Contents

Abbreviations and Acronyms

ADR	Air Defence Radar
AGLV	Area of Great Landscape Value
AIS	Automatic Identification System
ATC	Air Traffic Control
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CFWG	Commercial Fisheries Working Group
DDV	Drop Down Video
DECC	Department of Energy and Climate Change
EC	European Commission
EMF	Electromagnetic Field
ESAS	European Seabirds at Sea
EU	European Union
FoF	Firth of Forth
FTMS	Forth and Tay Modelling System
FTOWDG	Forth and Tay Offshore Wind Developers Group
GBS	Gravity Base Substructures
GDL	Garden and Designed Landscape
HRA	Habitats Regulations Appraisal
ICOL	Inch Cape Offshore Limited
INSPIRE	Impulse Noise Sound Propagation and Impact Range Estimator
kJ	Kilojoules (unit of energy)
km	Kilometres
LCA	Landscape Character Assessment
LLA	Local Landscape Area

m	Metres
mg/l	Milligram per litre
MCA	Maritime and Coastguard Agency
MCEU	Marine Consents and Environment Unit
MOD	Ministry of Defence
MPA	Marine Protected Area
NATS	National Air Traffic Service
NCN	National Cycle Network
NIS	Non Indigenous Species
nm	Nautical mile
NnG	Neart Na Gaoithe Offshore Wind Limited
NRA	Navigational Risk Assessment
O&M	Operations and Maintenance
OfTW	Offshore Transmission Works
OSP	Offshore Substation Platform
PAD	Protocol for Archaeological Discoveries
PEXA	Practice and Exercise Areas
PMF	Priority Marine Feature
PSR	Primary Surveillance Radar
PTS	Permanent Threshold Shift
SAC	Special Area of Conservation
SLVIA	Seascape, Landscape and Visual Impact Assessment
SNH	Scottish National Heritage
SPA	Special Protection Area
SSC	Suspended Sediment Concentrations
STW	Scottish Territorial Waters
UK	United Kingdom

V	Volts
VOR	Valued Ornithological Receptor
WSI	Written Scheme of Investigation
WTG	Wind Turbine Generator
ZTV	Zone of Theoretical Visibility

23 Summary of Effects

23.1 Introduction

1 This chapter presents a summary of the key findings of the assessment of the environmental effects of the Project, alone and cumulatively with other projects. The predicted residual environmental impacts of the proposals are reported for each receptor assessed, taking account of the potential for significant positive and negative environmental effects, and mitigation which has been committed to by Inch Cape Offshore Limited (ICOL).

2 A collated summary of the findings of the Habitats Regulations Appraisals (HRA) is also presented.

23.2 Metocean and Coastal Processes

23.2.1 Assessment – the Project

3 Overall, the metocean and coastal processes assessment identified no significant direct or indirect impacts from the Project on the identified receptors – either in isolation or cumulatively, in the near- or far-fields, or in the short or long term.

4 The presence of construction vessels during the construction, operation and decommissioning phase of the Project will cause no meaningful direct change to water levels, current velocities or wave heights, or indirectly to the sediment transport regime.

5 During the construction, operation and decommissioning phase of the Project cable burial by energetic means would lead to local peaks in SSC of 300 mg/l above background (taken as an average across a strip approximately 200 m wide either side of the cable trench). Very localised peaks may be higher (probably in the thousands of mg/l), but will be limited to within a few tens of metres of burial activities. Most of the disturbed sediment will settle out within tens or a few hundred metres of the cable, over a period of seconds or minutes. The finest (mud and silt) sediment fractions will persist for longer in the water column, but will travel less than three kilometres and settle out within a few hours.

6 The deposition footprint resulting from the cable burial process (both inter-array cables and the Offshore Export Cable) is predicted to be thin, with average depths of up to five millimetres across a corridor extending 100 m either side of the cable.

7 During construction in the Development Area, the disposal of sediment from dredging for GBS installation will lead to local peaks in SSC of 4000 mg/l above background, dropping to 100 mg/l or less above background within 100 m of the discharge location. The resulting plumes will remain within the near-field (i.e. the Development Area), and will settle out within one to two hours of discharge.

8 The deposition footprint resulting from the disposal of sediment dredged for GBS installation would create very localised peaks of one to two metres in the immediate vicinity of the release point. Only 6.7 per cent of the Development Area would be covered to depths of five

centimetres or greater, with the effects likely to be long-lived or permanent through the life of the Project. Large settling depths are not predicted outside the near-field (i.e. the Development Area).

9 During construction, the formation of scour pits around jacket structures would lead to local peaks in SSC of 10 mg/l – 100 mg/l above background, dropping to 10 mg/l or less above background within 100 m of each structure. The resulting plumes will settle out within one hour of release. Scour pits are likely to reach a stable equilibrium depth within about one month, after which no further development of the scour pit will occur under normal conditions.

10 The deposition footprint resulting from scour around jacket foundations would create very localised peaks of about one metre in the immediate vicinity of the structure. Only 3.1 per cent of the Development Area would be covered to depths of five centimetres or greater, although the effects are likely to be long-lived or permanent through the life of the Project. The scour pits themselves would cover less than one per cent of the Development Area. Large settling depths are not predicted outside the near-field (i.e. the Development Area).

11 The construction phase of the Project will have minimal impact on designated nature conservation sites with geological interest features. The closest site, the potential Firth of Forth Banks Complex Marine Protected Area (MPA) might experience an increase in SSC of up to 30 mg/l above background during the disposal of dredged sediment for nearby GBS. This impact will be transient and will settle out within a few hours after the discharge stops. Settled sediment depths will be low – much less than one centimetre. Equivalent impacts from jacket scour or cable burial activities will be less than those relating to GBS dredging. All other designated conservation sites are distant from the Development Area (greater than 10 km).

12 The presence of GBS in the Development Area during the operational phase of the Project would cause a small modification of tides in the near-field; with changes in the far-field being inconsequential. Water levels in the near-field would change by up to 0.03 per cent of the mean spring tidal range. Average tidal currents would change by between three and seven per cent of peak currents on a mean spring tide. With respect to the wave regime small changes in the near-field and far-field up to about 10 km from the Development Area will be experienced. There will be no effect on the coastal zone. Wave heights would change by up to about two per cent of the average significant wave height or 0.5 per cent of the highest significant wave likely in any one year.

13 Alterations to water levels, currents and waves, due to the presence of GBS in the Development Area or the Offshore Export Cable in the Offshore Export Cable Corridor during the operational phases, would not cause important changes to SSCs or the sediment transport regime in either the near-field or far-field.

23.2.2 Assessment – the Project with Other Projects

14 Cumulative impacts on SSCs and the sediment transport regime due to the Project during construction are primarily limited to the impacts arising from the disposal of sediment dredged during GBS preparation and from Offshore Export Cable burial activities. However, these activities alone have spatially limited and/or short-lived impacts. The impacts will be additive, but still very limited in space and/or time and as such the cumulative impacts of the Project during construction will be only slightly higher than the impacts due to the Development Area and Offshore Export Cable Corridor considered in isolation.

15 Cumulative impacts due to the Project during the operational phase will be similar to those impacts due to the Development Area alone. This is because there is no infrastructure within the Offshore Export Cable Corridor that would directly affect water levels, currents or waves, or indirectly affect SSCs, the sediment transport regime, or identified receptors.

16 Cumulative impacts may exist due to the Project in conjunction with other developments or activities such as the proposed Neart na Gaoithe (NnG) and Firth of Forth (FoF) projects and associated offshore transmission infrastructure. All other developments and activities were scoped out either on the basis of distance from the Project, or because it was considered that there were no elements which would result in a cumulative impact.

17 During construction, impacts resulting from the Project in isolation were determined to be spatially localised and/or short-lived and impacts from the NnG and FoF developments are likely to be similar in extent. It was therefore determined that there would be no substantial interaction between the Project and other projects during the construction phase.

18 The presence of GBS in the Development Area and in the other two offshore wind farms during the operational phase of the Project would modify tides. These changes would be more widespread than for the Project in isolation, although still very small in magnitude. Water level changes in the far-field would not be measurable and average tidal currents would change by up to seven per cent of peak current speeds on a mean spring tide, in the near-field.

19 The presence of GBS in the Development Area and in the NnG and FoF Phase 1 projects during the operational phase of the Project would be of a similar magnitude to the Project in isolation, but they cover a larger area. The far-field and effects are predicted close to the coastal zone.

20 Alterations to water levels, currents and waves due to the presence of GBS in the Development Area and in the other two offshore wind farms would not cause important changes to SSCs or the sediment transport regime in either the near-field or far-field.

23.3 Underwater Noise

23.3.1 Assessment – the Project

21 A strong avoidance reaction, where the majority of animals are expected to avoid an area, would be expected for harbour porpoises at a range of 140 metres around the cable installation (i.e. trenching) noise source. All other species and noise sources (with the exception of impact piling) are expected to have a lower range of avoidance. A mammal would have to be within one metre of cable installation to be considered at risk of hearing damage.

22 For the maximum noise emission expected during impact piling, a potentially lethal effect is calculated at a range of six metres from the pile and physical injury within a range of 40 metres. It is very unlikely that marine mammals will be exposed to noise levels which have the potential to cause death/physical injury because a mitigation protocol has been developed by the Statutory Nature Conservation Agencies in order to reduce this risk to negligible levels.

23 For a single piling location, auditory injury is calculated to occur where a mammal is within the following approximate average range at the start of piling. Pinnipeds typically have much larger ranges as a consequence of the proposed criteria.

- 'Low-frequency cetacean': Worst case, 7 km; Most likely, 5.5 km.
- 'Mid-frequency cetacean': Worst case, 2.5 km; Most likely, 2.0 km.
- 'High-frequency cetacean': Worst case, 3.0 km; Most likely, 2.0 km.
- 'Pinniped (in water)': Worst case, 31.0 km; Most likely, 27.5 km.

24 Where there is piling at both locations simultaneously within the Development Area, the following average ranges are calculated, approximated to the nearest 500 m.

- 'Low-frequency cetacean': Worst case, 13.5 km; Most likely, 11.5 km.
- 'Mid-frequency cetacean': Worst case, 7.5 km; Most likely, 6.5 km.
- 'High-frequency cetacean': Worst case, 8.0 km; Most likely, 6.5 km.
- 'Pinniped (in water)': Worst case, 39.0 km; Most likely, 35.5 km.

25 The average range for 'strong avoidance' for a variety of key species is given below, approximated to the nearest 500 metres:

- Herring: 24 km;
- Salmon: 1.5 km;
- Trout: <500 m;
- Bottlenose dolphin: 12.5 km;
- Harbour porpoise: 18 km;

- Harbour seal: 15 km; and
- Minke whale: 31.5 km.

26 A lower likelihood of behavioural avoidance will occur at greater ranges.

27 The level of noise generated by the operational wind farm has been estimated. Generally, operational Wind Turbine Generators (WTGs) do not emit high noise levels and it is not expected that this noise will reach levels where any species of fish or mammal will have a strong aversive reaction.

28 During decommissioning, similar noise sources are expected as during construction, but with the notable exception of impact piling. As such, noise levels and potential effects should be in line with those noted above, where any trenching is likely to have the greatest impact.

23.3.2 Assessment – the Project with Other Projects

29 There is the potential for cumulative effects to occur should the FoF Phase 1 or NnG wind farms in the Firth of Forth (FoF) be constructed at the same time as the Project. These would generate their own noise, primarily where the foundations are also installed by impact piling. Generally, the propagation of noise over large distances would only be sufficient to cause a potential auditory injury to a mammal where an animal fled towards a noise source from their starting position on commencement of piling, or where an animal begins near the middle of the piling locations.

30 The ranges of behavioural avoidance where piling occurs simultaneously at multiple wind farms have been calculated. There is a risk of overlap of strong avoidance ranges from multiple wind farms especially for the most hearing sensitive species of fish (e.g. herring) and the marine mammals.

23.4 Benthic Ecology

23.4.1 Assessment – the Project

31 Some of the effects assessed on benthic ecology are long term but spatially restricted e.g. loss of original habitat. Others effects are of a large scale, such as an increase in SSC, but are localised and short term. Of the potential effects that have been assessed as occurring at the Development Area and Offshore Export Cable Corridor, even for the most sensitive habitats, impacts were no more than moderate significance on the benthic ecology.

32 The assessment showed that for the Development Area:

- A maximum of 5.54 km2 of seabed will be disturbed by direct, temporary construction activities, equating to 3.69 per cent of the Development Area. This resulted from seabed preparation and installation of GBS type WTGs, offshore substation platforms (OSPs), meteorological masts (met masts) and inter-array cable installation.

- Modelling of the effects on the hydrodynamic conditions and sediment regime relating to increases and SSC and associated deposition were taken from Chapter 10: Metocean and Coastal Processes.
- The maximum loss of original habitat during the operational phase of works in the Development Area will be 1.87 km2, equating to 1.25 per cent of the Development Area. This resulted from footprint of GBS type WTGs, OSPs, met masts and associated scour protection and inter-array cable protection.
- The creation of new habitat will equal the footprint of original habitat lost.
- Operation and Maintenance (O&M) activities will cause further disturbance to 0.14 km2 of seabed annually during the operational phase of the Project within the Development Area, equating to less than 0.09 per cent of the Development Area.

33 The assessment showed that for the Offshore Export Cable Corridor:

- The maximum total area of seabed disturbed by direct, temporary construction activities relating to Export Cable installation in the subtidal areas is 3.0 km2, equating to 3.0 per cent of the Offshore Export Cable Corridor. At Cockenzie and Port Seton a maximum of 2.0 per cent and 1.1 per cent of the intertidal area will be disturbed by temporary construction activities.
- Modelling of the effects on the hydrodynamic conditions and sediment regime relating to increases and SSC and associated deposition were taken from Chapter 10.
- The loss of original habitat will occur over a maximum area of 0.6 km2 (0.6 per cent of the Offshore Export Cable Corridor) during the operational phase due to cable protected by means other than burial.
- The creation of new habitat will equal the footprint of original habitat lost.
- O&M activities will cause further disturbance to 0.007 km2 of seabed annually during the operational phase of the Wind Farm and OfTW, equating to less than 0.01 per cent of the Offshore Export Cable Corridor.

34 Additional impacts on the benthic ecology at the Development Area and Offshore Export Cable Corridor that were assessed (with no significant impacts identified) include:

- Electromagnetic field (EMF) and thermal effects from cabling;
- Release of contaminants from sediments;
- Increased risk of pollution events;
- Scour and associated increases to SSC and sediment deposition;
- Introduction of Non Indigenous Species; and
- Introduction of new substrata and subsequent colonisation.

35 No significant impact interactions were identified throughout the assessment.

23.4.2 Assessment – the Project with Other Projects

36 Cumulatively, the Project (Wind Farm and OfTW within in Development Area and Offshore Export Cable Corridor) was assessed as a whole, as well as in combination with other projects in the area, specifically the offshore wind farms (the FoF Phase 1 and the NnG projects). No increase in significance as a result of cumulative impacts were identified either over the Project as a whole or across all projects assessed.

23.5 Natural Fish and Shellfish

23.5.1 Assessment – the Project

37 Development of the Project would not result in any effects on fish and shellfish receptors, either alone or cumulatively with other projects of more than moderate significance.

38 Piling noise during construction activities could potentially impact on hearing specialists such as herring, sprat and cod, and their spawning aggregations. However, site specific herring larvae data demonstrated that spawning activity of herring is concentrated in the northern part of the Buchan spawning grounds (north of the Development Area) and also the southern spawning ground associated with the Banks component (south of Development Area). Cod and sprat spawning occurs over much of the North Sea and any avoidance of the noise contour areas will not result in exclusion of individuals from the wider available spawning locations. Thus the impact of Project, related construction noise on hearing specialists will be moderate.

39 Indirect disturbance as a result of increased SSC during construction, as determined in *Chapter 10*, is not predicted to significantly impact any of the receptor groups due to the short duration and localised nature of the effect. Deposition of sediment is most likely to impact those species with a close association with the benthos such as sandeel. Habitats within the Development Area and Offshore Export Cable Corridor have been assessed during a site specific study and sediment deposition may affect areas of habitat defined as "suitable" for sandeel. However, very few sandeel were reported during site specific surveys or historical data on the area. Sediment deposition is unlikely to alter the characteristics of the sediment in terms of particle size and it is not predicted to lead to significant change in the sandeel population in the area as there are much more extensive areas of sub-prime and prime sandeel habitat available in the wider region. Thus, sediment deposition will result in at most minor/moderate impacts on the wider sandeel stocks.

40 Direct temporary disturbance of seabed habitats during construction, and long term loss of habitat during operation of the Project will affect areas of 8.56 km^2 and 2.47 km^2 respectively. These are considered to be small in the context of similar habitat beyond the Project areas. Most receptor groups have wide geographic ranges and broad diets and any changes to the species composition or availability of prey are not predicted to cause any significant effects to fish or shellfish populations in the area. Species with greater site fidelity (e.g. sandeel, shellfish and demersal spawners) are most likely to be affected by habitat disturbance and loss. Any effects during construction however, will be relatively localised and intermittent and the receptors are expected to exhibit high recoverability.

41 Effects of EMF associated with inter-array cabling and the Export Cable during operation is considered to be of negligible magnitude for electro-sensitive elasmobranchs. Small numbers of these species were captured during the baseline surveys and data on nursery areas indicates low intensity areas of wide ranging species in the vicinity of the Project. Additionally, due to the small areas around the cables where avoidance behaviours may be elicited in some individuals, interactions between sensitive species and EMF will be limited.

42 The receptor group, SAC qualifying species, has been assigned high sensitivity due to their conservation importance. Whilst uncertainty relating to movements during the marine phase of migratory SAC species is acknowledged, at most moderate impacts have been identified for these species as no barriers to migration will be created through either construction or operation of the Project alone or with other projects. Furthermore, impacts relating to habitat loss or disturbance are considered minor/moderate in relation to their wider migratory ranges.

43 It is not considered that activities relating to operational maintenance or decommissioning would result in any impacts on natural fish and shellfish receptors beyond those of the construction phase.

23.5.2 Assessment – the Project with Other Projects

44 Cumulative noise impacts of the Project with other projects is not considered to result in an increase in the significance of impacts for noise, as the area of disturbance predominately extends to the east and south of the Development Area and has little consequence for the spawning herring stock or other receptor groups. In addition to this, cumulative impacts are not considered to result in an increase in significance for effects relating to SSC and deposition and direct temporary disturbance or long term loss of habitat.

23.6 Marine Mammals

23.6.1 Assessment – the Project

45 It is predicted that the greatest impact on marine mammals from the Wind Farm and OfTW will occur during the construction phase, due to underwater noise from impact piling when there could be medium term (during piling) significant effects. Potential impacts to marine mammals from piling include potential Permanent Threshold Shift (PTS); change in the threshold of audibility and behavioural displacement.

46 Impact and population modelling undertaken indicates that impacts from piling activity will be minor in the long term for all marine mammal species. In the medium term (during piling activities), the impact of potential onset of PTS is considered to be up to moderate for seal species and minor for cetaceans and minke whale. During the period of piling, potential displacement due to avoidance is predicted to be of major impact to harbour and grey seals, moderate impact to bottlenose dolphin and minor impact to other cetaceans and minke whale. During construction periods when no impact piling is occurring, marine mammals may react to other sources of noise such as cable installation (trenching), rock placement,

cable laying, dredging and vessel noise. The impact of increased underwater noise from non-piling construction activities on all marine mammals is considered to be minor.

47 The potential increased risk to seal species from corkscrew injury due to increased vessel traffic during construction is considered to be moderate to harbour seals and minor to grey seals. The risk to both species during operation and maintenance is considered to be minor.

48 Other potential impacts on marine mammals from construction activities include collision with vessels, barrier effect due to avoidance of vessels, accidental pollution incidents and changes in prey availability. The impacts from these construction activities are all considered to be minor.

49 Potential impacts on marine mammals in the operation and maintenance phase of the Wind Farm and OfTW include behavioural disturbance as a consequence of operational noise, habitat loss due to the long term presence of the WTGs and cable protection, disturbance from EMF, toxic contamination, changes in prey availability, accidental pollution events and collision with maintenance vessels. Theses impacts are all considered to be minor.

50 Cumulative impacts of the Wind Farm and OfTW have been assessed. The key potential cumulative impacts on marine mammals that have been identified are noise from non-piling and piling related activities, collision risk from, and avoidance of, associated vessels and changes in prey availability. Through impact and population modelling, the long term significance impact of all of these effects has been determined to be minor. The potential impact to seals from corkscrew injuries from the use of vessels with ducted propellers for the Project would remain moderate for harbour seals and be minor for grey seals.

51 There is the potential for impact interactions associated with the construction of the Wind Farm and OfTW. These potential interactions have been identified as in-direct changes in prey availability, total increased collision risk (vessel movement and ducted propellers) and total increased underwater noise from construction activities such as piling, vessel movements and cable installation activities. However, it is likely that during the construction phase marine mammals will spend an increased proportion of time foraging outwith the Development Area (due to the direct impacts of increased underwater noise and disturbance), and therefore be at reduced collision risk and unaffected by changes in prey availability within the Development Area and Offshore Export Cable Corridor. As a consequence, impact interactions are assessed as of minor impact.

23.6.2 Assessment – the Project with Other Projects

52 Cumulative impacts of the Project and other projects with potentially over-lapping effects were also considered. These projects include other proposed offshore wind farms as well as non-wind farm projects. As for the Project assessment, the impacts arising from the noise produced during piling is considered to have the potential to cause significant effects. Impact and population modelling undertaken indicates that cumulative impacts from piling activity will be minor in the long term for all marine mammal species. The impact of increased underwater noise from non-piling construction activities, in-direct effect of habitat loss and change in prey availability and increased collision risk from vessels on all marine

mammals is considered to be minor. The potential increased risk to seal species from corkscrew injury due to cumulative increased vessel traffic during construction of the offshore wind farms of the Firths of Forth and Tay is considered to be moderate to harbour seals and minor to grey seals.

23.7 Ornithology

23.7.1 Assessment – the Project

53 It is predicted that during the construction phase the largest impact on birds from the Development Area works will occur through indirect disturbance via prey impacts from impact piling during the breeding season, when there could be minor/moderate effects on Arctic tern and common tern and minor effects on razorbill.

54 During construction periods ornithological receptors may react to sources of direct disturbance such as vessel movements. The impacts of increased disturbance from non-piling construction activities on all receptors is considered to be negligible.

55 It is predicted that during the operational phase the largest impact on birds from the Inch Cape Offshore Wind Farm will occur through displacement and collision risk. Population modelling was undertaken for four species (kittiwake, guillemot, razorbill and puffin) to support the impact assessment. Minor displacement impacts during the breeding season were predicted for kittiwake, guillemot, razorbill and puffin. Impacts from collision were predicted to be minor for kittiwake and gannet. Effects for all other receptors and all other seasons were considered to be negligible.

56 Potential impacts of decommissioning on ornithological receptors are predicted to be no greater than those concluded for the construction phase.

57 The key potential impacts on ornithological receptors associated with the works in the Offshore Export Cable Corridor are predicted to be direct disturbance and indirect impacts through changes in availability of prey species. At most, these impacts are considered to be negligible.

58 The assessment considered all cumulative impacts of the Project (the Wind Farm and OfTW) during construction, operation and decommissioning. The significance of all of these has been determined as negligible.

23.7.2 Assessment – the Project with Other Projects

59 Cumulative impacts of the Project with other projects during the construction phase were considered for all receptors. The key impact was identified to be indirect disturbance impacts via prey availability. Effects on receptors during the breeding season were determined as moderate for Arctic tern and common tern, and as minor for kittiwake and razorbill. Effects for all other receptors and all other seasons were considered to be negligible.

60 The cumulative assessment for the Project with other projects predicted a major impact on the regional breeding kittiwake population through collision risk. No other significant impacts were predicted for any Valued Ornithological Receptor (VOR).

61 The potential for impact interactions associated with the Wind Farm and the OfTW were assessed for the Project alone as well as cumulatively. No impact interactions were identified.

23.8 Seascape, Landscape and Visual

23.8.1 Assessment – the Project

62 It is recognised that commercial wind energy developments are likely to give rise to some significant effects on seascape, landscape or visual amenity. The Wind Farm will consist of a large number of tall WTGs, occupying an extensive sea area, but located at distances of over 15.4 km from the nearest point on the shore.

63 It is considered that the construction and operation activities relating to the installation of the Offshore Export Cable will not impact seascape, landscape and visual effects, with the exception of the construction of the landfall at either Cockenzie or Seton Sands, where there may be significant seascape and visual effects.

64 Significant effects on seascape areas are predicted for SA4: Montrose Bay; SA5 Long Craig; SA6 Lunan Bay; SA7 Lang Craig to The Deil's Heid; SA8 Arbroath to Monifieth; and SA12 St Andrews to Fife Ness. These would be the closest seascape character areas to the Development Area.

65 There would be, at most, Moderate effects on any of the Landscape Character areas in the SLVIA Study Area.

66 Significant effects are predicted on the St Andrews to Fife Ness Local Landscape Areas (LLA), some locations in Cambo Garden and Designed Landscape (GDL) and the Isle of May, one of the Forth Islands LLAs.

67 For visual amenity receptors, significant effects are predicted for properties in coastal settlements which have open and unobstructed seaward views in Aberdeenshire including Inverbervie, St Cyrus, Gourdon and Johnshaven; in Angus including, Braehead of Lunan, Auchmithie, Carnoustie and Arbroath; in Fife from, St Andrews, and parts of Crail. Parts of inland settlements in Fife which are close to the coastline such as Kingsbarns may experience significant effects.

68 Significant effects are predicted for road users on sections of the A92, and for recreational users of the Fife Coastal Path and National Cycle Network (NCN) Route 1 mainly between Arbroath, Montrose and Carnoustie and between Inverbervie and Montrose. For passengers on the main rail line between Edinburgh and Aberdeen significant effects are predicted for short sections of the route between Carnoustie and Arbroath. Significant effects are predicted for recreational users of coastal facilities at distances of up to approximately 20

km distance from the Development Area and potentially up to 35 km distance for locations with open sea views towards the Inch Cape WTGs and OSPs.

23.8.2 Assessment – the Project with Other Projects

69 The cumulative assessment considers the effects of the Inch Cape WTGs and OSPs, in addition to 33 onshore wind energy developments (including 11 existing or consented projects) and the two other offshore wind energy developments in the Forth and Tay, NnG and FoF Phase 1. The effects have been assessed in respect of seascape and landscape character areas; landscape designations including GDLs, LLAs, and Areas of Great Landscape Value (AGLVs); and visual amenity receptors including residents, recreational users of footpaths and cycle routes and other facilities and road users.

70 Significant cumulative effects are predicted for the same receptors as identified above and additionally on the seascape character area of SA11 St Andrews Bay; St Andrews Links LLA; Tentsmuir Coast LLA and St Andrews Links GDL.

23.9 Cultural Heritage and Marine Archaeology

23.9.1 Assessment – the Project

71 The potential for submerged prehistoric landscapes has been considered. Based on current evidence, including analysis and interpretation of marine geophysical data, the probability for any such material to exist within the Development Area and Offshore Export Cable Corridor is considered to be negligible.

72 The potential for impacts upon the setting of selected cultural heritage assets from the WTGs and OSPs has been considered in line with Historic Scotland's setting guidance with specific regard to the cultural heritage sensitivity of the receptors (a separate but related assessment on aesthetic impacts has been made as part of *Chapter 16*. The WTGs will be visible on the horizon from parts of the coastline during the operational phase of the Project.

73 Cultural heritage assets have been selected in consultation with Historic Scotland and local council archaeology services and consist of a number of Scheduled Monuments and listed buildings. The identified assets were assessed through site visits, wirelines and visualisations. In all of these cases the impacts to their setting arising from the Project is considered not to be significant.

74 No impact interactions have been identified with regard to cultural heritage.

23.9.2 Assessment – the Project with Other Projects

75 Cumulative impacts on cultural heritage assets for direct and indirect physical processes in all phases have been assessed and are considered not to be significant.

23.10 Commercial Fisheries

23.10.1 Assessment – the Project

76 Adverse impacts arising from the construction and operation of the Wind Farm and OfTW on commercially harvested and recreational fish and shellfish populations are discussed in full in *Chapter 13: Natural Fish and Shellfish* (see *Section 23.5*).

77 During construction and operation of the Wind Farm and OfTW (within the Development Area), fishing activity is expected to be excluded from certain areas, or access restricted during discrete periods. Moderate impacts on the scallop fishery are predicted due to potential loss of fishing ground and displacement of fishing activity during both the construction and operation phases; it is however recognised that a number of skippers of scallop dredge vessels may be reluctant to fish within the operational site due to the safety implications associated with scallop dredge gear and snagging risks and therefore a Moderate/Major significance of loss of fishing area on these vessels.

78 The impact of loss of grounds and displacement on the squid and crab and lobster fisheries is assessed as low/moderate.

79 During construction in the Development Area, a low/moderate impact is predicted on the crab and lobster fishery that uses static gear due to interference with fishing activities arising from navigational conflict. The impact on the scallop, squid and *nephrops* fisheries that use mobile gear is assessed as low. For all fisheries the impacts relating to interference with fishing activities during the operation phase of the Wind Farm and OfTW are reduced to negligible/low.

80 During the construction phase of the works in the Offshore Export Cable Corridor, moderate impacts have been identified on the *nephrops* and crab and lobster fisheries as a result of temporary loss or restricted access to traditional fishing grounds and displacement of fishing activity into other areas. The impact on the scallop and squid fisheries is assessed as low/moderate. This impact drops to negligible/low for the operational period.

81 There are potential safety risks to fishing vessels arising during the construction of inter-array and Export Cables which will be removed by the application of safety/exclusion zones during construction and completion of post construction mitigation such as a protocol for removal of seabed obstacles post construction.

82 Increases in steaming times to traditional fishing grounds during the construction and operation of both the Wind Farm and OfTW have been assessed as negligible/low for all fisheries.

83 It is predicted that the Wind Farm and OfTW do not result in an increase in significance of impacts when considered cumulatively for:

- Impacts on the scallop fishery as a result of loss of or restricted access to traditional fishing grounds and displacement of fishing activity;

- Impacts on the crab and lobster fishery as a result of loss or restricted access to fishing grounds, displacement and interference with fishing activities; and
- Safety, displacement and interference with fishing vessels.

84 This is because there are generally different fisheries targeted in each distinct geographical area considered in isolation, which result in a limited incremental impact when considered cumulatively.

23.10.2 Assessment – the Project with Other Projects

85 Although it is recognised that the Project will result in an increase in potential effects when considered cumulatively with other offshore developments in the Forth and Tay area, the incremental impact has not been considered as more significant than the Project in isolation. This conclusion applies to all fisheries in all phases of the projects.

86 The wide operational range of certain scallop dredging vessels (in some instances all around the United Kingdom (UK)) may result in their being affected by additional marine development around the UK. The cumulative effect upon the nomadic scallop fishery is dependent upon the productivity of grounds affected and the scale of effect identified for each project.

23.11 Shipping and Navigation

23.11.1 Assessment – the Project

87 For the assessment of effects of the Wind Farm and OfTW during construction, all effects can be reduced to a negligible/low level following the implementation of the Additional Mitigation measures.

23.11.2 Assessment – the Project with Other Projects

88 Cumulative effects were also assessed to consider the effect of multiple offshore wind farms in the outer Firth of Forth and Firth of Tay area (FoF Phase 1 and NnG). In the situation that construction activities are being undertaken simultaneously at more than one wind farm within the outer Firth of Forth and Firth of Tay region, all residual effects were assessed to be negligible/low. When considering the cumulative effects during the operation and maintenance phases of multiple projects, the following were identified as having the most significant residual effects:

- The cumulative effect on commercial vessels, potentially resulting in increased transit times and distances, vessel to vessel collision risk and vessel to structure allision risk (moderate residual effect);
- The cumulative effect on commercial fishing vessels, potentially resulting in deviations to avoid the development areas and vessel to structure allision risk (minor/moderate residual effect);

- The cumulative effect on marine radar systems, affecting all sea users (minor/moderate residual effect); and
- The cumulative effect on emergency responders, potentially increasing the need for emergency response activities and restricting access to casualties within the projects (minor/moderate residual effect).

23.12 Military and Civil Aviation

23.12.1 Assessment – the Project

89 As the entire OfTW infrastructure located in the Offshore Export Cable Corridor is below sea level, it will not have an impact on aviation interests.

90 During construction, and prior to commissioning, WTG blades will not be rotational. As a result the infrastructure will not be processed and presented onto control displays by the radar. Therefore, there will be no significant impacts on radar during the construction phase.

91 The direct, permanent effect of clutter as generated by the Wind Farm may hamper the radar operator's ability to distinguish actual aircraft returns from those created by the WTGs, and therefore degrade the safety and efficiency of the air traffic services being provided.

92 Once construction is completed and the WTGs operational, area of radar clutter is likely to be produced on the radar displays leading to a permanent operational effect. Clutter likely to be generated by the Wind Farm could obscure aircraft under control. The clutter could also hide genuine, conflicting aircraft targets. The employment of appropriate Additional Mitigation measures is under discussion with the MOD and will be implemented prior to construction commencing.

93 During decommissioning activities the static nature of the infrastructure is also such that it will not be processed and presented onto control displays by the radar, and as such the WTG decommissioning processes will have no significant effect on the effected radar systems; however the implemented mitigation measures will continue to operate whilst any WTGs remain operational.

23.12.2 Assessment – the Project with Other Projects

94 To assess the potential for a cumulative effect, radar line of sight analysis was completed on the location of the NnG and the FoF Phase 1 projects. Results indicated that there was likely to be a cumulative impact to the Leuchars and Buchan radar systems from the Project with NnG and the FoF Phase 1 projects. All three projects are potentially detectible by the Leuchars ATC PSR and both the Wind Farm and FoF Phase 1 projects are potentially detectible to the Buchan ADR. The application of appropriate mitigation measures are under discussion with the MOD and a collaborative approach to mitigation by FTOWDG will be sought where possible.

23.12.3 Additional Mitigation

95 For mitigation relating to the Buchan ADR, additional information will be provided to the MOD on layout and WTG height options within the Development Area, to allow the MOD to further refine an impact assessment. This may reduce potential impact on the ADR at Buchan to an acceptable level and remove the requirement for any technical mitigation. If not viable, then implementation and integration of a technical mitigation solution will be agreed as per the process set out by the MOD. Technical mitigation, if required, will most likely be in the form of modifications or upgrade to the Buchan T92 ADR.

96 Implementation and integration of technical mitigation solution for Leuchars ATC PSR will be agreed as per the process set out by the MOD. This assumes that the MOD requirements as stipulated in the User Requirements Document can be met. It is likely that mitigation will be informed by the MOD Technology Demonstration Programme which is due to report in early 2014.

23.13 Other Human Considerations

23.13.1 Marine Recreational Activities

97 A significant but short term impact on recreational sailing has been predicted during the construction phase of the Offshore Export Cable. This effect would be particularly experienced by those undertaking informal sailing and generally for inshore waters and would be limited to the busiest periods of construction. Similarly a significant short term cumulative impact is predicted on recreational sailors when the effects of construction of the Wind Farm and OfTW are assessed cumulatively, and if construction of the proposed NnG offshore wind farm takes place at the same time as the Project.

98 No significant Project impacts, cumulative impacts with other projects, or impact interactions are predicted on other marine or coastal recreational activities from the construction of the Wind farm and OfTW.

99 The landfall for the Offshore Export Cable will have a short term effect on other recreational uses of the coastline (regardless of the option selected) however, with mitigation through effective communications with recreational interests, short term impacts are predicted to be minor although they will increase for limited periods of time in the immediate vicinity of the Export Cable landfall as cable laying works will temporarily preclude recreation and access to the affected part of the beach.

23.13.2 Military Practice and Exercise Areas

100 The assessment has considered the effects of the Project works on areas identified in the Firth of Forth as Military Practice and Exercise Areas (PEXAs). One of these PEXAs, used by the MOD for naval (submarine) exercises, is crossed by the Offshore Export Cable Corridor. The Development Area has no interactions with any PEXAs.

101 Whilst there would be some short term disruption to any military exercises ongoing in a part of the PEXA during Offshore Export Cable laying construction works, co-ordination of the

work with the MOD and the regular issue of Notices to Mariners will be undertaken. It is not predicted that works would have a significant impact on the operation of the PEXA. In the longer term no significant impacts from operation, maintenance or decommissioning of the Wind Farm, or OfTW on PEXAs are predicted.

102 No significant impact interactions have been predicted on PEXAs from the Project and no significant cumulative impacts with other offshore or onshore projects are predicted.

23.13.3 Subsea Cables and Pipelines

103 A high pressure submarine gas pipeline in the Firth of Forth is crossed by the Offshore Export Cable Corridor. The crossing point lies to the north-west of North Berwick and would not be affected by the approach to both landfall locations for the Offshore Export Cable. The Development Area has no interactions with any subsea cables or pipelines.

104 The operation of the pipeline is not anticipated to be significantly affected by construction of the Offshore Export Cables which would be designed and constructed in accordance with a crossing agreement, which would be agreed in advance, with the pipeline operator. The predicted residual impact on the pipeline from construction of the Offshore Export Cable (and decommissioning if required) and the predicted impact for operation and maintenance of the Offshore Export Cable on the pipeline is not considered significant.

105 No significant impact interactions have been predicted on the gas pipeline from the Project and no significant cumulative impacts with other offshore or onshore projects are predicted.

23.13.4 Unexploded Ordnance

106 During construction, activities which will have contact with the seabed, either directly or via the placement of material, are at risk of disturbing unexploded ordnance with potentially damaging and dangerous effects. A number of mitigation measures have been identified to offset the risk of impacts. These focus on detailed geophysical surveys in advance of all intrusive works to locate and avoid positions of identified ordnance within the Development Area and Offshore Cable Export Corridor. These measures will seek to ensure that all risk is reduced to as low as reasonably practicable and the residual impact of all construction (and decommissioning) work is predicted to be minor.

107 With the implementation of committed mitigation (embedded and additional) the residual effect of operation and maintenance of the Project works on unexploded ordnance is predicted to be minor.

108 No significant impact interactions have been predicted on unexploded ordnance from the proposals and no significant cumulative impacts with other offshore or onshore developments are predicted.

23.14 Socioeconomics and Tourism

23.14.1 Assessment – the Project

109 The Project would lead to moderate/major positive effects on the labour market surrounding Cromarty Firth, under both the base and high construction impact scenarios, and moderate positive effects on the Dundee labour market in the high impact scenario only. There would be a low effect in both construction impact scenarios in the labour markets surrounding either Leith or Rosyth.

110 Given the construction period would be temporary (approximately four years), and the nature of the skills required would include both specialist and general labour capabilities, this would likely require the up-skilling and re-training of available local labour and the attraction of additional labour into each of these areas, resulting in the benefit of new and additional expenditure on local goods and services.

111 The permanent operation and maintenance jobs estimated for the Project would have a low and positive effect in all scenarios.

112 During the temporary decommissioning phase, the Project would have a moderate positive effect upon the labour market surrounding Cromarty Firth in both the base and high impact scenarios. Whilst the creation of new, and safeguarding of existing jobs, would have a positive effect economically and each job would be valuable to each area, the effect on the labour markets surrounding Leith, Rosyth, and Dundee would be minor positive.

113 In tourism and recreation terms the Landscape and Visual Impact presented in *Chapter 16* identifies a number of receptors as likely to experience significant major and moderate effects on visual amenity from the Project. However, benchmark Scottish Government research demonstrates that the vast majority of those engaged in outdoor recreational activities and who have seen an onshore wind farm would be unaffected. Similarly, a post-development assessment, undertaken as part of this socio-economic assessment, of eight existing and operational Round 1 offshore wind farms (smaller in scale than the Project but much closer to shore) indicates that no negative effects upon onshore tourism or recreational activities have arisen in their onshore hinterlands. Effects on tourist or recreational visitor numbers as a result of the Project are assessed as up to minor/moderate across the tourism study area.

114 The assessment of impacts on recreational sailing presented in *Chapter 21: Other Human Considerations* has identified short term significant effects on recreational sailing during laying of the Offshore Export Cable (*see Section 23.13*). There would be no significant effects during operation. At worst, during decommissioning of the Project there could be impacts similar to those of laying the Offshore Export Cable, if it were removed.

23.14.2 Assessment – the Project and Other Projects

115 The Project was assessed cumulatively with all of the other proposed large scale wind farm projects off the east coast of Scotland including those in Round 3 and STW leasing rounds, each assumed to be constructed over a similar timescale and drawing jointly upon the labour market catchments in this assessment.

116 In the construction phase in the high impact scenario Leith and Rosyth are assessed as likely to experience a moderate positive effect. Both Dundee and Cromarty Firth are assessed in the high impact scenario as likely to experience a major positive effect, assuming these areas could attract the requisite type and number of labour to meet any excess demand.

117 During the operation and maintenance phase cumulatively both Dundee and Cromarty Firth would be likely to experience a major positive effect in each of the impact scenarios. Leith and Rosyth would be likely to experience a moderate to major positive effect in the high impact scenario only.

118 Moderate positive effects would be likely to arise at both the Cromarty Firth and Dundee over the decommissioning period if all the projects were to be supplied by these locations.

119 The cumulative assessment assumes that all of these projects would be serviced from each of the individual locations, which would not occur in practice, and the operation and maintenance activities of these projects would likely be distributed geographically round the east of Scotland making use of the nearest appropriate service base location.

23.15 Summary of Habitats Regulations Appraisals

120 An assessment of the predicted impacts of the construction, operation, maintenance and decommissioning of the Wind Farm and OfTW on European designated nature conservation sites has been undertaken. This is known as Habitats Regulations Appraisal (HRA) and has specifically addressed effects on Natura 2000 sites which are designated under European Directives and implemented through the Regulation 48 of the *Conservation (Natural Habitats, &c.) Regulations 1994*. These sites are known as Special Protection Areas (SPAs) which are designated under the *Birds Directive* and Special Areas of Conservation (SACs) which are designated under the *Habitats Directive*.

121 The HRA initially considered the potential for a Likely Significant Effect of the Project on designated sites. A screening assessment was then undertaken to determine Likely Significant Effect. The HRA was completed for predicted impacts of the Project on sites where there was a potential for a Likely Significant Effect. The HRA then considered the potential for impacts on European sites from the Project's different components and in combination with other plans and projects.

122 A range of SACs and their qualifying habitats and species were considered in the HRA:

- Berwickshire and North Northumberland Coast SAC.
- Firth of Tay and Eden Estuary SAC.

- Isle of May SAC.
- Moray Firth SAC.
- River Dee SAC.
- River Tweed SAC.
- River Tay SAC.
- River Teith SAC.
- River South Esk SAC.

123 Impact assessment included consideration of effects such as: the direct and indirect effects of underwater noise; changes to metocean and coastal processes; collision risk; loss of seabed and coastal habitat and effects from disturbance during construction; maintenance, operation and decommissioning. It is concluded that the Project alone or in combination with other plans and projects will have no adverse effect on site integrity to any of the SACs and that they will maintain their contribution to favourable conservation status of the qualifying species.

124 Seven SPAs were identified as having the potential for a Likely Significant Effect. Three of those were designated due to the populations of their qualifying interests in the non-breeding season: Slamannan Plateau SPA, Upper Solway Flats and Marshes SPA and the Firth of Forth SPA. The remaining four sites were designated due to the populations of their qualifying interests in the breeding season: Forth Islands SPA, Fowlsheugh SPA, St. Abb's Head to Fast Castle SPA and Buchan Ness to Collieston Coast SPA.

125 Assessment of predicted impacts on qualifying species for coastal and offshore SPAs was a core part of the HRA due to the potential to affect birds in a number of ways including displacement from important feeding areas, collision risk with WTGs, barrier effects on flight paths and migratory routes and indirect effects on food sources.

126 Detailed information on a range of impact sources (particularly disturbance, indirect impacts on prey species, displacement and collision) has been collated to inform the assessment of the conservation objectives for each of these SPAs together with an assessment of the viability of the existing populations of kittiwake, guillemot, razorbill and puffin.

127 For the SPAs designated due to the populations of their qualifying interests in the non-breeding season it was concluded beyond reasonable scientific doubt that the Project alone or in-combination with any other plans or projects would have no adverse effect on site integrity for any of these SPAs.

128 For the SPAs designated due to the populations of their qualifying interests in the breeding season it was concluded beyond reasonable scientific doubt that the Project alone would have no adverse effect on site integrity for any of these SPAs. At the time of writing information was not available to allow apportionment of kittiwake collision mortality from other projects to individual SPAs and allow conclusions to be presented on the in-combination effects on the population of kittiwake as viable component of these four SPAs.

It was therefore not possible to conclude no adverse effect on site integrity due to in combination effects from other projects.

References

European Parliament, Council (2009). *Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (codified version of Directive 79/409/EEC as amended)*. Available at: http://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm

Great Britain Parliament (1994). *The Conservation (Natural Habitats, &c.) Regulations 1994*. Available at: http://www.legislation.gov.uk/uksi/1994/2716/contents/made

The Council of the European Communities (1992). *Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora (Habitats Directive)* as amended. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1992L0043:20070101:EN:HTML [Accessed September 2012].