14 Biological Environment

14.1 Benthic Ecology

14.1.1 Summary

14.1.1.1 This chapter presents the results of assessment of the likely significant cumulative impacts upon benthic ecology arising from the proposed Telford, Stevenson and MacColl offshore wind farms and offshore transmission infrastructure in conjunction with other existing or reasonably foreseeable marine and coastal developments and activities. MORL's approach to the assessment of cumulative impacts is described in Chapter 1.3 (Environmental Impact Assessment).

14.1.1.2 In conjunction with other developments and activities within the locale, the Project will only have minor cumulative effects on benthic habitat loss and introduction of new substrate as a result of the operation of the proposals. Cumulative effects of temporary seabed disturbances arising from the construction phase of the Projects are considered to be **not significant** with regard to benthic ecology. A summary of the likely significant cumulative effects is provided in Table 14.1-1 below.

Table 14.1-1 Cumulative Effects Summary

Effect / Receptor	MORL Whole Project	Beatrice Offshore Wind Farm	Beatrice Demonstrator Project	SHEFA-2 Subsea Cable	Beatrice and Jacky Oil Platforms	Sensitivities for Telford, Stevenson and MacColl	Additional Mitigation Measures (if required)
Construction / Decommissioning							
Temporary Seabed Disturbances	Minor	Minor	Not significant	Not significant	Not significant	No effects specific to Telford, Stevenson or MacColl (or combinations of them)	None required
	No significant cumulative effect						
Operation							
Habitat Loss	Minor	Minor	Not significant	Not significant	Not significant	No effects specific to Telford, Stevenson or MacColl (or combinations of them)	None required
	Minor adverse cumulative effect						
Change in Habitat	Minor	Minor	Not significant	Not significant	Not significant	No effects specific to Telford, Stevenson or MacColl (or combinations of them)	None required
	Minor adverse cumulative effect						

14.1.2 Assessment of Cumulative Effects

14.1.2.1 This following paragraphs present the results of the assessment of the likely significant cumulative effects upon benthic ecology arising from the Project in conjunction with other existing or reasonably foreseeable marine and coastal developments and activities.

14.1.2.2 The spatial context within which the cumulative assessment is set is based largely upon the expected range of benthic ecology receptors. Benthic ecology, including seabed habitats and associated faunal communities are relatively immobile and will be generally constrained to the boundaries of the three proposed wind farm developments and the offshore export cable route. Some benthic fish and larger crustaceans obviously have the potential to range beyond the wind farm boundaries although the smaller species, which typically fall within the consideration of benthic ecology, will only range over comparatively small distances. Larger and more mobile fish and shellfish fauna are addressed in Chapter 14.2 (Fish and Shellfish Ecology). Consequently, any direct effects of far field projects and activities beyond the three proposed wind farm boundaries will not contribute to direct cumulative effects on benthic ecology and are thus excluded from this assessment. The exception to this is the perceived incremental loss of original seabed habitat and the introduction of new hard substrata across the wider region as a result of multiple offshore developments, for instance the three proposed wind farms in combination with the Beatrice Offshore Wind Farm and the MORL Western Development Area (WDA). In this respect, the spatial context of the assessment is broadened to encompass other projects within the outer Moray Firth where comparable biotopes serving similar ecosystem functions occur.

14.1.2.3 Indirect effects associated with the movement of sediment plumes from other developments and activities may interact with those arising from the Project giving rise to indirect cumulative effects. Therefore, this chapter considers other local projects and ongoing activities within the Moray Firth, which may give rise to sediment plumes. Given that such sediment plume interaction will only occur within the extents of tidal excursions, any projects and activities outside of this tidal range are not considered, as the associated indirect sediment effects on benthic ecology will be insignificant at these greater distances.

14.1.2.4 The developments and activities considered within the cumulative assessment are listed below:

- Proposed Beatrice Offshore Wind Farm (BOWL) and associated transmission infrastructure;
- Proposed MORL Western Development Area (WDA);
- Proposed SHETL hub and associated transmission infrastructure;
- Beatrice Demonstrator Project turbines;
- SHEFA-2 telecommunications cable; and
- Beatrice and Jacky oil platforms and associated infrastructure.

14.1.3 Methodology

14.1.3.1 The assessment methodology has followed that outlined in the Moray Firth Offshore Wind Developers Group (MFOWDG) Discussion Document (ERM, 2011; see Technical Appendix 1.3 D).

14.1.3.2 To inform the assessment of cumulative effects between the BOWL and MORL developments, MFOWDG have developed a joint biotope map using comparable survey methodologies and interpretative techniques across both developments (see Figure 14.1-1, Volume 6 a). This shows that at a broad habitat level there are some commonalities across the four developments including the dominance of circalittoral fine sands (**CFiSa**) and coarse sediments (**ICS** and **CCS**). As such it is relevant to consider these types of broad habitats and their respective ecosystem functions collectively within the current cumulative assessment. Whilst Figure 14.1-1, Volume 6 a shows less agreement between the Telford, Stevenson, MacColl and BOWL sites at the finer resolution biotope level, the field sample data supports classification of these biotopes in both instances nonetheless. It is therefore likely that **moeVen** and **CFiSa** biotopes do abut at or close to the boundaries between the four developments, as indicated in Figure 14.1-1, Volume 6 a, which may be a reflection of the differences in bathymetry across the four sites. The apparent sharp transition from **moeVen** to **CFiSa** as shown is likely to be an artefact of the mapping and cropping of biotopes at the Telford, Stevenson and MacColl and BOWL boundary and it is more probable that the transition between these two biotopes is more gradual reflecting a broad continuum of physical, bathymetry and biological conditions across the wider region.

Worst Case Scenario - BOWL

14.1.3.3 A summary of the realistic worst case parameters of wind farm design for the BOWL site in terms of benthic ecology is provided in Table 14.1-2 below. Note that BOWL has provided their Rochdale parameters and so worst case scenarios are well understood with respect to this development.

14.1.3.4 The worst case parameters for the Telford, Stevenson and MacColl wind farms and the offshore transmission infrastructure are as provided in Chapter 7.1 and Chapter 10.1 (Benthic Ecology) respectively.

Table 14.1-2 Summary of BOWL Worst Case Parameters

Worst Case Parameters	Scenario Assessed
Incremental Loss of Habitat and Introduction of New Habitat	
• Installation of 277 turbines if lowest rated (3.6 MW) turbines selected, plus 2 AC OSPs and 1 AC / DC substation; • Gravity base and scour protection with combined permanent zone of influence of 11,690 m^2 per foundation; and • Length of export cable = 65 km (up to three trenches) requiring 0.26 km^2 of cable protection.	Total area of loss of original habitat and area of new hard substrata **= 4.07 km^2** equating to **3.34 %** of the BOWL (turbine site and cable site) development area.
Temporary Seabed Disturbances	
• Installation of 280 gravity base foundations (turbines and OSPs); • Length of inter-array cables = 325 km and trench width = 3 m; and • Length of export cable = 65 km (up to 3 trenches).	Increases in suspended sediment concentrations arising from worst case parameters.

Worst Case Scenario – Western Development Area

14.1.3.5 The Western Development Area (WDA) comprises part of the MORL Zone, within which the three proposed wind farm sites (Telford, Stevenson and MacColl) are located. The maximum capacity to be installed in the entire Zone is 1.5 GW and MORL has applied for a maximum of 1.5 GW within three currently proposed wind farm sites.

14.1.3.6 The WDA may be developed up to a maximum of 500 MW capacity if less than 1.5 GW of capacity is delivered by the Project in the EDA. In total the consented capacity of the Project and the WDA will not exceed 1.5 GW.

14.1.3.7 The linkage between the WDA and the three proposed wind farm sites necessitates a slightly different approach to assessment of cumulative effects, as the effects arising from the 'worst case' for the Project cannot simply be added to the 'worst case' scenario for the WDA. Instead, assessment of the likely significant cumulative effects of the Project and the WDA follows a similar format to the 'sensitivity assessments' of the individual wind farm proposals in paragraphs 7.1.9.11 and 7.1.9.12 in Chapter 7.1 (Benthic Ecology) (i.e. where the effects of combinations of projects are considered). The worst case parameters for the WDA are provided in Table 14.1-3 below.

Table 14.1-3 Summary of WDA Worst Case Parameters

Realistic Worst Case Parameters	Scenario Assessed
Incremental Loss of Habitat and Introduction of New Habitat	
• Installation of 100 turbines and one AC OSP with gravity base foundations and associated scour material; and • Cable protection associated with up to 4 J tubes per turbine assuming protection required up to 100 m distance from turbine and at 10 m width = 2,000 m^2 per turbine.	Total area of loss of original habitat and area of new hard substrata = **1.20 km^2** equating **to 0.5 %** of the WDA development area
Temporary Seabed Disturbances	
• Installation of 101 gravity base foundations (turbines and OSPs); • Length of inter-array cables = approximately 130 km and trench width = 3 m; and • Length of export cable = approximately 60 km (from WDA to converter stations to the east of the EDA).	Increases in suspended sediment concentrations arising from worst case parameters

Other Developments

14.1.3.8 Parameters associated with the SHETL hub project remain unconfirmed and so individual and cumulative effects are unquantifiable at this stage. This cumulative assessment has therefore taken a more qualitative approach in defining likely effects.

14.1.3.9 The Beatrice Demonstrator Project turbines, SHEFA-2 cable and Beatrice and Jacky oil platforms are all operational and their parameters are known.

14.1.4 Cumulative Assessment

Items not Considered in Assessment

14.1.4.1 Cumulative effects on benthic ecology arising from changes to the hydrodynamic regime during operation of the Project has been scoped out of this assessment, as the numerical modelling undertaken as part of Chapters 13.1 (Hydrodynamics: Wave Climate and Tidal Regime) and 13.2 (Sedimentary and Coastal Processes) suggested no significant cumulative effects on tidal flows, wave climate and sediment transport as a result of the presence of other developments in conjunction with the Project.

14.1.4.2 Effects of EMFs have also been scoped out of cumulative assessment. As discussed in Chapter 10.1 (Benthic Ecology), the highly localised extents of EMF effects around the cable, the intended target burial depth of 1 m and the mobile nature of potentially sensitive species suggest that significant cumulative EMF effects on benthic ecology are unlikely to occur. Assessment of cumulative effects of EMF on mobile fish and crustaceans is presented in Chapter 14.2 (Fish and Shellfish Ecology).

14.1.4.3 Similarly, heat effects from cables on benthic ecology are scoped out. Given that these effects are also highly localised around the cable and the distances between cables, any cumulative effects on benthic ecology are highly unlikely to occur.

Items Considered in Assessment

14.1.4.4 The likely significant cumulative effects on benthic ecology considered include:

- Habitat loss;
- Temporary seabed disturbances; and
- Change in habitat.

14.1.4.5 The following text provides an assessment of the likely significant cumulative effect for the scoped in items.

Habitat Loss

14.1.4.6 The BOWL and Telford, Stevenson and MacColl developments and their associated offshore transmission infrastructure, together with the WDA (if developed) and any infrastructure associated with the SHEFA and SHETL cable and offshore hub, will result in a cumulative incremental loss of seabed habitat in the outer Moray Firth as a result of the successive placements of turbine and OSP foundations and protection material on the seabed throughout respective sites. Whilst design parameters for the SHEFA and SHETL cable and the offshore hub are unknown at this stage, details for the WDA and BOWL proposed development are well understood. Furthermore, a joint biotope mapping initiative was undertaken between the BOWL and MORL developers to inform cumulative assessment of incremental habitat loss between these two particular developments on the Smith Bank.

14.1.4.7 Assessment of realistic worst case scenarios for the BOWL and MORL developments, relating to the size of the footprint and maximum foreseeable number of the largest turbine and OSP foundations and associated scour protection, showed that 7.28 km^2 of circalittoral and infralittoral coarse sediments and circalittoral fine sands will be lost. To put this into perspective this equates to

2.90 % and 3.76 % of the BOWL area and combined Telford, Stevenson, MacColl developments respectively. Further seabed areas of 0.26 km^2 and 0.38 km^2 will be lost as a result of the placement of cable protection material along the BOWL and MORL export cables respectively. These will be in addition to the total area of original seabed habitat already lost as a result of the placement of infrastructure associated with the Beatrice oil field, Jacky oil field and Beatrice Demonstrator Project. The total cumulative loss of original seabed habitat will therefore remain the same regardless of final development permutations across the four MORL sites.

14.1.4.8 The spatial extent of this cumulative effect is small within the context of the wider outer Moray Firth area and the significance of cumulative effects on biodiversity and ecosystem functioning is considered **minor.** The Scottish PMF biotope **moeVen** was only identified within the BOWL development site so there will be no cumulative effect on this particular receptor.

14.1.4.9 The maximum footprint of the components of the BOWL and WDA developments is well understood and so uncertainty associated with this assessment is regarded as low.

Temporary Seabed Disturbances

14.1.4.10 Significant direct and indirect cumulative effects relating to temporary seabed disturbances are not anticipated because of the small spatial scale of related effects and the general insensitivity of receiving habitats (see Chapter 10.1: Benthic Ecology). Annex I habitat features were not identified within the boundaries of the BOWL development and are consequently major cumulative impacts on benthic ecology are not expected.

14.1.4.11 Sediment plumes arising from simultaneous construction of the three proposed wind farms, the proposed BOWL wind farm and potentially the WDA (if developed) are not forecast to interact significantly. This is because suspended sediments will be transported along the axis of the principal tidal currents and so will move along parallel pathways and are thus not expected to converge or inter-mingle. Whilst there may be potential for suspended sediments arising from both the offshore generating stations and offshore transmission infrastructure of both MORL and BOWL to interact (see Chapter 12.1: Whole Project Assessment), significant cumulative effects are not forecast due to the typically low suspended sediment concentrations (SSCs) predicted and the rapid dilution of dispersion of suspended sediments in the receiving waters. Numerical modelling (Chapter 13.2: Sedimentary and Coastal Processes) shows that accumulation of sediment as a result of the construction of the three proposed wind farms and the BOWL development to the south and west of both developments will be of a thickness of < 1 mm. Equally, effects associated with the installation of the proposed SHETL cable are likely to be local, of low magnitude and temporary so that significant cumulative effects with the Project are not anticipated. Significance of cumulative effects in this regard is therefore considered to be **not significant**.

14.1.4.12 Installation of the Project and BOWL together with the SHETL offshore transmission infrastructure export cables will temporarily disturb fine muddy sand sediments corresponding to the biotope classification SpnMeg. This biotope is a component of the Scottish draft PMF list "burrowed mud" feature. No permanent loss of this feature is forecast and recovery of the biotope following temporary seabed disturbances is predicted to occur within 5 years, as assessed in Chapter 10.1 (Benthic Ecology) following cessation of the disturbance. The characterising

seapens and large burrowing prawns are thought to be relatively long lived, requiring a number of years to reach sexual maturity and so recovery of these species may take several years if significantly affected (see Chapter 10.1: Benthic Ecology). The scale of this temporary disturbance will be very small in relation to the potential SpnMeg biotope resource available across the wider Moray Firth, as indicated by National Biodiversity Network data (see Technical Appendix 4.2 B). Furthermore, significant sediment plume interaction between export cable activities is not forecast due to the distances involved, the generally parallel direction of dispersion within tidal current streams and the rapid dilution and dispersion of raised SSCs to ambient levels. Accordingly, cumulative effects on this PMF feature are not expected and are considered to be **not significant**.

14.1.4.13 Commercial fishing activities involving mobile demersal gears can also raise suspended sediments into the water column increasing local levels of SSCs. There is therefore the potential for further cumulative sediment effects to arise where this activity occurs within the footprint of indirect construction effects. The magnitude and spatial scale of potential cumulative effects are presently difficult to qualify as the footprint of commercial fishing varies spatially and temporally. However, given the generally rapid dispersion and dilution of raised SSCs, the low intolerance of receiving sediment habitats and the temporary nature of the disturbance, then the significance of any associated cumulative effects is considered to be **not significant**.

Change in Habitat

14.1.4.14 The introduction of new hard substrate in the form of the vertical surfaces of turbines, OSPs and scour protection material in the outer Moray Firth has the potential to increase local species diversity as they will provide suitable areas for colonisation by a range of epifaunal populations. Additionally, scour material will increase the availability of refugia for larger, more mobile epibenthos such as fish and crabs, attracted by the greater availability of food resources (see Chapter 14.2: Fish and Shellfish Ecology). At the local level around each turbine, therefore, there is a potential for increases in biodiversity and productivity. However, at the wider, cumulative level, the perceived positive effects are less certain. This is because any colonising epifaunal populations will probably already be represented within the outer Moray Firth (for example: attached to existing platforms within the Beatrice oil field). Consequently, any species colonising the new habitat will already have been recorded elsewhere within the wider area and overall effects on regional biodiversity will be marginal. Accordingly, the effects are judged to be localised and significant cumulative effects in this respect are not predicted.

14.1.4.15 New habitat associated with turbine arrays also has potential for colonisation by non-indigenous species (NIS). At site level, the significance has already been assessed as minor as residual effects are likely to be localised (see Chapter 7.1: Benthic Ecology). Collectively, the Project, the BOWL development and the WDA could arguably represent a greater opportunity for establishment and spread of NIS compared to any single turbine array and therefore it may be reasonable to raise the significance of the perceived effect. However, given the lack of any evidence of significant effects of NIS on native communities at other wind farm developments then the likely significant cumulative effect would remain as **minor**. Uncertainty however remains high as assessed in Chapter 7.1 (Benthic Ecology).

Assessment of WDA

14.1.4.16 For the purposes of this assessment it has been assumed that the potential effect of the WDA on benthic ecology will, at worst, be as assessed in Chapter 7.1 (Benthic Ecology) for the three wind farm sites and Chapter 10.1 (Benthic Ecology) for the offshore transmission infrastructure. Construction works will not run in parallel at the WDA and the EDA and therefore there is no potential for additive effects during the construction phase.

Assessment of Other Developments

14.1.4.17 In relation to the SHETL hub project, it is assumed that it will result in temporary seabed disturbances, including the raising of sediment plumes as a result of trenching or ploughing during installation. It is also assumed to contribute to the incremental loss of organic benthic habitat and to habitat change as a result of the placement of foundations and protection material on the seabed.

14.1.5 References

BERR (2088). Review of cabling techniques and environmental effects applicable to the offshore wind farm industry. Technical Report. January 2008.

ERM (2011). Moray Firth Offshore Wind Developers Group Cumulative Impacts Assessment Discussion Document April 2011

14.2 Fish and Shellfish Ecology

14.2.1 Summary of Effects and Mitigation

14.2.1.1 A summary of the cumulative impact assessment is given below in Table 14.2-1 below. Likely significant cumulative effects (above minor) have been identified in relation to construction noise on a number of species, namely, cod, herring, salmon and sea trout. In addition, the potential for a significant cumulative effect associated to loss of habitat to occur on sandeels has been identified.

14.2.1.2 The uncertainties in relation to the assessment of certain effects given their spatial extent (i.e. introduction of new habitat, EMFs and operational noise) have also been noted.

14.2.1.3 The expected cumulative effects are summarised in Table 14.2-1 below.

Proposed Mitigation Measures and Residual Effects

14.2.1.4 No mitigation specific to cumulative effects on fish and shellfish ecology has been proposed.

14.2.1.5 The significance of effects assigned to the MORL Project take account of the monitoring and mitigation measures described in Chapter 7.2 and Chapter 10.2 (Fish and Shellfish Ecology) for the three proposed wind farms and the offshore transmission infrastructure (OfTI) respectively.

Table 14.2-1 Cumulative Impact Summary

Effect / Receptor	MORL Total Project	BOWL (generating station and associated transmission infrastructure)	European Offshore Wind Development Centre	WDA	Sensitivities for Telford, Stevenson and MacColl, and OfTI	Mitigation Method (if required)
Construction / Decommissioning						
Increased SSCs and Sediment Re-Deposition	General: Minor Salmon and sea trout: Minor	Minor General: Minor Salmon and sea trout: Minor	Salmon and sea trout specific: Negligible-Minor	General: Minor Salmon and sea trout: Minor	N / A	None proposed
Overall CIA for Increased SSCs and Sediment Re-Deposition	Cumulative effects associated to increased suspended sediment concentrations and sediment re-deposition are expected to be of **minor significance.**					
Construction Noise	General : Minor Salmon and sea trout: Minor	General; Minor Cod and Herring: Minor to moderate	Salmon and sea trout specific: Minor	General : Minor Salmon and sea trout: Minor	N / A	None proposed

Effect / Receptor	MORL Total Project	BOWL (generating station and associated transmission infrastructure)	European Offshore Wind Development Centre	WDA	Sensitivities for Telford, Stevenson and MacColl, and OfTI	Mitigation Method (if required)
Overall CIA for Construction Noise	In general terms the cumulative effect of construction noise is expected to be of minor significance. Exceptions to these are as follows: Cod and herring: it is considered that noise associated to the MORL Project / EDA together with BOWL could result in cumulative impacts of moderate significance. Salmon and sea trout: It is considered that noise associated to the MORL Project / WDA together with BOWL and the EOWDC could result in an effect of minor to moderate significance on salmon and sea trout.					
Operation						
Loss of Habitat	General: Minor Sandeels: Minor Salmon and sea trout: Minor	General: Negligible to Minor Sandeels; Minor Salmon and sea trout: Minor	Salmon and sea trout specific: Negligible	General: Negligible to Minor Sandeels: Minor Salmon and sea trout: Minor	N / A	None proposed
Overall CIA for Loss of Habitat	Loss of habitat is expected to result in a cumulative effect of minor significance on fish and shellfish species in general. An exception to this is the potential for a cumulative effect to occur on sandeels. Given the uncertainties in relation to the distribution of sandeels in the BOWL site and in the wider Moray Firth, it is considered that there is potential for a cumulative effect of minor to moderate significance to occur. This would be dependent on the location of high density sandeel patches and their degree of overlap with wind farm infrastructure (i.e. turbine foundations).					
Introduction of New Habitat	General: Minor	General: Negligible to Minor	Salmon and sea trout specific: Negligible	General: Minor	N / A	None proposed
Overall CIA for Introduction of New Habitat	Based on current available information it is expected that introduction of new habitat will result in a cumulative impact of minor significance on fish and shellfish species (including salmon and sea trout). In this context the relatively larger area of the developments proposed in the Moray Firth , in comparison to those currently operational where post construction monitoring has been carried out to date, should however be noted.					
EMFs	General: Minor	General: Minor	Salmon and sea trout specific: Minor	General: Minor	N / A	None proposed
Overall CIA for EMFs	Based on current available information it is expected that EMF related effects will results in a cumulative effect of minor significance behaviour. The relatively larger area of the developments proposed in the Moray Firth in comparison to those currently operational, where post construction monitoring has been carried out, should however be noted in this context. The results of MSS current research on this field may further contribute to the understanding of the potential effect of EMFs on fish and shellfish.					

Effect / Receptor	MORL Total Project	BOWL (generating station and associated transmission infrastructure)	European Offshore Wind Development Centre	WDA	Sensitivities for Telford, Stevenson and MacColl, and OfTI	Mitigation Method (if required)
Operational Noise	General: Minor	General: Minor	Salmon and sea trout specific; Negligible-Minor	General; Minor	N / A	None proposed
Overall CIA for Operational Noise	Based on current available information it is expected that operational noise related effects will result in a cumulative effect of minor significance on fish and shellfish receptors. The relatively larger area of the developments proposed in the Moray Firth in comparison to those currently operational, where post construction monitoring has been carried out, should however be noted in this context.					
Changes to Fishing Activity	General: Below moderate Salmon and sea trout: Below moderate	General:Below moderate Salmon and sea trout: Below Moderate	Salmon and sea trout: Negligible	General: Below moderate Salmon and sea trout: Below moderate	N / A	None proposed
Overall CIA for Fishing Activity	No significant cumulative effects (above minor) on fish and shellfish species (including salmon and sea trout) are expected associated to changes to fishing activity.					

14.2.2 Assessment of Cumulative Impacts

14.2.2.1 This chapter details the assessment of cumulative effects upon fish and shellfish ecology arising from the three proposed wind farm sites (Telford, Stevenson and MacColl) and the OfTI (the Project) in conjunction with other existing and foreseeable planned marine project / development activities.

14.2.2.2 The geographical scope of the cumulative assessment is principally focused in the Moray Firth area. It is, however, recognised that some species may spend varying periods of time outside the Moray Firth and, as a result, there is potential for these to be affected by other activities / developments further afield.

14.2.2.3 The developments and activities considered in detail within the cumulative impact assessment are listed below:

- Beatrice Offshore Wind Farm (BOWL) and associated infrastructure; and
- MORL Western Development Area (WDA) generating stations.

14.2.2.4 The list of projects/activities can be found in Table 1.3-3 in the introductory chapters (Chapter 1.3: Environmental Impact Assessment). In addition, the following developments have been identified which may have cumulative effects over the life of the Project but where there is insufficient information available for a detailed assessment of cumulative effects to be carried out:

- The SHETL cable and offshore hub;
- Relevant oil and gas activities (Beatrice and Jacky platforms and associated infrastructure);

- Marine energy developments in the Pentland Firth and Orkney waters;
- Port and harbour developments in the Moray Firth;
- Dredging and sea disposal in the Moray Firth; and
- Relevant military activities.

14.2.2.5 It should be noted that likely cumulative effects arising from dredging, sea disposal and port and harbour development in the Moray Firth, have not been taken forward for assessment, since these are sporadic and typically short-term activities and concentrated along the coastline of the Moray Firth.

14.2.2.6 In the particular case of salmon and sea trout, given their migratory behaviour and their potential (particularly for salmon) to transit other coastal areas around Scotland, the proposed European Offshore Wind Development Centre (EOWDC), the Firth of Forth Round 3 wind farm development and the Scottish Territorial Waters (STW) wind farm developments proposed in the Firth of Forth (Inch Cape and Neart na Gaoithe wind farms) have also been considered for assessment of cumulative impacts. It should be noted that of these, detailed information only exists for the EOWDC project (See Table 14.2-6 below).

14.2.3 Methodology

14.2.3.1 The assessment methodology used has followed the methodology proposed in the cumulative impacts discussion document (Moray Firth Offshore Wind Developers Group Cumulative Impact Assessment Discussion Document (ERM, 2011)) (Technical Appendix 1.3 D) and is consistent with the approach described in the wind farms and OfTI specific impact assessments provided in Chapter 7.2 and Chapter 10.2 (Fish and Shellfish Ecology) respectively.

Worst Case Scenario for Projects where Detailed Assessment is Possible

14.2.3.2 A summary of the realistic worst case parameters of wind farm design for the BOWL project, the WDA and the EOWDC, in terms of fish and shellfish ecology, is provided in Table 14.2-2, Table 14.2-3 and Table 14.2-4 respectively. Worst case parameters for Telford, Stevenson and MacColl and the OfTI are as provided in Chapter 7.2 and Chapter 10.2 (Fish and Shellfish Ecology).

BOWL Worst Case Parameters

Table 14.2-2 Summary of BOWL Worst Case Parameters

Worst Case Parameters	Scenario assessed
Construction Noise	
Installation of 277 turbines	Four pin piles (2.4 m diameter) per foundation
Max, number of simultaneous piling events	Two

Increased suspended sediment concentration and sediment re-deposition	
Installation of 280 gravity base foundations (turbines and OSPs) **Length of inter-array cables = 325 km and trench width = 3 m.** **Length of export cable = 65 km**	Drilling to facilitate pin pile installation and seabed preparation for installation of gravity bases. Inter array cable and export cable burial by energetic means
Loss of Habitat and Introduction of New Habitat	
Installation of 277 turbines if lowest rated (3.6 MW) turbines selected, plus 2 AC OSPs and 1 AC / DC substation. **Gravity base and scour protection with combined permanent zone of influence of 11,690 m² per foundation.**	Total area of loss of original habitat and area of new hard substrata = 3.52 km² equating to 2.7 % of the BOWL development area
Operational Noise	
Installation of maximum number of turbines (277)	
EMFs	
Inter array cabling total length	325 km
Export cabling length	65 km
Changes to Fishing Activity	
Installation of maximum number of turbines (277)	

Western Development Area

14.2.3.3 The WDA comprises part of the MORL Zone, within which the three proposed wind farm sites (Telford, Stevenson and MacColl) are located. The maximum capacity to be installed in the entire Zone is 1.5 GW and MORL has applied for a maximum of 1.5 GW within three proposed wind farm sites.

14.2.3.4 The WDA may be developed for a maximum of 500 MW of capacity if less than 1.5 GW of capacity is delivered by the Project in the EDA. In total, the consented capacity of the Project and the WDA will not exceed 1.5 GW.

14.2.3.5 The connection between the WDA and the three proposed wind farm sites necessitates a slightly different approach to assessment, as the effects arising from the "worst case" for the Project cannot simply be added to the "worst case" scenario for the WDA. Instead, assessment of the likely significant cumulative effects of the Project and the WDA will therefore follow a similar format to that undertaken for the sensitivity assessments of the individual wind farm proposals in the Offshore Generating Station Impact Assessment (Chapter 7.2: Fish and Shellfish Ecology).

Table 14.2-3 Summary of WDA Worst Case Parameters

Realistic Worst Case Parameters	Scenario Assessed
Increased Sediment Concentrations and Sediment Re-Deposition	
Installation of 101 gravity base foundations (turbine and OSPs) **Length of inter-array cables = approximately 130 km and trench width = 3 m.** **Length of export cable = approximately 60 km (from WDA to converter stations to the east of the EDA)**	Drilling to facilitate pin pile installation and seabed preparation for installation of gravity bases and cable burial cable by energetic means
Construction Noise	
Installation of 100 turbines	Jackets on pin piles (2.5 m diameter)
Max. number of simultaneous piling operations	Two
Loss of Habitat / Introduction of New Habitat	
Installation of 100 turbines and one AC OSPs with gravity base foundations and associated scour material. **Cable protection associated with up to 4 J tubes per turbine assuming protection required up to 50 m distance from turbine and at 10 m width = 2,000 m² per turbine;**	Total area of loss of original habitat and area of new hard substrata = 1.20 km² equating to 0.5 % of the WDA development area. Note: development within the WDA will offset development within Telford, Stevenson and MacColl.
Operational Noise	
Installation of maximum number of turbines	100
EMFs	
Inter array cabling	130 km
Export cable	Approx. 60 km (from WDA to converter station to the east of the EDA)
Changes to Fishing Activity	
Installation of maximum number of turbines	100

European Offshore Wind Development Centre (EOWDC) in Aberdeen Bay

Table 14.2-4 Summary of European Offshore Wind Development Centre (EOWDC) Worst Case Parameters (Source: Vattenfall, 2012)

Worst Case Parameters	Scenario Assessed
Construction Noise	
Installation of 11 turbines	Monopiles (8.5 m diameter)
Max, number of simultaneous piling events	One
Increased Suspended Sediment Concentration and Sediment Re-Deposition	

Worst Case Parameters	Scenario Assessed
Installation of 11 turbines **Installation of inter-array cables** **Installation of export cable**	Gravity base foundations (40 m diameter) Max length 13 km Max length 26 km
Loss of Habitat and Introduction of New Habitat	
Installation of 11 turbines	Gravity base foundations (40 m diameter)
Operational Noise	
Installation of maximum number of turbines (11)	
EMFs	
Inter array cabling total length	Max length 13 km
Export cabling length	Max length 26 km
Changes to Fishing Activity	
Installation of maximum number of turbines (11)	

Other Developments

14.2.3.6 Developments that are at an earlier stage, and for which there are limited development details at this stage, are also considered. Detailed cumulative impact assessment of these developments is not possible as insufficient information is available. Instead, a commentary on the potential for cumulative effects on the basis of the information available is presented, but no quantitative conclusions on the likely significance of any impacts can be drawn.

14.2.3.7 All marine renewable projects considered in the CIA are shown in Figure 1.3-1, Volume 6 a.

14.2.4 Detailed Impact Assessment

14.2.4.1 The types of impacts considered in this cumulative impact assessment are:

- Increased suspended sediment concentrations (SSCs) and sediment re-deposition;
- Construction noise;
- Loss of habitat;
- Introduction of new habitat;
- EMFs;
- Operational noise; and
- Changes to fishing activity.

Increased Suspended Sediment Concentrations (SSCs) and Sediment Re-Deposition

General

14.2.4.2 The release of sediment into the water column as a result of construction works being carried out simultaneously in adjacent areas may result in an impact on fish and shellfish species. The likely cumulative impact of multiple and simultaneous sources of sediment release is detailed in Chapter 13.2 (Sedimentary and Coastal Processes). This takes account of the following:

- The Project and BOWL foundation installation (drilling for pin piles or bed preparation of GBS);
- The Project and BOWL inter array cable burial; and
- The Project and BOWL transmission cable burial.

14.2.4.3 The maximum cumulative result of interaction between sediment plumes is an additive increase in SSCs. As indicated in Chapter 13.2 (Sedimentary and Coastal Processes) no significant cumulative effects are expected as a result of this. Similarly, no significant cumulative effects in terms of sediment re-deposition have been identified in Chapter 13.2.

14.2.4.4 Taking the above into account the construction phase of the BOWL site is expected to result in effects of **minor significance** on fish and shellfish receptors. The cumulative effect on fish and shellfish receptors associated to increased suspended sediment concentrations and sediment re-deposition is therefore considered to be of **minor significance** on fish and shellfish in general.

Salmon and Sea Trout Specific

14.2.4.5 In the case of salmon and sea trout, in addition to the above, SSCs and sediment re-deposition associated with installation activities in the EOWDC project, may further contribute to the potential cumulative effects identified above for fish and shellfish in general, assuming salmon and sea trout also transit the Aberdeen Bay area during migration. Given the small number of foundations needing installation in the EOWDC (11) and the relatively small associated cabling (Table 14.2-4 above) disturbance through increased SSCs resulting from construction works at the EOWDC is expected to result in an effect of **negligible to minor significance** on salmon and sea trout.

14.2.4.6 Taking the above into account, the cumulative effect associated with increased suspended sediment concentrations and sediment re-deposition on salmon and sea trout is considered, as assessed to be of **minor significance**.

Construction Noise

General

14.2.4.7 For assessment of the cumulative impact of construction noise, it has been considered that piling operations may take place simultaneously at the BOWL project and the three proposed wind farm sites.

14.2.4.8 Worst case cumulative noise scenarios were modelled taking the potential maximum of eight simultaneous piling operations (six at Telford, Stevenson and MacColl / WDA and two at BOWL). The outputs of these are provided in Chapter

3.6 (Underwater Noise) and Technical Appendix 3.6 A for herring, cod, salmon and dab.

14.2.4.9 The expected impact ranges taking the cumulative scenario are similar to those expected from piling at six locations within Telford, Stevenson and MacColl (discussed in Chapter 7.2: Fish and Shellfish Ecology). The noise effects associated to piling at BOWL, given the smaller number of piling operations needed (installation of a maximum of 277 turbines), the maximum of two piling operations proposed and the modelled impact ranges, are expected to be of minor significance on fish and shellfish species in general. An exception to this is the effect on cod and herring. Given the uncertainties in relation to the use that these species make of the Moray Firth area, particularly in relation to the extent and relative importance of the area in terms of spawning grounds, there may be potential for effects of minor to moderate associated with noise during construction of the BOWL site to occur.

14.2.4.10 Taking the above into account construction noise is considered to result in a cumulative effect of **minor significance** on fish and shellfish in general with the exception of cod and herring, for which a cumulative effect of **moderate significance** may occur.

Salmon and Sea Trout Specific

14.2.4.11 In the particular case of salmon and sea trout, given the relatively small ranges associated with two piling operations at BOWL, noise derived from construction work at BOWL is considered to result in an effect of minor significance on these species.

14.2.4.12 Salmon and sea trout may however also be subject to noise generated during construction of EOWDC in the Aberdeen Bay area, prior to their arrival to, or after leaving the Moray Firth area. In light of the limited number of foundations needing installation for the EOWDC project (11), it is considered that effects associated to construction noise will be of minor significance.

14.2.4.13 Taking the potential for salmon and sea trout to be exposed to construction noise not only in the Moray Firth area but also further afield, the cumulative effect of construction noise on these species is assessed to be of minor to **moderate significance**.

14.2.4.14 It should be noted that the potential for a cumulative impact to occur will be dependent on the construction schedules and final design engineering parameters used (i.e. foundation type), on the timing and migration route taken by salmon and sea trout populations from different rivers, and on the degree of overlap between these, and areas impacted by construction noise.

Loss of Habitat

General

14.2.4.15 The installation of the BOWL will result in an incremental loss of habitat as a result of successive placement of foundations onto the seabed, which will add to that resulting from Telford, Stevenson and MacColl, and the OfTI. The loss of seabed area is however expected to be small in relation to the distribution range of the fish and shellfish species present in the area (approx. 4.07 km^2 associated with the BOWL). The loss of habitat resulting from both the BOWL site is therefore expected

to result in an effect of negligible to minor significance on fish and shellfish species in general. The cumulative effect arising from this is therefore assessed to be of minor significance.

14.2.4.16 In the particular case of sandeels, the potential for a cumulative impact to occur will be dependent on the location of high density sandeel patches, the overall distribution of sandeel habitat in the Moray Firth and the degree of overlap between these and wind farm related infrastructure. The results of the sandeel survey undertaken, suggest that there are not extensive areas supporting important sandeel populations in the three wind farms sites.

14.2.4.17 Taking the relatively small area expected to be lost through the installation of the BOWL project, the effect of loss of habitat on sandeels is expected to be of **minor significance**. The distribution and relative importance of the BOWL site and the wider Moray Firth in terms of sandeel distribution, are however currently unknown. In light of this and taking a precautionary approach, the cumulative effect of loss of habitat on sandeels is considered to be of **minor to moderate significance**.

Salmon and Sea Trout Specific

14.2.4.18 In the case of salmon and sea trout, the introduction of the EOWDC will further contribute the loss of seabed habitat described above for fish and shellfish in general. Given the small size of the EOWDC it is expected that loss of habitat will result in an effect of negligible significance. Taking the above into account, the cumulative effect of loss of habitat on salmon and sea trout is considered to be, as assessed for fish and shellfish in general above, of **minor significance**.

Introduction of New Habitat

General

14.2.4.19 The adjacent location of BOWL will result in an increase in the spatial effect derived from the introduction of new habitat, resulting from the operational phase of the Project itself.

14.2.4.20 Post-construction monitoring undertaken in operational wind farms does not suggest that introduction of new habitat has had a significant detrimental impact on fish and shellfish species. As assessed for the three wind farms sites in Chapter 7.2 (Fish and Shellfish Ecology), it is expected that introduction of new habitat associated with the BOWL project, will result in an effect of minor significance. The associated cumulative effect on fish and shellfish species in general, is similarly expected to be of **minor significance**. The comparatively larger spatial extent of the potential impact, taking into account all the developments considered in this assessment and their proximity, should however be noted in this context.

Salmon and Sea Trout Specific

14.2.4.21 In the case of salmon and sea trout, assuming fish also transit the Aberdeen Bay area, there is potential for the EOWDC to further add to the effect associated with introduction of new habitat identified above. Given the small footprint of the EOWDC project, however, its effect on salmon and sea trout is expected to be negligible. Taking this into account, the cumulative effect of introduction of new habitat on salmon and sea trout is considered to be, as identified above for fish and shellfish in general, of **minor significance**.

Electromagnetic Fields (EMFs)

General

14.2.4.22 The adjacent location of BOWL will result in an increase in the spatial extent of EMF related effects associated with the operational phase of the Project itself.

14.2.4.23 Post-construction monitoring undertaken in operational wind farms to date, does not suggest that EMF related effects have had a significant detrimental impact on fish and shellfish species. EMF related effects resulting from both the BOWL project and the WDA are therefore considered to be of minor significance. Taking the above into account the cumulative effect associated with this on fish and shellfish species in general is considered to be of **minor significance**. As indicated in the introduction of new habitat paragraphs above, the comparatively larger spatial extent of the likely effects, taking into account all the developments considered in this assessment and their proximity, should however be noted in this context.

Salmon and Sea Trout Specific

14.2.4.24 In the particular case of salmon and sea trout, there is potential for fish to be exposed to EMF related effects associated with the EOWDC in the Aberdeen Bay. Given the small area potentially affected (taking the relatively small cabling needed for this development and its proximity to shore) and in view of the results of the EMF modelling provided in Technical Appendix 4.3 D for AC cables, the effect of EMFs during the operational phase of the EOWDC is considered of minor significance. The cumulative effect of EMF on salmon and sea trout, it is considered to be, as assessed above for fish and shellfish in general, of **minor significance**.

14.2.4.25 The results of MSS current research on the effect of EMFs on migratory fish, will contribute to further understanding of the potential cumulative effects associated to EMFs (see Technical Appendix 4.3 D).

Operational Noise

General

14.2.4.26 The adjacent location of BOWL will result in an increase in the spatial extent of operational noise related effects associated with the Project.

14.2.4.27 Post-construction monitoring undertaken in operational wind farms to date, does not suggest that operational noise related effects have had a significant detrimental impact on fish and shellfish species. Operational noise related effects resulting from the BOWL project are therefore considered to be of **minor significance**. Taking the above into account the cumulative effect associated with this on fish and shellfish species in general is considered to be of **minor significance.** The comparatively larger spatial extent of the potential effects, taking into account all the developments considered in this assessment and their proximity should however be noted in this context.

Salmon and Sea Trout Specific

14.2.4.28 In the particular case of salmon and sea trout, assuming fish transit the Aberdeen Bay area during migration, there is potential for fish to be exposed to operational

noise related effects associated with the EOWDC in the Aberdeen Bay. Given the small area likely affected due to the small size of the EOWDC project, the effect of operational noise is considered of negligible to minor significance. Taking the above into account, the cumulative effect of operational noise on salmon and sea trout, is considered to be of **minor significance**.

Changes to Fishing Activity

General

14.2.4.29 The potential for changes to fishing activity to result in a cumulative impact on fish and shellfish species, will depend on the level of fishing activity that the operational BOWL project supports. A decrease in fishing effort, or a change in the fishing methods or practices used within these sites, and along their cables, may result in changes to the seabed community which will in turn have an effect on fish and shellfish species. Species commercially targeted in the area and those caught as by-catch, may benefit from a decrease in direct fishing mortality if fishing activity is reduced. In this context, however, as mentioned in Chapter 7.2 and Chapter 10.2 (Fish and Shellfish Ecology), the potential for fishing effort to be displaced into other sensitive areas within the Moray Firth or further afield should be noted. In the particular case of scallop dredging, Telford, Stevenson and MacColl and the WDA are fishing grounds of relative importance at the regional level, whilst the area of the BOWL site sustains lower levels of scallop dredging activity. As indicated in Chapter 7.2 and Chapter 10.2 (Fish and Shellfish Ecology), it will be possible for fishing to continue in the three wind farms sites and in the area of the OfTI. Provided this is also the case in the BOWL site, there is **little potential for a significant cumulative effect (above minor)** associated to changes to fishing activity to occur.

Salmon and Sea Trout Specific

14.2.4.30 In addition to the above, in the case of salmon and sea trout, changes to fishing activity during the operational phase of the EOWDC could further contribute to the potential cumulative impacts identified above. Given the small area of the EOWDC project, it is however considered that changes to fishing activity in this site would result in a negligible effect on salmon and sea trout.

14.2.4.31 It is therefore considered that there is **no potential for a significant cumulative effect (above minor)** on salmon and sea trout to occur associated with changes to fishing activity.

14.2.5 Assessment of WDA

14.2.5.1 There are no significant differences between the WDA and EDA in terms of the fish and shellfish ecology baseline environment that they support. For the purposes of this assessment it has therefore been assumed that the likely effect of the WDA on fish and shellfish species will, at worst, be as assessed in Chapter 7.2 (Fish and Shellfish Ecology) for the three proposed wind farm sites. It should be noted that construction works are unlikely to run in parallel at the WDA and the EDA and therefore during the construction phase, there is no potential for additive effects associated to the WDA and EDA to occur. It should also be noted that in the WDA scenario there is less construction in the EDA as a consequence.

14.2.6 Commentary on Other Relevant Development Proposals for which Insufficient Information is Available to Allow Detailed Cumulative Impact Assessment

Construction

14.2.6.1 There is potential for increased SSCs and sediment re-deposition and noise associated to construction works in other marine developments / activities to occur on fish and shellfish, including installation of the SHETL cable and hub, Oil and Gas and military activities in the Moray Firth. The potential for a cumulative impact to occur will depend on the location and nature of these activities.

14.2.6.2 In the particular case of herring, as spawning of the Orkney / Shetland stock primarily takes place in the area between the Orkney and the Shetlands, there might be also potential for suspended sediment concentrations, sediment re-deposition and construction noise associated to the Pentland Firth and Orkney waters marine energy developments to further contribute to cumulative impacts.

14.2.6.3 In addition to the above, there is potential for Salmon and Sea Trout to be subject to increased SSCs, sediment re-deposition and construction noise associated to construction works in the proposed offshore wind farm developments in the Firth of Forth.

Operation

14.2.6.4 Other offshore developments, including the SHETL cable and offshore hub, potential future Oil and Gas related infrastructure and the proposed Pentland Firth and Orkney waters marine renewable developments, may further contribute to any cumulative effects associated to loss of habitat, introduction of new habitat, operational noise, EMFs and changes to fishing activity during the operational phase.

14.2.6.5 In the case of salmon and sea trout, in addition to the developments identified above, the proposed offshore wind farm developments in the Firth of Forth area may also further contribute to any cumulatively effects identified during the operational phase.

14.2.7 Habitats Regulations Appraisal

14.2.7.1 The methodology used for assessing cumulative effects on designated sites has followed the methodology described in Chapter 7.2 and Chapter 10.2 (Fish and Shellfish Ecology) for the three proposed wind farm sites and the OfTI respectively.

14.2.7.2 The relevant SACs needing assessment in relation to fish and shellfish resources are as specified in the JNCC and SNH scoping response (28/10/2010) as follows:

- Berriedale & Langwell Waters SAC;
- River Evelix SAC;
- River Moriston SAC;
- River Oykel SAC;
- River Spey SAC; and
- River Thurso SAC.

14.2.7.3 The qualifying status of the relevant SAC species and the conservation objectives of each SAC are given in Table 14.2-5 below.

Table 14.2-5 Qualifying Status of SAC Species and SAC Conservation Objectives

SAC	Species with Qualifying Status	Conservation Objectives
Berriedale & Langwell Waters	**Atlantic salmon**: Primary reason for SAC selection	• To avoid deterioration of the habitats of Atlantic salmon or significant disturbance to Atlantic salmon, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and • To ensure for the qualifying species that the following are maintained in the long term: 1. Population of the species, including range of genetic types for salmon, as a viable component of the site; 2. Distribution of the species within the site; 3. Distribution and extent of habitats supporting the species; 4. Structure, function and supporting processes of habitats supporting the species; and 5. No significant disturbance of the species.
River Evelix	**Freshwater pearl mussel**: Primary reason for SAC selection	• To avoid deterioration of the habitats of freshwater pearl mussel or significant disturbance to freshwater pearl mussel, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and • To ensure for the qualifying species that the following are maintained in the long term: 1. Population of the species as a viable component of the site; 2. Distribution of the species within the site; 3. Distribution and extent of habitats supporting the species; 4. Structure, function and supporting processes of habitats supporting the species; 5. No significant disturbance of the species; 6. Distribution and viability of the species' host species; and 7. Structure, function and supporting processes of habitats supporting the species' host species.
River Moriston	**Freshwater pearl mussel**: Primary reason for SAC selection **Atlantic salmon**: Qualifying feature for SAC selection	• To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and

SAC	Species with Qualifying Status	Conservation Objectives
River Moriston (continued)	**Freshwater pearl mussel**: Primary reason for SAC selection **Atlantic salmon**: Qualifying feature for SAC selection	• To ensure for the qualifying species that the following are maintained in the long term: 1. Population of the species, including range of genetic types for salmon, as a viable component of the site; 2. Distribution of the species within the site; 3. Distribution and extent of habitats supporting the species; 4. Structure, function and supporting processes of habitats supporting the species; 5. No significant disturbance of the species; 6. Distribution and viability of freshwater pearl mussel host species; and 7. Structure, function and supporting processes of habitats supporting fresh water pearl mussel host species.
River Oykel	**Freshwater pearl mussel**: Primary reason for SAC selection **Atlantic salmon**: Qualifying feature for SAC selection	Idem as above
River Spey	**Freshwater pearl mussel**; Primary reason for SAC selection **Atlantic salmon**: Primary reason for SAC selection **Sea lamprey**: Primary reason for SAC selection **Otter**: Primary reason for SAC selection	Idem as above
River Thurso	**Atlantic salmon**: Primary reason for SAC selection	Idem as for the Berriedale & Langwell Waters SAC

14.2.7.4 For the SACs detailed above, the effects on the relevant fish and shellfish qualifying species have been assessed (taking account of their conservation objectives) using the following criteria:

1. Deterioration of the habitats of the qualifying species;
2. Significant disturbance to the qualifying species;
3. Changes in the distribution of the species within the site; and
4. Changes in the distribution and extent of habitats supporting the species.

14.2.7.5 In addition, in the particular case of Atlantic salmon and freshwater pearl mussel SAC populations, the following criteria have also been taken into account for assessment:

5. Changes to the population of the species, including range of genetic types of salmon as a viable component of the site; and
6. Changes to the distribution of freshwater pearl mussel host species and to the

structure, function and supporting processes of habitats supporting fresh water pearl mussel host species.

14.2.7.6 It should be noted that, as indicated by the JNCC / SNH in their scoping response, in the case of salmon, it is not possible to conclusively identify from / to which SAC watercourses any particular individuals (post smolts or adults) are coming or going. The assumption that all individuals are SAC salmon should therefore be made. As a result the effects identified for salmon are considered to be applicable to any of the relevant SACs. In the case of freshwater pearl mussel, as any effect on the SAC populations could only be a result of their host species being adversely affected (salmon and sea trout) the same limitation applies. In order to assess likely effects on freshwater pearl mussel SAC populations it has therefore been assumed that the effects identified for Atlantic salmon apply to the freshwater pearl mussel's host species in the relevant SACs.

14.2.7.7 A summary assessment of the likely cumulative effects on the relevant Atlantic salmon, freshwater pearl mussel and sea lamprey SAC populations is given in Table 14.2-6 below. This is based in the impact assessment provided above for salmon and sea trout, in the case of Atlantic salmon and freshwater pearl mussel, and on the assessment provided above for fish and shellfish in general, in the case of sea lamprey.

Table 14.2-6 Summary of Cumulative Effects on Designated Sites

Species	Criterion	Assessment
Atlantic Salmon	1	The salmon SACs are located at a considerable distance from the Project, the BOWL site and the EOWDC. The habitat of the SACs will not be subject to any direct deterioration as a result of the construction / decommissioning or operation of these. Deterioration of the marine habitats of Atlantic salmon could however occur: Chapter 14.1 predicts negligible to minor effects on benthic habitats. This cumulative chapter predicts minor effects associated to loss of habitat and introduction of new habitat and no potential for effects above minor associated to changes to fishing activity to occur.
	2	This cumulative chapter predicts that disturbance through increased SSC, sediment re-deposition and EMFs will results in a minor cumulative effect. Noise during construction, has however been considered to have potential to result in minor to moderate effects on Atlantic salmon.
	3	Significant disturbance to the species has been identified in relation to cumulative construction noise. Significant disturbance to the habitat of the species is however not expected to occur (See assessment against criteria 1 and 2 for Atlantic salmon above). Taking the above into account, there might be potential for changes to the distribution of the species in the site to occur. This will depend on the degree of overlap between construction noise and migrating salmon. Effects are considered to be of minor-moderate significance.
	4	As assessed for criteria 1 for Atlantic salmon above
	5	As assessed in criteria 1, 2, 3 and 4 for salmon above.

Species	Criterion	Assessment
Freshwater Pearl Mussel	**1**	The freshwater pearl mussel SACs are located at a considerable distance from the Project, the BOWL site and the EOWDC. The habitat of the SACs will not be subject to any direct deterioration as a result of the construction / decommissioning or operation of these developments.
	2	Given the distribution of freshwater pearl mussel (restricted to the freshwater habitat) direct disturbance to the species has no potential to occur
	3	Given the distribution of the species (restricted to the freshwater habitat) direct changes to the distribution of the species in any of the SACs associated to the developments considered in the cumulative assessment has no potential to occur.
	4	As assessed for criteria 1 for freshwater pearl mussel above.
	6	As assessed for criteria 1, 2, 3, 4 and 5 for Atlantic salmon above.
Sea Lamprey	**1**	The Spey SAC is located at a considerable distance from the Project, the BOWL site and the EOWDC. The habitat of the SAC will not be subject to any direct deterioration as a result of the construction / decommissioning or operation of the three wind farms. Deterioration of the marine habitats of sea lamprey could however occur: Chapter 14.1 predicts negligible to minor effects on benthic habitats. This cumulative chapter predicts minor effects associated to loss of habitat, and introduction of new habitat and no potential for effects above minor associated to changes to fishing activity to occur.
	2	This cumulative chapter predicts disturbance through increased SSCs, sediment re-deposition, construction and operational noise, and EMFs to result in cumulative effects of minor significance on sea lamprey
	3	Changes to the distribution of the species are not expected in the site as no significant disturbance to the species has been identified to either its habitat or the species itself (See assessment against criteria 1 and 2 for sea lamprey above)
	4	As assessed for criteria 1 for sea lamprey above

14.2.7.8 The above assessments on the relevant SACs for the MORL project have determined that there is potential for cumulative effects on the SAC populations of Atlantic salmon to occur. As a result, there may also be indirect cumulative effects on freshwater pearl mussel SAC populations to take place.

14.2.7.9 In the case of sea lamprey, no likely significant cumulative effects have been identified on the relevant SAC population.

14.2.7.10 It should be noted that the assessment of the effects on Atlantic salmon has taken a precautionary approach due to the limited information currently available in relation to the use that Atlantic salmon make of the Moray Firth area and other coastal waters around Scotland. In addition, as it is not possible to conclusively identify from / to which SAC watercourses any particular individuals (post smolts or adults) are coming or going the conservative assumption that all salmon individuals are SAC salmon has had to be made.

14.2.7.11 As indicated in Chapter 7.2 (Fish and Shellfish Ecology) for the three proposed wind farm sites, in view of the current level of uncertainty, MORL is committed, in consultation with Marine Scotland and other relevant stakeholders (i.e. DSFBs), to undertake appropriate survey work and monitoring with the objective of increasing the confidence in the impact assessment and identifying whether

mitigation is required, and if so, to define feasible measures in order to reduce the significance of the likely effects to levels that are satisfactory to both regulators and stakeholders.

14.2.7.12 Taking the above into account, it is expected that no significant cumulative effects on Conservation Objectives will occur, and therefore no changes to the population viability of Atlantic salmon, freshwater pearl mussel and sea lamprey in any of the SACs requiring assessment.

14.2.8 References

ERM, 2011. Moray Firth Offshore Wind Developers Group Cumulative Impact Assessment Discussion Document.

Vattenfall, 2012. Aberdeen Bay wind farm project. Information available at: http://www.vattenfall.co.uk/en/aberdeen-bay.htm (Accessed: 28/05/2012)

14.3 Marine Mammals

14.3.1 Summary of Effects and Mitigation

Summary of Effects

14.3.1.1 This chapter presents the results of assessment of the potential significant cumulative effects upon marine mammals arising from the Project in conjunction with other existing or reasonably foreseeable marine and coastal developments and activities. MORL's approach to the assessment of cumulative impacts is described in Chapter 1.3 (Environmental Impact Assessment).

14.3.1.2 The cumulative effects on marine mammals that were assessed are:

- Permanent hearing damage and temporary displacement resulting from increased noise from piling activities;
- Reduction in prey due to noise from construction activities;
- Increased collision risk from vessels; and
- Changes in prey availability.

14.3.1.3 A detailed cumulative assessment was undertaken with BOWL. Cumulative effects with other developments within and outwith the Moray Firth have also been considered. However, no detailed cumulative assessment was possible for most of the other developments due to insufficient information being available.

14.3.1.4 The assessment process has used noise propagation and impact analysis to quantify the potential risks of physical injury and displacement due to piling noise of the Project and BOWL, and used population modelling to assess the potential long term effects on harbour seal and bottlenose dolphin.

Summary of Residual Effects and Mitigation

14.3.1.5 Temporary, significant effects on marine mammal receptors from piling noise are predicted during the construction phases of the Project and BOWL project, but no cumulative long term population level effects are predicted. No other significant cumulative effects are predicted.

14.3.1.6 No additional mitigation measures to the outlined in Chapter 7.3 and Chapter 10.3 (Marine Mammals) are proposed.

14.3.1.7 A summary of the expected cumulative effects is provided in Table 14.3-1 below.

Table 14.3-1 Cumulative Impact Summary

Receptor / Effect	MORL Total Project	BOWL (generating station and associated transmission infrastructure)	Sensitivities for Telford, Stevenson and MacColl, and OFTO	Mitigation Method (if required)
Construction				
Harbour Seal (hearing damage, displacement, reduction in prey and collision risk)	No significant long term effects	No significant long term effects	No significant differences between projects	None additional to the detailed in Chapters 7.3 and 10.3
Overall CIA for Harbour Seal	Major significance over medium term for individuals during construction phase with minor significance long term impacts on the population for all construction scenarios modelled.			
Grey Seal (hearing damage, displacement, reduction in prey and collision risk)	No significant long term effects	No significant long term effects	No significant differences between projects	None additional to the detailed in Chapters 7.3 and 10.3
Overall CIA for Grey Seal	Major significance over medium term for individuals during construction phase with minor significance long term impacts on the population for all construction scenarios modelled.			
Harbour Porpoise (hearing damage, displacement, reduction in prey and collision risk)	No significant long term effects	No significant long term effects	No significant differences between projects	None additional to the detailed in Chapters 7.3 and 10.3
Overall CIA for Harbour Porpoise	Major significance over medium term for individuals during construction phase with minor significance long term impacts on the population for all construction scenarios modelled.			
Bottlenose Dolphin (hearing damage, displacement, reduction in prey and collision risk)	No significant long term effects	Qualitative assessment of significant effects.	No significant differences between projects	None additional to the detailed in Chapters 7.3 and 10.3
Overall CIA for Bottlenose Dolphin	Medium significance over medium term for individuals during construction phase with minor significance long term impacts on the population for all construction scenarios modelled.			
Minke Whale (hearing damage, displacement, reduction in prey and collision risk)	No significant long term effects	No significant long term effects	No significant differences between projects	None additional to the detailed in Chapters 7.3 and 10.3
Overall CIA For Minke Whale	Major significance over medium term for individuals during construction phase with minor significance long term impacts on the population for all construction scenarios modelled.			

Receptor / Effect	MORL Total Project	BOWL (generating station and associated transmission infrastructure)	Sensitivities for Telford, Stevenson and MacColl, and OFTO	Mitigation Method (if required)
Operation				
Harbour Seal (reduction in prey availability))	Not significant	Not significant	No significant differences between projects	None additional to the detailed in Chapters 7.3 and 10.3
Overall CIA for Harbour Seal	Low magnitude, long term duration and minor significance			
Grey Seal (reduction in prey availability))	Not significant	Not significant	No significant differences between projects	None additional to the detailed in Chapters 7.3 and 10.3
Overall CIA for Grey Seal	Low magnitude, long term duration and minor significance			
Harbour Porpoise (reduction in prey availability))	Not significant	Not significant	No significant differences between projects	None additional to the detailed in Chapters 7.3 and 10.3
Overall CIA for Harbour Porpoise	Low magnitude, long term duration and minor significance			
Bottlenose Dolphin (reduction in prey availability))	Not significant	Not significant	No significant differences between projects	None additional to the detailed in Chapters 7.3 and 10.3
Overall CIA for Bottlenose Dolphin	Low magnitude, long term duration and minor significance			
Minke Whale (reduction in prey availability))	Not significant	Not significant	No significant differences between projects	None additional to the detailed in Chapters 7.3 and 10.3
Overall CIA for Minke Whale	Low magnitude, long term duration and minor significance			

14.3.2 Assessment of Cumulative Impacts

14.3.2.1 The geographical scope of the cumulative assessment is principally focused in the Moray Firth area. It is, however, recognised that some mobile species may spend varying periods of time outside the Moray Firth and, as a result, there is potential for these to be affected by other activities / developments further afield.

14.3.2.2 The potential cumulative impact of the MORL developments and the Beatrice Offshore Wind Farm Ltd development (BOWL) is considered in detail within this assessment.

14.3.2.3 In addition, the following developments have been identified which may have cumulative effects over the life of the Project, but where there is insufficient information available for a detailed assessment of cumulative effects to be carried out:

- Developments within the Moray Firth:
  - SHETL hub and transmission cable;
  - Port and harbour developments within the Moray Firth;
  - Oil and gas activities; and
  - MoD activities.
- Developments outwith the Moray Firth:
  - Proposed Forth and Tay offshore wind projects (Neart na Gaoithe, Firth of Forth and Inch Cape offshore wind farms);
  - Proposed European Offshore Wind Deployment Centre (EOWDC); and
  - Proposed Pentland Firth and Orkney wave and tidal energy developments.

14.3.3 Methodology

14.3.3.1 The assessment methodology has followed that outlined in the Moray Firth Offshore Wind Developers Group Discussion Document (ERM, 2011; see Technical Appendix 1.3 D).

14.3.3.2 A summary of the methodologies used within this assessment can be found in Chapter 7.3 (Marine Mammals). A full review of likely significant effects on marine mammals and the methodologies used can be found in the following technical appendices:

- Technical Appendix 7.3 A (Marine Mammals: Environmental Impact Assessment);
- Technical Appendix 7.3 B (Framework for assessing the impacts of pile-driving noise from offshore wind farm construction on Moray Firth harbour seal populations);
- Technical Appendix 7.3 C (SAFESIMM impact assessment for seals and cetaceans);
- Technical Appendix 7.3 D (A comparison of behavioural responses by harbour porpoise and bottlenose dolphins to noise);
- Technical Appendix 7.3 E (Identification of appropriate noise exposure criteria for assessing auditory injury for Pinnipeds using offshore wind farm sites);
- Technical Appendix 7.3 F (Noise propagation and SAFESIMM model outputs);
- Technical Appendix 7.3 G (Habitat Regulations Appraisal: Marine Mammals - Two SAC's listing marine mammals as qualifying features can be found within the Moray Firth. For the purpose of Appropriate Assessment, an appraisal under the Habitats Regulation is presented within is appendix); and

- Technical Appendix 7.3 H (EPS Assessment: Supplementary Information - All cetaceans present within the Moray Firth are European Protected Species (EPS). MORL recognises that an EPS license A preliminary assessment is presented, which will be revised once construction parameters have been finalised).

14.3.3.3 Additional supporting information on underwater noise modelling activities can be found in Chapter 3.6 and Technical Appendix 3.6 A (Underwater Noise).

14.3.3.4 Data have been shared between MORL and BOWL to allow for a detailed cumulative assessment (including construction scenarios and predicted blow energy profiles to drive pin piles used in noise modelling).

Worst Case Scenario for Projects where Detailed Assessment is Possible

14.3.3.5 A summary of the worst case parameters of wind farm design for the BOWL project, in terms of marine mammals is provided in Table 14.3-2 below. The worst case parameters for the Telford, Stevenson and MacColl wind farms and the offshore transmission infrastructure are as provided in Chapter 7.3 and Chapter 10.3 (Marine Mammals) respectively.

Table 14.3-2 Summary of BOWL Worst Case Parameters

Worst Case Parameters	**Scenario Assessed**		
Construction Noise			
Installation of 277 turbines	Four pin piles (2.4 m diameter) per foundation		
Max, number of simultaneous piling events	Two		
Predicted blow energy profile provided by BOWL as being required to drive a 2.4 m diameter pin into the soils of the BOWL site	**Impact Energy (kJ)**	**No of blows**	**Time**
	280	1,200	20 mins
	920	3,700	1 hr
	1,380	3,700	1 hr
	1,840	3,700	1 hr
	2,300	3,700	1 hr
Increased Suspended Sediment Concentration and Sediment Re-Deposition			
Installation of 277 turbines	Drilling to facilitate pin pile installation and seabed preparation for installation of gravity bases. Inter array cable and export cable burial by energetic means.		
Loss of Habitat and Introduction of New Habitat			
Installation of 277 turbines	Use of tubular jackets and gravity bases		

Western Development Area

14.3.3.6 The Western Development Area (WDA) comprises part of the MORL Zone, within

which the three proposed wind farm sites (Telford, Stevenson and MacColl) are located. Telford, Stevenson and MacColl represent the Eastern Development Zone (EDA). The maximum capacity to be installed in the MORL Zone (EDA and WDA) is 1.5 GW and MORL has applied for a maximum of 1.5 GW within three proposed wind farm sites within the EDA.

14.3.3.7 The WDA may be developed for a maximum of 500 MW of capacity if less than 1.5 GW of capacity is delivered by the Project in the EDA. In total, the consented capacity of the Project and the WDA will not exceed 1.5 GW.

14.3.3.8 The connection between the WDA and the three proposed wind farm sites necessitates a slightly different approach to assessment, as the effects arising from the "worst case" for the Project cannot simply be added to the "worst case" scenario for the WDA. Instead, assessment of the likely significant cumulative effects of the Project and the WDA will follow a similar format to that undertaken for the sensitivity assessments of the individual wind farm proposals in the Offshore Generating Station Impact Assessment chapter (Chapter 7.3: Marine Mammals).

14.3.3.9 A summary of the worst case parameters of wind farm design for the WDA in terms of marine mammals is provided in Table 14.3-3 below.

Table 14.3-3 Summary of MORL WDA Worst Case Parameters

Realistic Worst Case Parameters	Scenario Assessed
Construction Noise	
Installation of 100 x 5 MW turbines	Four pin piles (2.5 m diameter) per foundation
Max, number of simultaneous piling events	Two
Increased Sediment Concentrations and Sediment Re-Deposition	
Installation of 100 x 5 MW turbines	Drilling to facilitate pin pile installation and seabed preparation for installation of gravity bases and burial of Inter-array cable by energetic means.
Loss of Habitat / Introduction of New Habitat	
Installation of 100 x 5 MW turbines	Incremental loss of habitat as a result of successive placement of foundations onto the seabed

Other Developments

14.3.3.10 Developments that are at an earlier stage, and for which there are limited development details at this stage, are also considered. Detailed cumulative impact assessment for most of these developments is not possible as insufficient information is available. Instead, a commentary on the potential for cumulative effects on the basis of the information available is presented, but no quantitative conclusions on the likely significance of any impacts can be drawn. Where a detailed assessment has been possible this is based on the professional judgement of potential significant effects drawing upon information which is available at the time.

14.3.3.11 Table 14.3-4 below provides details of renewable energy developments outside

the Moray Firth that have been considered in the cumulative assessment.

Table 14.3-4 Details of Renewable Energy Developments Outside of the Moray Firth Included in the Cumulative Impact Assessment

Renewable Project	Details
Neart na Gaoithe Offshore Wind Farm	Proposed scheme of up to 450 MW at Neart na Gaoithe, within the Firth of Forth, for which a Marine Licence Application is due for submission within Quarter two 2012 and construction is scheduled to begin in 2014.
Firth of Forth Offshore Wind Farm	Up to three phases of development within the Round 3 Zone outside the 12 nm boundary within the Firth of Forth and Tay. The owner consortia are currently preparing an impact assessment for phase 1, within the northern region of the Zone 1,075 MW. This phase is scheduled to begin construction in 2015.
Inch Cape Offshore Wind Farm	Proposed wind farm of up to 1,190 MW at Inch Cape which is scheduled to begin construction in 2016.
European Offshore Wind Deployment Centre	Proposed demonstrator site comprising 11 turbines. Construction proposed for 2013 and 2014.
Wave & Tidal	Eleven wave and tidal power projects have been awarded lease options by the Crown Estate within the Pentland Firth and Orkney waters strategic area. The developments are not far enough through the design and licensing process to be able to offer details on installation methodologies at this time.

14.3.3.12 All marine renewable projects considered in the CIA are shown in Figure 1.3.1, Volume 6 a.

Habitats Regulations Appraisal Methods

14.3.3.13 As part of the Habitat Regulations, the potential significant cumulative effects from the proposed developments on SACs will be assessed by the competent authority through consideration of each SACs conservation objectives (see Technical Appendix 7.3 A). A summary is presented in 14.3.7 below and full details of this appraisal can be found in Technical Appendix 7.3 G (HRA).

14.3.4 Detailed Impact Assessment

14.3.4.1 Rochdale Envelope parameters have been provided by BOWL to enable a detailed cumulative impact assessment to be undertaken for the MORL and BOWL developments.

14.3.4.2 The types of effects considered in this cumulative impact assessment are:

- Permanent hearing damage and temporary displacement resulting from increased noise from piling within the Project and BOWL developments;
- Reduction in prey due to noise from construction activities associated with the Project and BOWL;
- Increased collision risk from vessels associated with the Project and BOWL; and

- Reduction in prey availability due to infrastructure associated with the Project and BOWL.

14.3.4.3 The following activities / effects have not been considered within this cumulative assessment as their potential effects were considered not significant in the primary assessment for the Telford, Stevenson and MacColl wind farms:

- Risk of stranding from electromagnetic fields generated by transmission cables;
- Long term avoidance resulting from the presence of offshore structures including generating station operating noise; and
- Prey contamination due to toxic (heavy metal) contamination from use of sacrificial anodes and antifouling paints.

14.3.4.4 The receptors identified for consideration in this cumulative impact assessment are:

- Grey seal;
- Harbour seal;
- Harbour porpoise;
- Bottlenose dolphin; and
- Minke whale.

Permanent Hearing Damage and Temporary Displacement from Increased Noise from Piling

14.3.4.5 The use of the SPEAR model presented in Chapters 7.3 and 10.3 (Marine Mammals) has provided evidence that the greatest source of noise during the construction period will be from impact piling. The INSPIRE noise propagation modelling discussed in Chapter 7.3, and explained in detail in Technical Appendix 7.3 A, was extended to include the additional wind farm foundation piling activities of the adjacent BOWL proposal. Consultation with the BOWL developers provided the proposed pin pile diameter for pinned jacket foundations and modelled blow energies required for their installation (see Technical Appendix 3.6 A: Underwater noise, and above in Table 14.3-2). For the purposes of this assessment, the installation of the three OSPs within the BOWL Rochdale Envelope are considered to occur within the construction period and footprint of the offshore generation station, and thus are included within the effects assessed.

14.3.4.6 As with the three proposed wind farms of Telford, Stevenson and MacColl, jackets with pin piles are considered to be the worst case foundation technology within the BOWL Rochdale Envelope with regards impacts upon marine mammals (Table 14.3-2). The details of the noise propagation modelling undertaken are provided within Chapter 3.6 and Technical Appendix 3.6 A (Underwater noise). The outputs were used to predict the number of individuals of the key marine mammal species within the Moray Firth which fell within the criteria for PTS onset or could be displaced due to noise related disturbance (see Technical Appendices 7.3 A and 7.3 B full methodology).

14.3.4.7 Figure 01 in Technical Appendix 7.3 F shows the location of piling installations modelled for each Scenario.

14.3.4.8 The three scenarios below reflect different potential build out timescales of the

Project and BOWL schemes considered in this assessment:

- Scenario D: – Two vessels piling within the BOWL site for two years (2014 to 2015) immediately followed by two vessels piling within the three proposed wind farms for three years (2016 to 2018). Within the BOWL site, locations A & B were chosen as representative of worst case spatially as they are closest to the sensitive receptors. Within the MORL sites, locations 1 & 5 were modelled to represent the closest location to the most sensitive receptors and the worst case spatially due to the noise impact from these two locations covering the largest area of sea. This model therefore represents a five year build out programme from 2014 to 2018;
- Scenario E: – This scenario represents a six year build out phase utilising a single piling vessel for the four sites (three proposed wind farms and BOWL). The model assumes a three year build out programme for BOWL (2014 to 2016) and a five year build out programme for the three proposed wind farms (2016 to 2020) with a year of overlap in which both sites are under construction (2016). The modelling was based on piling occurring at location A in BOWL, and location 1 for the three proposed wind farms. These two locations were chosen as being representative of worst case as they are closest to the most sensitive receptors; and
- Scenario F: – Two piling vessels working within each site simultaneously (total of eight vessels) resulting in a two year construction period. This scenario would start in 2016, with the model scenarios based on there being piling at locations A & B on the BOWL site and 1-6 locations on the three proposed wind farm sites.

14.3.4.9 In order to obtain the required construction combinations for this assessment, the modelling of perceived noise propagations and associated behavioural displacement, along with SAFESIMM modelling to predict potential PTS exposure, were undertaken in yearly stages. This presents a difference from the modelling undertaken for the Generating Station and the OfTI works, in which disturbance and potential for PTS onset were modelled for the first year of construction, and then equal levels of disturbance and PTS onset assumed for all subsequent years of the construction phase as there were no changes in the scenarios modelled per year (see Chapter 7.3 and Technical Appendix 7.3 A (Marine Mammals) for more details). The yearly noise modelling outputs presented in Technical Appendix 7.3 F for the cumulative assessment were then used to calculate the maximum number of animals potentially displaced, and SAFESIMM used to calculate the number of animals exposed to sufficient noise to induce PTS onset, over the course of the full construction phases of both projects.

14.3.4.10 Details of the inherent conservatism that is purposefully adopted in the assessment methodology can be found in Table 7.3-11 in Chapter 7.3. These assumptions include that a) displacement will lead to reduced fitness and a failure to breed in the affected year and b) that individuals experiencing PTS are subjected to an additional 25 % mortality risk. Table 14.3-5 below provides the numerical outputs from this modelling process for the scenarios assessed. Separate values are presented for the different phases within each scenario. The figures in brackets within the table represent the number of individuals expressed as a percentage of the Moray Firth populations or SCANS II Block J for minke whales[1]. The seal PTS values were modelled using 186 dB SELs and cetaceans

[1] The details of these population estimates for each species can be found in Chapter 4.4 (Marine Mammals). The population of minke whales potentially subject to the effects of the Project construction phase was taken to be 1,462, based upon SCANS II model estimates for block J (which includes the Moray Firth).

using 198 dB SELs. High, medium and low levels of displacement were calculated as described in Technical Appendix 7.3 B. The number of individual harbour seals and bottlenose dolphins estimated to experience displacement and PTS were then used in population modelling for both species, the results of which are presented as Plate 14.3-1 to Plate 14.3-3 and Plate 14.3-4 below (see Technical Appendices 7.3 A and 7.3 B: Seal Assessment Framework for full details on both methodologies).

Table 14.3-5 Predicted Number of Individuals Affected by Piling Noise Each Year of Construction for Each Project

Scenario D					
	Harbour Seal	**Grey Seal**	**Harbour Porpoise**	**Bottlenose Dolphin**	**Minke Whale**
PTS					
2014 to 2015 (BOWL)	237.2 (20.5 %)	347.5 (10.9 %)	12.9 (0.2 %)	0.11(0.1 %)	24.7 (1.7 %)
2016 to 2018 (MORL)	197.5 (17.1 %)	301.3 (9.5 %)	10.2 (0.2 %)	0.07 (< 0.01 %)	10.7 (0.7 %)
Behavioural Displacement Each Year for the Total Spread of the Construction Vessels					
2014 to 2015 (BOWL)					
High	813 (68.8 %)	1,604 (44.6 %)	4,343 (71.0 %)	33 (17.0 %)	214 (14.6 %)
Best Fit	613 (51.8 %)	1,101 (30.6 %)	3,263 (53.3 %)	20 (10.3 %)	179 (12.2 %)
Low	66 (5.6 %)	80 (2.2 %)	383 (6.3 %)	1 (0.5 %)	25 (1.7 %)
2016 to 2018 (MORL)					
High	823 (69.6 %)	1,656 (46 %)	4,056 (73.7 %)	33 (16.8 %)	218 (14.9 %)
Best Fit	629 (53.2 %)	1,184 (32.9 %)	3,442 (56.3 %)	19 (9.7 %)	185 (12.7 %)
Low	66 (5.6 %)	94 (2.6 %)	367 (6.0 %)	1 (0.3 %)	27 (1.8 %)
Scenario E					
	Harbour Seal	**Grey Seal**	**Harbour Porpoise**	**Bottlenose Dolphin**	**Minke Whale**
PTS					
2014 to 2015 (BOWL)	168.6 (14.6 %)	236.5 (7.5 %)	8.2 (0.1 %)	0.07 (< 0.1 %)	35.4 (2.4 %)
2016 to 2016 (BOWL + MORL)	210.1 (18.1 %)	300 (9.5 %)	11.5 (0.2 %)	0.1 (0.1 %)	24.2 (1.7 %)

2017 to 2020 (MORL)	120.9 (10.4 %)	170 (5.4 %)	6.4 (0.1 %)	0.06 (< 0.1 %)	12.3 (0.8 %)
Behavioural Displacement Each Year for the Total Spread of the Construction Vessels					
2014 to 2015 (BOWL)					
High	785 (66.4 %)	1,457 (40.5 %)	4,283 (70.0 %)	32 (16.3 %)	213 (14.6 %)
Best Fit	582 (49.2 %)	966 (26.9 %)	3,191 (52.2 %)	19 (9.6 %)	177 (12.1 %)
Lower	57 (4.8 %)	63 (1.7 %)	347 (5.7 %)	1 (0.4 %)	23 (15.7 %)
2016 to 2016 (BOWL + MORL)					
High	810 (68.5 %)	1,484 (41.3 %)	4,376 (71.5 %)	35 (17.8 %)	214 (14.6 %)
Best Fit	609 (51.4 %)	995 (27.7 %)	3,312 (54.1 %)	21 (10.7 %)	179 (12.2 %)
Lower	64 (5.4 %)	72 (2.0 %)	392 (6.4 %)	1 (0.4 %)	25 (1.7 %)
2017 to 2018 (MORL)					
High	731 (61.8 %)	1,159 (32.2 %)	4,015 (65.6 %)	31 (15.7 %)	206 (14.1 %)
Best Fit	522 (44.1 %)	739 (20.5 %)	2,933 (47.9 %)	17 (8.9 %)	168 (11.5 %)
Lower	42 (3.5 %)	45 (1.3 %)	263 (4.3 %)	0 (0.2 %)	20 (1.4 %)
Scenario F					
	Harbour Seal	**Grey Seal**	**Harbour Porpoise**	**Bottlenose Dolphin**	**Minke Whale**
PTS – Values provided here are for six vessels in MORL plus those numbers for two vessels in BOWL. MORL appreciate that this represents a series of double counting and thus over-representation of effects					
2016 to 2017	542 (46.3 %)	826 (18.4 %)	35 (0.6 %)	0.23 (0.2 %)	34.6 (2.4 %)
Behavioural Displacement Each Year for the Total Spread of the Construction Vessels					
High	888 (75.1 %)	1,850 (51.4 %)	5,151 (84.2 %)	82 (41.8 %)	223 (15.2 %)
Best Fit	705 (59.6 %)	1,358 (37.7 %)	4,219 (69.0 %)	67 (34.2 %)	194(13.3 %)
Lower	226 (19.1 %)	138 (3.8 %)	681 (11.1 %)	7 (3.6 %)	37 (2.5 %)

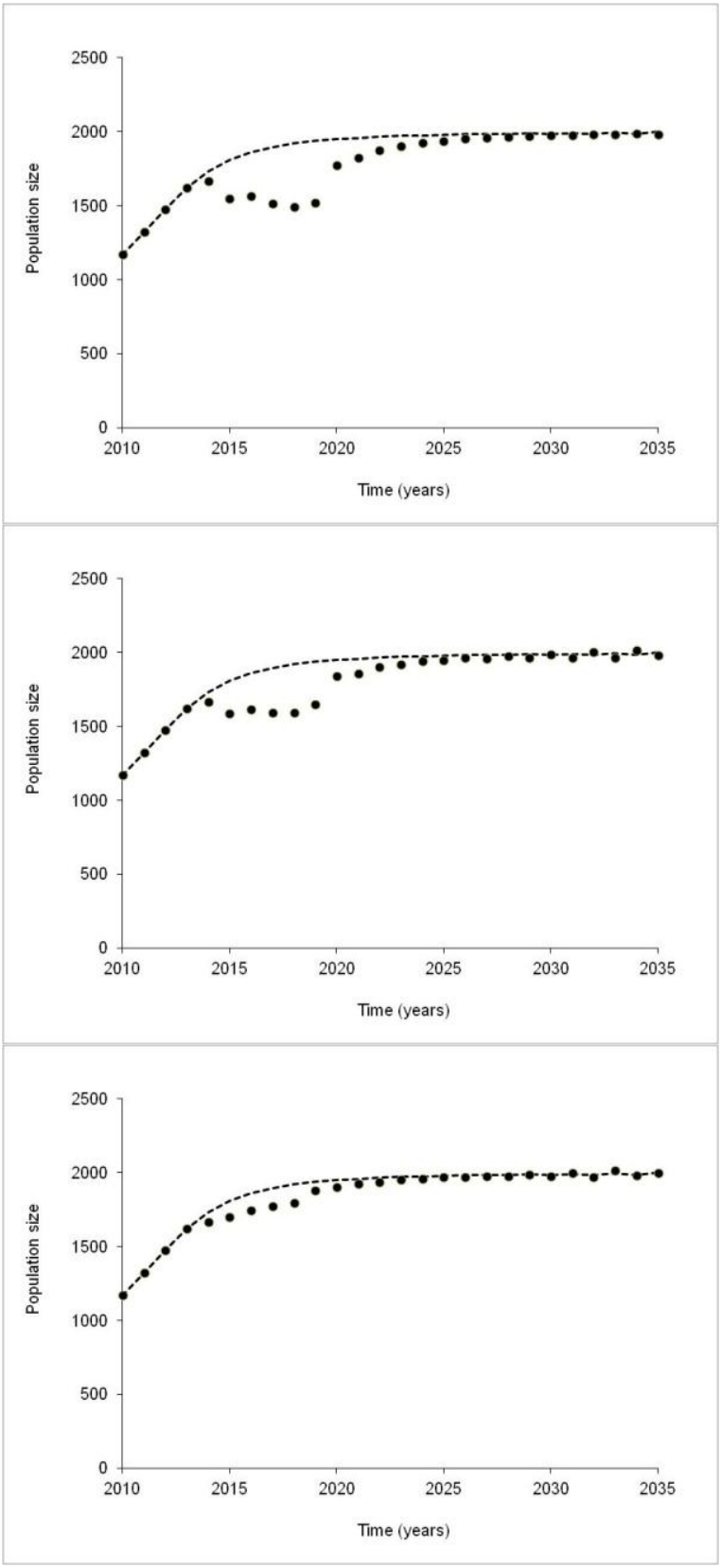

Plate 14.3-1 Scenario D (BOWL followed by MORL) - Population Modelling for the Harbour Seal Population in the Moray Firth. Data Based on 186 dB SAFESIMM Model Outputs. From Top to Bottom: Upper, Best Fit and Lower Prediction.

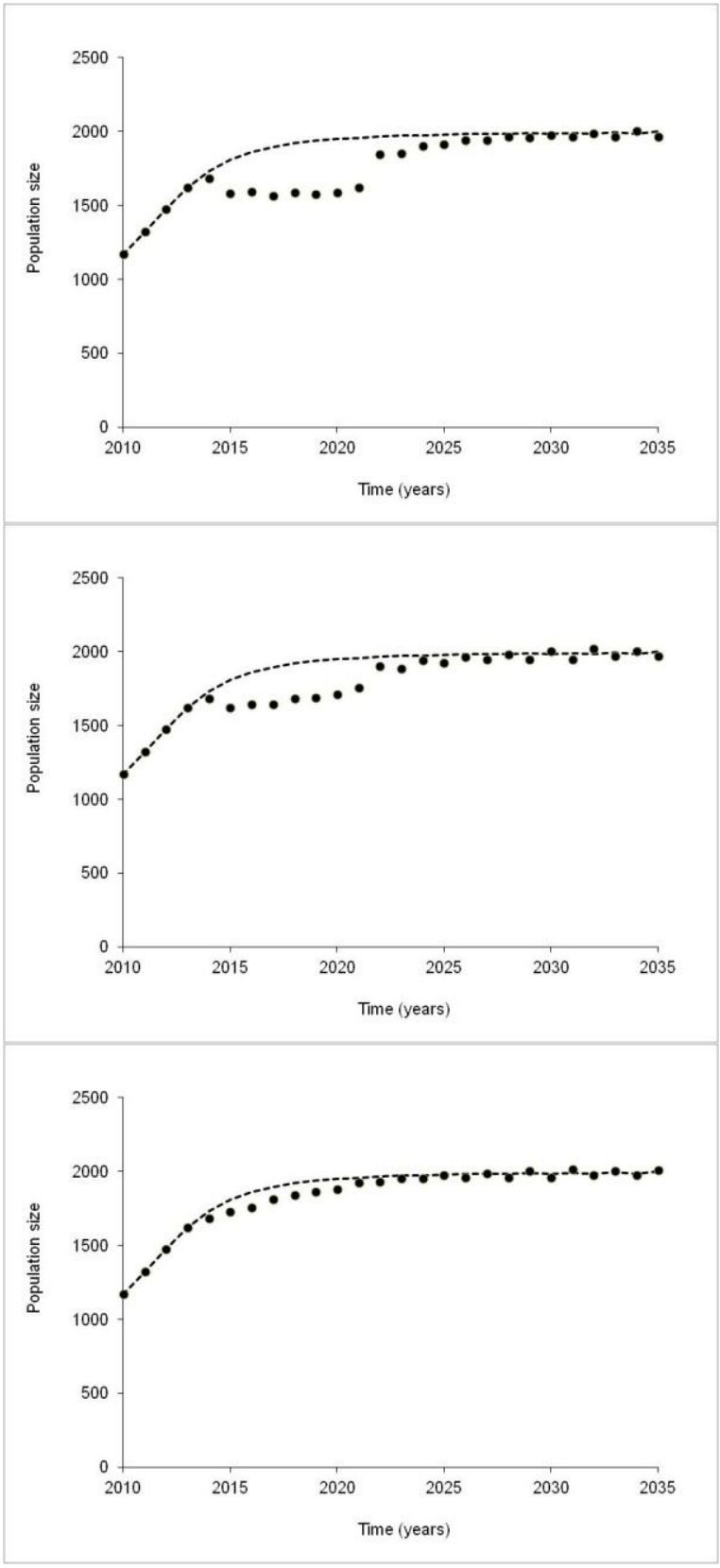

Plate 14.3-2 Scenario E (BOWL, overlapping for one year with MORL, followed by MORL) - Population Modelling for the Harbour Seal Population in the Moray Firth. Data Based on 186 dB SAFESIMM Model Outputs. From Top to Bottom: Upper, Best Fit and Lower Prediction.

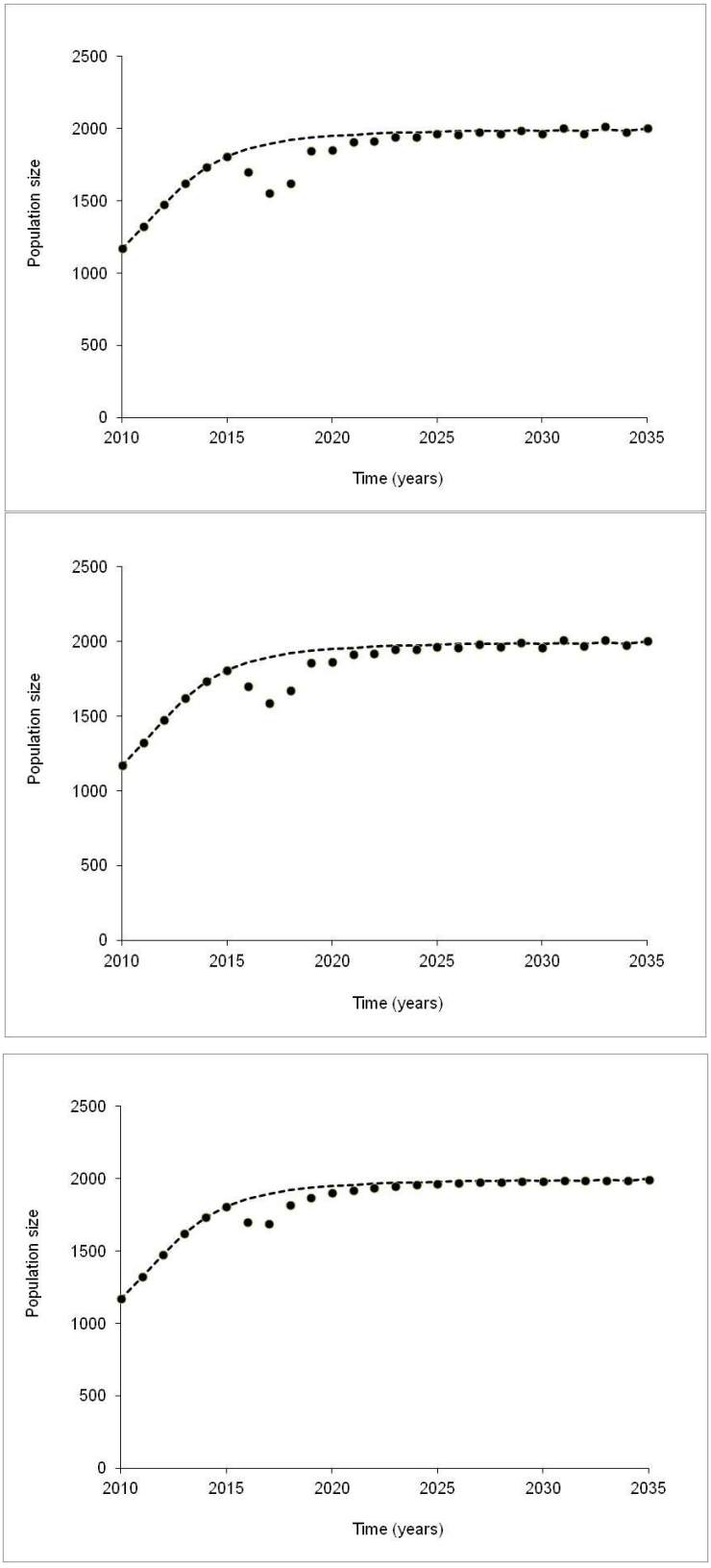

Plate 14.3-3 Scenario F (BOWL coinciding with MORL in 2016 to 2017) - Population Modelling for the Harbour Seal Population in the Moray Firth. Data Based on 186 dB SAFESIMM Model Outputs. From Top to Bottom: Upper, Best Fit and Lower Prediction.

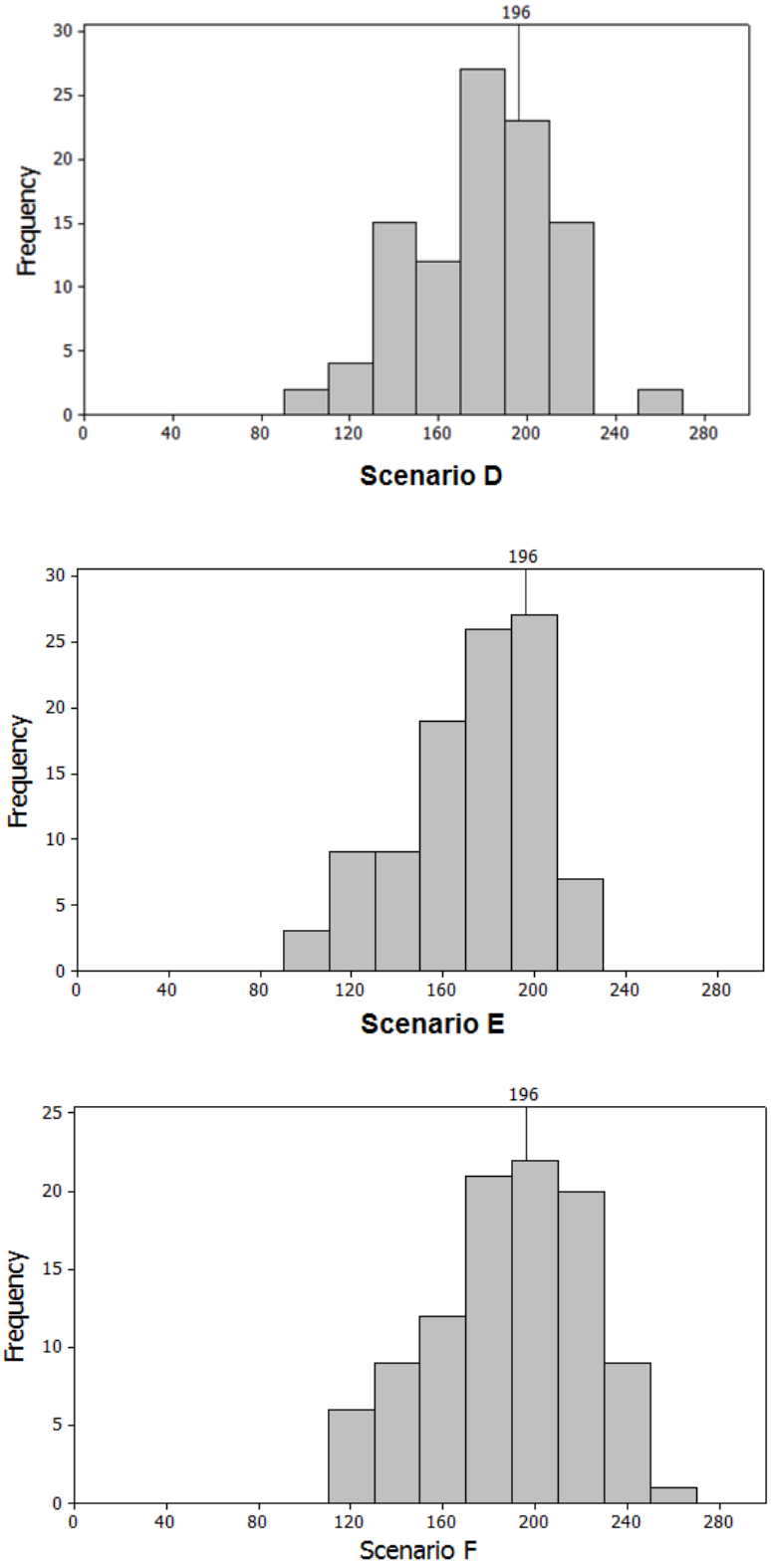

Plate 14.3-4 Scenarios D, E and F - Population Modelling for the Bottlenose Dolphin Population in the Moray Firth. Data Based on 198 dB SAFESIMM Model Outputs. Figures Represent the Frequency Distribution of Predicted Population Size after 25 Years

14.3.4.11 It can be seen from Table 14.3-5 that the increase in simultaneous piling activity between the three proposed wind farms and BOWL leads to an increase in modelled noise related displacement and the potential for individual animals to experience PTS. Alternatively, decreasing the number of simultaneous piling events reduces the number of modelled displaced individuals and those with the potential to experience PTS, while extending the duration of both effects. Comparison of the effects modelled to occur from the two proposals (the Project and BOWL) show similar predicted effects for both projects, although the effects from piling within the BOWL site are predicted to be slightly higher than those from the Project due to the BOWL development being closer to the inner Firth and harbour seal foraging grounds (see seal tagging studies in Technical Appendix 4.4 A: Baseline Marine Mammals).

14.3.4.12 The displacement of bottlenose dolphin under Scenario F is approximately twice that of either the three projects (Telford, Stevenson and MacColl) or BOWL being built out separately (Scenario D). Figure 4.4-11, Volume 6 provides predicted bottlenose dolphin distribution within the Moray Firth. The construction of the BOWL project is predicted to displace a proportion (17 %) of the bottlenose dolphin of the northern coastal waters of the Firth (see Technical Appendix 7.3 F for noise contours), while the construction of the Project is predicted to displace a similar proportion that utilise the southern region of the Firth (see Technical Appendix 7.3 F for noise contours) while piling is in operation. For the purposes of this impact assessment, the potential displacement of bottlenose dolphin from the southern regions of the Moray Firth has been considered as worst case.

14.3.4.13 Using the conservative assumptions detailed in Table 7.3-11 (Chapter 7.3: Marine Mammals), population modelling indicates that, while there could be medium term significant effects to the harbour seal (high magnitude, medium duration), these effects would not result in long term effects on population size. Thus, even the worst case potential effect is considered to be of low magnitude (predicted population size within 10 % of that predicted as a baseline if population parameters to not change within the Moray Firth) and so **minor significance** for harbour seals.

14.3.4.14 As with the piling activities within the three proposed wind farm sites described in Chapter 7.3 (Marine Mammals), predicted displacement for bottlenose dolphins is not expected from key foraging locations within the Moray Firth SAC, but there is the potential for partial disturbance within the corridor that links the Inner Moray Firth and Forth of Tay / Aberdeen. From this perspective, the temporal pattern of piling is important. The MORL Rochdale Envelope calculations estimate that the temporal pattern of piling if one vessel were to be used over a five-year duration would be highly intermittent, with a total piling time of 15 % of the total construction phase (wind farms and OfTI). As weather and build conditions for both the Project and BOWL sites are likely to be similar, Scenario D would represent an extension of the disturbance duration. If the number of piling vessels were greater than one, the number and duration of pile-free windows may reduce, although weather considerations would still be likely to provide some longer periods between piling. Such a decrease in the duration of pile-free windows would be compensated by a reduced overall construction phase if multiple vessels were utilised over an overall shorter construction phase. While the effects of behavioural displacement are considered to be of **medium significance** in the medium term for Scenarios D and E, **major significance** in the medium term for Scenario F, the overall long term effects upon the bottlenose dolphin are considered to be of low magnitude (predicted population size within

10 % of that predicted as a baseline if population parameters to not change within the Moray Firth) and so **minor significance**.

14.3.4.15 A similar qualitative modelling approach has been taken to the medium and long term impact assessment for grey seals, harbour porpoises and minke whales, although population modelling has not been undertaken for these species. Many of the grey seals observed within the Moray Firth originate from haul-out sites outside of the Moray Firth (see Technical Appendix 4.4 A: Marine Mammals Baseline). While the effects of behavioural displacement on grey seals within the Moray Firth are considered to be of **major significance** in the medium term, given that grey seals are not tied to specific breeding or feeding grounds within the Moray Firth it is considered that the long term impact on this species at the population level will be of **minor significance.**

14.3.4.16 Both harbour porpoise and minke whales exhibit widespread distributions and are not tied to specific feeding or breeding grounds. The effects from piling for the wind farm sites on individuals within the Moray Firth are considered of **major significance** in the medium term. However, given the widespread distribution and relative abundance of both species, the long term effects at the population level will be of **minor significance**.

14.3.4.17 A summary of the likely significant effects from piling noise from the Project and BOWL based on the precautionary modelling described above (with the precautionary nature of assumptions as detailed in Table 7.3-11 in Chapter 7.3: Marine Mammals) can be found in Table 14.3-6 below.

Table 14.3-6 Summary of Potential Effects from Piling Noise During Construction on Relevant Marine Mammal Receptors Using Precautionary Modelling Criteria

	Scenario D	**Scenario E**	**Scenario F**
Harbour Seal			
Predicted Effect	Major significance over medium term for individuals during construction phase with minor significance long term effects on the population.	Major significance over medium term for individuals during construction phase with minor significance long term effects on the population.	Major significance over medium term for individuals during construction phase with minor significance long term effects on the population.
Grey Seal			
Predicted Effect	Major significance over medium term for individuals during construction phase with minor significance long term effects on the population.	Major significance over medium term for individuals during construction phase with minor significance long term effects on the population.	Major significance over medium term for individuals during construction phase with minor significance long term effects on the population.
Harbour Porpoise			
Predicted Effect	Major significance over medium term for individuals during construction phase with minor significance long term effects on the population.	Major significance over medium term for individuals during construction phase with minor significance long term effects on the population.	Major significance over medium term for individuals during construction phase with minor significance long term effects on the population.

	Scenario D	Scenario E	Scenario F
Bottlenose Dolphin			
Predicted Effect	Medium significance over medium term for individuals during construction phase, with minor significance for long term effects on the population level.	Medium significance over medium term for individuals during construction phase, with minor significance for long term effects on the population level.	Medium significance over medium term for construction scenarios D and E and major significance for scenario F for individuals during construction phase, with minor significance for long term effects on the population level.
Minke Whale			
Predicted Effect	Major significance over medium term for individuals during construction phase with minor significance long term effects on the population.	Major significance over medium term for individuals during construction phase with minor significance long term effects on the population.	Major significance over medium term for individuals during construction phase with minor significance long term effects on the population.

Reduction in Prey Due to Noise from Construction Activities

14.3.4.18 Noise modelling was conducted to predict impact ranges from piling noise produced by the Project and BOWL simultaneously on key fish species (see Chapters 14.2: Fish and Shellfish Ecology and 3.6: Underwater Noise). Impact ranges were found to be similar to those derived from the worst case scenarios for the three proposed wind farm sites alone suggesting limited cumulative effects with the BOWL development.

14.3.4.19 The cumulative effects from noise during construction on potential marine mammal prey species are therefore considered to be of low magnitude for a medium duration and therefore of **minor significance.**

Increased Collision Risk from Vessels and Use of Ducted Propellers

14.3.4.20 The cumulative build out scenarios presented in Paragraph 14.3.4.8 show an increase in the duration or intensity of the construction activities when compared with the construction for the three proposed wind farms on their own (assessed in Chapter 7.3: Marine Mammals). The precise number and type of vessels to be used during construction is yet to be confirmed, but as reported in Chapter 15.2 (Shipping and Navigation), it was concluded that any vessel traffic would be slow moving in a predictable manner (along a predefined corridor). Should construction activities coincide, taking into account results presented by the SNH (Lusseau et al., 2011) examining effects of increased vessel use within the Moray Firth, the cumulative impact of increased vessel traffic on the resident population of bottlenose dolphins is considered to be of low magnitude for a medium duration and thus minor significance.

14.3.4.21 The cumulative effect of increased vessel traffic on harbour seals, grey seals, harbour porpoise and minke whale is also considered to be of low magnitude, medium duration and minor significance.

14.3.4.22 Since 2008 there has been increasing concern over the number of seal carcasses washed up at various locations on the UK coastline displaying the fatal

'corkscrew' injury. The precise mechanisms for these injuries have yet to be proven, although it has been suggested the animals have been pulled through ducted propellers. The use of ducted propellers is prevalent in the shipping industry, often used to aid positioning vessels (dynamic positioning). The bulk of the activities under discussion that would require dynamic positioning via use of ducted propellers will occur offshore, away from haul-out sites in the coastal waters of the Moray Firth. Both the Project and BOWL are greater than 30 nm away from the Dornoch Firth SAC.

14.3.4.23 Considering the uncertainty over the mechanism of the potential injury, the knowledge that local seal populations are recovering (refer to Chapter 7.4: Marine Mammals) and the low magnitude considered in the context of cumulative vessel activities, the impact of ducted propellers is considered to be uncertain and of low magnitude and therefore of **minor significance**.

Reduction in Prey Availability (Habitat Loss)

14.3.4.24 The worse case for habitat loss for marine mammals is associated with gravity base foundations. It is predicted that the installation of the BOWL development will result in an incremental loss of habitat as a result of successive foundation placement. However, this loss of seabed is expected to be small in relation to the distribution range of fish species in the area (See Chapter 14.2: Fish and Shellfish Ecology). The cumulative effects on marine mammal prey species are therefore considered to be of low magnitude, of long term duration and of **minor significance**.

14.3.5 Assessment of WDA

14.3.5.1 There are no significant geographical variations in the density of key marine mammal receptors (harbour seal, grey seal, harbour porpoise, bottlenose dolphin and minke whale) between the three proposed wind farms and the WDA (Chapter 4.4: Marine Mammals).

14.3.5.2 No detailed assessment has been undertaken on the potential permanent hearing damage and disturbance effects from piling during construction as no detail project information is available for the WDA. Nevertheless it is recognised that the WDA is located closer to designated sites for bottlenose dolphin (Moray Firth SAC) and harbour seal (Dornoch and Morrich More Firth SAC) (see Figure 4.4-1, Volume 6). This sensitivity will be taken into account in the design of the WDA.

14.3.5.3 There are no significant changes in the assessment of the Project on its own when considered cumulatively with the WDA with regards increased collision risk from vessels given that there are no significant variations in the marine mammal density between the three proposed wind farm sites and the WDA. There are also no significant geographical variations in the fish distribution between the three proposed wind farms and the WDA as mentioned in Chapter 14.2 (Fish and Shellfish Ecology). Therefore, no predicted additive effects on reduction in prey availability due to habitat loss are predicted given that there will be no additional loss of habitat from that assessed for the three proposed wind farms.

14.3.6 Other Development Proposals

14.3.6.1 The types of effects considered in this cumulative impact assessment are in line with those described within the detailed impact assessment above (in 14.3.4 of

this chapter). As no details of Rochdale Envelope parameters or construction methodology are available for the majority of these proposals, a qualitative (rather than quantitative) assessment has been undertaken.

14.3.6.2 These developments are:

- Developments within the Moray Firth:
  - SHETL hub and transmission cable;
  - Port and harbour developments within the Moray Firth;
  - Oil and gas activities; and
  - MoD activities.
- Developments outwith the Moray Firth:
  - Proposed Forth and Tay offshore wind projects (Neart na Gaoithe, Firth of Forth and Inch Cape offshore wind farms);
  - Proposed European Offshore Wind Deployment Centre (EOWDC); and
  - Proposed Pentland Firth and Orkney wave and tidal energy developments

SHETL HVDC Hub and Transmission Cable

14.3.6.3 In addition to the Project and BOWL construction activities, it is understood that SHETL may install cables through the Moray Firth to facilitate the grid connection between Shetland and mainland Scotland. A HVDC Hub may also be built to the north east of the MORL Zone (in 2.1.7 in Chapter 2.1). A map to show the route and potential infrastructure location of this proposal can be found in Figure 2.1-4, Volume 7.

14.3.6.4 It is considered that the potential effects of the construction of this infrastructure (OSPs and offshore transmission cabling) would be less than those discussed in Chapter 10.3 (Marine Mammals), as the number of OSPs to be constructed (the element of infrastructure that would elicit the highest avoidance responses for all marine mammal species if piling were used to secure the foundations) would be below the eight proposed for the MORL schemes. Cumulative displacement effects to the construction impacts of the Project and BOWL are therefore not considered to be significant.

Oil and Gas Activity

14.3.6.5 2D seismic surveys were undertaken across two distinct sites within the Moray Firth by PA Resources and Caithness Petroleum during the summer of 2011. Although the results of these surveys are not know at this time, MORL will continue to consult with both organisations to ensure that if / when any further activities or drilling operations are scheduled for the region, the activities can be included within a cumulative impact assessment. Preliminary analysis of the C-POD recording made during the summer of 2011 that coincided with the 2D seismic survey work, has indicated that there was no significant displacement seen of harbour porpoise within the Moray Firth from regions of 2D seismic activity. It is therefore concluded for the purposes of this assessment that no cumulative impacts would occur between the construction of the three proposed wind farms and BOWL site and any 2D seismic surveys outside of the wind farm footprints.

Port and Harbour Developments within the Moray Firth

14.3.6.6 The effect upon marine mammals from the increased vessel traffic associated with the construction and with operation and maintenance of the MORL and BOWL wind farms is discussed above. The construction and operation and maintenance ports for the Project and BOWL have yet to be confirmed, and so proposed traffic routes are unknown.

14.3.6.7 It is likely that ports identified for construction and operation and maintenance activities will expand in size to facilitate the increase in vessel traffic and storage facilities required. The works to expand these facilities would have the potential to disturb marine mammals that use the coastal strip such as harbour seals and grey seals (if near to favoured haul out sites) and bottlenose dolphin. However, disturbance would be of low magnitude (very localised), medium duration and of negligible significance to the marine mammal populations of the Moray Firth.

14.3.6.8 As such, the development of ports and harbours within the Moray Firth is not considered to pose a significant cumulative impact to the wind farm developments of MORL.

MoD Activities

14.3.6.9 As part of the scoping process, the Whale & Dolphin Conservation Society (WDCS) raised the issue of whether it was necessary to consider MoD aviation activity as a potential cumulative effect with underwater noise effects from construction activities (Table 4.4-1, Chapter 4.4: Marine Mammals). Potential cumulative effects from MoD activities have been considered in the draft Environmental Statement (ES) assessment and are discussed in more detail within Technical Appendix 7.3 A, with effects considered not significant as summarised below:

14.3.6.10 The underwater noise from passing aircraft is generally brief in duration (especially when compared to the duration of audibility in the air). Furthermore, unless the aircraft is directly overhead (± 13° from vertical), the sound it produces is likely to be inaudible or weakly audible to a marine mammal underwater (Richardson *et al.*, 1995). Given these are relatively short lived events with relatively low sound levels; it is unlikely that they would lead to significant adverse effects on marine mammals, either in isolation or in combination with other activities. Therefore, cumulative effects from MoD low flying activities are assessed as not significant.

14.3.6.11 Nevertheless, the potential cumulative effects from MoD activities have now been ruled out of the assessment as the MoD danger area that was partially located within the Project area has been removed (Chapter 8.3: Military and Civil Aviation).

Developments Outwith the Moray Firth:

14.3.6.12 A number of renewable developments outside of the Moray Firth are considered in conjunction with the Project (and BOWL) (see Table 14.3-4 above).

14.3.6.13 The limited information available on these projects to date does not allow for a detailed cumulative impact assessment. The impact assessment therefore forms a discussion, based on reviews of current knowledge marine mammal responses (including information from monitoring studies carried out in operational wind farms) and evidence presented within Chapter 7.3 (Marine Mammals) and

Technical Appendix 7.3 A. The wind farm projects within the Firths of Tay and Forth are known to contain piled foundations. Although the build conditions of the Pentland Firth and Orkney waters wave and tidal devices are not known at this time, it is assume for the purposes of this impact assessment that the Rochdale Envelopes for these schemes may involve piling. Therefore, the primary focus of this chapter is related to increased anthropogenic noise from piling activities outside of the Moray Firth.

14.3.6.14 Behavioural studies are planned to coincide with the two week installation window of a met mast which MORL intends to install in August and / or September of 2012 (see Chapter 7.3: Marine Mammals for more details). It is envisioned these studies will help to refine some of the conservative assumptions made within the development of the assessment methodology as defined in Table 7.3-11 of Chapter 7.3 (Marine Mammals).

Harbour Seals

14.3.6.15 As discussed in Chapter 4.4 (Marine Mammals), results from harbour seals tagged at Moray Firth haul-out sites demonstrate that they remain in the area when foraging. It is therefore unlikely that animals from this population will be directly affected by piling noise occurring at developments near the Forth and Tay or in the Pentland Firth and Orkney waters.

14.3.6.16 The levels of displacement predicted by the most precautionary models used in this ES suggest that up to 61 to 75 % of harbour seals may be displaced from regions of the Moray Firth affected by piling activities. The duration of this displacement is unknown, but it is expected to be temporary by scientific experts, and forthcoming data from DECC funded studies in the Wash can be used to test these hypotheses. Nevertheless, in the interim the most conservative assumption that animals are excluded for the whole year has been used in the modelling undertaken to inform this impact assessment and has identified no long term impact on the viability of this harbour seal population.

14.3.6.17 Displaced seals are likely to use alternative foraging areas within the Moray Firth where there are lower levels of disturbance. As seen during periods of natural changes in prey availability, these changes may also lead to temporary changes in the use of different Moray Firth haul-out sites (Thompson *et al.,* 1996). Harbour seals are not expected to be displaced to areas outside of the Moray Firth, and so would not suffer cumulative impact with projects occurring within the Firths of Forth and Tay or Pentland Firth and Orkney waters.

Grey Seals

14.3.6.18 Grey seals will travel over much larger areas than harbour seals, with tracking studies showing that many of the grey seals tracked within the Moray Firth originated from haul-out sites further afield. A number of the seals tracked within the Moray Firth were tagged on the Isle of May, confirming connectivity between the Moray Firth and the Firths of Forth and Tay.

14.3.6.19 Construction activities for the wind farms of the Firths of Tay and Forth are predicted to coincide with those of the Moray Firth over the period of 2014 to 2020. Precautionary modelling conducted for this ES predicts that between 32 to 52 % of grey seals currently using the Moray Firth may be displaced from the area during construction, depending on the construction scenario.

Tracking studies demonstrate that should foraging areas close to piling events become less preferable to grey seals, they are capable of travelling to alternative areas. The large foraging range of this species will ensure that feeding areas outside of the noise influence from construction of the Firth of Forth and Tay, and Pentland Firth and Orkney waters should the construction phases of these projects coincide, is likely.

Harbour Porpoise

14.3.6.20 Using the most conservative assumptions, between 65 to 84 % of harbour porpoise within the Moray Firth may be displaced during the piling activities within the Moray Firth, depending on the construction scenario. Harbour porpoise exhibit widespread distributions and are not tied to specific feeding or breeding grounds within the Moray Firth or elsewhere in the North Sea or North Atlantic. A population structure workshop held in 2007 under the aegis of the Agreement on the Conservation of Small Cetaceans of the Baltic, North-East Atlantic, Irish and North Seas (ASCOBANS) and the Helsinki Commission (HELCOM) concluded that there was some population structure within the North Sea, but the evidence was insufficient to define boundaries between any (sub-) populations at the time (ASCOBANS, 2009). Consequently, for the purposes of conservation, harbour porpoise in the North Sea are considered to represent a single population.

14.3.6.21 Relatively large numbers of harbour porpoise may be displaced from the Moray Firth and, although the details are not presently available, it can be assumed that significant numbers may be displaced from the Forth and Tay and Pentland Firth and Orkney waters areas due to piling associated with developments. Although the local effects from piling will be significant on this species in the areas surrounding specific construction activities, the generalised distribution of this species suggests that the cumulative effects across such a wide area will be relatively low and that alternative foraging areas in the North Sea for harbour porpoises are likely to be available.

Bottlenose Dolphins

14.3.6.22 The north east of Scotland population of bottlenose dolphins is known to range over a wide area of coast from the Moray Firth down to the Forth and Tay and beyond (Technical Appendix 4.4 A: Baseline Marine Mammals). Sightings of bottlenose dolphins tend to be close to the coast, with the majority occurring in waters of less than 25 m deep (Hastie *et al*., 2003; Canning, 2007; Robinson *et al*., 2007).

14.3.6.23 The extent to which Moray Firth SAC bottlenose dolphins are expected to be directly affected by piling noise in the Forth and Tay area is not currently known. The most precautionary models discussed within this document predict that between 16 - 42 % of the population could be disturbed within the Moray Firth as a result of piling noise. This value falls to between 11 - 34 % using the model of best fit. Predicted noise levels within those parts of the Moray Firth frequented by bottlenose dolphins are not expected to be sufficient to exclude animals from these areas. Nevertheless, the coastal nature of this population suggests that should piling lead to some individuals moving outside the Moray Firth, they could be further exposed to piling activities along the eastern coast, in particular in the Forth and Tay region. Piling activities at Aberdeen are predicted to be short in duration and completed prior to construction activities beginning at either the three proposed wind farm sites, or in the Forth and Tay region; although there

may be some overlap with the BOWL development within the Moray Firth. Details of levels of displacement likely to occur as a result of piling in the Forth and Tay area were not available to MORL at the time of publication.

Minke Whale

14.3.6.24 Using the precautionary fit, up to 15 % of minke whales within the Moray Firth could be displaced during the piling activities. As with harbour porpoise, minke whales exhibit generalised distributions throughout the North Sea or North Atlantic. It is unclear whether minke whales in UK waters move slightly offshore during the winter months or migrate further afield. If population differentiation between North Atlantic minke whales from different regions exists, it seems present only at low levels (Árnason & Spilliaert, 1991; Daníelsdóttir *et al*., 1992; Bakke *et al.,* 1996; Martinez & Pastene, 1999; Andersen *et al*., 2003; Anderwald *et al*., 2011). Sightings within the Moray Firth appear are most common between April and September, as has been reported for other areas (see Technical Appendix 4.4 A: Baseline Marine Mammals).

14.3.6.25 As discussed, impact assessments for the Forth and Tay offshore wind projects (Neart na Gaoithe, Firth of Forth and Inch Cape) are not presently available. Potential effects from development of wave and tidal projects within the Pentland Firth and Ornkey waters as also now know. Although the local effects from piling may be significant on this species in the areas surrounding specific construction activities, the generalised distribution of this species suggests that the cumulative effects across such a wide area of coastline will be minimal and that alternative areas in the northeast Atlantic for minke whales to forage are likely to be extensive. If all the assumptions detailed in Table 7.3-11 (Chapter 7.3: Marine Mammals) are confirmed, the assessments presented above are assessed as likely significant effects.

14.3.7 Habitats Regulations Appraisal

14.3.7.1 As part of the Habitat Regulations, the likely significant effects of the Project and cumulative effects with other developments on SACs will be assessed by the competent authority through consideration of each SACs conservation objectives (see Technical Appendix 7.3 A). The two SACs under consideration in this assessment are the Moray Firth SAC (qualifying feature: bottlenose dolphin) and the Dornoch Firth and Morrich More SAC (qualifying feature: harbour seal).

14.3.7.2 Terminology used is based on that suggested by the Intergovernmental Panel on Climate Change (IPCC). Definitions provided by the IPCC for levels of confidence in an assessment can be found in Technical Appendix 7.3 G. As part of the EIA for designated sites and to provide information to the competent authority, Table 14.3-7 below summarises the effects the Project and other identified developments are predicted to have on the Moray Firth and Dornoch Firth SACs in respect each of the five criteria listed below:

1. Changes in the distribution or extent of the habitats supporting the species;
2. Changes in the structure, function and supporting processes of habitats supporting the species;
3. Significant disturbance to the qualifying species;
4. Changes in the distribution of the species within the sites; and
5. The species being maintained as a viable component of the sites in the long term, and therefore the integrity of the sites.

14.3.7.3 Due to the number of conservative assumptions that have been made during the impact assessment for marine mammals, consultation with scientific experts has resulted in an assignation of a likely degree of certainty (66-100 % probability) to the predictions of cumulative effects between the Project and BOWL. The scientific experts involved in the development of the assessment methodology believe that the conservative nature of all the assumptions taken result in a substantial cumulative over-prediction of impact. Table 7.3-11 presented in Chapter 7.3 (Marine Mammals) provides details on the assumptions that have been made during this impact assessment, and why they represent the most conservative approach possible in each case.

14.3.7.4 The confidence levels used in the assessment of cumulative effects on the Dornoch Firth and Morrich Moore SAC are based on conservative assumptions proposed in the seal framework assessment (Technical Appendix 7.3 B) and detailed in Table 7.3-11 of Chapter 7.3 (Marine Mammals).

14.3.7.5 The main likely effects from the Project on the SACs assessed below arise from the construction activities of the three proposed wind farms. Therefore the assessment summary presented below for the MORL Project relates to the assessment detailed in Tables 7.3-15 and Table 7.3-16 in Chapter 7.3 (Marine Mammals). The cumulative effects refer to effects arising from the Project and BOWL assessed together.

14.3.7.6 For all the criteria assessed above there are no significant differences between the three proposed wind farms and therefore no detailed sensitivity assessment has been undertaken. No additional mitigation measures to the detailed in Chapters 7.3 and 10.3 (Marine Mammals) are considered.

Table 14.3-7 Summary of Assessment of the Moray Firth SAC per Conservation Objectives

Designated Site & Designated Feature	Criterion	MORL Project	Cumulative (MORL Project and BOWL)
Moray Firth SAC (bottlenose dolphins)	**1**	Changes to habitat distribution as a result of construction activities are considered to be exceptionally unlikely and not significant on the Moray Firth SAC (Table 7.3-15, Chapter 7.3). Confidence level: very high.	The footprint of the proposed wind farms do not overlap with the Moray Firth SAC. Bottlenose dolphins are primarily encountered within the coastal regions and thus not expected to occur within the wind farm areas. Chapter 14.1 predicts negligible to minor effects on benthic habitats within the footprints of the Telford, Stevenson and MacColl and BOWL farms. Taking into account predictions made in the ES and the fact that the SAC does not fall within the boundaries of the proposed developments, changes to habitat distribution as a result of construction activities are considered to be exceptionally unlikely and **not significant** on the Moray Firth SAC. **Confidence level: very high**
	2	Changes to habitat structure are considered to be exceptionally unlikely and not significant on the Moray Firth SAC (Table 7.3-15, Chapter 7.3). Confidence level: very high.	Chapter 14.2 predicts small or medium likely significant effects for piling noise on fish species from the Project and BOWL developments. Taking into account predictions made in the ES and the fact that the SAC does not fall within the boundaries of the proposed developments, changes to habitat structure are considered to be exceptionally unlikely and **not significant** on the Moray Firth SAC. **Confidence level: very high**

Designated Site & Designated Feature	Criterion	MORL Project	Cumulative (MORL Project and BOWL)
Moray Firth SAC (bottlenose dolphins) (Continued)	**3**	It is considered that any disturbance from piling noise on the bottlenose dolphin population will be likely but temporary in nature (i.e. only for the duration of the piling activities) and of minor significance in the long term (Table 7.3-15, Chapter 7.3). Confidence level: high	The primary disturbance to bottlenose dolphins from the Project and BOWL is considered to be increased noise from piling during the construction phase. This disturbance has the potential to cause displacement from habitats currently frequented by bottlenose dolphins within the Moray Firth. The locations of wind farms will not overlap with the Moray Firth SAC and bottlenose dolphins are primarily encountered within coastal regions and thus not expected to occur within the vicinity of the three proposed wind farms and BOWL. Levels of displacement predicted by the most precautionary models presented in Technical Appendix 7.3 A and presented above suggest that less than 34 % of the population will be displaced (based on the model of best fit) by piling activity related to the construction of both the Project and BOWL during 2016 to 2017 (eight piling vessels). This proportion rises to 42 % if the most precautionary model is used for behavioural response to piling noise. If a maximum of two construction vessels are use within the Moray Firth during any one year to build out the MORL and BOWL projects, a maximum of 11 % (best fit) or 19 % (precautionary fit) of bottlenose dolphin are predicted to be displaced during piling activities. Noise propagation models (see Technical Appendix 7.3 F) suggest that by the time sound waves produced by piling reach those parts of the southern Moray Firth which are commonly used by bottlenose dolphins; it will have reduced to approximately 70 dB_{ht}. Using the noise dose response curve from harbour propose behaviour described above and in detailed within Technical Appendix 7.3 A as a proxy for bottlenose dolphin, 70 dB_{ht} equates to between 20 % (best fit) and 40 % (conservative fit) displacement . Noise levels in the inner Moray Firth will be even lower. As described in Technical Appendix 7.3 D, analysis of available data indicates higher level responses by harbour porpoises than bottlenose dolphins to similar noise levels. Thus, using harbour porpoise as a proxy for bottlenose dolphin is likely to produce an overestimation of associated effect upon the bottlenose dolphin population. The modelling presented in Technical Appendix 7.3 A and summarised in Chapter 7.3 assumes piling will occur consistently across the construction period. In practice there will be gaps in piling operations, either from operational constraints (i.e. when re-positioning vessels) or during periods of bad weather, thus providing periods without the risk of disturbance. Taking all of this into account, it is considered that any disturbance from piling noise on the bottlenose dolphin population will be likely, **moderately significant** in the medium term but temporary in nature and of **minor significance** in the long term. **Confidence level: high**

Designated Site & Designated Feature	Criterion	MORL Project	Cumulative (MORL Project and BOWL)
Moray Firth SAC (bottlenose dolphins) (Continued)	**4**	It is considered that changes in species distribution are unlikely and if they were to occur, would be temporary in nature (i.e. only for the duration of piling activities). The overall effect of piling noise from the Project on species distribution is considered to be of minor significance in the long term. Confidence level: high	Many of the foraging areas used by the bottlenose dolphin population occur outside of the boundaries of the SAC and research has confirmed that individuals regularly leave the Moray Firth and spend time in other areas along the eastern coast (see Technical Appendix 4.4 A: Baseline Marine Mammals). Noise propagation and impact modelling presented in Technical Appendix 7.3 A suggests that while noise levels in coastal waters from piling activities within the proposed developments are predicted to elicit a response and may lead to low levels of displacement, they will not prevent movement by bottlenose dolphins along the southern coast of the Moray Firth.
			Given the large area that the population is known to inhabit, their distribution has the potential to be affected not only by proposed developments within the Moray Firth but also those proposed along the eastern coast. There is liable to be overlap between construction activities in the Moray Firth and in the Firths of Forth and Tay. Precise details of construction activities in the Forth and Tay area are not presently available but it is likely they will involve piling. No data has been published on the potential effects of piling within the Forth and Tay area but given the proximity of some of the developments to the coast, levels of displacement from the area are possible. It is therefore considered that changes in species distribution within the SAC as a result from the Project and BOWL construction activities are unlikely and if they were to occur, would be temporary in nature (i.e. only for the duration of piling activities). The overall effect of piling noise on species distribution is considered to be of **minor significance** long term. **Confidence level: high**
	5	It is predicted that the long term viability of the bottlenose dolphin population will not be affected by construction activities and the potential effects from piling noise on the population as a viable component of the SAC are unlikely and of minor significance. Confidence level: high	The population modelling described in Technical Appendix 7.3 A and summarised above predicts the abundance of bottlenose dolphins within the Moray Firth over a 25 year period, including years of presumed disturbance. Outputs from the most precautionary models for the worst case scenario[2], suggest that population levels will remain stable over the 25 year period, even with a period of disturbance resulting from the Project and BOWL construction activities. Therefore it is predicted that the long term viability of the bottlenose dolphin population will not be affected by construction activity, and the potential effects of piling noise on the population as a viable component of the SAC are unlikely and **not significant**. **Confidence level: high**
Overall CIA for Moray Firth SAC: no significant effects predicted on SAC integrity from development of BOWL and MORL developments.			

[2] Model F: eight piling vessels working simultaneously over a two year period; two vessels within each of the proposed BOWL and MORL sites (Telford, Stevenson and MacColl).

Table 14.3-8 Summary of Assessment of Dornoch Firth and Morrich More SAC

Designated site & Designated Feature	Criterion	MORL Project	Cumulative (MORL Project and BOWL)
Dornoch Firth and Morrich More SAC (harbour seals)	**1**	Taking into account predictions made in the ES, changes to habitat distribution (either within the SAC or in preferred foraging areas within the Moray Firth) as a result of piling activities are considered to be unlikely and not significant for the Dornoch Firth and Morrich More SAC. Confidence level: high	Chapter 14.1 predicts negligible to minor effects on benthic habitats within the footprints of the proposed Telford, Stevenson, MacColl and BOWL wind farms. The footprint of the proposed wind farms do not overlap with the SAC but do represent part of the harbour seal foraging range. Taking into account predictions made in the ES, changes to habitat distribution (either within the SAC or in preferred foraging areas within the Moray Firth) as a result of piling activities are considered to be unlikely and **not significant** for the Dornoch Firth and Morich More SAC. **Confidence level: high**
	2	The footprint of the proposed wind farms do not overlap with the SAC but do represent part of the harbour seal foraging range. Taking into account predictions made in the ES, changes to habitat structure as a result of piling noise (either within the SAC or in preferred foraging areas within the Moray Firth) are considered to be unlikely and not significant for harbour seal. Confidence level: high	Chapter 14.2 predicts small or medium likely significant effects for the cumulative effects of piling noise on fish species from the Project and BOWL developments. The footprint of the proposed wind farms do not overlap with the SAC but do represent part of the harbour seal foraging range. Taking into account predictions made in the ES, changes to habitat structure as a result of piling noise (either within the SAC or in preferred foraging areas within the Moray Firth) are considered to be unlikely and **not significant** for the Dornoch Firth and Morich More SAC. **Confidence level: high**
	3	It is considered that some harbour seals from this population are likely to experience major significant disturbance while foraging during the piling operations. This impact is not expected to extend for prolonged periods once piling temporarily ceases. The effects of this disturbance are considered to be temporary (i.e. the duration of piling activities) and of minor significance to the population long term. Confidence level: high	The primary disturbance to harbour seals from the Project and BOWL is considered to be increased noise from piling during the construction phase. This disturbance has the potential to cause displacement from some habitats currently frequented by harbour seals within the Moray Firth. Noise propagation modelling suggests that noise levels from piling will be low the inner Moray Firth and the Dornoch Firth and Morrich More SAC. Given the distance between the proposed developments and haul-out sites within the SAC (> 50 km), disturbance to seals hauled-out are considered to be unlikely. As shown in Chapter 4.4 (Marine Mammals), the footprint of the three proposed wind farms and BOWL represents part of the harbour seal foraging range and it is here that the greatest level of disturbance has the potential to occur. Modelling presented in Technical Appendix 7.3 A predict that up to 75 % of the population may be displaced from favoured feeding grounds as a result of piling noise based on the most precautionary models. The duration of this displacement is unknown, but it is expected to be temporary by scientific experts, and forthcoming data from DECC funded studies in the Wash can be used to test these hypotheses. Nevertheless, in the interim we have used the most conservative assumption that animals are excluded for the whole year.

Designated site & Designated Feature	Criterion	MORL Project	Cumulative (MORL Project and BOWL)
Dornoch Firth and Morrich More SAC (harbour seals) (Continued)	**3**		The modelling presented in Technical Appendix 7.3 A and summarised above assumes piling will occur consistently across the construction period. In practice it is expected there will be gaps in piling operations, either from operational constraints (i.e. when re-positioning vessels) or during periods of bad weather, which will provide periods in which seals can forage within the wind farms footprints. Modelling the proportion of the population to be excluded for the full duration of the construction period therefore represents a very precautionary approach. It is considered that some harbour seals from this population are likely to experience **major significant** disturbance while foraging during the piling operations. This effect is not expected to extend for prolonged periods once piling ceases. The effects of this disturbance are considered to be temporary (i.e. the duration of piling activities) and of minor significance to the population long term. Confidence level: high
	4	It is considered that changes in distribution of harbour seals associated with piling noise within the Moray Firth are likely but temporary in nature (i.e. duration of piling activities) and of minor significance. Confidence level: high	Annual haul-out surveys over the last 25 years have demonstrated that there have been natural changes in the distribution of harbour seals at different haul-out sites across the Moray Firth (Thompson *et al.*, 1996), including changes in the relative importance of sites within the SAC (Cordes *et al.*, 2011). Tagging studies have also shown that foraging areas used by harbour seals from Moray Firth haul-out sites are not within the boundaries of the SAC (Cordes *et al.*, 2011). The footprint of the proposed three wind farms and BOWL covers part of the harbour seals' potential foraging area (Smith Bank), and the most precautionary models presented in Technical Appendix 7.3 A predict that between 62 to 75 % of the population may be displaced as a result of piling noise. Displaced seals are likely to use alternative foraging areas within the Moray Firth where there are lower levels of disturbance. This would represent a potential temporary change in their distribution within the waters of the Moray Firth. As seen during periods of natural changes in prey availability, these changes may also lead to temporary changes in the use of different Moray Firth haul-out sites (Thompson *et al.*, 1996). Given the distance between the proposed developments and haul-out sites within the SAC (> 50 km), it is considered unlikely that haul-out sites will be directly disturbed from piling noise and therefore changes in haul-out distribution as a direct result of piling noise are considered unlikely, although indirect changes linked with changes in foraging patterns may occur. Population modelling (described in Technical Appendices 7.3 A, 7.3 B and summarised in Chapter 7.3) suggests while population levels may decrease during the construction period, the population is predicted to recover once construction is completed. Taking all of this into account, it is suggested that changes in distribution of harbour seals associated with piling noise within the Moray Firth are likely but temporary in nature (i.e. duration of piling activities) and of **minor significance**. **Confidence level: high**

Designated site & Designated Feature	Criterion	MORL Project	Cumulative (MORL Project and BOWL)
Dornoch Firth and Morrich More SAC (harbour seals) (Continued)	**5**	It is predicted that the long term viability of the harbour seal population will not be affected by construction activities, and potential effects from piling noise on the population as a viable component of the SAC are unlikely and of minor significance in the long term. Confidence level: high	The population modelling described in Technical Appendix 7.3 A and described above predicts that the abundance of harbour seals within the Moray Firth for each year over a 25 year period, including those years in which disturbance is predicted to occur. These projections suggest that population levels will decrease by no more than 23 % even for the most precautionary models and the worst case scenario, with the population recovering quickly over subsequent years. It is predicted that the long term viability of the harbour seal will not be affected and the likely effects from piling noise of the Project and BOWL on the population as a viable component of the SAC are unlikely and of **minor significance** in the long term. **Confidence level: high**
Overall CIA for Dornoch Firth and Morrich More SAC: no significant effects predicted on SAC integrity.			

14.3.8 References

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14.4 Ornithology

14.4.1 Summary of Effects and Mitigation

14.4.1.1 Given below is the assessment of cumulative effects upon ornithology arising from the proposed wind farm sites (Telford, Stevenson and MacColl) and offshore transmission infrastructure (OfTI), in conjunction with other existing and foreseeable planned marine project / development activities.

14.4.1.2 Potential cumulative effects arising from the onshore transmission infrastructure (OnTI) are addressed in Chapter 14.6 (Terrestrial Ecology).

Summary of Effects

14.4.1.3 A summary of the impact assessment when cumulative effects are taken into account is provided in Table 14.4-1 below. Inclusion of the BOWL wind farm in the cumulative impact assessment means that moderate-high effects are predicted for gannet, great black-backed gull and herring gull, resulting in the conclusion of significant effects on these species.

14.4.1.4 In terms of the SPAs assessed in Chapter 7.4 (Ornithology), the prediction of significant cumulative effects with Beatrice Offshore Wind Farm and associated infrastructure for great black-backed gull and herring gull means that significant effects are predicted on the East Caithness Cliffs integrity.

Summary of Residual Effects and Mitigation

14.4.1.5 No mitigation specific to cumulative effects on ornithology has been proposed, in addition to the described in the offshore generation station (Chapter 7.4: Ornithology).

14.4.1.6 Primary mitigation includes best-practice in terms of setting standard wind farm vessel corridors in order to minimise any potential disturbance. Operational monitoring requirements will be agreed with regulators and Statutory Nature Conservation Agencies (SNCAs).

Table 14.4-1 Cumulative Impact Summary

Effect / Receptor	MORL Total Project	BOWL (generating station and associated transmission infrastructure)	European Offshore Wind Deployment Centre (EOWDC)	Western Development Area (WDA)	Sensitivities for Telford, Stevenson and MacColl, and OFTO	Mitigation Method (if required)
Construction / Decommissioning						
Fulmar	Minor effect Not significant	Minor effect Not significant	Negligible effect Not significant	Minor effect Not significant	No difference.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Fulmar	Minor effect. Not significant					

Effect / Receptor	MORL Total Project	BOWL (generating station and associated transmission infrastructure)	European Offshore Wind Deployment Centre (EOWDC)	Western Development Area (WDA)	Sensitivities for Telford, Stevenson and MacColl, and OFTO	Mitigation Method (if required)
Gannet	Minor effect Not significant	Minor effect Not significant	Moderate effect Not significant	Minor effect Not significant	No difference.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Gannet	Minor effect. Not significant					
Shag	Negligible Effect Not significant	Negligible effect Not significant	Moderate effect Not significant	Negligible effect Not significant	No difference.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Shag	Negligible Effect. Not significant					
Arctic Skua	Negligible Effect Not significant	Minor effect Not significant	Negligible effect Not significant	Negligible effect Not significant	No difference.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Arctic Skua	Minor effect. Not significant					
Great Skua	Negligible Effect Not significant	Minor effect Not significant	Negligible effect Not significant	Negligible effect Not significant	No difference.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Great Skua	Minor effect. Not significant					
Kittiwake	Minor effect Not significant	Minor effect Not significant	Negligible effect Not significant	Minor effect Not significant	No difference.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Kittiwake	Minor effect. Not significant					
Great Black-Backed Gull	Minor effect Not significant	Minor effect Not significant	Minor effect Not significant	Minor effect Not significant	No difference.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Great Black-Backed Gull	Minor effect. Not significant					

Effect / Receptor	MORL Total Project	BOWL (generating station and associated transmission infrastructure)	European Offshore Wind Deployment Centre (EOWDC)	Western Development Area (WDA)	Sensitivities for Telford, Stevenson and MacColl, and OFTO	Mitigation Method (if required)
Herring Gull	Minor effect Not significant	Minor effect Not significant	Moderate Effect Not significant	Minor effect Not significant	No difference.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Herring Gull	Moderate to major effect. Significant					
Arctic Tern	Minor effect Not significant	Minor effect Not significant	Minor effect Not significant	Minor effect Not significant	No difference.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Arctic Tern	Minor effect. Not significant					
Guillemot	Minor effect Not significant	Minor effect Not significant	Minor effect Not significant	Minor effect Not significant	No difference.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Guillemot	Minor effect. Not significant					
Razorbill	Minor effect Not significant	Minor effect Not significant	Minor effect Not significant	Minor effect Not significant	No difference.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Razorbill	Minor effect. Not significant					
Puffin	Minor effect Not significant	Minor effect Not significant	Minor effect Not significant	Minor effect Not significant	No difference.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Puffin	Minor effect. Not significant					
Operation						
Fulmar	Minor effect Not significant	Minor effect Not significant	Negligible effect Not significant	Minor effect Not significant	No difference.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Fulmar	Minor effect. Not significant					

Effect / Receptor	MORL Total Project	BOWL (generating station and associated transmission infrastructure)	European Offshore Wind Deployment Centre (EOWDC)	Western Development Area (WDA)	Sensitivities for Telford, Stevenson and MacColl, and OFTO	Mitigation Method (if required)
Gannet	Moderate Effect Not significant	Minor effect Not significant	Moderate effect Not significant	Minor effect Not significant	Cumulative impact would still be moderate-major for any combination considered cumulatively with the BOWL wind farm.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Gannet	Moderate-major Effect. Significant					
Shag	Negligible Effect Not significant	Negligible effect Not significant	Moderate effect Not significant	Negligible effect Not significant	No difference.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Shag	Negligible Effect. Not significant					
Arctic Skua	Negligible Effect Not significant	Minor effect Not significant	Negligible effect Not significant	Negligible effect Not significant	No difference.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Arctic Skua	Minor effect. Not significant					
Great Skua	Negligible Effect Not significant	Minor effect Not significant	Negligible effect Not significant	Negligible effect Not significant	No difference.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Great Skua	Minor effect. Not significant					
Kittiwake	Minor effect Not significant	Minor effect Not significant	Negligible effect Not significant	Minor effect Not significant	No difference.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Kittiwake	Minor effect. Not significant					

Effect / Receptor	MORL Total Project	BOWL (generating station and associated transmission infrastructure)	European Offshore Wind Deployment Centre (EOWDC)	Western Development Area (WDA)	Sensitivities for Telford, Stevenson and MacColl, and OFTO	Mitigation Method (if required)
Great Black-Backed Gull	Minor effect Not significant	Minor effect Not significant	Minor effect Not significant	Minor effect Not significant	Cumulative impact would still be moderate-major for any combination considered cumulatively with the BOWL wind farm.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Great Black-Backed Gull	Moderate-major Effect. Significant					
Herring Gull	Moderate Effect Not significant	Minor effect Not significant	Moderate Effect Not significant	Minor effect Not significant	Cumulative impact would still be moderate-major for any combination considered cumulatively with the BOWL wind farm.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Herring Gull	Moderate-major Effect. Significant					
Arctic Tern	Minor effect Not significant	Minor effect Not significant	Minor effect Not significant	Minor effect Not significant	No difference.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Arctic Tern	Minor effect. Not significant					
Guillemot	Minor effect Not significant	Minor effect Not significant	Minor effect Not significant	Minor effect Not significant	No difference.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Guillemot	Minor effect. Not significant					
Razorbill	Minor effect Not significant	Minor effect Not significant	Minor effect Not significant	Minor effect Not significant	No difference.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Razorbill	Minor effect. Not significant					

Effect / Receptor	MORL Total Project	BOWL (generating station and associated transmission infrastructure)	European Offshore Wind Deployment Centre (EOWDC)	Western Development Area (WDA)	Sensitivities for Telford, Stevenson and MacColl, and OFTO	Mitigation Method (if required)
Puffin	Minor effect Not significant	Minor effect Not significant	Minor effect Not significant	Minor effect Not significant	No difference.	None additional to that outlined in Chapter 7.4 (Ornithology)
Overall CIA for Puffin	Minor effect. Not significant					

14.4.2 Assessment of Cumulative Impacts

14.4.2.1 The geographical scope of the cumulative assessment is principally focused in the Moray Firth area. It is, however, recognised that some mobile species may spend varying periods of time outside the Moray Firth and, as a result, there is potential for these to be affected by other activities / developments further afield.

14.4.2.2 The developments and activities considered in detail within the cumulative impact assessment are listed below:

- Beatrice Offshore Wind Farm (BOWL) and associated infrastructure;
- European Offshore Wind Deployment Centre (EOWDC); and
- MORL Western Development Area (WDA) generating stations.

14.4.2.3 In addition, the following developments have been identified which may have cumulative effects over the life of the Project but where there is insufficient information available for a detailed assessment of cumulative effects to be carried out:

- The SHETL HVDC hub and transmission cable;
- Dredging and sea disposal in the Moray Firth;
- Port and harbour developments in the Moray Firth;
- Neart Na Gaoithe (STW);
- Inch Cape (STW);
- Firth of Forth R3 Area; and
- Marine energy developments in the Pentland Firth and Orkney waters.

14.4.2.4 The SHETL subsea cable and HVDC hub (high current direct current connection between Shetland and Keith, Moray) has not been included in the CIA since potential effects on ornithological receptors were considered unlikely to arise (SHETL, 2009). Aggregate dredging and port / harbour developments are not included since there are currently none planned in the vicinity of three proposed wind farm sites or the transmission infrastructure.

14.4.2.5 A qualitative assessment on potential cumulative effects from the Forth and Tay offshore wind projects (Neart Na Gaoithe, Inch Cape and Firth of Forth R3 Area) and the marine energy developments in the Pentland Firth and Orkney waters is provided below in 14.4.6 of this chapter.

14.4.3 Methodology

14.4.3.1 The assessment methodology used has followed the methodology proposed in the cumulative impacts discussion document (Moray Firth Offshore Wind Developers Group Cumulative Impact Assessment Discussion Document (ERM, 2011)) (Technical Appendix 1.3 D).

14.4.3.2 The impact assessments presented for the BOWL wind farm and the EOWDC are taken directly from the appropriate ESs. The cumulative impact assessment, including the Project and BOWL developments has been based on the results on population viability modelling.

Realistic Worst Case Scenario for Projects where Detailed Assessment is Possible

14.4.3.3 Worst-case scenarios have been assumed for the three proposed wind farm sites (in line with the Rochdale Envelope as summarised in Table 14.4-2 below), the BOWL wind farm (as per the assumptions used in the BOWL-specific ornithological impact assessment in BOWL ES), and the WDA.

14.4.3.4 A summary of the worst case parameters of wind farm design for the BOWL Wind Farm and EOWDC in terms of ornithology is provided below in Table 14.4-2 and Table 14.4-3 respectively. The worst case parameters for the three proposed wind farm sites and the OfTI are as provided in Chapter 7.4 and Chapter 10.4 (Ornithology) respectively.

Table 14.4-2 Summary of BOWL Worst Case Parameters

Realistic Worst Case Parameters	Scenario Assessed
Construction and decommissioning	
Disturbance	Installation of 277 x 3.6 MW turbines within whole of site, and transmission infrastructure as per BOWL ES.
Operation	
Disturbance / Displacement	Installation of 277 x 3.6 MW turbines within whole of site, and transmission infrastructure as per BOWL ES.
Collision risk	Installation of 277 turbines (107.2 m rotor diameter) within whole of site

Table 14.4-3 Summary of EOWDC Worst Case Parameters

Realistic Worst Case Parameters	Scenario Assessed
Construction and decommissioning	
Disturbance	Installation of 11 x 4-10 MW turbines (100 MW of maximum capacity) within whole of site, and transmission infrastructure as per EOWDC ES.
Operation	
Disturbance / Displacement	Installation of 11 x 4-10 MW turbines (100 MW of maximum capacity) within whole of site, and transmission infrastructure as per EOWDC ES.
Collision risk	Installation of 11 turbines (150 m rotor diameter) within whole of site

Western Development Area

14.4.3.5 The Western Development Area (WDA) comprises part of the MORL Zone, within which the three proposed wind farm sites (Telford, Stevenson and MacColl) are located. The maximum capacity to be installed in the entire Zone is 1.5 GW and MORL has applied for a maximum of 1.5 GW within three proposed wind farm sites.

14.4.3.6 The WDA may be developed for a maximum of 500 MW of capacity if less than 1.5 GW of capacity is delivered by the Project in the EDA. In total the consented capacity of the Project and the WDA will not exceed 1.5 GW.

14.4.3.7 The connection between the WDA and the three proposed wind farm sites necessitates a slightly different approach to assessment, as the effects arising from the "worst case" for the Project cannot simply be added to the "worst case" scenario for the WDA. Instead, assessment of the likely significant cumulative effects of the Project and the WDA will therefore follow a similar format to that undertaken for the sensitivity assessments of the individual wind farm proposals in paragraph 7.4.11.1 In Chapter 7.4 (Ornithology).

14.4.3.8 A summary of the worst case parameters of wind farm design for the WDA in terms of ornithology is provided below in Table 14.4-4.

Table 14.4-4 Summary of MORL WDA Worst Case Parameters

Realistic Worst Case Parameters	Scenario Assessed
Construction and decommissioning	
Disturbance	Installation of 100 x 5 MW turbines within whole site.
Operation	
Disturbance / Displacement	Installation of 100 x 5 MW within whole of site.
Collision risk	Installation of 100 x 5 MW turbines (135 m rotor diameter) within whole of site

Other Developments

14.4.3.9 Developments that are at an earlier stage, and for which there are limited development details at this stage, are also considered. Detailed cumulative impact assessment of these developments is not possible as insufficient information is available. Instead, a commentary on the potential for cumulative effects on the basis of the information available is presented, but no quantitative conclusions on the likely significance of any effects can be drawn.

14.4.3.10 All marine renewable projects considered in the CIA are shown in Figure 1.3-1, Volume 6 a.

14.4.4 Detailed Impact Assessment

14.4.4.1 The likely significant effects that will be considered in this CIA on ornithological receptors are:

- Disturbance / displacement caused by the presence of the turbines, including indirect habitat effects due to changes in prey availability associated with presence of turbines; and
- Collision with turbines whilst in flight.

14.4.4.2 Cumulative barrier effects are predicted to be minor / negligible given that the conclusions of the individual impact assessments for this potential risk for the three proposed wind farm sites, BOWL, and EOWDC are for minor / negligible effects.

14.4.4.3 Additional species are included in this CIA. These additional species have been considered if included in the BOWL wind farm impact assessment. Additional species were considered in the EOWDC impact assessment that haven't been considered by either MORL or BOWL impact assessments, due to differences in location of the sites, and these have not been considered in the CIA.

14.4.4.4 The receptors identified for consideration in this cumulative impact assessment are:

- Fulmar;
- Gannet;
- Shag;
- Arctic skua;
- Great skua;
- Kittiwake;
- Great back-backed gull;
- Herring gull;
- Arctic tern;
- Guillemot;
- Razorbill; and
- Puffin.

Disturbance / Displacement

14.4.4.5 There is the potential for disturbance / displacement to arise from the Project, BOWL, and from the EOWDC. Estimates of this risk are provided for the three proposed wind farm sites (Chapter 7.4: Ornithology), BOWL, and EOWDC in Table 14.4-5 below. The cumulative disturbance / displacement effects have been predicted through reference to the PVAs.

14.4.4.6 For BOWL, analysis has been undertaken to assess displacement for: fulmar, gannet, great skua, kittiwake, great black-backed gull, herring gull, Arctic tern, guillemot, razorbill and puffin (BOWL, 2012). For these species the potential effect was predicted to be minor or negligible (Table 14.4-5 below). Analysis was not undertaken for other species, for which the effect is predicted to also be **minor or negligible**.

14.4.4.7 For EOWDC, analysis has been undertaken to assess displacement for three species: guillemot, razorbill, and puffin (Bloor, 2011). For these species the potential effect was predicted to be negligible (Table 14.4-5 below). Analysis was not undertaken for other species, for which the effect was predicted to also be **negligible**.

14.4.4.8 The effects associated with the transmission infrastructure (the three proposed wind farm sites and BOWL) were all predicted to be **minor / negligible** and are not expected to contribute to cumulative effects.

Table 14.4-5 Summary of Cumulative Disturbance / Displacement Estimates / Effects

Species	Summary
Fulmar	Telford, Stevenson and MacColl wind farms: 97 breeding individuals during summer - minor effect. BOWL wind farm: a mean of 345 individuals during the summer - minor effect. EOWDC: negligible effect. Cumulative: **minor effect** (< 0.6 % increase in likelihood of 15 % population reduction).
Gannet	Telford, Stevenson and MacColl wind farms: 13 breeding individuals during summer - minor effect. BOWL wind farm: a mean of 49 individuals during the summer - minor effect. EOWDC: negligible effect. Cumulative: **minor effect** (< 0.6 % increase in likelihood of 15 % population reduction).
Shag	Telford, Stevenson and MacColl wind farms: too low to model – negligible effect. BOWL wind farm: too low to model - negligible effect. EOWDC: moderate effect. Cumulative: **negligible effect.**
Arctic Skua	Telford, Stevenson and MacColl wind farms: too low to model – negligible effect. BOWL wind farm: too low to model - minor effect. EOWDC: negligible effect. Cumulative: **minor effect.**

Species	Summary
Great Skua	Telford, Stevenson and MacColl wind farms: too low to model – negligible effect. BOWL wind farm: a mean of 19 individuals during the summer - minor effect. EOWDC: negligible effect. Cumulative: **minor effect.**
Kittiwake	Telford, Stevenson and MacColl wind farms: 98 breeding individuals during summer - minor effect. BOWL wind farm: a mean of 260 individuals during the summer - minor effect. EOWDC: negligible effect. Cumulative: **minor effect** (< 1 % increase in likelihood of 15 % population reduction).
Great Black-Backed Gull	Telford, Stevenson and MacColl wind farms: 14 breeding individuals during summer - minor effect. BOWL wind farm: a mean of 35 individuals during the summer - minor effect. EOWDC: negligible effect. Cumulative: **minor effect** (0.1 % increase in likelihood of 15-25 % population reduction).
Herring Gull	Telford, Stevenson and MacColl wind farms: too low to model – minor effect. BOWL wind farm: a mean of 5 individuals during the summer - minor effect predicted. EOWDC: negligible effect. Cumulative: **minor effect** (< 1.5 % decline compared to baseline prediction).
Arctic Tern	Telford, Stevenson and MacColl wind farms: too low to model – negligible effect. BOWL wind farm: a mean of 12 individuals during the summer - minor effect. EOWDC: minor effect. Cumulative: **minor effect.**
Guillemot	Telford, Stevenson and MacColl wind farms: 1,683 breeding individuals during summer - minor effect. BOWL wind farm: a mean of 2,655 individuals during the summer - minor effect. EOWDC: peak of 1,355 birds - negligible effect, and different populations involved. Cumulative: **minor effect**.
Razorbill	Telford, Stevenson and MacColl wind farms: 415 breeding individuals during summer - minor effect. BOWL wind farm: a mean of 404 individuals during the summer - minor effect. EOWDC: peak of 241 birds - minor effect, and different populations involved. Cumulative: **minor effect** (< 1 % increase in likelihood of 15 % population reduction).
Puffin	Telford, Stevenson and MacColl wind farms: 479 breeding individuals during summer - minor effect. BOWL wind farm: a mean of 368 individuals during the summer - minor effect. EOWDC: peak of 342 birds - minor effect, and different populations involved. Cumulative: **minor effect** (< 0.1 % increase in likelihood of 15 to 25 % population reduction).

14.4.4.9 In conclusion, no significant cumulative effects are predicted due to disturbance / displacement.

Collision

14.4.4.10 There is the potential for collisions with turbines to occur from the offshore wind farm projects listed above. Estimates of this risk are provided for the three proposed wind farm sites, BOWL, and the EOWDC in Table 14.4-6 below. There are no collision effects predicted for other developments (i.e. the marine energy developments and the offshore transmission infrastructure).

14.4.4.11 For BOWL, analysis has been undertaken to assess collision risk for eight species: fulmar, gannet, Arctic skua, great skua, kittiwake, great black-backed gull, herring gull, and Arctic tern (BOWL, 2012). For these species the potential effect was predicted to be minor or negligible (Table 14.4-6 below). Analysis was not undertaken for other species due to numbers being too low to model, and the risk for these species is predicted to be **negligible**.

14.4.4.12 For EOWDC, analysis has been undertaken to assess collision risk for eight seabird species: fulmar, gannet, cormorant, kittiwake, common gull, herring gull, Sandwich tern and guillemot (Bloor, 2011). For these species the potential effect was predicted to be negligible (Table 14.4-6 below). It should be noted that the analysis technique used for EOWDC was different to that used for Telford, MacColl and Stevenson (i.e. the Band (2011) model), but this information is used here as being the best available. Analysis was not undertaken for other species due to numbers being too low to model, and the risk for these species is predicted to be **negligible**.

14.4.4.13 The collision rates used are 99.5 % for gannet, 98.5 % for large gulls (herring and great black-backed gull), 99 % for small gulls (kittiwake), and 98 % for all other species (fulmar, Arctic skua, great skua, Arctic tern). The cumulative collision effects have been predicted through reference to the PVAs.

Table 14.4-6 Summary of Cumulative Collision Risk Estimates / Effects

Species	Summary
Fulmar	Telford, Stevenson and MacColl wind farms: too low to model - negligible effect. BOWL wind farm: 27 per year (99 % avoidance) - negligible effect; 53 at 98 % avoidance. EOWDC: < 1 per year - negligible effect. Cumulative: **minor effect**.
Gannet	Telford, Stevenson and MacColl wind farms: 57 per year - moderate effect. BOWL wind farm: 66 per year - negligible effect. EOWDC: 2 per year - moderate effect. Cumulative: **moderate-major effect.**
Shag	Telford, Stevenson and MacColl wind farms: too low to model - negligible effect. BOWL wind farm: too low to model - negligible effect. EOWDC: minor effect. Cumulative: **negligible effect.**

Species	Summary
Arctic Skua	Telford, Stevenson and MacColl wind farms: too low to model - negligible effect. BOWL wind farm: 6 per year - negligible effect; 11 at 98 % avoidance. EOWDC: negligible effect. Cumulative: **negligible effect.**
Great Skua	Telford, Stevenson and MacColl wind farms: too low to model - negligible effect. BOWL wind farm: 13 per year - negligible effect; 25 at 98 % avoidance. EOWDC: negligible effect. Cumulative: **negligible effect.**
Kittiwake	Telford, Stevenson and MacColl wind farms: 75 per year - minor effect. BOWL wind farm: 132 per year - negligible effect. EOWDC: 4 per year - negligible effect. Cumulative: **minor effect**
Great Black-Backed Gull	Telford, Stevenson and MacColl wind farms: 105 per year - minor effect. BOWL wind farm: 302 per year - minor effect; 453 at 98.5 % avoidance. EOWDC: minor effect. Cumulative: **moderate-major effect.**
Herring Gull	Telford, Stevenson and MacColl wind farms: 156 per year - moderate effect. BOWL wind farm: 494 per year - minor effect; 741 at 98.5 % avoidance. EOWDC: 7 per year - moderate effect. Cumulative: **moderate-major effect.**
Arctic Tern	Telford, Stevenson and MacColl wind farms: too low to model - negligible effect. BOWL wind farm: 8 per year - negligible effect; 16 at 98 % avoidance. EOWDC: negligible effect. Cumulative: **negligible effect.**
Guillemot	Telford, Stevenson and MacColl wind farms: too low to model - negligible effect. BOWL wind farm: 13 per year - negligible risk; 27 at 98 % avoidance. EOWDC: < 1 per year - minor effect. Cumulative: **negligible effect.**
Razorbill	Telford, Stevenson and MacColl wind farms: too low to model - negligible effect. BOWL wind farm: 1 per year - negligible effect; 1 at 98 % avoidance. EOWDC: minor effect. Cumulative: **negligible effect.**
Puffin	Telford, Stevenson and MacColl wind farms: too low to model - negligible effect. BOWL wind farm: too low to model - negligible effect. EOWDC: minor effect. Cumulative: **negligible effect.**

14.4.4.14 In conclusion, due to the inclusion of the BOWL wind farm, significant cumulative collision effects are predicted for gannet, great black-backed gull and herring gull.

14.4.5 Assessment of WDA

14.4.5.1 As mentioned above the WDA may be developed for a maximum of 500 MW of capacity if less than 1.5 GW of capacity is delivered by the Project in the EDA. As the three proposed wind farms were assessed for a total of 1.5 GW the effects of the three wind farm sites cannot be added to the effects of the WDA.

14.4.5.2 The WDA assessment presented below in Table 14.4-7 have been estimated by scaling the estimates for the three proposed wind farm sites based on the WDA being 33 % in MW capacity (equating approximately to number of turbines, disturbance / displacement risk and collision risk). The collision rates used are 99.5 % for gannet, 98.5 % for large gulls (herring and great black-backed gull), 99 % for small gulls (kittiwake), and 98 % for all other species (fulmar, Arctic skua, great skua, Arctic tern).

Table 14.4-7 Summary of Cumulative Disturbance / Displacement and Collision Risk Estimates / Effects

Species	Disturbance / displacement estimates / effects	Collision risk estimates / effects
Fulmar	WDA: 33 breeding individuals during summer - minor effect.	WDA: minor - negligible effect.
Gannet	WDA: Four breeding individuals effected during summer - minor effect.).	WDA: 18 per year – minor-moderate effect.
Shag	MORL WDA: low numbers – negligible effect.	WDA: minor - negligible effect.
Arctic Skua	MORL WDA: low numbers – negligible effect.	WDA: minor - negligible effect.
Great Skua	MORL WDA: low numbers – negligible effect.	WDA: minor - negligible effect.
Kittiwake	MORL WDA: 33 breeding individuals during summer - minor effect.	WDA: 25 per year - minor effect.
Great Black-Backed Gull	WDA: low numbers – minor effect.	WDA: 52 per year - minor effect.
Herring Gull	WDA: low numbers – minor effect.	WDA: 522 per year - minor effect.
Arctic Tern	WDA: low numbers – negligible effect.	WDA: minor - negligible effect.
Guillemot	WDA: 337 breeding individuals during summer - minor effect.	WDA: minor - negligible effect.
Razorbill	WDA: 83 breeding individuals during summer - minor effect.	WDA: minor - negligible effect.
Puffin	WDA: 96 breeding individuals during summer - minor effect.	WDA: minor - negligible effect.

14.4.6 Commentary on Other Relevant Development Proposals for which Insufficient Information is Available to Allow Detailed Cumulative Impact Assessment

14.4.6.1 Marine energy developments in the Pentland Firth and Orkney waters would have been included in the CIA if data were available. There is the potential for these developments to affect ornithological interests through disturbance / displacement, habitat loss and mortality through underwater collision. The key species are potentially likely to be subject to cumulative effects, are those that forage underwater in tidal streams, such as guillemot, razorbill and puffin.

14.4.6.2 Based on foraging distances there is the potential for gannet breeding in the Firth of Forth Islands SPA to forage with the three proposed wind farm sites, which would require the inclusion in the CIA of the Firth of Forth Round 3 zone, Inch Cape offshore wind farm, and Neart Na Gaoithe offshore wind farm (Forth and Tay wind projects). However, data from tracking studies (Technical Appendix 4.5 A) show that individuals from this SPA very rarely forage within the three proposed wind farm sites, and so the Forth and Tay wind projects have been excluded from the CIA.

14.4.7 Cumulative Effects on Designated Sites

14.4.7.1 The methodology used for assessing cumulative effects on designated sites has followed the methodology described in 7.4.4 in Chapter 7.4 (Ornithology).

14.4.7.2 For relevant SPAs, the effects on each species were assessed based on the following five criteria:

1. Changes in the distribution or extent of the habitats supporting the species;
2. Changes in the structure, function and supporting processes of habitats supporting the species;
3. Significant disturbance to the qualifying species;
4. Changes in the distribution of the species within the sites; and
5. The species being maintained as a viable component of the sites in the long-term, and therefore the integrity of the sites.

14.4.7.3 These assessments are provided below in Table 14.4-8 for the East Caithness Cliffs SPA, North Caithness Cliffs SPA and Troup, Pennan and Lion's Heads SPA.

14.4.7.4 The main effects from the Project on the SPAs assessed below arise from the effects of the three proposed wind farms. Therefore the assessment summary presented below for the MORL Project relates to the assessment detailed in Chapter 7.4 (Ornithology). The PVA outputs for SPA species are provided in Appendix A of Technical Appendix 4.5 A.

Table 14.4-8 Summary of Cumulative Effects on Designated Sites

Designated Site	Designated Features	Criteria	MORL Project	Cumulative (MORL, BOWL, EOWDC)	Sensitivities for Telford, Stevenson and MacColl, and OFTO	Mitigation Method (if required)
East Caithness Cliffs SPA	Fulmar	1	Chapter 7.1 predicts negligible to minor effects on benthic habitats.	Minor effect; not significant.	No difference.	None additional to that outlined in Chapter 7.4
		2	Chapter 7.2 predicts effects on prey species to be minor during construction / decommissioning and operation.			
		3	Risk of disturbance assessed as minor (certain) – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
		4	No effect on distribution within SPA due to the three proposed wind farm sites being 20 km from the SPA.			
		5	No effect on species viability – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
	Shag	1	Chapter 7.1 predicts negligible to minor effects on benthic habitats.	Minor effect; not significant.	No difference.	None additional to that outlined in Chapter 7.4
		2	Chapter 7.2 predicts effects on sandeels to be minor during construction / decommissioning and operation.			
		3	Risk of disturbance assessed as minor (certain) due to low numbers on sites.			
		4	No effect on distribution within SPA due to the three proposed wind farm sites being 20 km from the SPA.			
		5	No effect on species viability.			
	Cormorant	1	No effects on habitat – not recorded on site.	Minor effect; not significant.	No difference.	None additional to that outlined in Chapter 7.4
		2	No effects on habitat – not recorded on site.			
		3	Risk of disturbance assessed as negligible (certainty – probable) due to none recorded on the sites (coastal species).			
		4	No effect on distribution within SPA due to the three proposed wind farm sites being 20 km from the SPA.			

Designated Site	Designated Features	Criteria	MORL Project	Cumulative (MORL, BOWL, EOWDC)	Sensitivities for Telford, Stevenson and MacColl, and OFTO	Mitigation Method (if required)
East Caithness Cliffs SPA (continued)		5	No effect on species viability.			
	Peregrine	1	No effects on habitat – not an offshore species.	Minor effect; not significant.	No difference.	None additional to that outlined in Chapter 7.4
		2	No effects on habitat – not an offshore species.			
		3	Risk of disturbance assessed as negligible (certainty – probable) due to being an onshore species.			
		4	No effect on distribution within SPA due to the three proposed wind farm sites being 20 km from the SPA.			
		5	No effect on species viability.			
	Kittiwake	1	Chapter 7.1 predicts negligible to minor effects on benthic habitats.	Minor effect; not significant.	No difference.	None additional to that outlined in Chapter 7.4
		2	Chapter 7.2 predicts effects on sandeels to be minor during construction / decommissioning and operation.			
		3	Risk of disturbance assessed as minor (certain) – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
		4	No effect on distribution within SPA due to the three proposed wind farm sites being 20 km from the SPA.			
		5	No effect on species viability – the effect on the SPA population is predicted to be a < 1 % increase in likelihood of 10 % reduction.			
	Herring gull	1	Chapter 7.1 predicts negligible to minor effects on benthic habitats.	Moderate-major effect; significant.	Cumulative impact would still be moderate-major for any combination considered cumulatively with the BOWL wind	None additional to that outlined in Chapter 7.4
		2	Chapter 7.2 predicts effects on prey species to be minor during construction / decommissioning and operation.			
		3	Risk of disturbance assessed as minor (certain) – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			

Designated Site	Designated Features	Criteria	MORL Project	Cumulative (MORL, BOWL, EOWDC)	Sensitivities for Telford, Stevenson and MacColl, and OFTO	Mitigation Method (if required)
East Caithness Cliffs SPA (continued)		4	No effect on distribution within SPA due to the three proposed wind farm sites being 20 km from the SPA.		farm.	
		5	No effect on species viability – the effect on the SPA population is predicted to be a 10 % increase in likelihood of 10 % reduction.			
	Great black-backed gull	1	Chapter 7.1 predicts negligible to minor effects on benthic habitats.	Moderate-major effect; significant.	Cumulative impact would still be moderate-major for any combination considered cumulatively with the BOWL wind farm.	None additional to that outlined in Chapter 7.4
		2	Chapter 7.2 predicts effects on prey species to be minor during construction / decommissioning and operation.			
		3	Risk of disturbance assessed as minor (certain) – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
		4	No effect on distribution within SPA due to the three proposed wind farm sites being 20 km from the SPA.			
		5	No effect on species viability – the effect on the SPA population is predicted to be a 1 % increase in likelihood of 10 % reduction.			
	Guillemot Guillemot (continued)	1	Chapter 7.1 predicts negligible to minor effects on benthic habitats.	Minor effect; not significant.	No difference.	None additional to that outlined in Chapter 7.4
		2	Chapter 7.2 predicts effects on sandeels to be minor during construction / decommissioning and operation.			
		3	Risk of disturbance assessed as minor (certain) – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
		4	No effect on distribution within SPA due to the three proposed wind farm sites being 20 km from the SPA.			
		5	No effect on species viability – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			

Designated Site	Designated Features	Criteria	MORL Project	Cumulative (MORL, BOWL, EOWDC)	Sensitivities for Telford, Stevenson and MacColl, and OFTO	Mitigation Method (if required)
East Caithness Cliffs SPA (continued)	Razorbill	1	Chapter 7.1 predicts negligible to minor effects on benthic habitats.	Minor effect; not significant.	No difference.	None additional to that outlined in Chapter 7.4
		2	Chapter 7.2 predicts effects on sandeels to be minor during construction / decommissioning and operation.			
		3	Risk of disturbance assessed as minor (certain) – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
		4	No effect on distribution within SPA due to the three proposed wind farm sites being 20 km from the SPA.			
		5	No effect on species viability – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
	Puffin	1	Chapter 7.1 predicts negligible to minor effects on benthic habitats.	Minor effect; not significant.	No difference.	None additional to that outlined in Chapter 7.4
		2	Chapter 7.2 predicts effects on sandeels to be minor during construction / decommissioning and operation.			
		3	Risk of disturbance assessed as minor (certain) – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
		4	No effect on distribution within SPA due to the three proposed wind farm sites being 20 km from the SPA.			
	Puffin (continued)	5	No effect on species viability – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
Overall CIA for East Caithness Cliffs SPA: effect on SPA integrity due to prediction of increased mortality of herring gull and great black-backed gull arising cumulatively with BOWL wind farm.						
North Caithness Cliffs SPA	Fulmar	1	Chapter 7.1 predicts negligible to minor effects on benthic habitats.	Minor effect; not significant.	No difference.	None additional to that

Designated Site	Designated Features	Criteria	MORL Project	Cumulative (MORL, BOWL, EOWDC)	Sensitivities for Telford, Stevenson and MacColl, and OFTO	Mitigation Method (if required)
North Caithness Cliffs SPA		2	Chapter 7.2 predicts effects on prey species to be minor during construction / decommissioning and operation.			outlined in Chapter 7.4
		3	Risk of disturbance assessed as minor (certain) – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
		4	No effect on distribution within SPA due to the three proposed wind farm sites being 33 km from the SPA.			
		5	No effect on species viability – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
	Peregrine	1	No effects on habitat – not an offshore species.	Minor effect; not significant.	No difference.	None additional to that outlined in Chapter 7.4
		2	No effects on habitat – not an offshore species.			
		3	Risk of disturbance assessed as negligible (certainty – probable) due to being an onshore species.			
		4	No effect on distribution within SPA due to the three proposed wind farm sites being 33 km from the SPA.			
		5	No effect on species viability.			
	Kittiwake	1	Chapter 7.1 predicts negligible to minor effects on benthic habitats.	Minor effect; not significant.	No difference.	None additional to that outlined in Chapter 7.4
		2	Chapter 7.2 predicts effects on sandeels to be minor during construction / decommissioning and operation.			

Designated Site	Designated Features	Criteria	MORL Project	Cumulative (MORL, BOWL, EOWDC)	Sensitivities for Telford, Stevenson and MacColl, and OFTO	Mitigation Method (if required)
North Caithness Cliffs SPA		3	Risk of disturbance assessed as minor (certain) – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
		4	No effect on distribution within SPA due to the three proposed wind farm sites being 33 km from the SPA.			
		5	No effect on species viability – the effect on the SPA population is predicted to be a < 1 % increase in likelihood of 10 % reduction.			
	Guillemot	1	Chapter 7.1 predicts negligible to minor effects on benthic habitats.	Minor effect; not significant.	No difference.	None additional to that outlined in Chapter 7.4
		2	Chapter 7.2 predicts effects on sandeels to be minor during construction / decommissioning and operation.			
		3	Risk of disturbance assessed as minor (certain) – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
		4	No effect on distribution within SPA due to the three proposed wind farm sites being 33 km from the SPA.			
		5	No effect on species viability – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
	Razorbill	1	Chapter 7.1 predicts negligible to minor effects on benthic habitats.	Minor effect; not significant.	No difference.	None additional to that outlined in Chapter 7.4
		2	Chapter 7.2 predicts effects on sandeels to be minor during construction / decommissioning and operation.			

Designated Site	Designated Features	Criteria	MORL Project	Cumulative (MORL, BOWL, EOWDC)	Sensitivities for Telford, Stevenson and MacColl, and OFTO	Mitigation Method (if required)
North Caithness Cliffs SPA		3	Risk of disturbance assessed as minor (certain) – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
		4	No effect on distribution within SPA due to the three proposed wind farm sites being 33 km from the SPA.			
		5	No effect on species viability – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
	Puffin	1	Chapter 7.1 predicts negligible to minor effects on benthic habitats.	Minor effect; not significant.	No difference.	None additional to that outlined in Chapter 7.4
		2	Chapter 7.2 predicts effects on sandeels to be minor during construction / decommissioning and operation.			
		3	Risk of disturbance assessed as minor (certain) – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
		4	No effect on distribution within SPA due to the three proposed wind farm sites being 33 km from the SPA.			
		5	No effect on species viability – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
Overall CIA for North Caithness Cliffs SPA: no effect predicted on SPA integrity.						
Troup, Pennan and Lion's Heads SPA	Fulmar	1	Chapter 7.1 predicts negligible to minor effects on benthic habitats.	Minor effect; not significant.	No difference.	None additional to that outlined in Chapter 7.4
		2	Chapter 7.2 predicts effects on prey species to be minor during construction / decommissioning and operation.			

Designated Site	Designated Features	Criteria	MORL Project	Cumulative (MORL, BOWL, EOWDC)	Sensitivities for Telford, Stevenson and MacColl, and OFTO	Mitigation Method (if required)
Troup, Pennan and Lion's Heads SPA		3	Risk of disturbance assessed as minor (certain) – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
		4	No effect on distribution within SPA due to the three proposed wind farm sites being 49 km from the SPA.			
		5	No effect on species viability – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
	Kittiwake	1	Chapter 7.1 predicts negligible to minor effects on benthic habitats.	Minor effect; not significant.	No difference.	None additional to that outlined in Chapter 7.4
		2	Chapter 7.2 predicts effects on sandeels to be minor during construction / decommissioning and operation.			
		3	Risk of disturbance assessed as minor (certain) – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
		4	No effect on distribution within SPA due to the three proposed wind farm sites being 49 km from the SPA.			
		5	No effect on species viability – the effect on the SPA population is predicted to be a < 1 % increase in likelihood of 10 % reduction.			
	Herring gull	1	Chapter 7.1 predicts negligible to minor effects on benthic habitats.	Minor effect; not significant.	No difference.	None additional to that outlined in Chapter 7.4
		2	Chapter 7.2 predicts effects on prey species to be minor during construction / decommissioning and operation.			

Designated Site	Designated Features	Criteria	MORL Project	Cumulative (MORL, BOWL, EOWDC)	Sensitivities for Telford, Stevenson and MacColl, and OFTO	Mitigation Method (if required)
Troup, Pennan and Lion's Heads SPA		3	Risk of disturbance assessed as minor (certain) – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
		4	No effect on distribution within SPA due to the three proposed wind farm sites being 49 km from the SPA.			
		5	No effect on species viability – the effect on the SPA population is predicted to be a 10 % increase in likelihood of 10 % reduction.			
	Guillemot	1	Chapter 7.1 predicts negligible to minor effects on benthic habitats.	Minor effect; not significant.	No difference.	None additional to that outlined in Chapter 7.4
		2	Chapter 7.2 predicts effects on sandeels to be minor during construction / decommissioning and operation.			
		3	Risk of disturbance assessed as minor (certain) – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
		4	No effect on distribution within SPA due to the three proposed wind farm sites being 49 km from the SPA.			
		5	No effect on species viability – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
	Razorbill	1	Chapter 7.1 predicts negligible to minor effects on benthic habitats.	Minor effect; not significant.	No difference.	None additional to that outlined in Chapter 7.4
		2	Chapter 7.2 predicts effects on sandeels to be minor during construction / decommissioning and operation.			

Designated Site	Designated Features	Criteria	MORL Project	Cumulative (MORL, BOWL, EOWDC)	Sensitivities for Telford, Stevenson and MacColl, and OFTO	Mitigation Method (if required)
Troup, Pennan and Lion's Heads SPA		3	Risk of disturbance assessed as minor (certain) – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
		4	No effect on distribution within SPA due to the three proposed wind farm sites being 49 km from the SPA.			
		5	No effect on species viability – the effect on the SPA population is predicted to be a < 0.1 % increase in likelihood of 10 % reduction.			
Overall CIA for Troup, Pennan and Lion's Heads SPA: no effect predicted on SPA integrity.						

14.4.7.5 The above cumulative assessments have determined significant effects on the East Caithness Cliffs SPA integrity due to prediction of increased mortality of herring gull and great black-backed gull arising cumulatively with BOWL wind farm.

14.4.7.6 No significant cumulative effects are predicted on the Conservation Objectives of North Caithness Cliffs SPA and Troup, Pennan and Lion's Head SPA, and therefore no change to population viability of their designated species.

14.4.7.7 No cumulative effects on the additional SPAs considered in Chapter 7.4 (Ornithology) are predicted, due to the distance from the MORL sites, and therefore no detailed CIA has been undertaken.

14.4.7.8 No detailed assessment of cumulative effects on designated sites from developments that are at an earlier stage has been possible. However, based on the information available, no additional significant effects are predicted given the distance from the developments listed in Paragraph 14.4.2.3 to the designated sites assessed above and the lack of ecological connectivity.

14.4.8 References

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14.5 Intertidal Ecology

14.5.1 Assessment of Cumulative Impacts

14.5.1.1 It is considered that there is no potential for cumulative impacts on intertidal ecology.

14.5.1.2 Chapter 4.6 (Intertidal Ecology) showed that there are no highly mobile or wide ranging intertidal ecology receptors associated with Fraserburgh Beach (fish and shellfish are dealt with in Chapter 10.2: Fish and Shellfish Ecology). Accordingly, the appropriate spatial scale for cumulative impact assessment in this regard is very local. Furthermore, likely significant direct and indirect effects of the installation and operation of the wind farm development on intertidal ecology will be temporary and highly localised (see Chapter 10.5).

14.5.1.3 Consultation with Aberdeenshire Council indicates that there are no foreseeable plans or projects within the vicinity of the proposed export cable landfall and therefore no interaction between scheme effects and those arising from other foreseeable projects. Cumulative impact assessment on intertidal ecology is therefore not appropriate.

14.5.1.4 Effects of the installation of two separate cable bundles at the landfall site at Fraserburgh Beach have been assessed in Chapter 10.5 (Intertidal Ecology). The two separate cable trenches (one per cable bundle) will be constructed at least one year apart and recovery of intertidal habitats is expected to be complete well within the intervening period. No spatial or temporal interaction of associated impacts will therefore occur.

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14.6 Terrestrial Ecology

14.6.1 Summary

14.6.1.1 This chapter presents the results of assessment of the likely significant cumulative impacts upon terrestrial ecology arising from the proposed onshore transmission infrastructure (OnTI) in conjunction with other existing or reasonably foreseeable onshore developments and activities. MORL's approach to the assessment of cumulative impacts is described in Chapter 1.3 (Environmental Impact Assessment).

14.6.1.2 A summary of the likely significant cumulative impacts is provided in Table 14.6–1 below. None of the individual impacts on valued ecological receptors (VERs) identified in Chapter 10.6 (Terrestrial Ecology) were considered to increase due to potential cumulative impacts, and hence no additional mitigation is required. In general terms it is considered that there is limited potential for cumulative impacts to occur.

14.6.1.3 This chapter contains relevant information on the offshore transmission infrastructure (OsTI) to allow Scottish Ministers and Marine Scotland to make decisions on the applications for Section 36 consents and Marine Licences for the three proposed wind farm sites and the OfTI. Discussions are ongoing with landowners to determine the exact location and layout of the substation(s) on their land within the preferred onshore substation area. This will be finalised following production of a masterplan by the owner / operator of the Peterhead Power Station compound which forms part of the preferred area. Once the precise location and layout for the onshore substation(s) and export cable location has been confirmed, an application for planning permission for the OnTI will be submitted to Aberdeenshire Council and will be supported by this ES and such further information as is required to support the planning application.

Table 14.6–1 Cumulative Impact Summary

Receptor	MORL OnTI	Cumulative Impact	Mitigation Method (if required)
Construction / Decommissioning			
Loch of Strathbeg SPA (habitat loss)	Negligible	Negligible	None required
Loch of Strathbeg SPA (disturbance / displacement)	Negligible	Negligible	None required
Terrestrial Breeding Birds	Negligible	Negligible	None required
Coastal Wintering Birds	Negligible	Negligible	None required
Buchan Ness to Collieston SAC	Negligible	Negligible	None required
Loch of Strathbeg Ramsar and SSSI	Negligible	Negligible	None required
Rora Moss SSSI	Negligible	Negligible	None required
Blanket Bog	Minor	Minor	None required

Receptor	MORL OnTI	Cumulative Impact	Mitigation Method (if required)
Acid / Neutral Flush	Minor	Minor	None required
Dry Modified Bog	Negligible	Negligible	None required
Dune Grassland Coastland	Negligible	Negligible	None required
Semi–improved and Unimproved Neutral Grassland	Negligible	Negligible	None required
Running and Standing Water	Minor	Minor	None required
Swamp, Marginal and Inundation Vegetation	Negligible	Negligible	None required
Marshy Grassland	Negligible	Negligible	None required
Waterbodies	Negligible	Negligible	None required
Plantation and Semi–Natural Woodlands	Negligible	Negligible	None required
Arable Land	Negligible	Negligible	None required
Improved Grassland	Negligible	Negligible	None required
Tall Ruderal Herb and Fern	Negligible	Negligible	None required
Amenity Grassland	Negligible	Negligible	None required
Dense / Scattered Scrub	Negligible	Negligible	None required
Ephemeral / Short Perennial	Negligible	Negligible	None required
Otter	Minor	Minor	None required
Badger	Minor	Minor	None required
Bat Roost and Habitat Suitability	Negligible–minor	Negligible–minor	None required
Operation			
Loch of Strathbeg SPA	Negligible	Negligible	None required
Terrestrial Breeding Birds	Negligible	Negligible	None required
Coastal Wintering Birds	Negligible	Negligible	None required
Buchan Ness to Collieston SAC	Negligible	Negligible	None required
Loch of Strathbeg Ramsar and SSSI	Negligible	Negligible	None required
Rora Moss SSSI	Negligible	Negligible	None required
Blanket Bog	Minor	Minor	None required
Acid / Neutral Flush	Negligible	Negligible	None required

Receptor	MORL OnTI	Cumulative Impact	Mitigation Method (if required)
Dry Modified Bog	Negligible	Negligible	None required
Dune Grassland / Open Dune Coastline	Negligible	Negligible	None required
Semi–Improved and Unimproved Neutral Grasslands	Negligible	Negligible	None required
Watercourses and Standing Water	Negligible	Negligible	None required
Swamp, Marginal and Inundation Vegetation	Negligible	Negligible	None required
Marshy Grassland	Negligible	Negligible	None required
Waterbodies	Negligible	Negligible	None required
Plantation and Semi–Natural Woodlands	Negligible	Negligible	None required
Arable Land	Negligible	Negligible	None required
Improved Grassland	Negligible	Negligible	None required
Tall Ruderal Herb and Fern	Negligible	Negligible	None required
Amenity Grassland	Negligible	Negligible	None required
Dense / Scattered Scrub	Negligible	Negligible	None required
Ephemeral / Short Perennial	Negligible	Negligible	None required
Mud / Sand Coastland and Boulders / Rock Coastland	Negligible	Negligible	None required
Otter	Minor	Minor	None required
Badger	Minor	Minor	None required
Bat Roost and Habitat Suitability	Negligible–Minor	Negligible–Minor	None required

14.6.2 Assessment of Cumulative Impacts

14.6.2.1 The scope of cumulative impacts assessment for terrestrial ecology considered planned developments which match the following criteria:

- Within 5 km of the onshore cable route;
- For which environmental impact assessments were available;
- Those which are current (expired applications were excluded: those dated prior to 05 March 2007);
- Those which are live (withdrawn or refused applications were excluded); and
- For structures greater than 50 m in height.

14.6.2.2 Planned developments comprising structures greater than 50 m in height were considered because this height category represents an appropriate distinguishing feature between large, commercial developments, in particular wind farms, and smaller applications. Selecting planned developments comprising structures greater than 50 m in height, allowed potentially relevant developments to be highlighted from Aberdeenshire Council's extensive list of applications.

14.6.2.3 The scope of cumulative impacts assessment highlighted ten planned developments. These were assessed for potential cumulative impacts on the VERs identified in Chapter 10.6 (Terrestrial Ecology). Environmental impact assessments were not available for all planned developments for all VERs. The developments and activities considered within the cumulative impact assessment are listed in Table 14.6–2 below.

Table 14.6–2 Cumulative Impact Assessment Scope – Developments and Activities

Name	Details	Evidence	Planning Status	Construction Timescale
Within the Study Area				
Peterhead Power Station	550 MW combined cycle gas turbine power station fuelled by a hydrogen–rich fuel stream, associated buildings, plant and 2 x 90 m high gas turbine stacks for generation of carbon–free electricity for national transmission system; also formation of emergency access road from highway (A90 trunk road);	ES, published Aug 2006 (ERM, 2006)	Approved Jun 2007	Not known
Within 5 km of the Study Area				
Overside and Greenwellheads Farms (wind farm)	Erection of 4 x 99.5 m high (to blade tip) 2.3 MW wind turbines.	ES, published Mar 2011 (Green Cat Renewables, 2011a)	In planning	Not known
St Fergus Moss (wind farm)	Three wind turbines, < 100 m to blade tip with associated infrastructure, proposed by The Greenspan Agency	ES, published Jun 2010 (The Greenspan Agency, 2010a)	Approved, Feb 2012	Not known
Ednie Farms (Bruxiehill Wind Farm Extension)	Erection of 2 x 79.6 m high (to blade tip) 800 KW wind turbines and associated infrastructure.	Environmental report, published Nov 2009 (Green Cat Renewables, 2009)	Approved Sep 2010	Not known
Redbog Extension (wind farm)	Two wind turbines, < 80 m to blade tip with associated infrastructure, proposed by Peter Chapman	ES, published Nov 2010 (Green Cat Renewables, 2010)	In planning	Not known

Name	Details	Evidence	Planning Status	Construction Timescale
Middleton of Rora (wind farm)	Erection of 81 m high (to blade tip) 850 KW wind turbine, also construction of substation, hardstanding, foundation and access track.	Environmental report, published Aug 2010 (The Greenspan Agency, 2010b)	Approved Sep 2011	Not known
Mains of Inverugie (wind farm)	Erection of 79.6 m high (to blade tip) wind turbine and associated infrastructure.	Environmental report, published Nov 2011 (Green Cat Renewables, 2011b)	In planning	Not known
Keith Inch and Green Hill (wind farm)	Erection of 2 x 99.5 m high (to blade tip) 2.3 MW wind turbines and associated infrastructure.	Environmental Statement, published Mar 2011 (Green Cat Renewables, 2011c)	In planning	Not known
Gallows Hill, Inverquhomery Wind Turbine	Erection of 79.6 m high (to blade tip) wind turbine and associated infrastructure.	Environmental Statement, published Aug 2011 (Fowlie *et al.*, 2011)	Approved Mar 2012	Not known
Aldie Wind Farm	Erection of 2 x 87 m high (to blade tip) wind turbines and associated infrastructure.	Supporting Statement (TNEI, 2011)	In planning	Not known

14.6.3 Methodology

14.6.3.1 The assessment methodology followed that outlined in Chapter 1.3 (Environmental Impact Assessment).

14.6.3.2 Information on the design and effects of the other developments considered in the assessment has been drawn from the evidence sources listed in Table 14.6–2 above.

14.6.4 Detailed Impact Assessment

14.6.4.1 Likely significant effects considered in this cumulative impact assessment are:

- Habitat loss and disturbance / displacement on Loch of Strathbeg SPA during construction, operation and decommissioning;
- Habitat loss and disturbance / displacement on terrestrial breeding birds during construction, operation and decommissioning;
- Habitat loss and disturbance / displacement on coastal wintering birds during construction, operation and decommissioning;
- Pollution and damage / disturbance on habitats during construction, operation and decommissioning;
- Habitat loss and disturbance on otter during construction, operation and decommissioning;
- Habitat loss and disturbance on badger during construction, operation and decommissioning; and
- Habitat loss and disturbance on bat roost and habitat suitability during construction, operation and decommissioning.

Habitat Loss and Disturbance on Loch of Strathbeg SPA

14.6.4.2 Environmental impact assessments for most proposed developments considered in the cumulative assessment include consideration of impacts from predicted collision risk and displacement on geese from proposed wind farms within the vicinity of the OnTI, and from habitat loss and displacement from the proposed Peterhead Power Station. A summary of results from individual assessments presented in the ES are described below:

Bruxiehill

14.6.4.3 The predicted annual collision rate of pink–footed geese at 99 % avoidance was 9.4 birds per year. As this number is small relative to the overall population of the species wintering at Loch of Strathbeg SPA, impact significance was predicted to be minor.

Inverquhomery

14.6.4.4 A minor impact was predicted.

Keith Inch and Green Hill

14.6.4.5 A negligible impact was predicted.

Mains of Inverugie

14.6.4.6 Only low numbers of geese passed over or fed near the planned development. A minor impact was predicted.

Middleton of Rora

14.6.4.7 The predicted annual collision rate of pink–footed geese at 99 % avoidance was 4,304 birds per year. As this equates to 0.01 % of the qualifying population at the Loch of Strathbeg SPA, impact significance was predicted to be negligible.

Overside and Greenwellheads Farms

14.6.4.8 The predicted annual collision rate of pink–footed geese at 99 % avoidance was 134 birds per year. This equates to 2,850 collisions during the 25 years lifespan of the planned development, which would cause the mortality of approximately 3.4 % of the Loch of Strathbeg SPA qualifying wintering population and 4.3 % of the qualifying migratory population. It was concluded that the proposed wind farm was unlikely to affect the SPA population dynamics and the impact significance was predicted to be minor.

Peterhead Power Station

14.6.4.9 A negligible impact was predicted.

Redbog

14.6.4.10 The proposed site does not hold any Loch of Strathbeg Goose Management Scheme refuges and birds will feed within 200 m of turbines (Larsen and Masden, 2000), thus the number of geese potentially displaced was considered to be low. Predicted collision mortality over the 25 years lifespan of the proposed wind farm

was approximately 0.5 % of the Loch of Strathbeg SPA qualifying wintering pink–footed goose population and 2.7 % of the qualifying migratory population. However, two existing turbines at Redbog, which lie 800 m from the planned development at the nearest point, were described to have been operational for two and a half years with no evidence of any bird collisions. Furthermore, these existing turbines are fitted with vibration sensors on each blade which log unusual vibrations. Investigation of each turbine's log showed that no unusual vibration alarms had been generated, supporting the view that no bird collisions had occurred at Redbog. Collision mortality was therefore thought to be much lower than predicted. A negligible impact was predicted.

St Fergus Moss

14.6.4.11 The predicted annual collision rate of pink–footed geese at 99 % avoidance was 13.5 birds per year. A negligible impact was predicted.

14.6.4.12 No significant cumulative impacts are predicted on habitat loss and disturbance on Loch of Strathbeg SPA. Additional information on Habitats Regulations Appraisal is provided in 14.6.5 below.

Habitat Loss and Disturbance on Terrestrial Breeding and Coastal Wintering Birds

14.6.4.13 Potential cumulative impacts on breeding and wintering birds included consideration of impacts from habitat loss and displacement from developments within the vicinity of the OnTI. A summary of results from individual assessments presented in this ES are described below:

Aldie Farm

14.6.4.14 The impact of collision risk on breeding herring gulls was predicted to be negligible.

Bruxiehill

14.6.4.15 All species observed were common or locally common in northeast Scotland. Most breeding birds would not be adversely affected by the development, although it is possible that one pair of skylark and one pair of either lapwing or oystercatcher would be displaced. Wintering birds would not be affected by the planned development. All species observed were considered to be more vulnerable to change in local agricultural practice than to the slight loss of habitat caused by the development. A negligible impact was predicted.

Inverquhomery

14.6.4.16 Four yellowhammer and four skylark breeding territories were recorded, however as similar breeding habitat is available locally, impacts were considered to be low. A negligible impact was predicted for both breeding and wintering birds.

Keith Inch and Green Hill, Main of Inverugie, Middleton of Rora, Overside and Greenwellheads Farms and Peterhead Power Station

14.6.4.17 A negligible impact on breeding and wintering birds was predicted.

Redbog

14.6.4.18 A modest amount of displacement of breeding birds in the immediate vicinity of the planned development was predicted, however as the site is surrounded by a large amount of similar habitat, overall impacts on regional populations were predicted to be low. Impact significance was predicted to be minor for breeding birds and negligible for wintering birds.

St Fergus Moss

14.6.4.19 No species recorded were of high or medium sensitivity. One pair of ringed plover may be displaced by the development; however the plovers were recorded during 2009 surveys but were not observed in 2010. Most breeding birds were recorded in vegetation along the site boundary and avoided the open peat where the turbines are proposed. The proposed development would not have an adverse affect on breeding or wintering species. A negligible impact was predicted.

14.6.4.20 No significant cumulative impacts from habitat loss and disturbance on terrestrial breeding and coastal wintering birds are predicted given the minor and negligible individual impacts predicted above.

Pollution and Damage / Disturbance of Habitats

14.6.4.21 Potential cumulative impacts on habitats included consideration of impacts from pollution and damage / disturbance from developments within the vicinity of the OnTI. A summary of results from individual assessments presented in this ES are described below:

Bruxiehill

14.6.4.22 Most of the habitat was intensively managed agricultural land sown with cereal crops. Remaining habitat was restricted to field margins or the margins of ditches and burns, and a small deciduous plantation. Only one plant of local importance (great willowherb) and none of national importance was found. Botanically, the development was considered to be of low sensitivity. A negligible impact was predicted.

Mains of Inverugie, Middleton of Rora, Overside and Greenwellheads Farms, Peterhead Power Station and Redbog

14.6.4.23 A negligible impact was predicted.

14.6.4.24 All the above developments were considered to have a negligible impact and therefore no significant cumulative impacts are predicted.

Habitat Loss and Disturbance on Otter

14.6.4.25 Potential cumulative impacts otter included consideration of impacts from habitat loss and disturbance from developments within the vicinity of the OnTI. Only negligible impacts were predicted from the Peterhead Power Station and St Fergus Moss developments and therefore no significant cumulative impacts on otter are predicted.

Habitat Loss and Disturbance on Badger

14.6.4.26 Only negligible impacts were predicted from the Peterhead Power Station development and therefore no cumulative impacts on badger are predicted.

Habitat Loss and Disturbance on Bat Roost and Habitat Suitability

14.6.4.27 A summary of results from individual assessments presented in this ES relevant to the assessment of cumulative impacts on bat roost and habitat suitability are described below:

Overside and Greenwellheads Farms

14.6.4.28 Only a single pipistrelle was recorded. A negligible impact was predicted.

Peterhead Power Station

14.6.4.29 A negligible impact was predicted.

Redbog

14.6.4.30 Both proposed turbines are close to intersections of linear features of a type commonly used by bats. However, observations during 2010 surveys did not indicate these features were used at dusk with much regularity or by particularly high numbers of bats. Impact significance was predicted to be moderate.

St Fergus Moss

14.6.4.31 Only a single bat pass was recorded. A negligible impact was predicted.

14.6.4.32 No significant cumulative impacts from the OnTI on bat roost and habitat suitability are predicted and therefore the predicted impact remains negligible–minor.

14.6.5 Cumulative Effects on Designated Sites

14.6.5.1 As part of Habitat Regulations Appraisal, predicted cumulative effects on designated sites will be assessed by the Competent Authority through consideration of each site's conservation objectives (refer to Chapter 4.1: Designated Sites). Two internationally designated sites, VERs, were considered in this cumulative impact assessment:

- Loch of Strathbeg SPA (relevant qualifying species: greylag goose and pink–footed goose); and
- Buchan Ness to Collieston SAC (qualifying habitat: vegetated sea cliffs).

14.6.5.2 The assessment by the Competent Authority is based on whether the following designated site conservation objectives will be affected by negative cumulative impacts:

- To maintain the population / distribution / extent of qualifying species / habitats on site;
- To maintain the distribution and extent of habitats supporting qualifying species;

- To maintain the structure, function and supporting processes of qualifying habitats and habitats supporting qualifying species;
- No significant disturbance to qualifying species / habitats; and
- To maintain distribution of typical species as components of qualifying habitats.

14.6.5.3 None of the individual impacts on the two internationally designated sites VERs identified in Chapter 10.6 (Terrestrial Ecology) arising from proposed projects were considered to result in significant cumulative effects. It is considered that there is limited potential for conservation objectives to be affected by negative cumulative impacts.

14.6.6 References

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