Chapter 24 Summary of Environmental Impact Assessment

Source	Pathway	Receptor	Significance of impact	Mitigation	Significance post-mitigation	Cumulative/in-combination impact significance	Explanatory notes
Geology and Water Quality: Offshore site							
Installation and presence of offshore infrastructure	Hydrodynamic processes	Sandbanks	No impacts predicted as no pathway present.				
		Coastline					
Presence of vessels and machinery	Accidental spills or leaks of pollutants	Water quality/ designated waters	Moderate significance	Following best practice and observation of MARPOL Convention regulations. Application of a SEMP and Pollution Control and Spillage Response Plan.	Minor significance		None identified other than the potential for accidental spillage or leakage. Following mitigation this risk should be managed to be as low as reasonably practicable during the installation, operation and decommissioning phases.
Geology and Water Quality: Export cable route							
Installation and presence of export cable (trenching, drilling)	Increased suspended sediment, changes to hydrodynamics and disturbance to contaminated sediments	Coastline and water quality	No impacts assessed as being of moderate or major significance.				
Physical Processes: Offshore site and export cable route							
Bed preparation for gravity bases (dredging) and burial of inter-array cables	Suspended sediment concentration (SSC) and seabed features		Although changes to SSC are relatively high compared with background levels, this will be for short period during construction. Significance of this impact will be dependent on the vulnerability of the relevant receptors.				
	Seabed features (bedforms)		Resulting deposition will occur over the whole development area. Settled material will be the same as the ambient conditions, and will be subject to the natural processes of erosion/deposition experienced at the site. No material change to seabed features or bedforms are predicted.				
Presence of gravity base and turbines	Water level		Predicted changes are very small compared with natural variability, and would not be measureable. The importance of the change is therefore negligible in both near and far-field.				
	Tidal currents		Near-field changes are small and within the range expected due to natural variability. Far-field changes will be negligible. The importance of the change to the tidal regime is therefore low.				
	Wave heights		Near-field and cumulative far-field changes small compared with natural variability. The importance of the change to wave climate is therefore low.				
	Sediment regime		Near-field changes are comparable with natural variability. No material change to seabed features is predicted. No far-field or cumulative changes are predicted. Importance of changes to sediment regime is therefore low.				
	Coastal processes		No changes to coastal processes.				
Scour around jacket foundations	SSC		Scour occurs on spring tides only therefore excess sediments are introduced gradually and periodically.				
	Seabed features (bedforms)		Scour pits are expected to remain as stable, permanent features around structures (highly limited infilling).				
Removal of gravity base turbines	SSC		Negligible.				
	Seabed features (bedforms)						
Air Quality: Offshore site and export cable route							
Exhaust, NO_X and SO_2 emissions from vessels	Inhalation	Multiple	No impacts assessed as being of moderate or major significance.				
Wind turbines	Spinning of blades creating/enhancing sea fog	Humans and birds					

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Ornithology							
• Possible impacts on birds arising from the proposed development include collision with turbines, exclusion from the offshore site if birds avoid entering an area with turbines (displacement) and barrier effects, where birds avoid flying through the proposed development and have to fly further to go around it; • Collision risk modelling was conducted for the 12 high priority species to determine if there would be any significant effects arising from birds colliding with turbines. Of the 12 high priority species, collision impacts for little gull in autumn were ranked as being of minor significance; • Impacts from displacement on razorbills after the breeding season were ranked as being of minor significance, with no significant impacts for displacement for the other high priority species; • Impacts from barrier effects on razorbills in the breeding season were ranked as being of moderate significance, with no significant impacts for barrier effects for the other high priority species; • Impacts from collision, displacement and barrier effects for the remaining low priority species were ranked as not significant; • Cumulative impacts have been assessed including other plans or projects, in particular the adjacent offshore wind farm developments in the Firth of Forth. The results from the cumulative collision risk modelling identified potentially significant cumulative collision impacts for gannet and kittiwake. In addition, potentially significant cumulative displacement impacts were identified for gannet and razorbill in the breeding season; and • Possible measures to mitigate against potential impacts on birds have been considered and will be developed more fully as the project progresses. These include potentially raising the turbine height to reduce potential collisions with turbine blades.						
Marine Mammals: Offshore site							
Piling and drilling during installation of jacket foundations, vessel noise and presence	Noise direct effects and displacement	Marine mammal species (not harbour seal)	No impacts assessed as being of moderate or major significance.				
Vessel and turbine noise and presence	Noise and presence leading to physical impact						
Piling and drilling during installation of jacket foundations, vessel noise and presence	Noise Lethal effect/Permanent Threshold Shift (PTS)	Harbour seal	Moderate significance	Minimise the duration of piling activities. Where practicable, preferentially selecting installation techniques that emit least amount of sound. Optimising soft start procedures and minimising hammer energy. Use of Acoustic Deterrent Devices and/or visual and acoustic detection devices. Consider avoiding the starting of the installation of turbine foundations immediately prior to, or during pupping period.	Reduced risk of auditory injury.	Moderate significance	Area of potential impacts relatively wide and numbers high. Population of harbour seal is unfavourable.
	Noise Displacement/ Temporary Threshold Shift (TTS)		Moderate significance		Reduced risk of temporary auditory injury.	Moderate significance	
	Noise partial displacement/behaviour		Moderate significance		Reduced area of potential displacement.	Moderate significance	
	Noise Lethal effect/PTS	Bottlenose dolphin	Not significant		Reduced risk of auditory injury.	Not significant	Area of potential impact very localised and numbers at risk very low from PTS. Bottlenose dolphins may relocate but potential for a high proportion to receive sound exposure levels that may cause some behavioural changes. At a cumulative level area of potential impact very localised and numbers at risk very low from PTS. Bottlenose dolphins may relocate but potential for a high proportion to receive sound exposure levels that may cause some behavioural changes.
	Noise Displacement/TTS		Minor significance		Reduced risk of temporary auditory injury.	Minor significance	
	Noise partial displacement/behaviour		Minor significance		Reduced area of potential displacement	Moderate/major significance	
Marine Mammals: Export cable route							
Inter-array and export cables	Electromagnetic fields	All marine mammal species	No impacts assessed as being of moderate or major significance.				
Benthic Ecology: Offshore site							

Source	Pathway	Receptor	Significance of impact	Mitigation	Significance post-mitigation	Cumulative/in-combination impact significance	Explanatory notes
Installation and operation of offshore infrastructure	Habitat disturbance, increase in suspended sediment concentration, presence of new substrate	Biotopes present in the offshore site	No impacts assessed as being of moderate or major significance.				
Benthic Ecology: Export cable route							
Installation and presence of export cables and associated protection	Habitat disturbance, increase in suspended sediment concentration, presence of new substrate	Biotopes present in the offshore site	No impacts assessed as being of moderate or major significance.				
Fish and Shellfish Ecology: Offshore site							
Installation of jacket foundations	Pile driving creating noise and vibration	Herring - behavioural response (avoidance)	Moderate significance	Soft start piling. Further mitigation measures are being actively researched through national research groups and other consortia.	Minor to moderate Significance	Moderate to major Significance	Probability is Medium. Uncertainty is High. The radius of strong and significant avoidance behaviour overlaps with herring (a hearing specialist) nursery and spawning grounds across the region.
		Cod - behavioural response (avoidance)	Minor to moderate significance		Minor significance	Minor to moderate significance	Probability is Medium. Uncertainty is High. This is a qualitative assessment as the noise modelling did not profile cod. As a hearing specialist cod are sensitive to underwater noise, though not to the same degree as herring but more so than flatfish species.
		Flatfish species - behavioural response (avoidance)	Minor to moderate significance		Minor significance	Minor to moderate significance	Probability is High. Uncertainty is Medium. Dab are most affected by particle motion rather than sound pressure and so impacts are predicted to be low. However, at a cumulative level there is some overlap in zones of strong and significant avoidance behaviour predicted.
		Salmon and sea trout - behavioural response (avoidance)	Minor significance		Minor significance	Minor to moderate significance	Probability is High. Uncertainty is Medium. Salmon and sea trout are only predicted to be in the offshore area intermittently and are not a hearing specialist, hence their vulnerability remains low.
Installation of turbines, subsea cables and associated structures	Habitat disturbance and increase in SSC	Fish and shellfish populations	No impacts assessed as being of moderate or major significance.				
Presence of turbine foundations and inter-array cabling with scour protection	Tides, current speeds, new substrate material						

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Gearbox and generator of wind turbines	Operational noise						
Inter-array cables	Electromagnetic fields and seabed sediment heating						
Fish and Shellfish Ecology: Export cable route							
Sediment disturbance during export cable burial	Habitat disturbance and sediment re-suspension and smothering	Fish and shellfish populations	No impacts assessed as being of moderate or major significance.				
Export cables	Electromagnetic fields and seabed sediment heating						
Commercial Fisheries: Offshore site							
Offshore site construction activities	Loss or restricted access to fishing grounds	Fishing vessels operating in the vicinity of the wind farm	Moderate significance	Several mitigation approaches suggested including the development of a working group, see Section 16.3.3 Mitigation and Residual Impacts.	Once mitigation measures are in place these could reduce the significance of the predicted impacts to minor.	Moderate significance	Fishing vessels will not be able to safely resume activities until the seabed is returned to an acceptable level for fishing activities to be safely resumed. Although the frequency and duration of the impact is moderate, the fishing grounds impacted are low intensity on a regional scale.
	Displacement of fishing vessels into other areas	Fishing vessels operating in the general vicinity of the wind farm	Moderate significance	Several mitigation approaches suggested including the development of a working group, see Section 16.3.3 Mitigation and Residual Impacts.	Once mitigation measures are in place these could reduce the significance of the predicted impacts to minor.	Moderate significance	Fishing vessels will not be able to safely resume activities until the seabed is returned to an acceptable level for fishing activities to be safely resumed. Although the frequency and duration of the impact is moderate, the fishing grounds impacted are low intensity on a regional scale.
Offshore site construction activities	Increasing steaming time to fishing grounds, fouling of static gear or changes to towing patterns	Fishing vessels operating in the general vicinity of the wind farm	No impacts assessed as being of moderate or major significance.				
Turbines and associated structures in operation	Loss of or restricted access to fishing grounds, displacement, increasing steaming times, possible fouling	Fishing vessels					

Source	Pathway	Receptor	Significance of impact	Mitigation	Significance post-mitigation	Cumulative/in-combination impact significance	Explanatory notes
Commercial Fisheries: Export cable route							
Export cable installation activities	Loss or restricted access to fishing grounds	Fishing vessels operating in the vicinity of the cable route	Moderate significance	Several mitigation approaches suggested including the development of a working group, see Section 16.3.3 Mitigation and Residual Impacts.	Once mitigation measures are in place these could reduce the significance of the predicted impacts to minor.	Moderate significance	Fishing vessels will not be able to safely resume activities until the seabed is returned to an acceptable level for fishing activities to be safely resumed. The area is discrete and construction is relatively short term.
Export cable installation activities	Displacement of fishing vessels into other areas	Fishing vessels operating in the general vicinity of the cable route	Moderate significance	Several mitigation approaches suggested including the development of a working group, see Section 16.3.3 Mitigation and Residual Impacts.	Once mitigation measures are in place these could reduce the significance of the predicted impacts to minor.	Moderate significance	Fishing vessels will not be able to safely resume activities until the seabed is returned to an acceptable level for fishing activities to be safely resumed. Fishing vessels operating in the immediate vicinity of the cable route will be displaced into other areas for the duration of installation works. However, the area is discrete and construction is relatively short term.
Operational export cables	Loss of or restricted access to fishing grounds, displacement, increasing steaming times, possible fouling	Fishing vessels	No impacts assessed as being of moderate or major significance.				
Shipping and Navigation: Offshore site							
Physical presence of wind farm structures	Physical change in the environment due to wind farm structures leading to a loss of navigable sea room and deviations around structures which may lead to increased collision risk (vessel-to-vessel and vessel-to-structure)	Commercial shipping	Moderate significance	Best practice Marine Control Centre monitoring vessel activity and safety zones/guard vessels.	Minor significance	Moderate significance	Vessels should be able to pre-plan their voyage and based on analysis of shipping data there is available sea room east and west of the site for shipping to increase passing distance from wind farm structures.
Physical presence of wind farm structures	Physical change in the environment due to wind farm structures leading to a loss of navigable sea room and deviations around structures resulting in an increased collision risk (vessel-to-vessel and vessel-to-structure)	Fishing vessels	Moderate significance	Best practice, including a marine control centre monitoring fishing vessels and safety zones/guard vessels.	Minor significance	Minor significance	Fishing vessels should be aware of the wind farm through liaison and consultation. Impacts on fishing vessels steaming passed the site are similar to other passing vessels. However, there are good prospects for fishing vessels to navigate within the wind farm.

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Shipping and Navigation: Export cable route							
Physical presence of wind farm cables	Physical change in the environment due to subsea cables resulting in a risk of fishing gear interaction (snagging)	Vessels	No impacts assessed as being of moderate or major significance.				
Military and Aviation: Offshore site							
Radar signals reflected by turbines	Inconvenience or risk due to clutter on radar display	RAF Leuchars PSR	Major significance	Change airspace by designating area over the wind farm as a Transponder Mandatory Zones (TMZ).	Minor significance	Minor significance	TMZ could mitigate all proposed wind farms in the Firth of Forth, similar to the solution proposed for the Greater Wash Regional Scheme (GWRS).
Radar signals reflected by turbines	Inconvenience or risk due to clutter on radar display	RAF Leuchars PSR	Major significance	Infill radar (single onshore system or multiple offshore systems local to turbines).	Minor significance	Minor significance	No significant additional cumulative impact, assuming the infill solution can be applied to all proposed Firth of Forth wind farms.
Shadowing of radar signals behind turbines	Reduced detectability of aircraft behind turbines	RAF Leuchars PSR	Moderate significance	Infill radar system.	Minor significance	Minor significance	
Military and Aviation: Export cable route							
No impacts predicted							
Maritime Archaeology and Cultural Heritage: Offshore site and export cable route							
Seabed preparation	Dredging / cable ploughing/ anchoring	Known wreck sites EA62, EA64, EA65, EA67, EA68 and EA70	Major significance	Sites avoided; Exclusion zones established around sites; Anchor patterns will be designed to avoid known targets; and Archaeological reporting protocol to be established and followed during construction, operation and decommissioning.	Not significant	Not significant	
Seabed preparation	Dredging / cable ploughing/ anchoring	Known wreck sites EA53, EA63	Moderate significance	Sites avoided; Exclusion zones established around sites; Anchor patterns will be designed to avoid known targets; and Archaeological reporting protocol to be established and followed during construction, operation and decommissioning.	Not significant	Not significant	

Source	Pathway	Receptor	Significance of impact	Mitigation	Significance post-mitigation	Cumulative/in-combination impact significance	Explanatory notes
Seabed preparation	Dredging / cable ploughing/ anchoring	High potential geophysical targets EMU_0095, EMU_0098, EMU_0100, EMU_0106 and EMU_0413 High potential geophysical targets EMU_0199, EMU_0327, EMU_0384 and EMU_0413	Major significance	Sites avoided; Exclusion zones established around sites; Anchor patterns will be designed to avoid known targets; and Archaeological reporting protocol to be established and followed during construction, operation and decommissioning.	Not significant	Not significant	
Seabed preparation	Dredging / cable ploughing/ anchoring	Medium potential geophysical targets EMU_004, EMU_0134, EMU_0177, EMU_0259, EMU_0262, EMU_0291, EMU_0294 and EMU_0367	Moderate significance	Sites avoided; Exclusion zones established around sites; Anchor patterns will be designed to avoid known targets; and Archaeological reporting protocol to be established and followed during construction, operation and decommissioning.	Not significant	Not significant	
Seascape and Visual Impacts: Offshore site							
Presence of offshore turbines	Regional seascape units	SA 12: St Andrews to Fife Ness and SA13: East Neuk of Fife	Moderate significance	Offshore turbines at around 15-20 km offshore will have a pervasive influence on the character of areas where coastal views are available.		Moderate significance	Offshore turbines at relatively close range will have a pervasive influence on the character of areas where coastal views are available.
		All others	No impacts assessed as being of moderate or major significance.				
	Landscape character types	All assessed					
	Landscape designations	All assessed					
Views of offshore turbines	Viewpoints	Arbroath, Carnoustie	Moderate significance	Turbines will be seen by residents and visitors, in the middle distance, in the open sea.		Moderate-minor significance	
		Tentsmuir	Moderate significance	Turbines seen within the centre of open sea views, by recreational users.		Major-moderate significance	Neart na Gaoithe and Inch Cape equally distant, both occupying the more open sea.
		St. Andrews, East Scores	Moderate significance	Large number of high sensitivity visitors and residents will have slightly restricted views of the turbines beyond headland to east.		Major-moderate significance	Neart na Gaoithe and Inch Cape equally distant, with the latter occupying the more open sea.

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		North Berwick Law	Moderate significance	Distant views of the turbines will be seen by visitors who come to appreciate the broad sea views.		Moderate-minor significance	
		St. Abb's Head	Moderate significance	Turbines will be seen by recreational users, looking to the north away from the open sea.		Moderate-minor significance	
		Dunbar	Major-moderate significance	Turbines will be seen by large numbers of residents and visitors, in the central part of the view.		Moderate significance	
		Fife Ness, Lochabler Rock	Major significance	Relatively close range view of turbines within the open sea, will be seen by visitors and a small number of residents.		Major significance	Neart na Gaoithe likely to be viewed at relatively close range with other offshore developments visible behind.
		Anstruther Easter	Major significance	Relatively close range view of turbines occupying the open sea between Fife Ness and the Isle of May. Relatively few residents and visitors would experience this impact as the town is focused on the harbour which looks predominantly southeast.		Major-moderate significance	Neart na Gaoithe likely to be viewed at relatively close range with other offshore developments only partly visible behind.
		Isle of May	Major significance	Relatively close range views from a presently remote location. Few viewers will experience this effect, and largely in the summer months when tourist trips are scheduled.		Major significance	Neart na Gaoithe likely to be viewed at relatively close range with other offshore developments visible behind.
		Other viewpoints	No impacts assessed as being of moderate or major significance.				
	Routes	John Muir Way, NCN Route 1 and 76, Fife Tourist Route	Moderate significance	Continuous but oblique views of the proposed offshore development.		Moderate-minor significance	Neart na Gaoithe likely to be viewed with other offshore developments visible behind.
		Impacts on routes: Fife Coastal Path, Isle of May Ferry	Major significance	Fife Coastal Path passes relatively close, with continuous views towards the proposed offshore development Isle of May ferry has continuous relatively close range views of the proposed offshore development.		Major significance	Neart na Gaoithe likely to be viewed at relatively close range with other offshore developments visible behind or adjacent.
		Impacts on other routes	No impacts assessed as being of moderate or major significance.				

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Seascape and Visual Impacts: Export cable route							
Export cable installation	Line of sight	Recreational and residential viewers	Major significance			n/a	The short term impact will be of major significance due to the high sensitivity of the beach, and would last up to 4-5 months (allowing a weather contingency of 2 months). Short term visual impacts of major significance will occur in views from the vicinity of the intertidal works, including from the beach, caravan park, nearby properties and from the John Muir Way.
Other Users: Offshore Site and export cable route							
Installation of turbines and associated structures and inter-array cables	Increase in SSC, changes to habitats and hydrodynamic regime, offshore safety zones	Scuba diving, recreational fisheries (through fish species), sailing	No impacts assessed as being of moderate or major significance.				
Presence of offshore structures	Navigation hazard, increased sightseeing	Sailing vessels and tour operators					
Other Users: Export cable route							
Installation of export cable (offshore and coastal)	Disturbance to sediments, hydrodynamics, habitats. Amenity changes such as access loss, noise, dust, traffic, saftey zones	Recreational users such as fisheries, coastal walkers, surfers, sailing, and local caravan park	No impacts assessed as being of moderate or major significance.				
Socioeconomics: Offshore site and export cable route							
Neart na Gaoithe Wind Farm	Business supply chain	GVA - study area and Scotland	Moderate significance			Moderate significance	The project will likely produce a significant positive increase in GVA for the study area and the other areas of analysis. The scale of overall change will be proportionately small, however, and will be concentrated in the development phase.
Neart na Gaoithe Wind Farm	Business supply chain	Employment - study area and Scotland	Moderate significance			Moderate significance	The project will likely produce a significant positive increase in employment in the study area, although the extent of this impact is subject to a wide range of potential outcomes depending on where development phase contracts are placed. The majority of jobs created are expected to be above existing benchmark averages in terms of average earnings per worker, reflecting the skill profile of the expected job opportunities.
Neart na Gaoithe Wind Farm	Tourists	Tourism economy – study area	Based on the qualitative assessment, this is not significant. The ready availability of alternative options for tourists limits the potential scope of impact, as does the temporary nature of the main source of potential adverse impacts.				