gaoithe in combination with other plans or projects on razorbills from St Abb's Head to Fast Castle SPA is 0.08% of the breeding population. The level of impact estimated will not affect the conservation status of the species, nor the conservation objectives of the site and therefore there will be no adverse effect on the integrity of the St Abb's Head to Fast Castle SPA from displacement impacts from of razorbills.

### **7.3.7 St Abb's Head to Fast Castle SPA - Conclusions**

#### **7.3.7.1 Neart na Gaoithe Site Specific Assessment**

- 479 Based on information previously presented in the application, the reassessment of impacts using alternative model parameters and approaches and three years of site-specific data. It is concluded that the level of impact predicted from Neart na Gaoithe alone will not affect the conservation status of any of the qualifying species, nor the conservation objectives of the site and therefore there will be no adverse effect on the integrity of the St Abb's Head to Fast Castle SPA.

#### **7.3.7.2 Cumulative and In-Combination Impact Assessment**

- 480 Based on the data inputs available at the time of submission including Seagreen ES (Seagreen, 2012) Seagreen HRA (Seagreen, 2013), Inch Cape Offshore Wind Farm First Annual Ornithological Report (*pers. comm.*, ICOL, 2012) additional ICOL supplied data (*pers. comm.*, ICOL, 2013), the reassessment of impacts using alternative model parameters and approaches, three years of site specific data and new data from other offshore wind farms, it is concluded that the level of impact predicted from Neart na Gaoithe in combination will not affect the conservation status of any of the qualifying species, nor the conservation objectives of the site and therefore there will be no adverse effect on the integrity of the St Abb's Head to Fast Castle SPA.



## 7.4 Buchan Ness to Collieston Coast SPA

### 7.4.1 Buchan Ness to Collieston Coast SPA - Site Information

Site overview information for the Forth Islands SPA is provided in Table 7.74 below.

Table 7.74: Site overview for Buchan Ness to Collieston Coast SPA.

Site Information	Details
<b>Site designation – qualifying species and features</b>	Buchan Ness to Collieston Coast SPA lies approximately 113 km to the north of Neart na Gaoithe. The site comprises an area of sea cliffs and coastal strip stretching along the Aberdeenshire coast, north of Collieston.
<b>Site designation – qualifying species and features</b> <b>* Indicates assemblage qualifier only</b>	<ul style="list-style-type: none"> <li>● Fulmar (<i>Fulmarus glacialis</i>)</li> <li>● Herring gull (<i>Larus argentatus</i>)*</li> <li>● Kittiwake (<i>Rissa tridactyla</i>)*</li> <li>● Shag (<i>Phalacrocorax aristotelis</i>)*</li> <li>● Guillemot (<i>Uria aalge</i>)*</li> </ul> <p>Seabird assemblage</p>
<b>Site conservation objectives</b>	<p>To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and</p> <p>To ensure for the qualifying species that the following are maintained in the long term:</p> <ul style="list-style-type: none"> <li>● Population of the species as a viable component of the site;</li> <li>● Distribution of the species within site;</li> <li>● Distribution and extent of habitats supporting the species;</li> <li>● Structure, function and supporting processes of habitats supporting the species; and</li> </ul> <p>No significant disturbance of the species.</p>

### 7.4.2 Buchan Ness to Collieston Coast SPA - Screened in Species

481 Following the screening exercise undertaken above, the following species and effects have been screened into the HRA for this site based on advice from SNH and the offshore site being within the mean maximum foraging range (+1SD) of the SPA (SNH, 2012) (Table 7.75):

Table 7.75: Screened in species and LSEs for Buchan Ness to Collieston Coast SPA.

Species	Likely Significant Effect
<b>Fulmar</b>	Displacement effects due to physical presence of the wind turbines.
<b>Guillemot</b>	Displacement effects due to physical presence of the wind turbines.

### 7.4.3 Buchan Ness to Collieston Coast SPA - Fulmar

#### 7.4.3.1 Neart na Gaoithe Site Specific Assessment

482 The Neart na Gaoithe HRA Screening Assessment, presented in Annex A has not identified Neart na Gaoithe as causing a likely significant effect on fulmars breeding at the Buchan Ness to Collieston Coast SPA. SNH has advised that there is a likely significant effect on fulmars from Buchan Ness (SNH, 2012).

483 Site specific surveys indicate that fulmar occur throughout the year in the offshore site with peak numbers at the end of the breeding season in September and also during the winter months of December and January. Relatively low numbers generally occurred between during the summer months. During the breeding period (April to September) peak numbers occurred in September with a peak of up to 252 fulmars in the offshore site and a 2 km buffer. The three year mean peak in the offshore site and 2 km buffer during the breeding period was 154 individuals (Table 7.76).

Table 7.76: The estimated three-year mean peak numbers of fulmar in the offshore site (with a 1 and 2 km buffer).

		Breeding	Non-breeding
3-year mean peak	Offshore site	61	59
	Offshore site + 1 km	105	89
	Offshore site + 2 km	154	118

#### 7.4.3.1.1 Displacement

484 The results from the displacement assessment undertaken indicate that based on three years data and assuming a 10% displacement effect out to 2 km and a precautionary assumption of 2% mortality rate during the colony attendance period, no fulmars are predicted to die due to being displaced during the breeding season (Table 7.77).

Table 7.77: The estimated number of fulmars at risk of mortality following displacement from Neart na Gaoithe with a 2 km buffer in breeding period.

Displacement level (%)	Mortality (%)												
	0%	2%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
10%	0	1	2	3	5	6	8	9	11	12	14	15	
20%	1	2	3	6	9	12	15	18	22	25	28	31	
30%	1	2	5	9	14	18	23	28	32	37	42	46	
40%	1	3	6	12	18	25	31	37	43	49	55	62	
50%	2	4	8	15	23	31	39	46	54	62	69	77	
60%	2	5	9	18	28	37	46	55	65	74	83	92	
70%	2	5	11	22	32	43	54	65	75	86	97	108	
80%	2	6	12	25	37	49	62	74	86	99	111	123	
90%	3	7	14	28	42	55	69	83	97	111	125	139	
100%	3	8	15	31	46	62	77	92	108	123	139	154	

**Three-year mean peak of 154 fulmars in the offshore site & 2 km buffer in the breeding season (April to Sept)**

\*Green Shading indicates displacement level assessed in HRA and 10% either side. 10% displacement and 2% Mortality are considered most likely displacement/mortality rates for HRA purposes

485 Apportioning the impacts from displacement across the regional SPA population none of those possibly impacted are predicted to be from the Buchan ness to Collieston Coast SPA (Table 7.78). The level of impact predicted will not affect the conservation status of the species, nor the conservation objectives of the site and therefore there will be no adverse effect on the integrity of the Buchan Ness to Collieston Coast SPA from displacement impacts on fulmars.

Table 7.78: The estimated number of fatalities arising from displacement effects from the Neart na Gaoithe Site.

SPA colony	Fulmar			
	SPA breeding population (individuals)	Distance from Neart na Gaoithe (km)	Possible number of fatalities	% of breeding Pop <sup>n</sup>
Forth Islands	8,490	16	2	0.02
Fowlsheugh	238	62	0	0
Buchan Ness to Collieston	2,778	113	0	0

7.4.3.2 Cumulative and In-Combination Impact Assessment

486 The potential displacement of fulmars from other plans or projects could cause an in-combination impact. However, as no impacts are predicted to occur from Neart na Gaoithe on the fulmar breeding population at Buchan Ness to Collieston Coast SPA, no in-combination impact with Neart na Gaoithe will occur.

## 7.4.4 Buchan Ness to Collieston Coast SPA - Guillemot

### 7.4.4.1 Neart na Gaoithe Specific Assessment

487 Neart na Gaoithe HRA Screening Assessment, presented in Annex A, has not identified guillemots from the Buchan Ness to Collieston Coast SPA as being a qualifying species at risk of a likely significant effect from displacement effects. SNH have advised that there will be a likely significant effect (SNH 2012)

488 Results from site specific monitoring indicate that peak numbers of guillemots occurred during the post-breeding period, particularly during September and October. During the colony attendance period (April to June) the peak estimated number of guillemots in Year 1 occurred in June, with 387 birds in the offshore site but when including a 2 km buffer peak numbers occurred in April with 924 individuals. In Year 2, estimated numbers of guillemots in the offshore site peaked in April (3,789 birds), with 4,323 birds including a 2 km buffer. In Year 3, peak estimated numbers of guillemots in the offshore site peaked in May (1,477 birds), while estimated numbers including a 2 km buffer area peaked in April (2,965 birds).

489 The three year mean peak during the breeding period within the offshore site was 1,896 guillemots, this increased to 2,737 birds when including a 2 km buffer area (Table 7.79).

Table 7.79: The three-year mean peak estimated numbers of guillemots in the offshore site (with a 1 & 2 km buffer).

		At colony	Chicks at sea	Post-breeding	Non-breeding
<b>3-year mean peak</b>	Offshore site	1,896	2,044	3,783	1,060
	Offshore site + 1 km	2,295	2,840	5,356	1,544
	Offshore site + 2 km	2,737	3,717	7,308	2,040

490 The potential number of mortalities arising from displacement impacts has been apportioned between the colonies that are within the mean maximum foraging range of 82.4 km (or 134.3 km if mean maximum foraging range plus 1SD) based on colony size and the distance from Neart na Gaoithe (Table 7.80).

Table 7.80: Possible number of adult guillemot fatalities arising from displacement impacts from Neart na Gaoithe across regional SPAs during the colony attendance period.

SPA colony	Guillemot			
	Potential number of fatalities = 76			
	SPA breeding population (individuals)	Distance from Neart na Gaoithe (km)	Possible number of fatalities	% of breeding Pop <sup>n</sup>
Buchan Ness to Collieston Coast	20,858	113	<1	<0.00
Forth Islands	22,553	16	46	0.2
St Abb's Head	34,415	31	17	0.05
Fowlsheugh	44,920	62	8	0.01
Farne Islands	49,076	72	5	0.01

491 The results show that less than one guillemot per colony attendance period and less than 0.00% of the breeding population, might be impacted by displacement effects based on a 40% displacement effect and 10 mortality rate.

492 The level of impact predicted will not affect the conservation status of the species, nor the conservation objectives of the site and therefore there will be no adverse effect on the integrity of the Buchan Ness to Collieston Coast SPA from displacement impacts on guillemots.

#### 7.4.4.2 Cumulative and In-Combination Impact Assessment

##### 7.4.4.2.1 Displacement

493 The potential displacement of guillemots from other plans or projects could cause an in-combination impact. However, as, in effect, no impacts are predicted to occur from Neart na Gaoithe on the guillemot breeding population at Buchan Ness to Collieston Coast SPA, no in-combination impact with Neart na Gaoithe will occur.

#### 7.4.5 Buchan Ness to Collieston Coast SPA - Conclusions

494 This assessment presents further detail and modified approaches to the information to inform an HRA provided within the application. The scope of the document is based on advice received from SNH on the application (SNH, 2012) and Marine Scotland (*pers. comm.*, Marine Scotland, 2013).

495 The results of this assessment verify the conclusions made within the application.

496 It is concluded that based on the available evidence, Neart na Gaoithe offshore wind farm will not cause alone an adverse effect on the integrity of the following SPAs:

- Forth Islands SPA;
- Fowlsheugh SPA;
- St Abb's Head to Fast Castle SPA; and
- Buchan Ness to Collieston SPA.

497 Data available at the time of submission including Seagreen ES (Seagreen, 2012) Seagreen HRA (Seagreen, 2013), Inch Cape Offshore Wind Farm First Annual Ornithological Report (*pers. comm.*, ICOL, 2012) and additional ICOL supplied data (*pers. comm.*, ICOL, 2013) are included to inform the In-combination assessment. However, caution should be applied to any conclusions drawn due to the lack of finalised data available.

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## Annex A: HRA Screening

Table A.1: Buchan Ness to Collieston Coast

		Buchan Ness to Collieston Coast SPA		
<b>Area</b>		5,400.94 ha		
<b>Distance from NNG development area</b>		111 km		
<b>Article 4.1</b>		-		
<b>Article 4.2 – Migratory Species</b>		-		
<b>Article 4.2 – Assemblage</b>		<b>Assemblage</b> <ul style="list-style-type: none"> <li>● Guillemot <i>Uria aalge</i>;</li> <li>● Kittiwake <i>Rissa tridactyla</i>;</li> <li>● Herring Gull <i>Larus argentatus</i>;</li> <li>● Shag <i>Phalacrocorax aristotelis</i>; and</li> <li>● Fulmar <i>Fulmarus glacialis</i>.</li> </ul>		
<b>Conservation Objectives: See Section 6.1</b>				
Qualifying Feature		Potential Impact	Details	Effect
Guillemot	As	Collision	A total of 6,812 guillemots were recorded in flight during three years of site specific surveys. All but one were recorded below rotor height of 27.5 m. Collision risk modelling predicts no mortalities per year.	No Likely Significant Effect.
		Barrier	Although within the maximum reported foraging range for guillemot, the SPA is beyond the mean maximum foraging range of 84 km for this species. The mean reported foraging range is only 38 km (Thaxter <i>et al.</i> 2012) and therefore few birds present during the breeding period will be from this SPA. Any barrier effects will be negligible compared to the distance this site is from the proposed development.	No Likely Significant Effect.
		Displacement	The proposed development is located 113 km from the SPA and therefore few if any guillemots will be impacted from displacement during the breeding	<b>Likely Significant Effect.</b>

		Buchan Ness to Collieston Coast SPA		
			<p>period. The total area impacted should displacement occur is estimated to be 0.4% of the total foraging area available for guillemots. The site is within the maximum foraging range and advice from SNH is that there is likely to be a significant effect from displacement.</p> <p>Although guillemots may be affected by vessel disturbance the area predicted to be impacted will be very localised (some hundreds of metres) and temporary and therefore no likely significant effect will occur during construction or decommissioning.</p>	
Fulmar	As	Collision	Of the 1,831 fulmar sightings for which flight height data were recorded from three years of surveys a total 1,806 fulmars were flying below 7.5 m above sea surface and 99.9% of all flights were below turbine height and therefore the risk of any impacts from collision mortality is negligible.	No Likely Significant Effect
		Barrier	The SPA is within the reported mean maximum foraging range of 400 km for breeding fulmars and therefore fulmars from this SPA could be impacted by barrier effects (Thaxter <i>et al.</i> 2012). However, the additional estimated distance a fulmar will have to detour around the proposed development should a barrier effect occur, will be a very small compared to the overall distance flown.	No Likely Significant Effect.
		Displacement	The fulmar has a very extensive foraging range. It is estimated that on average, displacement could result in the effective loss of up to 0.06% of the foraging habitat of the regional breeding fulmar population and therefore the proportion of possible suitable foraging habitat that may be lost, should displacement occur, is very small. SNH have advised that there may be a likely significant effect on fulmar from this site.	<b>Likely Significant Effect.</b>
Herring gull	As	Collision	Of the 1,646 herring gulls for which flight heights were recorded, 21.7% were at turbine height and therefore at risk of collision. The SPA is beyond the maximum foraging range for herring gull during the breeding season and therefore birds at this site are at very low risk of being impacted.	No Likely Significant Effect.
		Barrier	The SPA is beyond the maximum foraging range of 92 km for herring gull during the breeding season (Thaxter <i>et al.</i> 2012) and therefore birds at this site are	No Likely Significant Effect.

		Buchan Ness to Collieston Coast SPA		
			not predicted to be impacted by barrier effects.	
		Displacement	Evidence from constructed offshore wind farms indicate that herring gulls are not displaced by wind farms (Petersen <i>et al.</i> 2006). The SPA is beyond the maximum foraging range of 92 km for herring gull during the breeding season (Thaxter <i>et al.</i> 2012) and therefore birds at this site are not predicted to be impacted by displacement impacts.	No Likely Significant Effect.
Kittiwake	As	Collision	Of the 6,945 kittiwakes for which flight heights were recorded, 4.8% were above rotor height of 27.5 m. The SPA is outwith the reported mean maximum foraging range of 60 km and 83.3 km (including +1 S.D.). The mean foraging range of 24.8 m for kittiwake during the breeding season (Thaxter <i>et al.</i> 2012) and therefore birds at this site are at very low risk of being impacted during the breeding period.	<b>Likely Significant Effect.</b>
		Barrier	The proposed development is beyond the mean maximum foraging range for kittiwake during the breeding period. Although, some birds may occur in the area the incremental increase in flight caused by a barrier impact to kittiwakes from a colony 113 km away will be very small.	No Likely Significant Effect.
		Displacement	The SPA is beyond the mean maximum (including 1.S.D) foraging range of kittiwakes from this site.	No Likely Significant Effect.
Shag	As	Collision	The maximum recorded foraging range for shag during the breeding season is 17 km (Thaxter <i>et al.</i> 2012) and therefore the site is beyond the maximum foraging range. No shags were recorded within the offshore site during three years of site specific surveys. All birds were recorded flying below turbine height. Therefore there is a very low risk of collision.	No Likely Significant Effect.
		Barrier	The site is beyond the maximum reported foraging range for shags during the breeding period and therefore no barrier effects will occur.	No Likely Significant Effect.
		Displacement	No shags were recorded within the offshore site and the site is beyond the maximum reported foraging range for this species. No displacement effects are predicted.	No Likely Significant Effect.

Buchan Ness to Collieston Coast SPA

Note Br = breeding, Wi = Winter, Mi = Migrant, As = Assemblage

Table A.2: Coquet Island

		Coquet Islands SPA		
<b>Area</b>		22.28 ha		
<b>Distance from NNG development area</b>		105 km		
<b>Article 4.1</b>		<b>Breeding;</b> <ul style="list-style-type: none"> <li>● Arctic Tern <i>Sterna paradisaea</i>;</li> <li>● Common Tern <i>Sterna hirundo</i>;</li> <li>● Roseate Tern <i>Sterna dougallii</i>; and</li> <li>● Sandwich Tern <i>Sterna sandvicensis</i>.</li> </ul>		
<b>Article 4.2 – Migratory Species</b>		<b>Breeding;</b> <ul style="list-style-type: none"> <li>● Puffin <i>Fratercula arctica</i>.</li> </ul>		
<b>Article 4.2 – Assemblage</b>		<b>Seabirds:</b> <ul style="list-style-type: none"> <li>● Black-headed Gull <i>Larus ridibundus</i>;</li> <li>● Puffin <i>Fratercula arctica</i>;</li> <li>● Arctic Tern <i>Sterna paradisaea</i>;</li> <li>● Common Tern <i>Sterna hirundo</i>;</li> <li>● Roseate Tern <i>Sterna dougallii</i>; and</li> <li>● Sandwich Tern <i>Sterna sandvicensis</i>.</li> </ul>		
<b>Conservation Objectives: See Section 6.1</b>				
Qualifying Feature		Potential Impact	Details	Effect
Arctic tern	Br/As	Collision	Of the 1,186 sightings of Arctic tern from which flight heights were recorded, 99.8% were of birds flying below rotor height. The maximum reported foraging range during the breeding period is 30 km (Thaxter <i>et al.</i> 2012) and therefore birds from this SPA will not be impacted during the breeding period.	No Likely Significant Effect.

		Coquet Islands SPA		
		Barrier	The vast majority of Arctic terns were only recorded during autumn migration when they fly to the Antarctic. The potential additional distance that an Arctic tern will fly should it detour will not cause any effect. The SPA is beyond the maximum recorded foraging range for breeding Arctic tern	No Likely Significant Effect.
		Displacement	No displacement effects to Arctic terns have been recorded from constructed offshore wind farms and the species is at low risk of displacement by boats (e.g. Furness & Wade 2012; Zucco <i>et al.</i> 2006). The SPA is outwith the maximum reported foraging range for Arctic tern and therefore no regularly barrier effects will occur during the breeding period.	No Likely Significant Effect.
Common tern	Br/As	Collision	The proposed development is 106 km away from the SPA and beyond the reported maximum foraging range of 30 km for breeding common terns (Thaxter <i>et al.</i> 2012). A total of 35 common terns were recorded in flight, all of which were below turbine height.	No Likely Significant Effect.
		Barrier	The proposed development is 106 km away from the SPA and beyond the reported maximum foraging range of 30 km for breeding common terns (Thaxter <i>et al.</i> 2012) and therefore there will be no barrier effects for common terns from this SPA during the breeding period.	No Likely Significant Effect.
		Displacement	The proposed development is 106 km away from the SPA and beyond the reported maximum foraging range of 30 km for breeding common terns (Thaxter <i>et al.</i> 2012) and therefore there will be no displacement effects for common terns from this SPA during the breeding period.	No Likely Significant Effect.
Roseate tern	Br/As	Collision	No roseate terns were recorded during site specific surveys.	No Likely Significant Effect.
		Barrier	No roseate terns were recorded during site specific surveys.	No Likely Significant Effect.
		Displacement	No roseate terns were recorded during site specific surveys.	No Likely Significant Effect.
Sandwich tern	Br/As	Collision	No Sandwich terns were recorded during site specific surveys.	No Likely Significant Effect.
		Barrier	No Sandwich terns were recorded during site specific surveys.	No Likely Significant Effect.
		Displacement	No Sandwich terns were recorded during site specific surveys.	No Likely Significant Effect.

		Coquet Islands SPA		
Puffin	Mi (br)/As	Collision	Of the 7,049 puffins were recorded in flight 99.9% were recorded flying below turbine height. There is a very low risk of collision.	No Likely Significant Effect.
		Barrier	The mean maximum foraging range for puffin is reported to be 105 km and the maximum is 200 km, therefore puffins from this SPA may be impacted from a barrier effect. However, the site is in excess of 100 km away and the additional distance birds may have to fly around the wind farm should they forage beyond the offshore site will be relatively small compared to the overall distance puffins may fly. The mean foraging distance is 4 km from a colony and the majority of puffins will forage in waters nearer to the SPA.	No Likely Significant Effect.
		Displacement	The mean maximum foraging range for puffin is reported to be 105 km and the maximum is 200 km, therefore puffins from this SPA may be impacted from a displacement effect. Furness & Wade (2012) identified puffins as being at relatively low risk of disturbance from vessels.	No Likely Significant Effect.
Black-headed gull	As	Collision	A total of 39 black-headed gulls were recorded during site specific surveys. 26.3% of those recorded in flight were recorded at rotor height and therefore at risk of collision. However, the maximum foraging range reported for breeding black-headed gulls is 40 km (Thaxter <i>et al.</i> 2012) and therefore black-headed gulls from this SPA are not at risk of an impact during this period.	No Likely Significant Effect.
		Barrier	The maximum foraging range reported for breeding black-headed gulls is 40 km and therefore black-headed gulls from this SPA are not at risk of an impact during this period.	No Likely Significant Effect.
		Displacement	The maximum foraging range reported for breeding black-headed gulls is 40 km and therefore black-headed gulls from this SPA are not at risk of an impact during this period.	No Likely Significant Effect.
<p><b>Note Br = breeding, Wi = Winter, Mi = Migrant, As = Assemblage</b></p>				



Table A.3: Fala Flow

		Fala Flow SPA Ramsar		
<b>Area</b>		323 ha		
<b>Distance from NNG development area</b>		58 km		
<b>Article 4.1</b>		-		
<b>Article 4.2 – Migratory Species</b>		<b>Winter;</b> <ul style="list-style-type: none"> <li>● Pink-footed goose <i>Anser brachyrhynchus</i>.</li> </ul>		
<b>Article 4.2 – Assemblage</b>		-		
<b>Conservation Objectives: See Section 6.1</b>				
Qualifying Feature		Potential Impact	Details	Effect
Pink-footed goose	Wi	Collision	Of the 779 pink-footed geese recorded during site specific surveys 45.4% were flying above 27.5 m and therefore at risk of collision impacts. Collision risk modelling undertaken based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height predicts a total of eight collisions per year, based on a 98% avoidance rate. The 5 year peak mean count (2006/11) for Fala Flow is 5,204 individuals (Holt <i>et al.</i> 2012) and therefore if all eight collisions per year are from the SPA then up to 0.1% of the population may be impacted. This will not cause an adverse effect on the population	No Likely Significant Effect.
		Barrier	Pink-footed geese breeding in Iceland migrate to the UK in winter. Birds passing through the proposed development area will have flown in excess of 1,000 km and the additional distance birds may fly to detour around the wind farm is very small compared to the total distance flown.	No Likely Significant Effect
		Displacement	No pink-footed geese were recorded using the area and no displacement impacts will occur	No Likely Significant Effect
<b>Note Br = breeding, Wi = Winter, Mi = Migrant, As = Assemblage</b>				

Table A.4: Farne Islands

Farne Islands SPA			
Area	101.86 ha		
Distance from NNG development area	72 km		
Article 4.1	<b>Breeding;</b> <ul style="list-style-type: none"> <li>● Arctic Tern <i>Sterna paradisaea</i>;</li> <li>● Common Tern <i>Sterna hirundo</i>;</li> <li>● Roseate Tern <i>Sterna dougallii</i>; and</li> <li>● Sandwich Tern <i>Sterna sandvicensis</i>.</li> </ul>		
Article 4.2 – Migratory Species	<b>Breeding;</b> <ul style="list-style-type: none"> <li>● Guillemot <i>Uria aalge</i>; and</li> <li>● Puffin <i>Fratercula arctica</i>.</li> </ul>		
Article 4.2 – Assemblage	<ul style="list-style-type: none"> <li>● Kittiwake <i>Rissa tridactyla</i>;</li> <li>● Shag <i>Phalacrocorax aristotelis</i>;</li> <li>● Cormorant <i>Phalacrocorax carbo</i>;</li> <li>● Puffin <i>Fratercula arctica</i>;</li> <li>● Guillemot <i>Uria aalge</i>;</li> <li>● Arctic Tern <i>Sterna paradisaea</i>;</li> <li>● Common Tern <i>Sterna hirundo</i>;</li> <li>● Roseate Tern <i>Sterna dougallii</i>; and</li> <li>● Sandwich Tern <i>Sterna sandvicensis</i>.</li> </ul>		
Conservation Objectives: See Section 6.1			
Qualifying Feature	Potential Impact	Details	Effect

		Farne Islands SPA		
Roseate tern	Br/As	Collision	No roseate terns were recorded.	No likely significant effect
		Barrier	No roseate terns were recorded.	No likely significant effect
		Displacement	No roseate terns were recorded.	No likely significant effect
Sandwich tern	Br/As	Collision	No Sandwich terns were recorded during site specific surveys.	No likely significant effect
		Barrier	No Sandwich terns were recorded during site specific surveys.	No likely significant effect
		Displacement	No Sandwich terns were recorded during site specific surveys.	No likely significant effect
Arctic tern	Br/As	Collision	Of the 1,186 sightings of Arctic tern from which flight heights were recorded, 99.8% were of birds flying below rotor height. The maximum reported foraging range during the breeding period is 30 km (Thaxter <i>et al.</i> 2012) and therefore birds from this SPA will not be impacted during the breeding period.	No likely significant effect
		Barrier	The vast majority of Arctic terns were only recorded during autumn migration when they fly to the Antarctic. The potential additional distance that an Arctic tern will fly should it detour will not cause any effect. The SPA is beyond the maximum recorded foraging range for breeding Arctic tern	No likely significant effect
		Displacement	No displacement effects to Arctic terns have been recorded from constructed offshore wind farms and the species is at low risk of displacement by boats (e.g. Furness & Wade 2012; Zucco <i>et al.</i> 2006). The SPA is outwith the maximum reported foraging range for Arctic tern and therefore no regularly barrier effects will occur during the breeding period.	No likely significant effect
Common tern	Br/As	Collision	The proposed development is 72 km away from the SPA and beyond the reported maximum foraging range of 30 km for breeding common terns (Thaxter <i>et al.</i> 2012). A total of 36 common terns were recorded in flight, all of which were below turbine height.	No Likely Significant Effect.
		Barrier	The proposed development is 72 km away from the SPA and beyond the reported maximum foraging range of 30 km for breeding common terns (Thaxter <i>et al.</i> 2012) and therefore there will be no barrier effects for common terns from this SPA during the breeding period.	No Likely Significant Effect.

		Farne Islands SPA		
		Displacement	The proposed development is 72 km away from the SPA and beyond the reported maximum foraging range of 30 km for breeding common terns (Thaxter <i>et al.</i> 2012) and therefore there will be no displacement effects for common terns from this SPA during the breeding period.	No Likely Significant Effect.
Puffin	Mi (br)/As	Collision	Of the 7,049 puffins were recorded in flight 99.9% were recorded flying below turbine height. There is a very low risk of collision.	No Likely Significant Effect.
		Barrier	The mean maximum foraging range for puffin is reported to be 105 km and the maximum is 200 km, therefore puffins from this SPA may be impacted from a barrier effect. However, the additional distance birds may have to fly around the wind farm should they forage beyond it will be relatively small compared to the overall distance puffins may fly. The mean foraging distance is 4 km from a colony and the majority of puffins will forage in waters nearer to the SPA and relatively few are predicted to forage regularly beyond the proposed development area.	No Likely Significant Effect.
		Displacement	The mean maximum foraging range for puffin is reported to be 105 km and the maximum is 200 km, therefore puffins from this SPA may be impacted from a displacement effect. Furness & Wade (2012) identified puffins as being at relatively low risk of disturbance from vessels.	No Likely Significant Effect.
Guillemot	Mi (br)/As	Collision	A total of 6,812 guillemots were recorded in flight during three years of site specific surveys. All but one guillemot was recorded below rotor height of 27.5 m. Collision risk modelling predicts no mortalities per year.	No Likely Significant Effect.
		Barrier	The reported mean maximum foraging range of guillemot is 84 km and the mean reported foraging range is only 38 km (Thaxter <i>et al.</i> 2012). Therefore, birds from this SPA may detour around the proposed development in order to forage but the majority will forage in nearshore waters during the breeding period. Based on an average detoured flight path predicted for other colonies to the south of the proposed development areas it is predicted that a barrier effect could cause an additional detour of 2 km. Any barrier effects will be small compared to the distance this site is from the proposed development and the impacts negligible.	No Likely Significant Effect.

		Farne Islands SPA		
		Displacement	<p>The proposed development is located 72 km from the SPA and therefore few guillemots will be impacted from displacement during the breeding period. The total area impacted should displacement occur is estimated to be 0.4% of the total foraging area available for guillemots and therefore not predicted to have an adverse effect.</p> <p>Although guillemots may be affected by vessel disturbance the area predicted to be impacted will be very localised (some hundreds of metres) and temporary and therefore no likely significant effect will occur during construction or decommissioning.</p>	No Likely Significant Effect
Shag	As	Collision	The maximum recorded foraging range for shag during the breeding season is 17 km (Thaxter <i>et al.</i> 2012) and therefore the site is beyond the maximum foraging range. No shags were recorded within the offshore site during three years of site specific surveys. All birds were recorded flying below turbine height. Therefore there is a very low risk of collision.	No Likely Significant Effect.
		Barrier	The site is beyond the maximum reported foraging range for shags during the breeding period and therefore no barrier effects will occur.	No Likely Significant Effect.
		Displacement	No shags were recorded within the offshore site and the site is beyond the maximum reported foraging range for this species. No displacement effects are predicted.	No Likely Significant Effect.
Cormorant	As	Collision	The maximum recorded foraging range for cormorant during the breeding season is 35 km (Thaxter <i>et al.</i> 2012) and therefore the site is beyond the maximum foraging range. No cormorants were recorded within the proposed development area during site specific survey and only seven cormorants occurred in the buffer zone.	No Likely Significant Effect.
		Barrier	The site is beyond the maximum reported foraging range for cormorants during the breeding period and therefore no barrier effects will occur.	No Likely Significant Effect.
		Displacement	The site is beyond the maximum reported foraging range for cormorants during the breeding period and therefore no displacement effects will occur.	No Likely Significant Effect.

		Farne Islands SPA		
Kittiwake	As	Collision	Of the 6,945 kittiwakes for which flight heights were recorded, 4.8% were above rotor height of 27.5 m. The SPA is outwith the reported mean maximum foraging range of 60 km. The mean foraging range of 24.8 m for kittiwake during the breeding season (Thaxter <i>et al.</i> 2012) and therefore birds at this site are at very low risk of being impacted during the breeding period.	No Likely Significant Effect.
		Barrier	The proposed development is beyond the mean maximum foraging range for kittiwake during the breeding period. Although, some birds may occur in the area the incremental increase in flight caused by a barrier impact to kittiwakes from a colony 72 km away will be very small.	No Likely Significant Effect.
		Displacement	Kittiwakes demonstrate relatively low levels of displacement and assuming 25% of kittiwakes are displaced during the breeding season from the offshore site buffered to 1 km the impact of this would be the effective loss of up to 0.1% of the foraging habitat of the regional population. The loss of up to 0.1% of the foraging habitat is considered negligible.	No Likely Significant Effect.
<p><b>Note Br = breeding, Wi = Winter, Mi = Migrant, As = Assemblage</b></p>				

Table A.5: Firth of Forth

Firth of Forth SPA & Ramsar	
<b>Area</b>	6,313.72 ha
<b>Distance from NNG development area</b>	16 km
<b>Article 4.1</b>	<p><b>Passage;</b></p> <ul style="list-style-type: none"> <li>● Sandwich Tern <i>Sterna sandvicensis</i>.</li> </ul> <p><b>Winter;</b></p> <ul style="list-style-type: none"> <li>● Bar-tailed Godwit <i>Limosa lapponica</i>;</li> <li>● Golden Plover <i>Pluvialis apricaria</i>;</li> <li>● Red-throated Diver <i>Gavia stellate</i>; and</li> <li>● Slavonian Grebe <i>Podiceps auritus</i>.</li> </ul>
<b>Article 4.2 – Migratory Species</b>	<p><b>Winter;</b></p> <ul style="list-style-type: none"> <li>● Knot <i>Calidris canutus</i>;</li> <li>● Pink-footed Goose <i>Anser brachyrhynchus</i>;</li> <li>● Redshank <i>Tringa tetanus</i>;</li> <li>● Shelduck <i>Tadorna tadorna</i>; and</li> <li>● Turnstone <i>Arenaria interpres</i>.</li> </ul>
<b>Article 4.2 – Assemblage</b>	<p><b>Assemblage</b></p> <ul style="list-style-type: none"> <li>● Scaup Aythya marila;</li> <li>● Slavonian Grebe <i>Podiceps auritus</i>;</li> <li>● Golden Plover <i>Pluvialis apricaria</i>;</li> <li>● Bar-tailed Godwit <i>Limosa lapponica</i>;</li> <li>● Pink-footed Goose <i>Anser brachyrhynchus</i>;</li> </ul>

Firth of Forth SPA & Ramsar	
	<ul style="list-style-type: none"> <li>● Shelduck <i>Tadorna tadorna</i>;</li> <li>● Knot <i>Calidris canutus</i>;</li> <li>● Redshank <i>Tringa tetanus</i>;</li> <li>● Turnstone <i>Arenaria interpres</i>;</li> <li>● Great Crested Grebe <i>Podiceps cristatus</i>;</li> <li>● Cormorant <i>Phalacrocorax carbo</i>;</li> <li>● Red-throated Diver <i>Gavia stellate</i>;</li> <li>● Mallard <i>Anas platyrhynchos</i>;</li> <li>● Curlew <i>Numenius arquata</i>;</li> <li>● Eider <i>Somateria mollissima</i>;</li> <li>● Long-tailed duck <i>Clangula hyemalis</i>;</li> <li>● Common Scoter <i>Melanitta nigra</i>;</li> <li>● Velvet Scoter <i>Melanitta fusca</i>;</li> <li>● Goldeneye <i>Bucephala clangula</i>;</li> <li>● Red-breasted Merganser <i>Mergus serrator</i>;</li> <li>● Oystercatcher <i>Haematopus ostralegus</i>;</li> <li>● Ringed Plover <i>Charadrius hiaticula</i>;</li> <li>● Grey Plover <i>Pluvialis squatarola</i>;</li> <li>● Lapwing <i>Vanellus vanellus</i>;</li> <li>● Dunlin <i>Calidris alpina alpina</i>; and</li> <li>● Wigeon <i>Anas penelope</i>.</li> </ul>
<p><b>Conservation Objectives: See Section 6.1</b></p>	



		Firth of Forth SPA & Ramsar		
Qualifying Feature		Potential Impact	Details	Effect
Sandwich tern	Pa	Collision	No Sandwich terns were recorded during site specific surveys.	No Likely Significant Effect.
		Barrier	No Sandwich terns were recorded during site specific surveys.	No Likely Significant Effect.
		Displacement	No Sandwich terns were recorded during site specific surveys.	No Likely Significant Effect.
Bar-tailed godwit	Wi/As	Collision	One bar-tailed godwit was recorded during site specific surveys. It was flying below 7.5 m. Collision risk modelling undertaken based on an assumed population of 1,000 bar-tailed godwits passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The five year mean peak count (2006/11) of bar-tailed godwit in the Forth Estuary is 1,274 birds (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA a total of 0.5% of the wintering population may be impacted. Not all impacts will be from this SPA.	No Likely Significant Effect.
		Barrier	The closest breeding bar-tailed godwits are in northern Fennoscandia and the Kola Peninsula over 2,000 km away. The additional distance migrating bar-tailed godwits will have to fly to detour around the proposed development is negligible.	No Likely Significant Effect.
		Displacement	No bar-tailed godwits were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Golden plover	Wi/As	Collision	A total of 20 golden plover were recorded during site specific surveys, of which 14 (58.3%) of all flights were at rotor height. Collision risk modelling was not undertaken for golden plover but was for the similar grey plover. Based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height collision risk modelling estimated a total of six collisions per year, based on a 98% avoidance rate. The SPA citation reports a wintering population of 2,949 golden plover at the Forth Islands SPA (SNH 2013). Therefore, if all predicted collisions are from this SPA, a total of 0.2% of the wintering population may be	No Likely Significant Effect.

		Firth of Forth SPA & Ramsar		
			impacted. Not all impacts will be from this SPA.	
		Barrier	Golden plover breed in the UK and across from Iceland to central Siberia (Wernham <i>et al.</i> 2002) and winter across the UK. It is not possible to predict where birds crossing the proposed development may occur from but any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown during migration.	No Likely Significant Effect.
		Displacement	No golden plover were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Red-throated diver	Wi/As	Collision	No red-throated divers were recorded within the proposed development area and only five were within the eight km buffer. All five birds were recorded flying below turbine height.	No Likely Significant Effect.
		Barrier	Red-throated divers breed in northern Scotland, Scandinavia and Russia and winter in coastal water across the North Sea. Birds migrating will make a relatively small detour around the wind farm if a barrier effect occurs compared to the total distance undertaken during migration.	No Likely Significant Effect.
		Displacement	No red-throated diver were recorded using the site.	No Likely Significant Effect.
Slavonian grebe	Wi/As	Collision	No Slavonian grebes were recorded during site specific surveys.	No Likely Significant Effect.
		Barrier	No Slavonian grebes were recorded during site specific surveys.	No Likely Significant Effect.
		Displacement	No Slavonian grebes were recorded during site specific surveys.	No Likely Significant Effect.
Knot	Mi (wi)/As	Collision	No knot were recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 knot passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The five year mean peak count (2006/11) of knot in the Forth Estuary is 3,484 birds (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA a total of 0.2% of the wintering population may be impacted.	No Likely Significant Effect.
		Barrier	Knot breed in the high Arctic and undertake some the longest known non-stop	No Likely Significant Effect.

		Firth of Forth SPA & Ramsar		
			migrations of any species. Birds wintering in estuaries across Europe will not be impacted by a very small negligible increase in flight distance should a barrier effect occur.	
		Displacement	No knot were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Pink-footed goose	Mi (wi)/As	Collision	Of the 577 pink-footed geese recorded during site specific surveys 45.4% were flying above 27.5 m and therefore at risk of collision impacts. Collision risk modelling undertaken based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height predicts a total of eight collisions per year, based on a 98% avoidance rate. The 5 year peak mean count (2006/11) for Forth Estuary is 3,484 individuals (Holt <i>et al.</i> 2012) and therefore if all eight collisions per year are from the SPA then up to 0.2% of the population may be impacted. This will not cause an adverse effect on the population.	No Likely Significant Effect.
		Barrier	Pink-footed geese breeding in Iceland migrate to the UK in winter. Birds passing through the proposed development area will have flown in excess of 1,000 km and the additional distance birds may fly to detour around the wind farm is very small compared to the total distance flown.	No Likely Significant Effect.
		Displacement	No pink-footed geese were recorded using the area and no displacement impacts will occur.	No Likely Significant Effect.
Redshank	Mi (wi)/As	Collision	A total of four redshank were recorded during site specific surveys. All were flying below rotor height. Collision risk modelling was not undertaken for redshank but was for the similar grey plover. Based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height collision risk modelling estimated a total of seven collisions per year, based on a 98% avoidance rate. The 5 year peak mean population (2006/11) of redshank at the Forth Estuary is 4,594 (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA, a total of 0.1% of the wintering population may be impacted.	No Likely Significant Effect.
		Barrier	Redshank breed in the UK and across from Iceland to Russia and winter across the UK. It is not possible to predict where birds crossing the proposed	No Likely Significant Effect.

		Firth of Forth SPA & Ramsar		
			development may occur from but are likely to be either UK breeding birds or birds from Iceland (Wernham <i>et al.</i> 2002). Any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown to during migration.	
		Displacement	No redshank were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Shelduck	Mi (wi)/As	Collision	No shelduck were recorded during site specific surveys. Collision risk modelling was not undertaken for shelduck but based on the predicted collision impacts from the larger Goose species that were modelled, no more than eight collisions per year are predicted. The five year mean peak count (2006/11) of shelduck in the Forth Estuary is 3,394 birds (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA a total of 0.2% of the wintering population may be impacted.	No Likely Significant Effect.
		Barrier	No shelduck were recorded during site specific surveys and no barrier effects will occur should occasional migrating birds detour around the proposed development.	No Likely Significant Effect.
		Displacement	No shelduck were recorded during site specific surveys and no displacement effects will occur.	No Likely Significant Effect.
Turnstone	Mi (wi)/As	Collision	A total of two turnstone were recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 turnstone passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The five year mean peak count (2006/11) of turnstone in the Forth Estuary is 764 birds (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA a total of 1% of the wintering population may be impacted. However, the probability that all possible collisions are of birds from this one SPA is very unlikely as the UK wintering population is 48,000 individuals. The majority of turnstone potentially passing through the site will not be associated with this SPA.	No Likely Significant Effect.

		Firth of Forth SPA & Ramsar		
		Barrier	Turnstone that winter in the UK breed in the Arctic areas of East Canada and Greenland. Those that pass through to wintering sites in West Africa originate from Scandinavia across to Siberia (Holt <i>et al.</i> 2012). It is not possible to predict where birds crossing the proposed development may occur from but any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown by turnstones during migration.	No Likely Significant Effect.
		Displacement	No turnstone were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Scaup	As	Collision	No scaup were recorded during site specific surveys. No collision risk modelling was undertaken. At the time of citation the population was 437 individuals and 4% of UK wintering population. (SNH 2013). Since then numbers occurring at the site have reduced (Holt <i>et al.</i> 2012) and with peak counts of 146 in the Forth Estuary (Forrester <i>et al.</i> 2007).	No Likely Significant Effect.
		Barrier	Scaup wintering in the UK are from Iceland or Scandinavia and western Siberia. The potential incremental increase in flight distance should a barrier effect occur will be negligible compared to the overall distance flown during migration.	No Likely Significant Effect.
		Displacement	No scaup were recorded using the site and displacement effects will occur.	No Likely Significant Effect.
Great-crested grebe	As	Collision	The cited population of great-crested grebe in the Firth of Forth Islands SPA is 720 individuals (SNH 2013). The population has since decreased to less than 300 individuals (Forrester <i>et al.</i> 2007). No great-crested grebes were recorded during site specific surveys and flight heights have been reported to be below turbine height (Cook <i>et al.</i> 2012).	No Likely Significant Effect.
		Barrier	No great-crested grebes were recorded during site specific surveys. No barrier effects will occur.	No Likely Significant Effect.
		Displacement	No great-crested grebes were recorded during of site specific surveys. No displacement effects will occur.	No Likely Significant Effect.
Cormorant	As	Collision	The maximum recorded foraging range for cormorant during the breeding	No Likely Significant Effect.

		Firth of Forth SPA & Ramsar		
			season is 35 km (Thaxter <i>et al.</i> 2012) and therefore the site is within the maximum foraging range. No cormorants were recorded within the proposed development area during site specific surveys and only seven cormorants occurred in the buffer zone. No cormorants were recorded at rotor height and more widely they are reported to fly predominantly below turbine height and therefore there is very low risk of collision (Cook <i>et al.</i> 2012).	
		Barrier	The site is within the maximum reported foraging range for cormorants during the breeding period but no cormorants were recorded within the proposed development area, therefore no barrier effects will occur.	No Likely Significant Effect.
		Displacement	The site is within the reported foraging range for cormorants during the breeding period but no cormorants were recorded using the proposed development area and therefore no displacement effects will occur.	No Likely Significant Effect.
<b>Mallard</b>	As	Collision	No mallard were recorded during site specific surveys. If, based on the modelled number of collisions for Geese, up to eight mallard per year are impacted then this will impact 0.3% of the population reported at the time of citation (SNH 2013). Not all mallard at risk of collision will be from this SPA.	No Likely Significant Effect.
		Barrier	No mallard were recorded flying through the proposed development area. The incremental increase in total flight activity due to a barrier effect will be negligible for migrating mallard.	No Likely Significant Effect.
		Displacement	No mallard were recorded using the proposed development area and no displacement effects will occur.	No Likely Significant Effect.
<b>Curlew</b>	As	Collision	A total of 13 curlew were recorded during site specific surveys all of which were flying below rotor height. Collision risk modelling undertaken based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimates a total of seven collisions per year, based on a 98% avoidance rate. The 5 year peak mean count (2006/11) of curlew at the Forth Estuary is 4,053 (Holt <i>et al.</i> 2012). If all predicted collisions are from this SPA, a total of 0.2% of the wintering population may be impacted.	No Likely Significant Effect.

		Firth of Forth SPA & Ramsar		
		Barrier	Curllew wintering in the UK are from either the UK or from Scandinavia (Wernham <i>et al.</i> 2002). It is not possible to predict where birds crossing the proposed development may occur from but those from Scandinavia may have flown in excess of 1,000 km during migration and therefore any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown.	No Likely Significant Effect.
		Displacement	No curlew were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Long-tailed duck	As	Collision	No long-tailed duck were recorded during site specific surveys. Recorded flight heights for long-tailed duck indicate a very low risk of collision with none of 114 recorded flight heights at rotor height (Cook <i>et al.</i> 2012)	No Likely Significant Effect.
		Barrier	Long-tailed ducks wintering in Britain migrate from northern Fennoscandia and northwest Russia (Wernham <i>et al.</i> 2002). Therefore the potential increase in overall distance flown should a barrier effect occur will be very small compared to the overall migration distance.	No Likely Significant Effect.
		Displacement	No long-tailed ducks were recorded using the proposed development area and no displacement effects will occur.	No Likely Significant Effect.
Common scoter	As	Collision	A total of seven common scoter were recorded during site specific surveys. All were recorded flying below turbine height. Modelled flight height data for common scoter predicts that over 95% of all flights are below turbine height (Cook <i>et al.</i> 2012). Therefore there is a very low risk of collision.	No Likely Significant Effect.
		Barrier	Common scoter wintering in the UK are predominantly from the Russian Arctic and will not be impacted by the relatively small additional distance required to detour around the proposed development during migration.	No Likely Significant Effect.
		Displacement	No common scoter were recorded using the proposed development area and no displacement impacts will occur.	No Likely Significant Effect.
Velvet scoter	As	Collision	No velvet scoter were recorded during site specific surveys. As with common scoter, the majority of flights will be significantly below turbine height (Cook <i>et al.</i> 2012). Therefore there is a very low risk of collision.	No Likely Significant Effect.

		Firth of Forth SPA & Ramsar		
		Barrier	Velvet scoter wintering in the UK are predominantly from the Scandinavia and Russia and will not be impacted by the relatively small additional distance required to detour around the proposed development during migration.	No Likely Significant Effect.
		Displacement	No velvet scoter were recorded using the proposed development area and no displacement impacts will occur.	No Likely Significant Effect.
Goldeneye	As	Collision	No goldeneye were recorded during site specific surveys. No flight height data are available for goldeneye but it is predicted to be at low risk of collision impacts (Cook <i>et al.</i> 2012). No goldeneye were recorded and they are at low risk of collision.	No Likely Significant Effect.
		Barrier	Goldeneye wintering in the UK may be from the small UK breeding population or from the much larger population that migrate from Scandinavia and Russia. The relatively small additional distance required to detour around the proposed development should a barrier effect occur during migration will be negligible.	No Likely Significant Effect.
		Displacement	No goldeneye were recorded using the proposed development area and no displacement impacts will occur.	No Likely Significant Effect.
Red-breasted merganser	As	Collision	No red-breasted mergansers were recorded during site specific surveys. No flight height data are available for red-breasted merganser but it is predicted to be at low risk of collision impacts (Cook <i>et al.</i> 2012). No red-breasted mergansers were recorded and they are at low risk of collision.	No Likely Significant Effect.
		Barrier	Red-breasted merganser wintering in the UK may be from the UK breeding population or from Iceland and Scandinavia (Forrester <i>et al.</i> 2007). The relatively small additional distance required to detour around the proposed development should a barrier effect occur during migration will be negligible.	No Likely Significant Effect.
		Displacement	No red-breasted mergansers were recorded using the proposed development area and no displacement impacts will occur.	No Likely Significant Effect.
Oystercatcher	As	Collision	A total of four oystercatcher were recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000	No Likely Significant Effect.



		Firth of Forth SPA & Ramsar	
			oystercatchers passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of seven collisions per year, based on a 98% avoidance rate. The five year mean peak count (2006/11) of oystercatcher in the Forth Estuary is 7,419 birds (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA a total of 0.1% of the wintering population may be impacted.
		Barrier	Oystercatchers that winter in the northern Britain may be from the UK or from Scandinavia, Iceland and Faroes (Wernham <i>et al.</i> 2002). It is not possible to predict where birds crossing the proposed development may occur from but any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown by oystercatchers during migration.
		Displacement	No oystercatchers were recorded using the site and no displacement effects will occur.
<b>Ringed plover</b>	As	Collision	One ringed plover was recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 ringed plover passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The five year mean peak count (2006/11) of ringed plover in the Forth Estuary is 621 birds (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA a total of 1% of the wintering population may be impacted. This assumes that all ringed plover at risk of an impact are from this SPA. The Scottish wintering population is up to 25,000 individuals (Forrester <i>et al.</i> 2007) and therefore it is likely that at least some of those that may be impacted will not be from this SPA.
		Barrier	Ringed plovers that winter in eastern Britain may be from the UK or from Fennoscandia (Wernham <i>et al.</i> 2002). It is not possible to predict where birds crossing the proposed development may occur from but any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown by ringed plover during migration.
		Displacement	No ringed plovers were recorded using the site and no displacement effects will

		Firth of Forth SPA & Ramsar		
			occur.	
Grey plover	As	Collision	No grey plover were recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 grey plover passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The population at the time of citation is 724 birds (SNH 2013). Therefore, if all predicted collisions are from this SPA a total of 1% of the wintering population may be impacted. This assumes that all grey plover at risk of an impact are from this SPA. The Scottish wintering population is up to 2,800 individuals and up to 10,000 may occur during migration (Forrester <i>et al.</i> 2007) and therefore it is likely that at least some of those that may be impacted will not be from this SPA.	No Likely Significant Effect.
		Barrier	Grey plover breed in the high Arctic and winter as far south as southern Africa (Wernham <i>et al.</i> 2002). They are long distance migrants and therefore any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown by grey plover during migration.	No Likely Significant Effect.
		Displacement	No grey plovers were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Lapwing	As	Collision	No lapwing were recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 lapwing passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The population at time of citation is 4,184 birds (SNH 2013). Therefore, if all predicted collisions are from this SPA a total of 0.1% of the wintering population may be impacted. Not all collisions will be from this SPA.	No Likely Significant Effect.
		Barrier	Lapwings wintering in the UK are from either the UK or from Scandinavia (Wernham <i>et al.</i> 2002). It is not possible to predict where birds crossing the proposed development may occur from but those from Scandinavia may have flown in excess of 1,000 km during migration and therefore any small additional increase in flight due to barrier effects will be negligible compared to	No Likely Significant Effect.

		Firth of Forth SPA & Ramsar		
			the total distance flown.	
		Displacement	No lapwings were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Dunlin	As	Collision	A total of seven dunlin were recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 dunlin passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The five year peak mean population (2006/11) is 5,995 birds (Holt <i>et al.</i> 2012) and therefore, if all predicted collisions are from this SPA a total of 0.1% of the wintering population may be impacted.	No Likely Significant Effect.
		Barrier	Dunlin wintering in the UK are from either the UK or from Scandinavia or further east (Wernham <i>et al.</i> 2002). It is not possible to predict where birds crossing the proposed development may occur from but those from Scandinavia may have flown in excess of 1,000 km during migration and therefore any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown.	No Likely Significant Effect.
		Displacement	No dunlin were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Wigeon	As	Collision	A total of 41 wigeon were recorded during site specific surveys, of which 4.8% were flying at rotor height and at risk of collision. No collision risk modelling has been undertaken for wigeon but based on predicted number of collisions for the significantly larger Geese species a total of eight collisions per year are predicted to occur. The population of the site at the time of citation was 2,139 individuals. Therefore up to 0.4% of the population may be impacted if they are all from this SPA. However, not all predicted impacts will be from this SPA.	No Likely Significant Effect.
		Barrier	Wigeon wintering in the UK are from either the UK or from the relatively small UK breeding population or from the much larger breeding populations in Fennoscandia, Russia and western Siberia (Wernham <i>et al.</i> 2002). It is not possible to predict where birds crossing the proposed development may occur from but those from Scandinavia or further afield will have flown in excess of 1,000 km during migration and therefore any small additional increase in flight	No Likely Significant Effect.

Firth of Forth SPA & Ramsar			
			due to barrier effects will be negligible compared to the total distance flown.
		Displacement	No wigeon were recorded using the proposed development area and no displacement impacts will occur.
No Likely Significant Effect.			
<b>Note Br = breeding, Wi = Winter, Mi = Migrant, As = Assemblage</b>			

Table A.6: Firth of Tay and Eden Estuary

Firth Tay & Eden Estuary SPA & Ramsar	
<b>Area</b>	6,923.29 ha
<b>Distance from NNG development area</b>	30 km
<b>Article 4.1</b>	<p><b>Breeding;</b></p> <ul style="list-style-type: none"> <li>● Little Tern <i>Sterna albifrons</i>; and</li> <li>● Marsh Harrier <i>Circus aeruginosus</i>.</li> </ul> <p><b>Winter;</b></p> <ul style="list-style-type: none"> <li>● Bar-tailed Godwit <i>Limosa lapponica</i>.</li> </ul>
<b>Article 4.2 – Migratory Species</b>	<p><b>Winter;</b></p> <ul style="list-style-type: none"> <li>● Greylag Goose <i>Anser anser</i>,</li> <li>● Pink-footed Goose <i>Anser brachyrhynchus</i>, and</li> <li>● Redshank <i>Tringa totanus</i></li> </ul>
<b>Article 4.2 – Assemblage</b>	<p><b>Assemblage</b></p> <ul style="list-style-type: none"> <li>● Velvet Scoter <i>Melanitta fusca</i>;</li> <li>● Pink-footed Goose <i>Anser brachyrhynchus</i>;</li> <li>● Greylag Goose <i>Anser anser</i>;</li> <li>● Redshank <i>Tringa tetanus</i>;</li> <li>● Cormorant <i>Phalacrocorax carbo</i>;</li> <li>● Shelduck <i>Tadorna tadorna</i>;</li> <li>● Eider <i>Somateria mollissima</i>;</li> <li>● Bar-tailed Godwit <i>Limosa lapponica</i>;</li> <li>● Common Scoter <i>Melanitta nigra</i>;</li> </ul>

Firth Tay & Eden Estuary SPA & Ramsar				
<ul style="list-style-type: none"> <li>● Black-tailed Godwit <i>Limosa limosa islandica</i>;</li> <li>● Goldeneye <i>Bucephala clangula</i>;</li> <li>● Red-breasted Merganser <i>Mergus serrator</i>;</li> <li>● Goosander <i>Mergus merganser</i>;</li> <li>● Oystercatcher <i>Haematopus ostralegus</i>;</li> <li>● Grey Plover <i>Pluvialis squatarola</i>;</li> <li>● Sanderling <i>Calidris alba</i>;</li> <li>● Dunlin <i>Calidris alpina alpina</i>; and</li> <li>● Long-tailed duck <i>Clangula hyemalis</i>.</li> </ul>				
<b>Conservation Objectives: See Section 6.1</b>				
Qualifying Feature		Potential Impact	Details	Effect
Little tern	Br	Collision	No little terns were recorded during site specific surveys.	No Likely Significant Effect.
		Barrier	No little terns were recorded during site specific surveys.	No Likely Significant Effect.
		Displacement	No little terns were recorded during site specific surveys.	No Likely Significant Effect.
Marsh harrier	Br	Collision	No Marsh harriers were recorded during specific surveys.	No Likely Significant Effect.
		Barrier	No Marsh harriers were recorded during specific surveys.	No Likely Significant Effect.
		Displacement	No Marsh harriers were recorded during site specific surveys.	No Likely Significant Effect.
Bar-tailed godwit	Wi/As	Collision	One bar-tailed godwit was recorded during site specific surveys. It was flying below 7.5 m. Collision risk modelling undertaken based on an assumed population of 1,000 bar-tailed godwits passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The five year mean peak count (2006/11) of bar-tailed godwit in the Tay and Eden estuaries 1,609 birds (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are	No Likely Significant Effect.

		Firth Tay & Eden Estuary SPA & Ramsar		
			from this SPA a total of 0.4% of the wintering population may be impacted. Not all impacts will be of birds from this SPA.	
		Barrier	The closest breeding bar-tailed godwits are in northern Fennoscandia and the Kola Peninsula over 2,000 km away. The additional distance migrating bar-tailed godwits will have to fly to detour around the proposed development is negligible.	No Likely Significant Effect.
		Displacement	No bar-tailed godwits were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Redshank	Mi (wi)/As	Collision	A total of four redshank were recorded during site specific surveys. All were flying below rotor height. Collision risk modelling was not undertaken for redshank but was for the similar grey plover. Based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height collision risk modelling estimated a total of seven collisions per year, based on a 98% avoidance rate. The cited redshank population for the Firth Tay and Eden Estuaries SPA is 1,800 individuals (SNH 2013). Therefore, if all predicted collisions are from this SPA, a total of 0.4% of the wintering population may be impacted. Not all impacts will be from this SPA.	No Likely Significant Effect.
		Barrier	Redshank breed in the UK and across from Iceland to Russia and winter across the UK. It is not possible to predict where birds crossing the proposed development may occur from but are likely to be either UK breeding birds or birds from Iceland (Wernham <i>et al.</i> 2002). Any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown to during migration.	No Likely Significant Effect.
		Displacement	No redshank were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Greylag goose	Mi (wi)/As	Collision	No greylag geese were recorded during site specific surveys. Collision risk modelling undertaken for other Goose species indicates that up to eight geese per year may be at risk of a collision impact. The peak 5 year mean population of greylag geese at this SPA is 1,344 individuals (Holt <i>et al.</i> 2012). If all those	No Likely Significant Effect.

		Firth Tay & Eden Estuary SPA & Ramsar		
			predicted to collide are from this SPA up to 0.6% of the population may be impacted. However, this is unlikely to be the case due to the lack of any observations of this species and the distance the SPA is from the proposed development area.	
		Barrier	Greylag geese wintering at this SPA breed in Iceland and therefore migrate over 1,000 km each year. The potential barrier effect should geese fly around the proposed development will be negligible.	No Likely Significant Effect.
		Displacement	No greylag geese were recorded within the proposed development area and no displacement effects will occur.	No Likely Significant Effect.
Pink-footed goose	Mi (wi)/As	Collision	Of the 577 pink-footed geese recorded during site specific surveys 45.4% were flying above 27.5 m and therefore at risk of collision impacts. Collision risk modelling undertaken based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height predicts a total of eight collisions per year, based on a 98% avoidance rate. The 5 year peak mean count (2006/11) for Firth Tay and Eden Estuaries is 7,678 individuals (Holt <i>et al.</i> 2012) and therefore if all eight collisions per year are from the SPA then up to 0.1% of the population may be impacted. This will not cause an adverse effect on the population.	No Likely Significant Effect.
		Barrier	Pink-footed geese fly breed in Iceland migrate to the UK in winter. Birds passing through the proposed development area will have flown in excess of 1,000 km and the additional distance birds may fly to detour around the wind farm is very small compared to the total distance flown.	No Likely Significant Effect.
		Displacement	No pink-footed geese were recorded using the area and no displacement impacts will occur.	No Likely Significant Effect.
Velvet scoter	As	Collision	No velvet scoter were recorded during site specific surveys. As with common scoter, the majority of flights will be significantly below turbine height (Cook <i>et al.</i> 2012). Therefore, there is a very low risk of collision.	No Likely Significant Effect.
		Barrier	Velvet scoter wintering in the UK are predominantly from the Scandinavia and Russia and will not be impacted by the relatively small additional distance	No Likely Significant Effect.



		Firth Tay & Eden Estuary SPA & Ramsar		
			required to detour around the proposed development during migration.	
		Displacement	No velvet scoters were recorded using the proposed development area and no displacement impacts will occur.	No Likely Significant Effect.
Cormorant	As	Collision	The maximum recorded foraging range for cormorant during the breeding season is 35 km (Thaxter <i>et al.</i> 2012) and therefore the site is within the maximum foraging range. No cormorants were recorded within the proposed development area during site specific surveys and only seven cormorants occurred in the buffer zone. No cormorants were recorded at rotor height and more widely they are reported to fly predominantly below turbine height and therefore there is very low risk of collision (Cook <i>et al.</i> 2012).	No Likely Significant Effect.
		Barrier	The site is within the maximum reported foraging range for cormorants during the breeding period but no cormorants were recorded within the proposed development area therefore no barrier effects will occur.	No Likely Significant Effect.
		Displacement	The site is within the reported foraging range for cormorants during the breeding period but no cormorants were recorded using the proposed development area and therefore no displacement effects will occur.	No Likely Significant Effect.
Eider	As	Collision	A total of 22 eider were recorded from site specific surveys, all of which were flying below turbine height. Modelled flight height data indicates that 2% of flight heights might be at rotor height and therefore there is a very low risk of collision.	No Likely Significant Effect.
		Barrier	Although the UK eider population is not strongly migratory birds may show some localised seasonal movements. The low numbers recorded indicate that there will be no significant barrier effect as birds pass only occasionally across the site.	No Likely Significant Effect.
		Displacement	No eider were seen using the proposed development area and no displacement impacts will occur.	No Likely Significant Effect.
Common scoter	As	Collision	A total of seven common scoter were recorded during site specific surveys. All were recorded flying below turbine height. Modelled flight height data for	No Likely Significant Effect.

		Firth Tay & Eden Estuary SPA & Ramsar		
			common scoter predicts that over 95% of all flights are below turbine height (Cook <i>et al.</i> 2012). Therefore there is a very low risk of collision.	
		Barrier	Common scoter wintering in the UK are predominantly from the Russian Arctic and will not be impacted by the relatively small additional distance required to detour around the proposed development during migration.	No Likely Significant Effect.
		Displacement	No common scoter were recorded using the proposed development area and no displacement impacts will occur.	No Likely Significant Effect.
Black-tailed godwit	As	Collision	No black-tailed godwits were recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 black-tailed godwits passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The population at the time of citation was 150 individuals (SNH 2013). Therefore, if all predicted collisions are from this SPA a total of 5.3% of the wintering population may be impacted. However, no black-tailed godwits were recorded and therefore the risk of any being impacted is very low. Furthermore, it is unlikely that all those modelled to be impacted will be from this SPA as the UK population is approximately 33,000 individuals (Holt <i>et al.</i> 2012).	No Likely Significant Effect.
		Barrier	There is small UK breeding population but most black-tailed godwits are from Iceland over 1,000 km away. The additional distance migrating black-tailed godwits will have to fly to detour around the proposed development is negligible.	No Likely Significant Effect.
		Displacement	No black-tailed godwits were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Goldeneye	As	Collision	No goldeneye were recorded during site specific surveys. No flight height data are available for goldeneye but it is predicted to be at low risk of collision impacts (Cook <i>et al.</i> 2012). No goldeneye were recorded and they are at low risk of collision.	No Likely Significant Effect.
		Barrier	Goldeneye wintering in the UK may be from the small UK breeding population	No Likely Significant Effect.

		Firth Tay & Eden Estuary SPA & Ramsar		
			or from the much larger population that migrate from Scandinavia and Russia. The relatively small additional distance required to detour around the proposed development should a barrier effect occur during migration will be negligible.	
		Displacement	No goldeneye were recorded using the proposed development area and no displacement impacts will occur.	No Likely Significant Effect.
Red-breasted merganser	As	Collision	No red-breasted merganser were recorded during site specific surveys. No flight height data are available for red-breasted merganser but it is predicted to be at low risk of collision impacts (Cook <i>et al.</i> 2012). No red-breasted merganser were recorded and they are at low risk of collision.	No Likely Significant Effect.
		Barrier	Red-breasted merganser wintering in the UK may be from the UK breeding population or from Iceland and Scandinavia (Forrester <i>et al.</i> 2007). The relatively small additional distance required to detour around the proposed development should a barrier effect occur during migration will be negligible.	No Likely Significant Effect.
		Displacement	No red-breasted merganser were recorded using the proposed development area and no displacement impacts will occur.	No Likely Significant Effect.
Oystercatcher	As	Collision	A total of four oystercatchers were recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 oystercatchers passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of seven collisions per year, based on a 98% avoidance rate. The oystercatcher population at the time of citation in the Firth of Tay and Eden Estuary is 5,100 birds (SNH 2013). Therefore, if all predicted collisions are from this SPA a total of 0.1% of the wintering population may be impacted.	No Likely Significant Effect.
		Barrier	Oystercatchers that winter in the northern Britain may be from the UK or from Scandinavia, Iceland and Faroes (Wernham <i>et al.</i> 2002). It is not possible to predict where birds crossing the proposed development may occur from but any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown by oystercatchers during migration.	No Likely Significant Effect.

		Firth Tay & Eden Estuary SPA & Ramsar		
		Displacement	No oystercatchers were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Dunlin	As	Collision	A total of seven dunlin were recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 dunlin passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The five year peak mean population (2006/11) is 2,715 birds (Holt <i>et al.</i> 2012) and therefore, if all predicted collisions are from this SPA a total of 0.2% of the wintering population may be impacted. Not all impacts will be from this SPA.	No Likely Significant Effect.
		Barrier	Dunlin wintering in the UK are from either the UK or from Scandinavia or further east (Wernham <i>et al.</i> 2002). It is not possible to predict where birds crossing the proposed development may occur from but those from Scandinavia may have flown in excess of 1,000 km during migration and therefore any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown.	No Likely Significant Effect.
		Displacement	No dunlin were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Sanderling	As	Collision	A total of two sanderling were recorded during site specific surveys. Collision risk modelling indicates that up to six sanderling per year may be impacted. The 5 year peak mean population at the site is 174 individuals (Holt <i>et al.</i> 2012) and therefore up to 3% of the population may be impacted. However, only two sanderling were recorded and therefore the risk of any being impacted is very low. Furthermore, it is unlikely that all those predicted to be impacted will be from this SPA as the UK population is approximately 12,000 individuals (Holt <i>et al.</i> 2012).	No Likely Significant Effect.
		Barrier	Sanderling are high Arctic breeders in northern Canada, Greenland and Siberia. They are long distance migrants and will not be impacted by any possible barrier effects.	No Likely Significant Effect.
		Displacement	No sanderling were recorded using the proposed development area. there will	No Likely Significant Effect.

		Firth Tay & Eden Estuary SPA & Ramsar		
			be no displacement effects.	
Grey plover	As	Collision	No grey plover was recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 grey plover passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The five year mean peak count (2006/11) of grey plover in the Eden and Tay Estuaries is 957 birds (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA a total of 0.7% of the wintering population may be impacted. This assumes that all grey plover at risk of an impact are from this SPA. This assumes that all grey plover at risk of an impact are from this SPA. The Scottish wintering population is up to 2,800 individuals and up to 10,000 may occur during migration (Forrester <i>et al.</i> 2007) and therefore it is likely that at least some of those that may be impacted will not be from this SPA.	No Likely Significant Effect.
		Barrier	Grey plover breed in the high Arctic and winter as far south as southern Africa (Wernham <i>et al.</i> 2002). They are long distance migrants and therefore any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown by grey plover during migration.	No Likely Significant Effect.
		Displacement	No grey plovers were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Long-tailed duck	As	Collision	No long-tailed duck were recorded during site specific surveys. Recorded flight heights for long-tailed duck indicate a very low risk of collision with none of 114 recorded flight heights at rotor height (Cook <i>et al.</i> 2012)	No Likely Significant Effect.
		Barrier	Long-tailed ducks wintering in Britain migrate from northern Fennoscandia and northwest Russia (Wernham <i>et al.</i> 2002). Therefore the potential increase in overall distance flown should a barrier effect occur will be very small compared to the overall migration distance.	No Likely Significant Effect.
		Displacement	No long-tailed ducks were recorded using the proposed development area and no displacement effects will occur.	No Likely Significant Effect.

Firth Tay & Eden Estuary SPA & Ramsar

Note Br = breeding, Wi = Winter, Mi = Migrant, As = Assemblage

Table A.7: Forth Islands

Forth Islands SPA	
<b>Area</b>	9,796.98 ha
<b>Distance from NNG development area</b>	16 km
<b>Article 4.1</b>	<p><b>Breeding;</b></p> <ul style="list-style-type: none"> <li>● Arctic Tern <i>Sterna paradisaea</i>;</li> <li>● Common Tern <i>Sterna hirundo</i>;</li> <li>● Roseate Tern <i>Sterna dougallii</i>; and</li> <li>● Sandwich Tern <i>Sterna sandvicensis</i>.</li> </ul>
<b>Article 4.2 – Migratory Species</b>	<p><b>Breeding;</b></p> <ul style="list-style-type: none"> <li>● Gannet <i>Morus bassanus</i>;</li> <li>● Lesser black-backed Gull <i>Larus fuscus</i>;</li> <li>● Puffin <i>Fratercula arctica</i>; and</li> <li>● Shag <i>Phalacrocorax aristotelis</i>.</li> </ul>
<b>Article 4.2 – Assemblage</b>	<p><b>Assemblage</b></p> <ul style="list-style-type: none"> <li>● Razorbill <i>Alca torda</i>;</li> <li>● Guillemot <i>Uria aalge</i>;</li> <li>● Kittiwake <i>Rissa tridactyla</i>;</li> <li>● Herring Gull <i>Larus argentatus</i>;</li> <li>● Cormorant <i>Phalacrocorax carbo</i>;</li> <li>● Fulmar <i>Fulmarus glacialis</i>;</li> <li>● Puffin <i>Fratercula arctica</i>;</li> <li>● Lesser Black-backed Gull <i>Larus fuscus</i>;</li> </ul>

		Forth Islands SPA		
		<ul style="list-style-type: none"> <li>● Shag <i>Phalacrocorax aristotelis</i>;</li> <li>● Gannet <i>Morus bassanus</i>;</li> <li>● Arctic Tern <i>Sterna paradisaea</i>;</li> <li>● Common Tern <i>Sterna hirundo</i>;</li> <li>● Roseate Tern <i>Sterna dougallii</i>; and</li> <li>● Sandwich Tern <i>Sterna sandvicensis</i>.</li> </ul>		
<b>Conservation Objectives: See Section 6.1</b>				
Qualifying Feature		Potential Impact	Details	Effect
Arctic tern	Br/As	Collision	<p>SNH have advised that there is a likely significant effect on Arctic terns (SNH 2012).</p> <p>Of the 1,186 sightings of Arctic tern from which flight heights were recorded, 99.8% were of birds flying below rotor height. The maximum reported foraging range during the breeding period is 30 km (Thaxter <i>et al.</i> 2012). Collision risk modelling undertaken assuming 2,000 birds per year passing through the offshore site and 3% at rotor height predicts an annual mortality of 0.1 birds per year.</p> <p>Consequently, collision risk modelling predicts one collision every ten years.</p>	No Likely Significant Effect
		Barrier	The vast majority of Arctic terns were only recorded during autumn migration when they fly to the Antarctic. The potential additional distance that an Arctic tern will fly should it detour will not cause any effect. The SPA is beyond the maximum recorded foraging range for breeding Arctic tern	No Likely Significant Effect
		Displacement	No displacement effects to Arctic terns have been recorded from constructed offshore wind farms and the species is at low risk of displacement by boats (e.g. Furness & Wade 2012; Zucco <i>et al.</i> 2006). The SPA is outwith the maximum reported foraging range for Arctic tern and therefore no regularly barrier effects will occur during the breeding period.	No Likely Significant Effect



		Forth Islands SPA		
Common tern	Br/As	Collision	<p>SNH have advised that there will be a likely significant effect on common terns from the proposed development (SNH 2012).</p> <p>However, the offshore site is 16 km away from the SPA and marginally beyond the mean maximum foraging range of 15.2 km for this species but within the mean maximum foraging range +1 S.D. of 26.4 km (Thaxter <i>et al.</i> 2012). A total of 36 common terns were recorded in flight, all of which were below turbine height. Collision risk modelling assuming 2,000 common terns per year passing through the site and 13% at rotor height predicts a total of 0.5 collisions per year.</p> <p>No common terns were recorded during the breeding period and therefore those recorded will have been migrating birds and from any SPA and a much larger population. The likelihood of the one collision predicted every two years being from this SPA is remote.</p>	No Likely Significant Effect
		Barrier	The proposed development is 16 km away from the SPA and there is potential for a barrier effect. Common terns were only recorded during the migration period when birds are flying to their wintering grounds off Africa. The additional distance caused by a possible barrier effect will be negligible.	No Likely Significant Effect
		Displacement	The proposed development is 16 km away from the SPA and therefore birds may be displaced. No common terns were recorded during the breeding season and therefore no displacement during this period is predicted to occur. Furness & Wade (2012) identified common tern as being at relatively low risk of displacement level impacts including from vessels.	No Likely Significant Effect
Roseate tern	Br/As	Collision	No roseate terns were recorded during site specific surveys.	No Likely Significant Effect.
		Barrier	No roseate terns were recorded during site specific surveys.	No Likely Significant Effect.
		Displacement	No roseate terns were recorded during site specific surveys.	No Likely Significant Effect.
Sandwich tern	Br/As	Collision	No Sandwich terns were recorded during site specific surveys.	No Likely Significant Effect.
		Barrier	No Sandwich terns were recorded during site specific surveys.	No Likely Significant Effect.

		Forth Islands SPA		
		Displacement	No Sandwich terns were recorded during site specific surveys.	No Likely Significant Effect.
Gannet	Mi (br)/As	Collision	Of the 41,250 gannets for which flight height data were collected, a total of 4.8% of were recorded at rotor height. Therefore there is the potential for a likely significant effect	Likely Significant Effect
		Barrier	Assuming that the mean destination distance of gannet foraging flights is 90 km (Thaxter <i>et al.</i> , 2012) flight routes of gannets affected by a barrier effect would be increased by approximately 3.5%. Studies on foraging gannets have shown that they are capable of extending foraging distances in response to distribution of prey, suggesting that birds would easily absorb the relatively minor increases in flight distances that a barrier could cause (Hamer <i>et al.</i> , 2007; Hamer <i>et al.</i> , 2011). On this basis, gannets appear to have a low sensitivity to barrier effects.	No Likely Significant Effect
		Displacement	Gannets are known to have a high level of displacement from offshore wind farms.	Likely Significant Effect
Lesser black-backed gull	Mi (br)/As	Collision	Of the 358 lesser black-backed gulls recorded in flight, 9.2% were recorded as flying above rotor height. Up to three lesser black-backed gulls are predicted to collide each year. If all these are from the SPA then 0.09% of the breeding population may be impacted. Advice from SNH is that there will be a likely significant effect on lesser black-backed gull (SNH, 2012)	Likely Significant Effect
		Barrier	Lesser black-backed gulls are not known to avoid wind farms (Zucco <i>et al.</i> 2006) and no barrier effects are predicted to occur.	No Likely Significant Effect
		Displacement	Lesser black-backed gulls are not known to avoid wind farms (Zucco <i>et al.</i> 2006) and no displacement effects are predicted to occur from the wind farm. Lesser black-backed gulls are not disturbed by vessels.	No Likely Significant Effect
Puffin	Mi (br)/As	Collision	Of the 7,049 puffins were recorded in flight 99.9% were recorded flying below turbine height. There is a very low risk of collision.	No Likely Significant Effect.
		Barrier	The mean maximum foraging range for puffin is reported to be 105 km,	No Likely Significant Effect.

		Forth Islands SPA		
			<p>therefore puffins from this SPA may be impacted from a barrier effect. The mean foraging distance is 4 km from a colony and the majority of puffins will forage in waters nearer to the SPA and relatively few are predicted to forage regularly beyond the proposed development area.</p> <p>Assuming that the average destination of barrier-affected flights lies on average 45 km from the colony, the mean increase in the length of affected flights is estimated to be approximately 3.7 km and therefore will not cause a likely significant effect.</p>	
		Displacement	<p>The mean maximum foraging range for puffin is reported to be 105 km, therefore puffins from this SPA may be impacted from a displacement effect.</p> <p>Furness &amp; Wade (2012) identified puffins as being at relatively low risk of disturbance effects from vessels.</p>	<b>Likely Significant Effect.</b>
Shag	Mi (br)/As	Collision	<p>The maximum recorded foraging range for shag during the breeding season is 17 km (Thaxter <i>et al.</i> 2012) and therefore the site is beyond the maximum foraging range. No shags were recorded within the offshore site during three years of site specific surveys. All birds were recorded flying below turbine height. Therefore there is a very low risk of collision.</p>	No Likely Significant Effect.
		Barrier	<p>The site is beyond the maximum reported foraging range for shags during the breeding period and therefore no barrier effects will occur.</p>	No Likely Significant Effect.
		Displacement	<p>No shags were recorded within the offshore site and the site is beyond the maximum reported foraging range for this species. No displacement effects are predicted.</p>	No Likely Significant Effect.
Razorbill	As	Collision	<p>Of 1,949 razorbills for which flight heights were recorded none were recorded at rotor height of 27.5 m. There is a very low risk of collision.</p>	No Likely Significant Effect.
		Barrier	<p>The mean maximum foraging range for razorbill is reported to be 48.5 km and the maximum is 95 km (Thaxter <i>et al.</i> 2012), therefore razorbills from this SPA may be impacted from a barrier effect. Modelling being developed to assess displacement impacts on a related Auk species, the guillemot (CEH <i>in prep.</i>) has indicated that on average there is no increase in flight times for birds from the</p>	No Likely Significant Effect.

		Forth Islands SPA	
			Forth Islands SPA with or without the presence of Neart na Gaoithe. A similar level of effect is predicted for razorbill and no significant barrier effect will occur.
		Displacement	The site is within the mean maximum foraging range of razorbills from this SPA and they may be displaced away from the offshore site during the breeding period potentially increasing risk of mortality.
Guillemot	As	Collision	A total of 6,812 guillemots were recorded in flight during three years of site specific surveys. All but one guillemot was recorded below rotor height of 27.5 m. Collision risk modelling predicts no mortalities per year.
		Barrier	The SPA is within the mean maximum foraging range of 84 km and the mean reported foraging range of 38 km (Thaxter <i>et al.</i> 2012) Therefore birds present during the breeding period will be from this SPA. Modelling being developed to assess displacement impacts on guillemots (CEH <i>in prep.</i> ) has also indicated that on average there is no increase in flight times for birds from the Forth Islands SPA with or without the presence of Neart na Gaoithe. Therefore no barrier effects likely to cause a significant effect.
		Displacement	If 50% of guillemots are displaced during the breeding season out to 1 km the impact this would be the effective loss of around 0.4% of the foraging habitat of the regional breeding population. The sensitivity of the population to displacement during the breeding period is unknown, but is likely to be moderate because birds are attending their breeding colonies and therefore will have high feeding requirements. Over 99% of available foraging habitat is still available and therefore guillemots may not be impacted by displacement impacts.  Although guillemots may be affected by vessel disturbance the area predicted to be impacted will be very localised (a few hundred metres) and temporary and therefore no likely significant effect will occur during construction or decommissioning.
Kittiwake	As	Collision	Of the 6,945 kittiwakes for which flight heights were recorded, 4.8% were above rotor height of 27.5 m. The SPA is within the reported mean maximum

		Forth Islands SPA		
			foraging range of 60 km and the mean foraging range of 24.8 m for kittiwake during the breeding season (Thaxter <i>et al.</i> 2012) and therefore birds at this site are at risk of being impacted during the breeding period. Collision risk modelling predicts a total annual number of collisions of 86 birds, of which 26 will be during the breeding period.	
		Barrier	The proposed development is within the mean foraging range for kittiwake during the breeding period. Modelling indicates that 5% of flights might be impacted and the size of the detours are relatively small.	No Likely Significant Effect.
		Displacement	Kittiwakes do not demonstrate displacement from operating offshore wind farms. Numbers of kittiwakes recorded at Horns rev increased following construction and similar results were obtained from Egmond aan Zee where post-construction monitoring showed statistically significant attraction to the wind farm during one survey with non-significant results (neither attraction or avoidance) for a further four surveys (Leopold <i>et al.</i> 2011). No displacement effects are predicted.	No Likely Significant Effect.
Herring gull	As	Collision	A total of 21.7% of all herring gulls recorded were flying at rotor height. Results from collision risk modelling indicate that up to 85 herring gulls are predicted to collide each year, of which 26 will be during the breeding period.	<b>Likely Significant Effect.</b>
		Barrier	Herring gulls are not known to avoid wind farms (Zucco <i>et al.</i> 2006) and no barrier effects are predicted to occur.	No Likely Significant Effect.
		Displacement	Herring gulls are not known to avoid wind farms (Zucco <i>et al.</i> 2006) and are not considered susceptible to disturbance impacts by boats many of which they will follow. No displacement effects are predicted to occur.	No Likely Significant Effect.
Cormorant	As	Collision	The maximum recorded foraging range for cormorant during the breeding season is 35 km (Thaxter <i>et al.</i> 2012) and therefore the site is within the maximum foraging range. No cormorants were recorded within the proposed development area during site specific surveys and only seven cormorants occurred in the buffer zone. No cormorants were recorded at rotor height and more widely they are reported to fly predominantly below turbine height and	No Likely Significant Effect.

		Forth Islands SPA	
			therefore there is very low risk of collision (Cook <i>et al.</i> 2012).
		Barrier	The site is within the maximum reported foraging range for cormorants during the breeding period but no cormorants were recorded within the proposed development area therefore no barrier effects will occur.
		Displacement	The site is within the reported foraging range for cormorants during the breeding period but no cormorants were recorded using the proposed development area and therefore no displacement effects will occur.
Fulmar	As	Collision	Of the 1,831 fulmar sightings for which flight height data were recorded from three years of surveys a total 1,806 fulmars were flying below 7.5 m above sea surface and 99.9% of all flights were below turbine height and therefore the risk of any impacts from collision mortality is negligible.
		Barrier	The mean destination distance of fulmar foraging flights is 48 km (Thaxter <i>et al.</i> , 2012). If a barrier effect occur this would mean that the flight routes of fulmars affected by a barrier effect would be increased by approximately 2.2% for the Isle of May. This is a relatively small increase in flight for a pelagic species that ranges up to 300 km from a colony and is an oceanic seabird spending a large proportion of its time in flight.
		Displacement	If displacement occur it is estimated that on average displacement could result in the effective loss of up to 0.06% of the foraging habitat of the regional breeding fulmar population. This is a very small proportion of the possible foraging habitat available. SNH have advised that there is potential likely significant effect of fulmar from this SPA (SNH 2012).
<p>Note Br = breeding, Wi = Winter, Mi = Migrant, As = Assemblage</p>			

Table A.8: Fowlsheugh

		Fowlsheugh SPA		
<b>Area</b>		1,303.54 ha		
<b>Distance from NNG development area</b>		62 km		
<b>Article 4.1</b>		<b>Breeding;</b> -		
<b>Article 4.2 – Migratory Species</b>		<b>Breeding;</b> <ul style="list-style-type: none"> <li>● Guillemot <i>Uria aalge</i>; and</li> <li>● Kittiwake <i>Rissa tridactyla</i>.</li> </ul>		
<b>Article 4.2 – Assemblage</b>		<b>Assemblage</b> <ul style="list-style-type: none"> <li>● Razorbill <i>Alca torda</i>;</li> <li>● Herring Gull <i>Larus argentatus</i>;</li> <li>● Fulmar <i>Fulmarus glacialis</i>;</li> <li>● Guillemot <i>Uria aalge</i>; and</li> <li>● Kittiwake <i>Rissa tridactyla</i>.</li> </ul>		
<b>Conservation Objectives: See Section 6.1</b>				
Qualifying Feature		Potential Impact	Details	Effect
Guillemot	Mi (br)/As	Collision	A total of 6,812 guillemots were recorded in flight during three years of site specific surveys. All but one guillemot was recorded below rotor height of 27.5 m. Collision risk modelling predicts no mortalities per year.	No Likely Significant Effect.
		Barrier	The SPA is within the mean maximum foraging range of 84 km but outwith the mean reported foraging range of 38 km (Thaxter <i>et al.</i> 2012). Therefore, birds present during the breeding period may be from this SPA. Modelling being developed to assess displacement impacts on guillemot has indicated that on average there is no increase in flight times for birds from the SPA with or	No Likely Significant Effect.

		Fowlsheugh SPA		
			without the presence of Neart na Gaoithe (CEH <i>in prep</i> ).	
		Displacement	<p>Guillemots from the SPA may be displaced during the breeding season. The sensitivity of the population to displacement during the breeding period is unknown.</p> <p>Although guillemots may be affected by vessel disturbance the area predicted to be impacted will be very localised and temporary and therefore no likely significant effect will occur during construction or decommissioning.</p>	<b>Likely Significant Effect.</b>
Kittiwake	Mi (br)/As	Collision	Of the 6,945 kittiwakes for which flight heights were recorded, 4.8% were above rotor height of 27.5 m. The SPA is marginally beyond the reported mean maximum foraging range of 60 km (Thaxter <i>et al.</i> 2012) and therefore birds at this site may be at risk of being impacted during the breeding period. Collision risk modelling predicts a total annual number of collisions of 86 birds, of which 26 will be during the breeding period.	<b>Likely Significant Effect.</b>
		Barrier	The proposed development is marginally beyond the mean maximum foraging range for kittiwake during the breeding period. Barrier effects will be negligible on birds from this SPA during the breeding period.	No Likely Significant Effect.
		Displacement	<p>Kittiwakes do not demonstrate displacement from operating offshore wind farms. Numbers of kittiwakes recorded at Horns rev increased following construction and similar results were obtained from Egmond aan Zee where post-construction monitoring showed statistically significant attraction to the wind farm during one survey with non-significant results (neither attraction or avoidance) for a further four surveys (Leopold <i>et al.</i> 2011).</p> <p>No displacement effects are predicted.</p>	No Likely Significant Effect.
Razorbill	As	Collision	Of the 1,949 razorbills for which flight heights were recorded none were recorded at rotor height of 27.5 m. There is a very low risk of collision.	No Likely Significant Effect.
		Barrier	The mean maximum foraging range for razorbill is reported to be 48.5 km and the maximum is 95 km (Thaxter <i>et al.</i> 2012), therefore this SPA is beyond the mean maximum foraging range but within the maximum. Razorbills from this SPA will only occasionally be impacted by a barrier effect during the breeding	No Likely Significant Effect.



		Fowlsheugh SPA		
			period and the incremental increase in foraging distance will be relatively small compared to the overall flights.	
		Displacement	Although the site is beyond the mean maximum foraging range birds may be displaced during the breeding period potentially increasing risk of mortality.	<b>Likely Significant Effect.</b>
Herring gull	As	Collision	A total of 21.7% of all herring gulls recorded were flying at rotor height. Results from collision risk modelling indicate that up to 85 herring gulls are predicted to collide each year, of which 26 will be during the breeding period.	<b>Likely Significant Effect.</b>
		Barrier	Herring gulls are not known to avoid wind farms (Zucco <i>et al.</i> 2006) and no barrier effects are predicted to occur.	No Likely Significant Effect.
		Displacement	Herring gulls are not known to avoid wind farms (Zucco <i>et al.</i> 2006) and are not considered susceptible to disturbance impacts by boats many of which they will follow. No displacement effects are predicted to occur.	No Likely Significant Effect.
Fulmar	As	Collision	Of the 1,831 fulmar sightings for which flight height data were recorded from three years of surveys a total 1,806 fulmars were flying below 7.5 m above sea surface and 99.9% of all flights were below turbine height and therefore the risk of any impacts from collision mortality is negligible.	No Likely Significant Effect.
		Barrier	The mean destination distance of fulmar foraging flights is 48 km (Thaxter <i>et al.</i> , 2012). If a barrier effect occurs it will cause a relatively small increase in flight for a pelagic species that ranges up to 300 km from a colony and is an oceanic seabird spending a large proportion of its time in flight.	No Likely Significant Effect.
		Displacement	If displacement occur it is estimated that on average displacement could result in the effective loss of up to 0.06% of the foraging habitat of the regional breeding fulmar population. This is a very small proportion of the possible foraging habitat available. SNH have advised that there is the potential for a likely significant effect on fulmar from this site.	<b>Likely Significant Effect.</b>
<b>Note Br = breeding, Wi = Winter, Mi = Migrant, As = Assemblage</b>				

Table A.9: Gladhouse Reservoir

		Gladhouse Reservoir SPA and Ramsar		
<b>Area</b>		187 ha		
<b>Distance from NNG development area</b>		71 km		
<b>Article 4.1</b>		-		
<b>Article 4.2 – Migratory Species</b>		<b>Winter</b> <ul style="list-style-type: none"> <li>● Pink-footed goose <i>Anser brachyrhynchus</i>.</li> </ul>		
<b>Article 4.2 – Assemblage</b>		-		
<b>Conservation Objectives: See Section 6.1}</b>				
Qualifying Feature		Potential Impact	Details	Effect
Pink-footed goose	Wi	Collision	Of the 577 pink-footed geese recorded during site specific surveys 45.4% were flying above 22.5 m and therefore at risk of collision impacts. Collision risk modelling undertaken based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height predicts a total of eight collisions per year, based on a 98% avoidance rate. The population reported at the time of citation is 10,500 individuals (SNH 2013) and therefore, if all eight collisions per year are from the SPA, up to 0.07% of the population may be impacted. This will not cause an adverse effect on the population.	No Likely Significant Effect.
		Barrier	Pink-footed geese breeding in Iceland, migrate to the UK in winter. Birds passing through the proposed development area will have flown in excess of 1,000 km and the additional distance birds may fly to detour around the wind farm is very small compared to the total distance flown.	No Likely Significant Effect.
		Displacement	No pink-footed geese were recorded using the area and no displacement impacts will occur	No Likely Significant Effect.
<b>Note Br = breeding, Wi = Winter, Mi = Migrant, As = Assemblage</b>				

Table A.10: Imperial Dock Leith

		Imperial Dock Leith SPA		
<b>Area</b>		0.11 ha		
<b>Distance from NNG development area</b>		61 km		
<b>Article 4.1</b>		<b>Breeding</b> <ul style="list-style-type: none"> <li>● Common tern <i>Sterna hirundo</i>.</li> </ul>		
<b>Article 4.2 – Migratory Species</b>		-		
<b>Article 4.2 – Assemblage</b>		-		
<b>Conservation Objectives: See Section 6.1</b>				
Qualifying Feature		Potential Impact	Details	Effect
Common tern	Br	Collision	The proposed development is 62 km away from the SPA and beyond the reported maximum foraging range of 30 km for breeding common terns (Thaxter <i>et al.</i> 2012). A total of 35 common terns were recorded in flight, all of which were below turbine height.	No Likely Significant Effect
		Barrier	The proposed development is 62 km away from the SPA and beyond the reported maximum foraging range of 30 km for breeding common terns (Thaxter <i>et al.</i> 2012) and therefore there will be no barrier effects for common terns from this SPA during the breeding period.	No Likely Significant Effect
		Displacement	The proposed development is 62 km away from the SPA and beyond the reported maximum foraging range of 30 km for breeding common terns (Thaxter <i>et al.</i> 2012) and therefore there will be no displacement effects for common terns from this SPA during the breeding period.	No Likely Significant Effect
<b>Note Br = breeding, Wi = Winter, Mi = Migrant, As = Assemblage</b>				

Table A.11: Lindisfarne

Lindisfarne SPA & Ramsar	
<b>Area</b>	3679.2 ha
<b>Distance from NNG development area</b>	54 km
<b>Article 4.1</b>	<p><b>Breeding;</b></p> <ul style="list-style-type: none"> <li>● Little Tern <i>Sterna albifrons</i>.</li> </ul> <p><b>Over winter;</b></p> <ul style="list-style-type: none"> <li>● Bar-tailed Godwit <i>Limosa lapponica</i>;</li> <li>● Golden Plover <i>Pluvialis apricaria</i>; and</li> <li>● Whooper Swan <i>Cygnus cygnus</i>.</li> </ul>
<b>Article 4.2 – Migratory Species</b>	<p><b>On passage;</b></p> <ul style="list-style-type: none"> <li>● Ringed Plover <i>Charadrius hiaticula</i>.</li> </ul> <p><b>Over winter;</b></p> <ul style="list-style-type: none"> <li>● Grey Plover <i>Pluvialis squatarola</i>;</li> <li>● Greylag Goose <i>Anser anser</i>;</li> <li>● Knot <i>Calidris canutus</i>;</li> <li>● Light-bellied Brent Goose <i>Branta bernicla hrota</i>; and</li> <li>● Wigeon <i>Anas penelope</i>.</li> </ul>
<b>Article 4.2 – Assemblage</b>	<p><b>Waterfowl:</b></p> <ul style="list-style-type: none"> <li>● Pink-footed Goose <i>Anser brachyrhynchus</i>;</li> <li>● Golden Plover <i>Pluvialis apricaria</i>;</li> <li>● Bar-tailed Godwit <i>Limosa lapponica</i>;</li> <li>● Greylag Goose <i>Anser anser</i>;</li> </ul>

Lindisfarne SPA & Ramsar				
<ul style="list-style-type: none"> <li>● Light-bellied Brent Goose <i>Branta bernicla hrota</i>;</li> <li>● Wigeon <i>Anas penelope</i>;</li> <li>● Whooper Swan <i>Cygnus cygnus</i>;</li> <li>● Knot <i>Calidris canutus</i>;</li> <li>● Redshank <i>Tringa tetanus</i>;</li> <li>● Shelduck <i>Tadorna tadorna</i>;</li> <li>● Eider <i>Somateria mollissima</i>;</li> <li>● Common Scoter <i>Melanitta nigra</i>;</li> <li>● Ringed Plover <i>Charadrius hiaticula</i>;</li> <li>● Lapwing <i>Vanellus vanellus</i>;</li> <li>● Dunlin <i>Calidris alpina alpina</i>; and</li> <li>● Grey Plover <i>Pluvialis squatarola</i>.</li> </ul>				
<b>Conservation Objectives: See Section 6.1</b>				
Qualifying Feature		Potential Impact	Details	Effect
Little Tern	Br	Collision	No little terns were recorded during site specific surveys.	No Likely Significant Effect.
		Barrier	No little terns were recorded during site specific surveys.	No Likely Significant Effect.
		Displacement	No little terns were recorded during site specific surveys.	No Likely Significant Effect.
Bar-tailed Godwit	Wi/As	Collision	One bar-tailed godwit was recorded during site specific surveys. It was flying below 7.5 m. Collision risk modelling undertaken based on an assumed population of 1,000 bar-tailed godwits passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The five year mean peak count (2006/11) of bar-tailed godwit in the Lindisfarne 2,145 birds (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions	No Likely Significant Effect.

		Lindisfarne SPA & Ramsar		
			are from this SPA a total of 0.3% of the wintering population may be impacted.	
		Barrier	The closest breeding bar-tailed godwits are in northern Fennoscandia and the Kola Peninsula over 2,000 km away. The additional distance migrating bar-tailed godwits will have to fly to detour around the proposed development is negligible.	No Likely Significant Effect.
		Displacement	No bar-tailed godwits were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Golden Plover	Wi/As	Collision	A total of 20 golden plover were recorded during site specific surveys, of which 14 (58.3%) of all flights were at rotor height. Collision risk modelling was not undertaken for golden plover but was for the similar grey plover. Based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height collision risk modelling estimated a total of six collisions per year, based on a 98% avoidance rate. The five year peak mean count for Lindisfarne is 4,137 (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA, a total of 0.1% of the wintering population may be impacted.	No Likely Significant Effect.
		Barrier	Golden plover breed in the UK and a wide geographical area from Iceland to central Siberia (Wernham <i>et al.</i> 2002) and winter across the UK. It is not possible to predict where birds crossing the proposed development may occur from but any small additional increase in flight due to barrier effects from the breeding grounds will be negligible compared to the total distance flown during migration.	No Likely Significant Effect.
		Displacement	No golden plover were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Whooper Swan	Wi/As	Collision	No whooper swans were recorded during site specific surveys. Satellite tagging studies indicate that whooper swans do not regularly occur across the proposed wind farm area (Griffin <i>et al.</i> 2010).	No Likely Significant Effect.
		Barrier	No whooper swans were recorded during site specific surveys. Satellite	No Likely Significant Effect.

		Lindisfarne SPA & Ramsar	
			tagging studies indicate that whooper swans do not regularly occur across the proposed wind farm area (Griffin <i>et al.</i> 2010).
		Displacement	No whooper swans were recorded during site specific surveys. Satellite tagging studies indicate that whooper swans do not regularly occur across the proposed wind farm area (Griffin <i>et al.</i> 2010).
Ringed Plover	Mi/As	Collision	One ringed plover was recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 ringed plover passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The five year mean peak count (2006/11) of ringed plover at Lindisfarne is 710 birds (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA a total of 0.8% of the wintering population may be impacted. This assumes that all ringed plover at risk of an impact are from this SPA. At least some ringed plover that may be impacted will not be from this SPA.
		Barrier	Ringed plovers that winter in eastern Britain may be from the UK or from Fennoscandia (Wernham <i>et al.</i> 2002). It is not possible to predict where birds crossing the proposed development may occur from but any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown by ringed plover during migration.
		Displacement	No ringed plovers were recorded using the site and no displacement effects will occur.
Grey Plover	Mi (wi)	Collision	No grey plover was recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 grey plover passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The five year mean peak count (2006/11) of grey plover at Lindisfarne is 2,115 birds (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA a total of 0.3% of the wintering population may be impacted. This assumes that all grey plover at

		Lindisfarne SPA & Ramsar		
			risk of an impact are from this SPA but at least some of those that may be impacted will not be from this SPA.	
		Barrier	Grey plover breed in the high Arctic and winter as far south as southern Africa (Wernham <i>et al.</i> 2002). They are long distance migrants and therefore any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown by grey plover during migration.	No Likely Significant Effect.
		Displacement	No grey plovers were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Greylag Goose	Mi (wi)/As	Collision	No greylag geese were recorded during site specific surveys. Collision risk modelling undertaken for other Goose species indicates that up to eight geese per year may be at risk of a collision impact. The population of greylag geese at this SPA at the time of citation was 1,416 individuals. If all those predicted to collide are from this SPA up to 0.6% of the population may be impacted. However, this is unlikely to be the case due to the lack of any observations of this species and the distance the SPA is from the proposed development area.	No Likely Significant Effect.
		Barrier	Greylag geese wintering at this SPA breed in Iceland and therefore migrate over 1,000 km each year. The potential barrier effect should geese fly around the proposed development will be negligible.	No Likely Significant Effect.
		Displacement	No greylag geese were recorded within the proposed development area and no displacement effects will occur.	No Likely Significant Effect.
Knot	Mi (wi)/As	Collision	No knot were recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 knot passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The five year mean peak count (2006/11) of knot at Lindisfarne is 3,517 birds (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA a total of 0.2% of the wintering population may be impacted. Not all collisions will be from this SPA.	No Likely Significant Effect.
		Barrier	Knot breed in the high Arctic and undertake some the longest known non-stop	No Likely Significant Effect.



		Lindisfarne SPA & Ramsar		
			migrations of any species. Birds wintering in estuaries across Europe will not be impacted by a very small negligible increase in flight distance should a barrier effect occur.	
		Displacement	No knot were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
<b>(Light-bellied) Brent Goose</b>	Mi (wi)/As	Collision	No brent geese were recorded during the site specific surveys.	No Likely Significant Effect.
		Barrier	No brent geese were recorded during the site specific surveys.	No Likely Significant Effect.
		Displacement	No brent geese were recorded during the site specific surveys.	No Likely Significant Effect.
<b>Wigeon</b>	Mi (wi)/As	Collision	A total of 41 wigeon were recorded during site specific surveys, of which 4.8% were flying at rotor height and at risk of collision. No collision risk modelling has been undertaken for wigeon but based on predicted number of collisions for the significantly larger Geese species a total of eight collisions per year are predicted to occur. The peak 5 year mean population is 11,011 individuals (Holt <i>et al.</i> 2012) and therefore up to 0.07% of the population may be impacted if they are all from this SPA. However, this is will not be the case.	No Likely Significant Effect.
		Barrier	Wigeon wintering in the UK are from either the UK or from the relatively small UK breeding population or from the much larger breeding populations in Fennoscandia, Russia and western Siberia (Wernham <i>et al.</i> 2002). It is not possible to predict where birds crossing the proposed development may occur from but those from Scandinavia or further afield will have flown in excess of 1,000 km during migration and therefore any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown.	No Likely Significant Effect.
		Displacement	No wigeon were recorded using the proposed development area and no displacement impacts will occur.	No Likely Significant Effect.
<b>Pink-footed Goose</b>	As	Collision	Of the 577 pink-footed geese recorded during site specific surveys 45.4% were flying above 27.5 m and therefore at risk of collision impacts. Collision risk modelling undertaken based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with	No Likely Significant Effect.

		Lindisfarne SPA & Ramsar		
			all birds flying at rotor height predicts a total of eight collisions per year, based on a 98% avoidance rate. The 5 year peak mean count (2006/11) for Lindisfarne is 4,532 individuals (Holt <i>et al.</i> 2012) and therefore, if all eight collisions per year are from the SPA, up to 0.2% of the population may be impacted. This will not cause an adverse effect on the population	
		Barrier	Pink-footed geese fly breed in Iceland migrate to the UK in winter. Birds passing through the proposed development area will have flown in excess of 1,000 km and the additional distance birds may fly to detour around the wind farm is very small compared to the total distance flown.	No Likely Significant Effect.
		Displacement	No pink-footed geese were recorded using the area and no displacement impacts will occur.	No Likely Significant Effect.
Redshank	As	Collision	A total of four redshank were recorded during site specific surveys. All were flying below rotor height. Collision risk modelling was not undertaken for redshank but was for the similar grey plover. Based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height collision risk modelling estimated a total of seven collisions per year, based on a 98% avoidance rate. The 5 year peak mean population (2006/11) of redshank at Lindisfarne is 1,460 individuals (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA, a total of 0.5% of the wintering population may be impacted.	No Likely Significant Effect.
		Barrier	Redshank breed in the UK and across from Iceland to Russia and winter across the UK. It is not possible to predict where birds crossing the proposed development may occur from but are likely to be either UK breeding birds or birds from Iceland (Wernham <i>et al.</i> 2002). Any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown to during migration.	No Likely Significant Effect.
		Displacement	No redshank were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.

		Lindisfarne SPA & Ramsar		
<b>Shelduck</b>	As	Collision	No shelduck were recorded during site specific surveys. Collision risk modelling was not undertaken for shelduck but based on the predicted collision impacts from the larger Goose species that were modelled, no more than eight collisions per year are predicted. The five year mean peak count (2006/11) of shelduck at Lindisfarne is 2.085 birds (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA a total of 0.4% of the wintering population may be impacted. However, it unrealistic to assume that many, if any, collisions will occur and if so that they are all from this SPA.	No Likely Significant Effect.
		Barrier	No shelduck were recorded during site specific surveys and no barrier effects will occur should occasional migrating birds detour around the proposed development.	No Likely Significant Effect.
		Displacement	No shelduck were recorded during site specific surveys and no displacement effects will occur.	No Likely Significant Effect.
<b>Eider</b>	As	Collision	A total of 22 eider were recorded from site specific surveys, all of which were flying below turbine height. Modelled flight height data indicates that 2% of flight heights might be at rotor height and therefore there is a very low risk of collision.	No Likely Significant Effect.
		Barrier	Although the UK eider population is not strongly migratory birds may show some localised seasonal movements. The low numbers recorded indicate that there will be no significant barrier effect as birds pass only occasionally across the site.	No Likely Significant Effect.
		Displacement	No eider were seen using the proposed development area and no displacement impacts will occur.	No Likely Significant Effect.
<b>Common scoter</b>	As	Collision	A total of seven common scoter were recorded during site specific surveys. All were recorded flying below turbine height. Modelled flight height data for common scoter predicts that over 95% of all flights are below turbine height (Cook <i>et al.</i> 2012). Therefore there is a very low risk of collision.	No Likely Significant Effect.
		Barrier	Common scoter wintering in the UK are predominantly from the Russian Arctic and will not be impacted by the relatively small additional distance	No Likely Significant Effect.

		Lindisfarne SPA & Ramsar		
			required to detour around the proposed development during migration.	
		Displacement	No common scoter were recorded using the proposed development area and no displacement impacts will occur.	No Likely Significant Effect.
Lapwing	As	Collision	No lapwing were recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 lapwing passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The 5 year peak mean population (2006/11) is 2,115 birds (Holt <i>et al.</i> 2013). Therefore, if all predicted collisions are from this SPA a total of 0.2% of the wintering population may be impacted. Not all lapwing potentially impacted will be from this SPA.	No Likely Significant Effect.
		Barrier	Lapwing wintering in the UK are either from the UK or from Scandinavia (Wernham <i>et al.</i> 2002). It is not possible to predict where birds crossing the proposed development may occur from but those from Scandinavia may have flown in excess of 1,000 km during migration and therefore any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown.	No Likely Significant Effect.
		Displacement	No lapwing were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Dunlin	As	Collision	A total of seven dunlin were recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 dunlin passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The five year peak mean population (2006/11) is 4,660 birds (Holt <i>et al.</i> 2012) and therefore, if all predicted collisions are from this SPA a total of 0.1% of the wintering population may be impacted.	No Likely Significant Effect.
		Barrier	Dunlin wintering in the UK are from either the UK or from Scandinavia or further east (Wernham <i>et al.</i> 2002). It is not possible to predict where birds crossing the proposed development may occur from but those from	No Likely Significant Effect.

		Lindisfarne SPA & Ramsar		
			Scandinavia may have flown in excess of 1,000 km during migration and therefore any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown.	
		Displacement	No dunlin were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
<b>Note Br = breeding, Wi = Winter, Mi = Migrant, As = Assemblage</b>				

Table A.12: Loch Leven

		Loch Leven SPA & Ramsar		
<b>Area</b>		1,611.81 ha		
<b>Distance from NNG development area</b>		62 km		
<b>Article 4.1</b>		<b>Over winter;</b> <ul style="list-style-type: none"> <li>● Whooper Swan <i>Cygnus cygnus</i>.</li> </ul>		
<b>Article 4.2 – Migratory Species</b>		<b>Over winter;</b> <ul style="list-style-type: none"> <li>● Pink-footed geese <i>Anser brachyrhynchus</i>; and</li> <li>● Shoveler <i>Anas clypeata</i>.</li> </ul>		
<b>Article 4.2 – Assemblage</b>		<b>Waterfowl:</b> <ul style="list-style-type: none"> <li>● Cormorant <i>Phalacrocorax carbo</i>;</li> <li>● Gadwall <i>Anas strepera</i>;</li> <li>● Teal <i>Anas crecca</i>;</li> <li>● Pochard <i>Aythya ferina</i>;</li> <li>● Tufted duck <i>Anas fuligula</i>; and</li> <li>● Goldeneye <i>Bucephala clangula</i>.</li> </ul>		
<b>Conservation Objectives: See Section 6.1</b>				
Qualifying Feature		Potential Impact	Details	Effect
<b>Whooper swan</b>	Wi/As	Collision	No whooper swans were recorded during site specific surveys. Satellite tagging studies indicate that whooper swans do not regularly occur across the proposed wind farm area (Griffin <i>et al.</i> 2010).	No Likely Significant Effect.
		Barrier	No whooper swans were recorded during site specific surveys. Satellite tagging studies indicate that whooper swans do not regularly occur across the proposed wind farm area (Griffin <i>et al.</i> 2010).	No Likely Significant Effect.

		Loch Leven SPA & Ramsar		
		Displacement	No whooper swans were recorded during site specific surveys. Satellite tagging studies indicate that whooper swans do not regularly occur across the proposed wind farm area (Griffin <i>et al.</i> 2010).	No Likely Significant Effect.
Pink-footed goose	Wi/As	Collision	Of the 577 pink-footed geese recorded during site specific surveys 45.4% were flying above 27.5 m and therefore at risk of collision impacts. Collision risk modelling undertaken based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height predicts a total of eight collisions per year, based on a 98% avoidance rate. The 5 year peak mean count (2006/11) for Loch Leven is 8,585 individuals (Holt <i>et al.</i> 2012) and therefore, if all eight collisions per year are from the SPA, up to 0.1% of the population may be impacted. This will not cause an adverse effect on the population.	No Likely Significant Effect.
		Barrier	Pink-footed geese breeding in Iceland migrate to the UK in winter. Birds passing through the proposed development area will have flown in excess of 1,000 km and the additional distance birds may fly to detour around the wind farm is very small compared to the total distance flown.	No Likely Significant Effect.
		Displacement	No pink-footed geese were recorded using the area and no displacement impacts will occur.	No Likely Significant Effect.
Shoveler	Wi/As	Collision	Two shoveler were recorded flying below turbine height. Based on the collision risk modelling undertaken for other wildfowl and waders and assuming up to eight collisions per year might occur. It is possible that up to 4% of the SPA shoveler population may be impacted. However, this assumes all possible collisions of shoveler are from this SPA, which will not be the case. The UK population is 11,014 individuals and therefore some, if not all, impacts (should they occur) will be on birds not associated with this SPA	No Likely Significant Effect.
		Barrier	Shoveler wintering in the UK may be from the small UK breeding population or from the much larger population that migrate from Scandinavia and Russia. The relatively small additional distance required to detour around the proposed development should a barrier effect occur during migration will be negligible.	No Likely Significant Effect.

		Loch Leven SPA & Ramsar		
		Displacement	No shoveler were recorded using the proposed wind farm area and no displacement impacts will occur	No Likely Significant Effect.
<b>Cormorant</b>	As	Collision	The maximum recorded foraging range for cormorant during the breeding season is 35 km (Thaxter <i>et al.</i> 2012) and therefore the site is beyond the maximum foraging range. No cormorants were recorded within the proposed development area during site specific surveys and only seven cormorants occurred in the buffer zone.	No Likely Significant Effect.
		Barrier	The site is beyond the maximum reported foraging range for cormorants during the breeding period and therefore no barrier effects will occur.	No Likely Significant Effect.
		Displacement	The site is beyond the maximum reported foraging range for cormorants during the breeding period and therefore no displacement effects will occur.	No Likely Significant Effect.
<b>Gadwall</b>	As	Collision	No gadwall were recorded from site specific surveys.	No Likely Significant Effect.
		Barrier	No gadwall were recorded from site specific surveys.	No Likely Significant Effect.
		Displacement	No gadwall were recorded from site specific surveys.	No Likely Significant Effect.
<b>Teal</b>	As	Collision	No teal were recorded from site specific surveys.	No Likely Significant Effect.
		Barrier	No teal were recorded from site specific surveys.	No Likely Significant Effect.
		Displacement	No teal were recorded from site specific surveys.	No Likely Significant Effect.
<b>Pochard</b>	As	Collision	No teal were recorded from site specific surveys.	No Likely Significant Effect.
		Barrier	No teal were recorded from site specific surveys.	No Likely Significant Effect.
		Displacement	No teal were recorded from site specific surveys.	No Likely Significant Effect.
<b>Tufted duck</b>	As	Collision	One tufted duck was recorded during site specific surveys.	No Likely Significant Effect.
		Barrier	Tufted ducks recorded offshore may be from the UK breeding population or migrants from breeding populations. Scottish breeding tufted ducks migrate mainly south-west (Wernham <i>et al.</i> 2002) and will therefore not be impacted. Therefore, those likely to occur will be migrants from Scandinavia and Russia	No Likely Significant Effect.



		Loch Leven SPA & Ramsar		
			and therefore not be impacted by a small potential barrier effect.	
		Displacement	No tufted duck were recorded using the proposed wind farm area and no displacement impacts will occur.	No Likely Significant Effect.
Goldeneye	As	Collision	No goldeneye were recorded during site specific surveys. No flight height data are available for goldeneye but it is predicted to be at low risk of collision impacts (Cook <i>et al.</i> 2012). No goldeneye were recorded and they are at low risk of collision.	No Likely Significant Effect.
		Barrier	Goldeneye wintering in the UK may be from the small UK breeding population or from the much larger population that migrate from Scandinavia and Russia. The relatively small additional distance required to detour around the proposed development should a barrier effect occur during migration will be negligible.	No Likely Significant Effect.
		Displacement	No goldeneye were recorded using the proposed development area and no displacement impacts will occur.	No Likely Significant Effect.
<p><b>Note Br = breeding, Wi = Winter, Mi = Migrant, As = Assemblage</b></p>				

Table A.13: Loch of Skene

		Loch of Skene SPA and Ramsar		
<b>Area</b>		120.89 ha		
<b>Distance from NNG development area</b>		91 km		
<b>Article 4.1</b>		<b>Over winter;</b> <ul style="list-style-type: none"> <li>● Whooper Swan <i>Cygnus cygnus</i>.</li> </ul>		
<b>Article 4.2 – Migratory Species</b>		<b>Over winter;</b> <ul style="list-style-type: none"> <li>● Greylag goose <i>Anser anser</i>.</li> </ul>		
<b>Article 4.2 – Assemblage</b>		-		
<b>Conservation Objectives: See Section 6.1</b>				
Qualifying Feature		Potential Impact	Details	Effect
<b>Whooper swan</b>	Wi	Collision	No whooper swans were recorded during site specific surveys. Satellite tagging studies indicate that whooper swans do not regularly occur across the proposed wind farm area (Griffin <i>et al.</i> 2010).	No Likely Significant Effect.
		Barrier	No whooper swans were recorded during site specific surveys. Satellite tagging studies indicate that whooper swans do not regularly occur across the proposed wind farm area (Griffin <i>et al.</i> 2010).	No Likely Significant Effect.
		Displacement	No whooper swans were recorded during site specific surveys. Satellite tagging studies indicate that whooper swans do not regularly occur across the proposed wind farm area (Griffin <i>et al.</i> 2010).	No Likely Significant Effect.
<b>Greylag goose</b>	Mi (wi)	Collision	No greylag geese were recorded during site specific surveys. Collision risk modelling undertaken for other Goose species indicates that up to eight geese per year may be at risk of a collision impact. The population at the time of citation was 10,840 individuals but the population at this site has declined significantly in recent years (SNH 2013, Holt <i>et al.</i> 2012). The site is the north of the proposed development and greylag geese migrate to and from Iceland	No Likely Significant Effect.

		Loch of Skene SPA and Ramsar		
			and therefore will not interact with the proposed development area.	
		Barrier	Greylag geese wintering at this SPA breed in Iceland and therefore migrate over 1,000 km each year. The site is the north of the proposed development and greylag geese migrate to and from Iceland and therefore will not interact with the proposed development area.	No Likely Significant Effect.
		Displacement	No greylag geese were recorded within the proposed development area and no displacement effects will occur.	No Likely Significant Effect.
<b>Note Br = breeding, Wi = Winter, Mi = Migrant, As = Assemblage</b>				

Table A.14: Montrose Basin

Montrose Basin SPA & Ramsar			
Area	984.61 ha		
Distance from NNG development area	42 km		
Article 4.1	<b>Breeding;</b> -		
Article 4.2 – Migratory Species	<b>Winter;</b> <ul style="list-style-type: none"> <li>● Greylag Goose <i>Anser anser</i>,</li> <li>● Knot <i>Calidris canutus</i>,</li> <li>● Pink-footed Goose <i>Anser brachyrhynchus</i>,</li> <li>● Redshank <i>Tringa totanus</i>,</li> </ul>		
Article 4.2 – Assemblage	<b>Assemblage</b> <ul style="list-style-type: none"> <li>● Dunlin <i>Calidris alpina alpina</i>;</li> <li>● Oystercatcher <i>Haematopus ostralegus</i>;</li> <li>● Eider <i>Somateria mollissima</i>;</li> <li>● Wigeon <i>Anas penelope</i>;</li> <li>● Shelduck <i>Tadorna tadorna</i>;</li> <li>● Redshank <i>Tringa tetanus</i>;</li> <li>● Knot <i>Calidris canutus</i>;</li> <li>● Greylag Goose <i>Anser anser</i>; and</li> <li>● Pink-footed Goose <i>Anser brachyrhynchus</i>.</li> </ul>		
Conservation Objectives: See Section 6.1			
Qualifying Feature	Potential Impact	Details	Effect

		Montrose Basin SPA & Ramsar		
Greylag goose	Mi (wi)/As	Collision	No greylag geese were recorded during site specific surveys. Collision risk modelling undertaken for other Goose species indicates that up to eight geese per year may be at risk of a collision impact. The 5 year peak mean population of greylag geese at this SPA is 686 individuals. If all those predicted to collide are from this SPA up to 1.2% of the population may be impacted. However, this is unlikely to be the case due to the lack of any observations of this species and the that the SPA is to the north of the proposed development and there will be no interactions with greylag geese flying to and from Iceland.	No Likely Significant Effect.
		Barrier	Greylag geese wintering at this SPA breed in Iceland and therefore migrate over 1,000 km each year. There will be no interaction with geese from this SPA and migrating to and from Iceland.	No Likely Significant Effect.
		Displacement	No greylag geese were recorded within the proposed development area and no displacement effects will occur.	No Likely Significant Effect.
Knot	Mi (wi)/As	Collision	No knot were recorded during f site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 knot passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The wintering population reported at the time of citation is 2,790 birds (SNH 2013). Therefore, if all predicted collisions are from this SPA a total of 0.2% of the wintering population may be impacted.	No Likely Significant Effect.
		Barrier	Knot breed in the high Arctic and undertake some the longest known non-stop migrations of any species. Birds wintering in estuaries across Europe will not be impacted by a very small negligible increase in flight distance should a barrier effect occur.	No Likely Significant Effect.
		Displacement	No knot were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Pink-footed goose	Mi (wi)/As	Collision	Of the 577 pink-footed geese recorded during site specific surveys 45.4% were flying above 27.5 m and therefore at risk of collision impacts. Collision risk modelling undertaken based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with	No Likely Significant Effect.

		Montrose Basin SPA & Ramsar		
			all birds flying at rotor height predicts a total of eight collisions per year, based on a 98% avoidance rate. The 5 year peak mean count (2006/11) for the Montrose Basin is 31,883 individuals (Holt <i>et al.</i> 2012) and therefore, if all eight collisions per year are from the SPA, up to 0.02% of the population may be impacted. This will not cause an adverse effect on the population.	
		Barrier	Pink-footed geese breeding in Iceland migrate to the UK in winter. Birds passing through the proposed development area will have flown in excess of 1,000 km and the additional distance birds may fly to detour around the wind farm is very small compared to the total distance flown.	No Likely Significant Effect.
		Displacement	No pink-footed geese were recorded using the area and no displacement impacts will occur.	No Likely Significant Effect.
Redshank	Mi (wi)/As	Collision	A total of four redshank were recorded during site specific surveys. All were flying below rotor height. Collision risk modelling was not undertaken for redshank but was for the similar grey plover. Based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height collision risk modelling estimated a total of seven collisions per year, based on a 98% avoidance rate. The 5 year peak mean population (2006/11) of redshank at the Montrose Basin is 2,178 individuals (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA, a total of 0.3% of the wintering population may be impacted.	No Likely Significant Effect.
		Barrier	Redshank breed in the UK and across from Iceland to Russia and winter across the UK. It is not possible to predict where birds crossing the proposed development may occur from but are likely to be either UK breeding birds or birds from Iceland (Wernham <i>et al.</i> 2002). Any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown to during migration.	No Likely Significant Effect.
		Displacement	No redshank were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Dunlin	As	Collision	A total of seven dunlin were recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 dunlin passing	No Likely Significant Effect.

		Montrose Basin SPA & Ramsar		
			through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The population at the time of citation was 5,200 birds (SNH 2013) and therefore, if all predicted collisions are from this SPA a total of 0.1% of the wintering population may be impacted.	
		Barrier	Dunlin wintering in the UK are from either the UK or from Scandinavia or further east (Wernham <i>et al.</i> 2002). It is not possible to predict where birds crossing the proposed development may occur from but those from Scandinavia may have flown in excess of 1,000 km during migration and therefore any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown.	No Likely Significant Effect.
		Displacement	No dunlin were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Oystercatcher	As	Collision	A total of four oystercatcher were recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 oystercatchers passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of seven collisions per year, based on a 98% avoidance rate. The oystercatcher population at the time of citation in the Montrose Basin SPA is 3,100 birds (SNH 2013). Therefore, if all predicted collisions are from this SPA a total of 0.2% of the wintering population may be impacted.	No Likely Significant Effect.
		Barrier	Oystercatchers that winter in the northern Britain may be from the UK or from Scandinavia, Iceland and Faroes (Wernham <i>et al.</i> 2002). It is not possible to predict where birds crossing the proposed development may occur from but any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown by oystercatchers during migration.	No Likely Significant Effect.
		Displacement	No oystercatchers were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Eider	As	Collision	A total of 22 eider were recorded from site specific surveys, all of which were flying below turbine height. Modelled flight height data indicates that 2% of flight heights might be at rotor height and therefore there is a very low risk of	No Likely Significant Effect.

		Montrose Basin SPA & Ramsar	
			collision.
		Barrier	Although the UK eider population is not strongly migratory birds may show some localised seasonal movements. The low numbers recorded indicate that there will be no significant barrier effect as birds pass only occasionally across the site.
		Displacement	No eider were seen using the proposed development area and no displacement impacts will occur.
Wigeon	As	Collision	A total of 41 wigeon were recorded during site specific surveys, of which 4.8% were flying at rotor height and at risk of collision. No collision risk modelling has been undertaken for wigeon but based on predicted number of collisions for the significantly larger Geese species a total of eight collisions per year are predicted to occur. The population at time of citation was 5,270 individuals (SNH 2013) and therefore up to 0.1% of the population may be impacted if they are all from this SPA. However, this is unlikely.
		Barrier	Wigeon wintering in the UK are from either the UK or from the relatively small UK breeding population or from the much larger breeding populations in Fennoscandia, Russia and western Siberia (Wernham <i>et al.</i> 2002). It is not possible to predict where birds crossing the proposed development may occur from but those from Scandinavia or further afield will have flown in excess of 1,000 km during migration and therefore any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown.
		Displacement	No wigeon were recorded using the proposed development area and no displacement impacts will occur.
Shelduck	As	Collision	No shelduck were recorded during site specific surveys. Collision risk modelling was not undertaken for shelduck but based on the predicted collision impacts from the larger Goose species that were modelled, no more than eight collisions per year are predicted. The five year mean peak count (2006/11) of shelduck at the Montrose Basin is 1,125 birds (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA a total of 0.7% of the population may be impacted. However, it unrealistic to assume that many, if any, collisions will



		Montrose Basin SPA & Ramsar		
			occur and if so that they are all from this SPA.	
		Barrier	No shelduck were recorded during site specific surveys and no barrier effects will occur should occasional migrating birds detour around the proposed development.	No Likely Significant Effect.
		Displacement	No shelduck were recorded during site specific surveys and no displacement effects will occur.	No Likely Significant Effect.
<b>Note Br = breeding, Wi = Winter, Mi = Migrant, As = Assemblage</b>				

Table A.15: Muir of Dinnet

		Muir of Dinnet SPA and Ramsar		
<b>Area</b>		157.6 ha		
<b>Distance from NNG development area</b>		92 km		
<b>Article 4.1</b>		-		
<b>Article 4.2 – Migratory Species</b>		<b>Over winter;</b> <ul style="list-style-type: none"> <li>● Greylag goose <i>Anser anser</i>.</li> </ul>		
<b>Article 4.2 – Assemblage</b>		-		
<b>Conservation Objectives: See Section 6.1</b>				
Qualifying Feature		Potential Impact	Details	Effect
Greylag goose	Mi (wi)	Collision	No greylag geese were recorded during site specific surveys. Collision risk modelling undertaken for other Goose species indicates that up to eight geese per year may be at risk of a collision impact. The population of greylag geese at this SPA at the time of citation was 29,458 individuals. The population has since decreased. However, the site is to the north of the proposed development area and there will be no interaction with geese from this site during their migration to and from Iceland.	No Likely Significant Effect.
		Barrier	Greylag geese wintering at this SPA breed in Iceland and therefore migrate over 1,000 km each year. The site is to the north of the proposed development area and there will be no interaction with geese from this site during their migration to and from Iceland.	No Likely Significant Effect.
		Displacement	No greylag geese were recorded within the proposed development area and no displacement effects will occur.	No Likely Significant Effect.
<b>Note Br = breeding, Wi = Winter, Mi = Migrant, As = Assemblage</b>				

TableA.16: Slammanan Plateau

		Slammanan Plateau SPA		
<b>Area</b>		591.32 ha		
<b>Distance from NNG development area</b>		101 km		
<b>Article 4.1</b>		-		
<b>Article 4.2 – Migratory Species</b>		<b>Over winter;</b> <ul style="list-style-type: none"> <li>● 'Taiga' bean goose <i>Anser fabalis fabalis</i>.</li> </ul>		
<b>Article 4.2 – Assemblage</b>		-		
<b>Conservation Objectives: See Section 6.1</b>				
Qualifying Feature		Potential Impact	Details	Effect
'Taiga' bean goose	Mi (wi)	Collision	No 'Taiga' bean geese were recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height predicts a total of eight collisions per year, based on a 98% avoidance rate. The five year peak mean bean goose population is only 269 birds (Holt <i>et al.</i> 2012) and therefore, considerably lower than the modelled population. If the proportion of collisions is in relation to the population size (i.e. approximately one quarter of those modelled) then up to two collisions per year may occur. However, studies have shown that Geese are very adept at avoiding wind farms with few collisions by geese reported (e.g. Petterson 2005; Petersen <i>et al.</i> 2006) and avoidance behaviour of greater than 99% may occur. Consequently, there may be no more than one collision per year from the SPA. Although it is not known from ringing studies which migration route bean geese wintering on the Slammanan Plateau may take, a direct route from the SPA to their breeding grounds would indicate that they will not fly across the proposed wind farm area.	No Likely Significant Effect.
		Barrier	Taiga bean geese wintering in Britain are thought to breed in Lapland and	No Likely Significant Effect.

Slammanan Plateau SPA				
			migrate to the UK in winter. Birds passing through the proposed development area will have flown in excess of 2,000 km and the additional distance birds may fly to detour around the wind farm is very small compared to the total distance flown.	
		Displacement	No bean geese were recorded using the area and no displacement impacts will occur.	No Likely Significant Effect.
<p><b>Note Br = breeding, Wi = Winter, Mi = Migrant, As = Assemblage</b></p>				

Table A.17: South Tayside Goose Roosts

		South Tayside Goose Roosts SPA		
<b>Area</b>		331.01 ha		
<b>Distance from NNG development area</b>		76 km		
<b>Article 4.1</b>		-		
<b>Article 4.2 – Migratory Species</b>		<b>Winter</b> <ul style="list-style-type: none"> <li>● Pink-footed goose <i>Anser brachyrhynchus</i>; and</li> <li>● Greylag goose <i>Anser anser</i>.</li> </ul>		
<b>Article 4.2 – Assemblage</b>		<b>Assemblage</b> <ul style="list-style-type: none"> <li>● Pink-footed goose <i>Anser brachyrhynchus</i>; and</li> <li>● Greylag goose <i>Anser anser</i>.</li> </ul>		
<b>Conservation Objectives: See Section 6.1</b>				
Qualifying Feature		Potential Impact	Details	Effect
Pink-footed goose	Mi (wi)/As (wi)	Collision	Of the 577 pink-footed geese recorded during site specific surveys 45.4% were flying above 22.5 m and therefore at risk of collision impacts. Collision risk modelling undertaken based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height predicts a total of eight collisions per year, based on a 98% avoidance rate. The cited pink-footed goose population for the South Tayside Goose Roosts SPA is 31,800 individuals (SNH 2013) and therefore, if all eight collisions per year are from the SPA, up to 0.02% of the population may be impacted. This will not cause an adverse effect on the population	No Likely Significant Effect.
		Barrier	Pink-footed geese breeding in Iceland migrate to the UK in winter. Birds passing through the proposed development area will have flown in excess of 1,000 km and the additional distance birds may fly to detour around the wind farm is very small compared to the total distance flown.	No Likely Significant Effect.

		South Tayside Goose Roosts SPA		
		Displacement	No pink-footed geese were recorded using the area and no displacement impacts will occur.	No Likely Significant Effect.
Greylag goose	Mi (wi)/As (wi)	Collision	No greylag geese were recorded during site specific surveys. Collision risk modelling undertaken for other Goose species indicates that up to eight geese per year may be at risk of a collision impact. The peak 5 year mean population of greylag geese at this SPA is 2,285 individuals (Holt <i>et al.</i> 2012). If all those predicted to collide are from this SPA up to 0.3% of the population may be impacted. However, this is unlikely to be the case due to the lack of any observations of this species and the distance the SPA is from the proposed development area.	No Likely Significant Effect.
		Barrier	Greylag geese wintering at this SPA breed in Iceland and therefore migrate over 1,000 km each year. The potential barrier effect should geese fly around the proposed development will be negligible.	No Likely Significant Effect.
		Displacement	No greylag geese were recorded within the proposed development area and no displacement effects will occur.	No Likely Significant Effect.
<b>Note Br = breeding, Wi = Winter, Mi = Migrant, As = Assemblage</b>				

Table A.18: St Abb’s Head to Fast Castle SPA

		St Abb’s Head to Fast Castle SPA		
<b>Area</b>		1,736.52ha		
<b>Distance from NNG development area</b>		31 km		
<b>Article 4.1</b>		-		
<b>Article 4.2 – Migratory Species</b>		-		
<b>Article 4.2 – Assemblage</b>		<b>Assemblage</b> <ul style="list-style-type: none"> <li>● Razorbill <i>Alca torda</i>;</li> <li>● Guillemot <i>Uria aalge</i>;</li> <li>● Kittiwake <i>Rissa tridactyla</i>;</li> <li>● Herring Gull <i>Larus argentatus</i>; and</li> <li>● Shag <i>Phalacrocorax aristotelis</i>.</li> </ul>		
<b>Conservation Objectives: See Section 6.1</b>				
Qualifying Feature		Potential Impact	Details	Effect
Guillemot	As	Collision	A total of 6,812 guillemots were recorded in flight during three years of site specific surveys. All but one were recorded below rotor height of 27.5 m. Collision risk modelling predicts no mortalities per year.	No Likely Significant Effect.
		Barrier	The SPA is within the mean maximum foraging range of 84 km and the mean reported foraging range of 38 km (Thaxter <i>et al.</i> 2012) Therefore birds present during the breeding period will be from this SPA. Modelling being developed to assess displacement impacts on the guillemot (CEH <i>in prep.</i> ) has indicated that on average there is no increase in flight times for birds from the SPA with or without the presence of Neart na Gaoithe. Therefore indicating no significant barrier effect.	No Likely Significant Effect.
		Displacement	Guillemots from this SPA may forage within the offshore site during the breeding period and may be. The sensitivity of the population to displacement	<b>Likely Significant Effect.</b>

		St Abb's Head to Fast Castle SPA		
			<p>at this time of year is unknown, but is likely to be moderate because birds are attending their breeding colonies and therefore will have high feeding requirements.</p> <p>Although guillemots may be affected by vessel disturbance the area predicted to be impacted will be very localised and temporary and therefore no likely significant effect will occur during construction or decommissioning.</p>	
Herring gull	As	Collision	A total of 21.7% of all herring gulls recorded were flying at rotor height. Results from collision risk modelling indicate that up to 85 herring gulls are predicted to collide each year, of which 26 will be during the breeding period.	<b>Likely Significant Effect.</b>
		Barrier	Herring gulls are not known to avoid wind farms (Zucco <i>et al.</i> 2006) and no barrier effects are predicted to occur.	No Likely Significant Effect.
		Displacement	Herring gulls are not known to avoid wind farms (Zucco <i>et al.</i> 2006) and are not considered susceptible to disturbance impacts by boats many of which they will follow. No displacement effects are predicted to occur.	No Likely Significant Effect.
Kittiwake	As	Collision	Of the 6,945 kittiwakes for which flight heights were recorded, 4.8% were above rotor height of 27.5 m. The SPA is within the reported mean maximum foraging range of 60 km but beyond the mean foraging range of 24.8 m for kittiwake during the breeding season (Thaxter <i>et al.</i> 2012). Birds at this site are at risk of being impacted during the breeding period. Collision risk modelling predicts a total annual number of collisions of 86 birds, of which 26 will be during the breeding period.	<b>Likely Significant Effect.</b>
		Barrier	The proposed development is within the mean maximum foraging range for kittiwake during the breeding period. Modelling indicates that 5% of flights might be impacted and the size of the detours are relatively small.	No Likely Significant Effect.
		Displacement	Kittiwakes do not demonstrate displacement from operating offshore wind farms. Numbers of kittiwakes recorded at Horns rev increased following construction and similar results were obtained from Egmond aan Zee where post-construction monitoring showed statistically significant attraction to the wind farm during one survey with non-significant results (neither attraction or	No Likely Significant Effect.



		St Abb's Head to Fast Castle SPA		
			avoidance) for a further four surveys (Leopold <i>et al.</i> 2011). No displacement effects are predicted.	
Razorbill	As	Collision	Of 1,949 razorbills for which flight heights were recorded none were recorded at rotor height of 27.5 m. There is a very low risk of collision.	No Likely Significant Effect.
		Barrier	The mean maximum foraging range for razorbill is reported to be 48.5 km and the maximum is 95 km (Thaxter <i>et al.</i> 2012), therefore razorbills from this SPA may be impacted by a barrier effects. Modelling being developed to assess displacement impacts on a related Auk species, the guillemot (CEH <i>in prep.</i> ) has indicated that on average there is no increase in flight times for birds from the St Abb's Head to Fast Castle SPA with or without the presence of Neart na Gaoithe. A similar level of effect is predicted for razorbill and no significant barrier effect will occur.	No Likely Significant Effect.
		Displacement	The site is within the mean maximum foraging range of razorbills from this SPA and they may be displaced away from the offshore site during the breeding period potentially increasing risk of mortality.	<b>Likely Significant Effect.</b>
Shag	As	Collision	The maximum recorded foraging range for shag during the breeding season is 17 km (Thaxter <i>et al.</i> 2012) and therefore the site is beyond the maximum foraging range. No shags were recorded within the offshore site during three years of site specific surveys. All birds were recorded flying below turbine height. Therefore there is a very low risk of collision.	No Likely Significant Effect.
		Barrier	The site is beyond the maximum reported foraging range for shags during the breeding period and therefore no barrier effects will occur.	No Likely Significant Effect.
		Displacement	No shags were recorded within the offshore site and the site is beyond the maximum reported foraging range for this species. No displacement effects are predicted.	No Likely Significant Effect.
<b>Note Br = breeding, Wi = Winter, Mi = Migrant, As = Assemblage</b>				

Table A.19: Upper Solway Flats and Marshes

Upper Solway Flats and Marshes SPA	
<b>Area</b>	331.01 ha
<b>Distance from NNG development area</b>	145 km
<b>Article 4.1</b>	<p><b>Winter</b></p> <ul style="list-style-type: none"> <li>● Bar-tailed Godwit <i>Limosa lapponica</i>;</li> <li>● Barnacle Goose <i>Branta leucopsis</i>;</li> <li>● Golden Plover <i>Pluvialis apricaria</i>; and</li> <li>● Whooper Swan <i>Cygnus cygnus</i>.</li> </ul>
<b>Article 4.2 – Migratory Species</b>	<p><b>Passage</b></p> <ul style="list-style-type: none"> <li>● Ringed Plover <i>Charadrius hiaticula</i>.</li> </ul> <p><b>Winter</b></p> <ul style="list-style-type: none"> <li>● Curlew <i>Numenius arquata</i>;</li> <li>● Dunlin <i>Calidris alpina alpina</i>;</li> <li>● Knot <i>Calidris canutus</i>;</li> <li>● Oystercatcher <i>Haematopus ostralegus</i>;</li> <li>● Pink-footed Goose <i>Anser brachyrhynchus</i>;</li> <li>● Pintail <i>Anas acuta</i>; and</li> <li>● Redshank <i>Tringa tetanus</i>.</li> </ul>
<b>Article 4.2 – Assemblage</b>	<p><b>Assemblage</b></p> <ul style="list-style-type: none"> <li>● Redshank <i>Tringa tetanus</i>;</li> <li>● Barnacle Goose <i>Branta leucopsis</i>;</li> <li>● Golden Plover <i>Pluvialis apricaria</i>;</li> </ul>

Upper Solway Flats and Marshes SPA				
<ul style="list-style-type: none"> <li>● Bar-tailed Godwit <i>Limosa lapponica</i>;</li> <li>● Pink-footed Goose <i>Anser brachyrhynchus</i>;</li> <li>● Pintail <i>Anas acuta</i>;</li> <li>● Oystercatcher <i>Haematopus ostralegus</i>;</li> <li>● Knot <i>Calidris canutus</i>;</li> <li>● Whooper Swan <i>Cygnus cygnus</i>;</li> <li>● Curlew <i>Numenius arquata</i>;</li> <li>● Lapwing <i>Vanellus vanellus</i>;</li> <li>● Great Crested Grebe <i>Podiceps cristatus</i>;</li> <li>● Cormorant <i>Phalacrocorax carbo</i>;</li> <li>● Shelduck <i>Tadorna tadorna</i>;</li> <li>● Mallard <i>Anas platyrhynchos</i>;</li> <li>● Scaup <i>Aythya marila</i>;</li> <li>● Goldeneye <i>Bucephala clangula</i>;</li> <li>● Ringed Plover <i>Charadrius hiaticula</i>;</li> <li>● Grey Plover <i>Pluvialis squatarola</i>; and</li> <li>● Dunlin <i>Calidris alpina alpina</i>.</li> </ul>				
<b>Conservation Objectives: See Section 6.1</b>				
Qualifying Feature		Potential Impact	Details	Effect
Bar-tailed godwit	Wi/As (wi)	Collision	One bar-tailed godwit was recorded during site specific surveys. It was flying below 7.5 m. Collision risk modelling undertaken based on an assumed population of 1,000 bar-tailed godwits passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The	No Likely Significant Effect

		Upper Solway Flats and Marshes SPA		
			five year mean peak count (2006/11) of bar-tailed godwit in the Solway Estuary is 663 birds (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions from a 1,000 birds are from this SPA a total of 0.9% of the wintering population may be impacted. However, the modelling is based on a population 40% greater than the peak winter counts and therefore is very precautionary.	
		Barrier	The closest breeding bar-tailed godwits are in northern Fennoscandia and the Kola Peninsula over 2,000 km away. The additional distance migrating bar-tailed godwits will have to fly to detour around the proposed development is negligible.	No Likely Significant Effect
		Displacement	No bar-tailed godwits were recorded using the site and no displacement effects will occur.	No Likely Significant Effect
Barnacle goose	Wi/As (wi)	Collision	A total of 900 barnacle geese were recorded, all of which were flying below turbine height. Collision risk modelling undertaken by SNH indicates that there will not be a likely significant impact on barnacle geese. Collision risk modelling undertaken based on an assumed 1,000 birds passing through the wind farm site at rotor height, predicts up to eight barnacle geese may be impacted. The five year peak mean population at the Solway Estuary is 31,021 individuals. Consequently up to 0.02% of the population may be impacted.	No Likely Significant Effect
		Barrier	Barnacle geese migrating from Svalbard to the Solway fly over 2,500 km. The potential incremental increase in overall distance flown should a barrier effect occur will be negligible	No Likely Significant Effect.
		Displacement	No barnacle geese were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Golden plover	Wi/As (wi)	Collision	A total of 20 golden plover were recorded during site specific surveys, of which 14 (58.3%) of all flights were at rotor height. Collision risk modelling was not undertaken for golden plover but was for the similar grey plover. Based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height collision risk modelling estimated a total of six collisions per year, based on a 98% avoidance rate. The five year peak mean count for Solway Estuary is 4,294	No Likely Significant Effect.

		Upper Solway Flats and Marshes SPA		
			(Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA, a total of 0.1% of the wintering population may be impacted.	
		Barrier	Golden plover breed in the UK and across from Iceland to central Siberia (Wernham <i>et al.</i> 2002) and winter across the UK. It is not possible to predict where birds crossing the proposed development may occur from but any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown during migration.	No Likely Significant Effect.
		Displacement	No golden plover were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Whooper swan	Wi/As (wi)	Collision	No whooper swans were recorded during site specific surveys. Satellite tagging studies indicate that whooper swans do not regularly occur across the proposed wind farm area (Griffin <i>et al.</i> 2010).	No Likely Significant Effect.
		Barrier	No whooper swans were recorded during site specific surveys. Satellite tagging studies indicate that whooper swans do not regularly occur across the proposed wind farm area (Griffin <i>et al.</i> 2010).	No Likely Significant Effect.
		Displacement	No whooper swans were recorded during site specific surveys. Satellite tagging studies indicate that whooper swans do not regularly occur across the proposed wind farm area (Griffin <i>et al.</i> 2010).	No Likely Significant Effect.
Ringed plover	Mi (Pa)/As (wi)	Collision	One ringed plover was recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 ringed plover passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The five year mean peak count (2006/11) of ringed plover at Solway Estuary is 1,367 birds (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA a total of 0.5% of the wintering population may be impacted. This assumes that all ringed plover at risk of an impact are from this SPA. It is likely that at least some of those that may be impacted will not be from this SPA.	No Likely Significant Effect.
		Barrier	Ringed plovers that winter in eastern Britain may be from the UK or from	No Likely Significant Effect.

		Upper Solway Flats and Marshes SPA		
			Fennoscandia (Wernham <i>et al.</i> 2002). It is not possible to predict where birds crossing the proposed development may occur from but any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown by ringed plover during migration.	
		Displacement	No ringed plovers were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Curlew	Mi (wi) /As (wi)	Collision	A total of 13 curlew were recorded during site specific surveys all of which were flying below rotor height. Collision risk modelling undertaken based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimates a total of seven collisions per year, based on a 98% avoidance rate. The 5 year peak mean count (2006/11) of curlew at the Solway Estuary is 3,214 (Holt <i>et al.</i> 2012). If all predicted collisions are from this SPA, a total of 0.2% of the wintering population may be impacted.	No Likely Significant Effect.
		Barrier	Curlew wintering in the UK are from either the UK or from Scandinavia (Wernham <i>et al.</i> 2002). It is not possible to predict where birds crossing the proposed development may occur from but those from Scandinavia may have flown in excess of 1,000 km during migration and therefore any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown.	No Likely Significant Effect.
		Displacement	No curlew were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Dunlin	Mi (wi)	Collision	A total of seven dunlin were recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 dunlin passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The five year peak mean population (2006/11) is 7,410 birds (Holt <i>et al.</i> 2012) and therefore, if all predicted collisions are from this SPA a total of 0.1% of the wintering population may be impacted.	No Likely Significant Effect.
		Barrier	Dunlin wintering in the UK are from either the UK or from Scandinavia or further east (Wernham <i>et al.</i> 2002). It is not possible to predict where birds	No Likely Significant Effect.

		Upper Solway Flats and Marshes SPA		
			crossing the proposed development may occur from but those from Scandinavia may have flown in excess of 1,000 km during migration and therefore any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown.	
		Displacement	No dunlin were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Knot	Mi (wi) /As (wi)	Collision	No knot were recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 knot passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The five year mean peak count (2006/11) of knot in the Solway Estuary is 11,326 birds (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA a total of 0.05% of the wintering population may be impacted.	No Likely Significant Effect.
		Barrier	Knot breed in the high Arctic and undertake some the longest known non-stop migrations of any species. Birds wintering in estuaries across Europe will not be impacted by a very small negligible increase in flight distance should a barrier effect occur.	No Likely Significant Effect.
		Displacement	No knot were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Oystercatcher	Mi (wi) /As (wi)	Collision	A total of four oystercatcher were recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 oystercatchers passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of seven collisions per year, based on a 98% avoidance rate. The five year mean peak count (2006/11) of oystercatcher in the Upper Solway Flats and Marshes is 27,969 birds (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA a total of 0.02% of the wintering population may be impacted.	No Likely Significant Effect.
		Barrier	Oystercatchers that winter in the northern Britain may be from the UK or from Scandinavia, Iceland and Faroes (Wernham <i>et al.</i> 2002). It is not possible to predict where birds crossing the proposed development may occur from but any small additional increase in flight due to barrier effects will be negligible	No Likely Significant Effect.

		Upper Solway Flats and Marshes SPA		
			compared to the total distance flown by oystercatchers during migration.	
		Displacement	No oystercatchers were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Pink-footed goose	Mi (wi) /As (wi)	Collision	Of the 577 pink-footed geese recorded during site specific surveys 45.4% were flying above 22.5 m and therefore at risk of collision impacts. Collision risk modelling undertaken based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height predicts a total of eight collisions per year, based on a 98% avoidance rate. The 5 year peak mean count (2006/11) for Solway Estuary is 18,140 individuals (Holt <i>et al.</i> 2012) and therefore, if all eight collisions per year are from the SPA, up to 0.04% of the population may be impacted. This will not cause an adverse effect on the population	No Likely Significant Effect.
		Barrier	Pink-footed geese breeding in Iceland migrate to the UK in winter. Birds passing through the proposed development area will have flown in excess of 1,000 km and the additional distance birds may fly to detour around the wind farm is very small compared to the total distance flown.	No Likely Significant Effect.
		Displacement	No pink-footed geese were recorded using the area and no displacement impacts will occur.	No Likely Significant Effect.
Pintail	Mi (wi)	Collision	No pintail were recorded from site specific surveys.	No Likely Significant Effect.
		Barrier	No pintail were recorded from site specific surveys.	No Likely Significant Effect.
		Displacement	No pintail were recorded from site specific surveys.	No Likely Significant Effect.
Redshank	Mi (wi)/As (wi)	Collision	A total of four redshank were recorded during site specific surveys. All were flying below rotor height. Collision risk modelling was not undertaken for redshank but was for the similar grey plover. Based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height collision risk modelling estimated a total of seven collisions per year, based on a 98% avoidance rate. The 5 year peak mean population (2006/11) of redshank at the Solway is 3,918	No Likely Significant Effect.



		Upper Solway Flats and Marshes SPA		
			individuals (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA, a total of 0.2% of the wintering population may be impacted.	
		Barrier	Redshank breed in the UK and across from Iceland to Russia and winter across the UK. It is not possible to predict where birds crossing the proposed development may occur from but are likely to be either UK breeding birds or birds from Iceland (Wernham <i>et al.</i> 2002). Any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown to during migration.	No Likely Significant Effect.
		Displacement	No redshank were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Lapwing	As (wi)	Collision	No lapwings were recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 lapwing passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. There is no population provided in the site citation but the low numbers modelled to be impacted and the location of the SPA are such that few, if any, collisions will occur.	No Likely Significant Effect.
		Barrier	Lapwing wintering in the UK are from either the UK or from Scandinavia (Wernham <i>et al.</i> 2002). It is not possible to predict where birds crossing the proposed development may occur from but those from Scandinavia may have flown in excess of 1,000 km during migration and therefore any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown.	No Likely Significant Effect.
		Displacement	No lapwing were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Great-crested grebe	As (wi)	Collision	There is no cited population of great-crested grebe in the Solway Flats and Marshes SPA (SNH 2013). The population is reported to be between 150 to 250 individuals (Forrester <i>et al.</i> 2007). No great-crested grebes were recorded during site specific surveys and flight	No Likely Significant Effect.

		Upper Solway Flats and Marshes SPA		
			heights have been reported to be below turbine height (Cook <i>et al.</i> 2012).	
		Barrier	No great-crested grebes were recorded during site specific surveys. No barrier effects will occur.	No Likely Significant Effect.
		Displacement	No great-crested grebes were recorded during site specific surveys. No displacement effects will occur.	No Likely Significant Effect.
<b>Cormorant</b>	As (wi)	Collision	The maximum recorded foraging range for cormorant during the breeding season is 35 km (Thaxter <i>et al.</i> 2012) and therefore the site is beyond the maximum foraging range. No cormorants were recorded within the proposed development area during site specific surveys and only seven cormorants occurred in the buffer zone.	No Likely Significant Effect.
		Barrier	The site is beyond the maximum reported foraging range for cormorants during the breeding period and therefore no barrier effects will occur.	No Likely Significant Effect.
		Displacement	The site is beyond the maximum reported foraging range for cormorants during the breeding period and therefore no displacement effects will occur.	No Likely Significant Effect.
<b>Shelduck</b>	As (wi)	Collision	No shelduck were recorded during site specific surveys. Collision risk modelling was not undertaken for shelduck but based on the predicted collision impacts from the larger Goose species that were modelled, no more than eight collisions per year are predicted. The five year mean peak count (2006/11) of shelduck at the Solway Estuary is 1,528 birds (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA a total of 0.5% of the population may be impacted. However, it unrealistic to assume that many, if any, collisions will occur and if so that they are all from this SPA.	No Likely Significant Effect.
		Barrier	No shelduck were recorded during site specific surveys and no barrier effects will occur should occasional migrating birds detour around the proposed development.	No Likely Significant Effect.
		Displacement	No shelduck were recorded during site specific surveys and no displacement effects will occur.	No Likely Significant Effect.
<b>Mallard</b>	As (wi)	Collision	No mallard were recorded during site specific surveys. No population figures	No Likely Significant Effect.

		Upper Solway Flats and Marshes SPA		
			are provided within the sites citation (SNH 2013). However, the lack of any sightings during surveys and the location of the SPA on the west coast indicates that there is a very low risk of any collision impacts.	
		Barrier	No mallard were recorded flying through the proposed development area. The incremental increase in total flight activity due to a barrier effect will be negligible for migrating mallard.	No Likely Significant Effect.
		Displacement	No mallard were recorded using the proposed development area and no displacement effects will occur.	No Likely Significant Effect.
<b>Scaup</b>	As (wi)	Collision	No scaup were recorded during site specific surveys. No collision risk modelling was undertaken. The pattern of ringing recoveries, indicates that birds along the west coast are more likely to be from Icelandic breeding populations (Wernham <i>et al.</i> 2002). Therefore there will be no interaction between these birds and the proposed development area, which is sited on the east coast.	No Likely Significant Effect.
		Barrier	Scaup wintering in the UK are from Iceland or Scandinavia and western Siberia. Birds migrating from Iceland to the Solway Estuary will not pass through the proposed development area.	No Likely Significant Effect.
		Displacement	No scaup were recorded using the site and displacement effects will occur.	No Likely Significant Effect.
<b>Goldeneye</b>	As (wi)	Collision	No goldeneye were recorded during site specific surveys. No flight height data are available for goldeneye but it is predicted to be at low risk of collision impacts (Cook <i>et al.</i> 2012). No goldeneye were recorded and they are at low risk of collision.	No Likely Significant Effect.
		Barrier	Goldeneye wintering in the UK may be from the small UK breeding population or from the much larger population that migrate from Scandinavia and Russia. The relatively small additional distance required to detour around the proposed development should a barrier effect occur during migration will be negligible.	No Likely Significant Effect.
		Displacement	No goldeneye were recorded using the proposed development area and no displacement impacts will occur.	No Likely Significant Effect.

		Upper Solway Flats and Marshes SPA		
Grey plover	As (wi)	Collision	No grey plover was recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 grey plover passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. The grey plover population at the time of citation was 720 individuals (SNH 2013). Therefore, if all predicted collisions are from this SPA a total of 0.9% of the wintering population may be impacted. This assumes that all grey plover at risk of an impact are from this SPA. The Scottish wintering population is up to 2,800 individuals and up to 10,000 may occur during migration (Forrester <i>et al.</i> 2007) and therefore it is likely that at least some of those that may be impacted will not be from this SPA.	No Likely Significant Effect.
		Barrier	Grey plover breed in the high Arctic and winter as far south as southern Africa (Wernham <i>et al.</i> 2002). They are long distance migrants and therefore any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown by grey plover during migration.	No Likely Significant Effect.
		Displacement	No grey plovers were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
<p><b>Note Br = breeding, Wi = Winter, Mi = Migrant, As = Assemblage</b></p>				

Table A.20: Ythan Estuary Sands of Forvie and Miekle Loch

Ythan Estuary, Sands of Forvie and Meikle Loch SPA & Ramsar				
<b>Area</b>		1,016.24 ha		
<b>Distance from NNG development area</b>		110 km		
<b>Article 4.1</b>		<b>Breeding;</b> <ul style="list-style-type: none"> <li>● Common Tern <i>Sterna hirundo</i>;</li> <li>● Little Tern <i>Sterna albifrons</i>; and</li> <li>● Sandwich Tern <i>Sterna sandvicensis</i>.</li> </ul>		
<b>Article 4.2 – Migratory Species</b>		<b>Winter;</b> <ul style="list-style-type: none"> <li>● Pink-footed Goose <i>Anser brachyrhynchus</i>.</li> </ul>		
<b>Article 4.2 – Assemblage</b>		<b>Assemblage</b> <ul style="list-style-type: none"> <li>● Redshank <i>Tringa tetanus</i>;</li> <li>● Lapwing <i>Vanellus vanellus</i>;</li> <li>● Eider <i>Somateria mollissima</i>; and</li> <li>● Pink-footed Goose <i>Anser brachyrhynchus</i>.</li> </ul>		
<b>Conservation Objectives: See Section 6.1</b>				
Qualifying Feature		Potential Impact	Details	Effect
Common tern	Br	Collision	The proposed development is 72 km away from the SPA and beyond the reported maximum foraging range of 30 km for breeding common terns (Thaxter <i>et al.</i> 2012). A total of 35 common terns were recorded in flight, all of which were below turbine height.	No Likely Significant Effect
		Barrier	The proposed development is 72 km away from the SPA and beyond the reported maximum foraging range of 30 km for breeding common terns (Thaxter <i>et al.</i> 2012) and therefore there will be no barrier effects for common	No Likely Significant Effect

		Ythan Estuary, Sands of Forvie and Meikle Loch SPA & Ramsar		
			terns from this SPA during the breeding period.	
		Displacement	The proposed development is 72 km away from the SPA and beyond the reported maximum foraging range of 30 km for breeding common terns (Thaxter <i>et al.</i> 2012) and therefore there will be no displacement effects for common terns from this SPA during the breeding period.	No Likely Significant Effect
Little tern	Br	Collision	No little terns were recorded during site specific surveys.	No Likely Significant Effect.
		Barrier	No little terns were recorded during site specific surveys.	No Likely Significant Effect.
		Displacement	No little terns were recorded during site specific surveys.	No Likely Significant Effect.
Sandwich tern	Br	Collision	No Sandwich terns were recorded during site specific surveys.	No Likely Significant Effect.
		Barrier	No Sandwich terns were recorded during site specific surveys.	No Likely Significant Effect.
		Displacement	No Sandwich terns were recorded during site specific surveys.	No Likely Significant Effect.
Pink-footed goose	Mi (wi)/As	Collision	Of the 577 pink-footed geese recorded during site specific surveys 45.4% were flying above 27.5 m and therefore at risk of collision impacts. Collision risk modelling undertaken based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height predicts a total of eight collisions per year, based on a 98% avoidance rate. The 5 year peak mean count (2006/11) for Ythan Estuary, Sands of Forvie and Meikle Loch SPA is 6,143 individuals (Holt <i>et al.</i> 2012) and therefore, if all eight collisions per year are from the SPA, up to 0.1% of the population may be impacted. This will not cause an adverse effect on the population	No Likely Significant Effect.
		Barrier	Pink-footed geese breeding in Iceland migrate to the UK in winter. Birds passing through the proposed development area will have flown in excess of 1,000 km and the additional distance birds may fly to detour around the wind farm is very small compared to the total distance flown.	No Likely Significant Effect.
		Displacement	No pink-footed geese were recorded using the area and no displacement impacts will occur.	No Likely Significant Effect.

		Ythan Estuary, Sands of Forvie and Meikle Loch SPA & Ramsar		
Redshank	As	Collision	A total of four redshank were recorded during site specific surveys. All were flying below rotor height. Collision risk modelling was not undertaken for redshank but was for the similar grey plover. Based on an assumed population of 1,000 birds passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height collision risk modelling estimated a total of seven collisions per year, based on a 98% avoidance rate. The 5 year peak mean population (2006/11) of redshank at the Ythan Estuary is 1,678 individuals (Holt <i>et al.</i> 2012). Therefore, if all predicted collisions are from this SPA, a total of 0.5% of the wintering population may be impacted. It is unrealistic to assume that all modelled collisions are from this one SPA and the impacts, if any, will be considerably lower.	No Likely Significant Effect.
		Barrier	Redshank breed in the UK and across from Iceland to Russia and winter across the UK. It is not possible to predict where birds crossing the proposed development may occur from but are likely to be either UK breeding birds or birds from Iceland (Wernham <i>et al.</i> 2002). Any small additional increase in flight due to barrier effects will be negligible compared to the total distance flown to during migration.	No Likely Significant Effect.
		Displacement	No redshank were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Lapwing	As	Collision	No lapwing were recorded during site specific surveys. Collision risk modelling undertaken based on an assumed population of 1,000 lapwing passing through the offshore site twice per year, on spring and autumn passage, with all birds flying at rotor height estimated a total of six collisions per year, based on a 98% avoidance rate. There is no population provided in the site citation but the low numbers modelled to be impacted and the location of the SPA are such that few, if any, collisions will occur.	No Likely Significant Effect.
		Barrier	Lapwings wintering in the UK are from either the UK or from Scandinavia (Wernham <i>et al.</i> 2002). It is not possible to predict where birds crossing the proposed development may occur from but those from Scandinavia may have flown in excess of 1,000 km during migration and therefore any small additional increase in flight due to barrier effects will be negligible compared to	No Likely Significant Effect.

		Ythan Estuary, Sands of Forvie and Meikle Loch SPA & Ramsar		
			the total distance flown.	
		Displacement	No lapwings were recorded using the site and no displacement effects will occur.	No Likely Significant Effect.
Eider	As	Collision	A total of 22 eider were recorded from site specific surveys, all of which were flying below turbine height. Modelled flight height data indicates that 2% of flight heights might be at rotor height and therefore there is a very low risk of collision.	No Likely Significant Effect.
		Barrier	Although the UK eider population is not strongly migratory, birds may show some localised seasonal movements. The low numbers recorded indicate that there will be no significant barrier effect as birds pass only occasionally across the site.	No Likely Significant Effect.
		Displacement	No eider were seen using the proposed development area and no displacement impacts will occur.	No Likely Significant Effect.
<b>Note Br = breeding, Wi = Winter, Mi = Migrant, As = Assemblage</b>				



## Annex A References

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