Morven North Offshore Wind Array Project

Environmental Impact Assessment Report

Volume 3, Annex 18.3: Shared In-combination Climate Change Impact (ICCI) Assessment

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1 Introduction

1.1.1.1 The Morven North Offshore Wind Array Project (hereafter, “Morven North”) and the Morven South Offshore Wind Array Project (hereafter, “Morven South”) are both located within the Morven Option Lease Agreement Site (hereafter, “Morven Site”) in Scottish offshore waters (Figure 2.1). Morven North is located approximately 61km from the Aberdeenshire coast (at its closest point) and Morven South is located approximately 86km from the Aberdeenshire coast (at its closest point). Each project will comprise wind turbines, Offshore Substation Platforms (OSPs), associated foundations, inter-array and interconnector cables and cable protection. Consent for the offshore export cables of Morven North and Morven South will be sought separately.

1.1.1.2 As shown in Figure 2.1, Morven North is situated northwest of Morven South. The external boundaries of Morven North and Morven South correspond with the boundaries of the Morven Site.

1.1.1.3 This In-combination Climate Change Impact (ICCI) Assessment presents combined evaluation of how anticipated future climate conditions may interact with and potentially exacerbate the environmental effects of Morven North and Morven South. This report accompanies the Environmental Impact Assessments (EIA) provided in Volume 2, Chapters 7 to 20 of the Morven North EIA Report and Morven South EIA Report to support the respective consent applications.

2 Methodology

2.1.1.1 The anticipated effects associated with future climate change were identified as climate risks within Table 3.3 of Volume 3, Annex 18.2: Shared Climate Change Risk Assessment and are set out in Table 3.1 below. These climate risks were then considered in relation to each environmental receptor within chapters 7 to 20 of the Morven North EIA Report and Morven South EIA Report in order to carry out a brief assessment of the likely significant effects (LSE[1]) of projected climate risks on each environmental receptor. The assessment has been undertaken in accordance with the EIA Guide to Climate Change Resilience and Adaptation (IEMA, 2020), published by the Institute of Environmental Management and Assessment (IEMA), which is now the Institute of Sustainability and Environmental Professionals (ISEP).

2.1.1.2 The baseline characterisation screening in Table 3.1 presents the receptor groups, the potential climate risks associated with the future climate and whether the receptors are considered sensitive and therefore assessed within this technical report. The screening considers the extent to which anticipated future climate change might exacerbate the LSE[1] of Morven North and Morven South on identified receptor groups (IEMA, 2020).

2.1.1.3 A summary assessment for each receptor considered sensitive to future climate change is presented in Table 4.1, which sets out:

- climate risks, as described in Table 3.3 of Volume 3, Annex 18.2: Shared Climate Change Risk Assessment, applied to Morven North and Morven South for the study area defined in Section 1 of the same report;
- receptors that are likely to be sensitive to the projected climate risks during the construction, Operation and Maintenance (O&M) and decommissioning phases of Morven North and Morven South, as screened in Table 4.1, based on professional judgement and/or literature reviews as noted in Volume 2, Chapters 7 to 20 of the Morven North and Morven South EIA Reports;
- a qualitative description of the identified potential ICCIs;
- a statement on whether the ICCI is likely to have a significant environmental effect on the receptors based on expert judgement (i.e. whether the predicted climate change risk exacerbates the LSE[1] to such a degree that LSE[1] identified in topic-specific assessment as not significant are now considered potentially significant, or LSE[1] identified as significant are found to have an exacerbated significance);
- an explanation of the approach to additional mitigation measures for predicted LSE[1] arising from the ICCI.

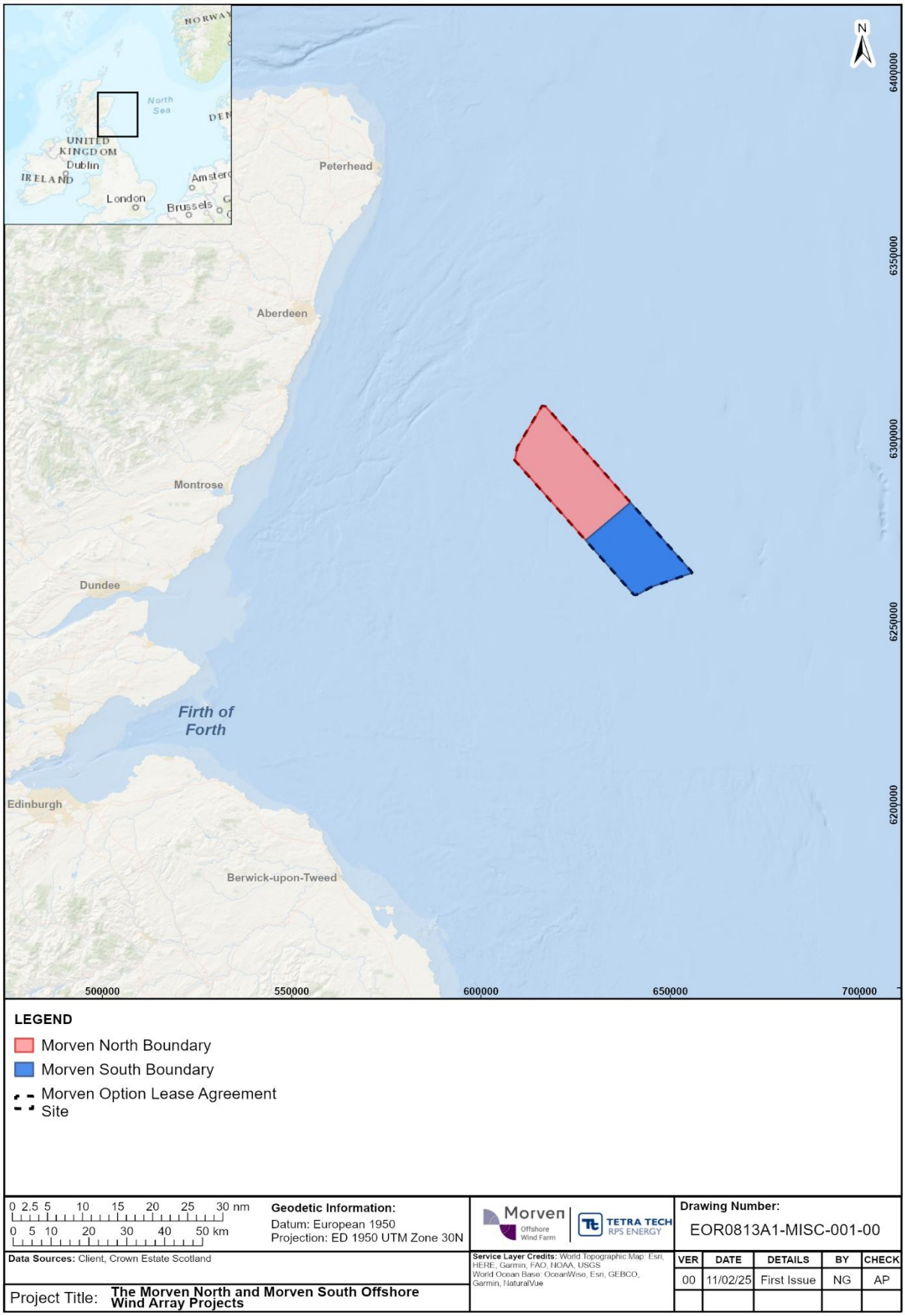

Figure 2.1: The boundaries of Morven North and Morven South within the Morven Option Lease Agreement Site

3 Baseline characterisation screening

3.1.1.1 Note: sensitivity has been determined with reference to the baseline conditions and impact assessments presented in the corresponding Morven North and Morven South topic chapters.

Table 3.1: Screening of Environmental Impact Assessment receptor groups likely to be sensitive to projected future climate risks for Morven North and Morven South

Green: receptor is not likely sensitive to impact pathway identified (i.e. screened out); orange: receptor is likely to be sensitive to the impact pathway identified (i.e. screened in).

Reference	Climate Risk*	Physical processes	Benthic subtidal ecology	Fish and shellfish ecology	Marine mammals	Offshore ornithology	Commercial fisheries	Shipping and navigation	Marine archaeology	Aviation (military and civil)	Other sea users and communications	Socio-economics	Major accidents and disasters	Human health
1	Increases in average and extreme temperatures, both in winter and summer.		a	a	a		a	b	a					
2	Increase in sea surface temperatures and ocean acidification.				c (Indirect)	c (Indirect)	c (Indirect)							c (Indirect)
3	Changes to rainfall patterns, leading to increased annual precipitation.						b	b						b
4	Increased frequency and intensity of extreme weather i.e. storms.				c (Indirect)	c (Indirect)								
5	Increased wind speeds and changes to wind patterns.				c (Indirect)		b	b						b
6	Increase in Mean Sea Level (MSL).													
7	Increased wave height.				c (Indirect)		b	b						
8	Changes in the tidal range.													

* As identified in Volume 3, Appendix 18.1: Shared Climate Change Risk Assessment.
a) The sensitivity of this receptor group to indirect effects resulting from increased sea temperatures is captured under climate risk 2;
b) The sensitivity of this receptor group to indirect effects resulting from increased occurrence of adverse weather is captured under climate risk 4; and
c) Related to secondary effects due to impacts on habitats or prey.

4 In-combination climate change impact assessment

Table 4.1: Consideration of in-combination climate change impact for Morven North and Morven South

C= Construction, O= O&M, D= Decommissioning phases

"✓" is used to denote the phase the potential impact can occur, "×" outlines there is no impact within this project phase

Impact identified in topic assessments	Relevant climate risk(s)	Phase			Potential Impact(s) identified	Potential ICCI identified	Discussion	ICCI significance		Mitigation measures
		C	O	D				Morven North	Morven South	
Volume 2, Chapter 7: Physical Processes										
Increased Suspended Sediment Concentrations (SSC) and associated deposition	4, 5, 6, 7, 8	✓	✓	✓	Impacts from sandwave clearance and dredging activities, cable trenching, intermittent contact and movement of mooring lines or subsea cables across the seabed, and removal of inter-array and interconnector cables may generate short-duration increases in SSC, and localised deposition during energetic conditions.	Potential ICCI from increased storm intensity, stronger waves, rising sea levels, increased wave height and changes in tidal range that could compound intermittent, event driven resuspension, namely short duration increases in SSCs and localised deposition.	Increased SSCs and associated deposition and sediment transport are considered in Section 7.11 of Volume 2, Chapter 7: Physical Processes of the Morven North and Morven South EIA Reports. SSC elevations are low in magnitude, spatially confined to the vicinity of works, and return to ambient conditions within a few tidal cycles, with deposition concentrated close to release sites and no material change to sediment transport pathways. The magnitude of impact is anticipated to be low, with effects of negligible significance for all phases. Limited, short-duration increase in SSC and associated deposition may occur near the north-west of Morven North, close to the Firth of Forth Banks Complex Marine Protected Area (MPA), however these are low in magnitude as they do not persist and do not affect the MPA's designated features, with effects of minor adverse significance. An increase in SSCs can be expected with the projected increased frequency and intensity of extreme weather i.e. storms. As the effect is temporally isolated, any increase in SSCs would occur intermittently for short portions of a tidal cycle before returning to ambient values, there is very limited potential for significant in-combination effects. This potential ICCI effect is not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 7.10 of Volume 2, Chapter 7: Physical Processes of the Morven North and Morven South EIA Reports.
Impacts to the tidal regime and wave regime due to the presence of infrastructure	4, 5, 6, 7, 8	×	✓	×	Localised modifications to the wave and tidal regime in the vicinity of foundations, reductions in the lee of structures and small increases adjacent to them, effects constrained by deep water and rapidly indistinguishable within natural variability.	Potential ICCI from increased storm intensity, increased wind speeds and changes to wind patterns, rising sea levels, increased wave height and changes in tidal range that could compound the influence of installed infrastructure on the wave regime.	Changes to wave climate and tidal regime associated with the presence of infrastructure are considered in Section 7.11 of Volume 2, Chapter 7: Physical Processes of the Morven North and Morven South EIA Reports. Modelling indicates small, local, event-scaled changes immediately around the largest structures, with negligible change at distance. The magnitude of impact is anticipated to be low, with effects of negligible significance. For Morven North, no material effect on designated features of the Firth of Forth Banks Complex MPA was found, with effects of minor adverse significance. These highly localised effects are not likely to be increased, or combine with the potential ICCIs identified, to result in an effect of greater significance. This potential ICCI effect is therefore not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 7.10 of Volume 2, Chapter 7: Physical Processes of the Morven North and Morven South EIA Reports.
Impacts to sediment transport and sediment transport pathways due to the presence of infrastructure	4, 5, 6, 7, 8	×	✓	×	Localised adjustments to residual currents and sediment transport pathways in the vicinity of foundations, scour protection and cable protection.	Potential ICCI from increased storm intensity, stronger waves, rising sea levels, increased wave height and changes in tidal range that may compound infrastructure influences on residual currents and sediment transport.	Changes to sediment transport and sediment transport pathways associated with the presence of infrastructure are considered in Section 7.11 of Volume 2, Chapter 7: Physical Processes of the Morven North and Morven South EIA Reports. Modelling indicates small, local changes in residual current speed and sediment load immediately around the largest structures, with the majority of the area within the Morven North and Morven South boundaries experiencing changes in sediment transport of less than 0.05 $m^3/d/m$. The magnitude of impact is anticipated to be low, with effects of negligible significance. Negligible change is expected at distance from structures, including very limited, non-material change to designated features of the Firth of Forth Banks Complex MPA due to Morven North, with effects of minor adverse significance. These highly localised effects are not likely to be increased, or combine with the potential ICCIs identified, to result in an effect of greater significance. This potential ICCI effect is not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 7.10 of Volume 2, Chapter 7: Physical Processes of the Morven North and Morven South EIA Reports.

Impact identified in topic assessments	Relevant climate risk(s)	Phase			Potential Impact(s) identified	Potential ICCI identified	Discussion	ICCI significance		Mitigation measures
		C	O	D				Morven North	Morven South	
Impacts to seasonal stratification due to the presence of infrastructure	1, 2, 3, 4	×	✓	×	Localised, marginal increases in vertical mixing around large structures, small percentage changes in temperature profiles near the thermocline, constrained by deep water and negligible at distance.	Potential ICCI from increased average and extreme air temperatures, sea surface temperatures, precipitation, and increased frequency and intensity of storms that could modulate mixing and thermocline position.	Changes to seasonal stratification associated with the presence of infrastructure are considered in Section 7.11 of Volume 2, Chapter 7: Physical Processes of the Morven North and Morven South EIA Reports. Small, local, event-scaled mixing will be confined to the vicinity of the largest structures, with negligible change at distance, no material effect on tidal fronts, and no breakdown of stratification. Any wind-wake influences are limited in deep water and do not alter the seasonal pattern. The magnitude of impact is anticipated to be low, with effects of minor adverse significance. These highly localised effects are not likely to be increased, or combine with the potential ICCIs identified, to result in an effect of greater significance. This potential ICCI effect is not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 7.10 of Volume 2, Chapter 7: Physical Processes of the Morven North and Morven South EIA Reports.
Volume 2, Chapter 8: Benthic Subtidal Ecology										
Temporary habitat loss/disturbance	2	✓	✓	✓	Temporary disturbance of subtidal habitats from sandwave clearance, trenching or jetting for cable installation and repair, jack-up spudcan footprints, anchor placements, Unexploded Ordnance (UXO) clearance, and small areas of legacy cable removal.	Potential ICCI from warming trends and acidification that either directly impact benthic receptors and/or alter living environments. This could affect the diversity and composition of benthic communities in-combination with impacts from temporary habitat loss and disturbance.	Impacts from temporary benthic habitat loss and disturbance are considered in Section 8.11 of Volume 2, Chapter 8: Benthic Subtidal Ecology of the Morven North and Morven South EIA Reports. For all phases, the magnitude of impacts for all receptors (including all Important Ecological Features (IEFs)) is predicted to be low, resulting in effects of minor adverse significance. Disturbance is spatially confined to works areas, and highly reversible. The construction phase is expected to generate the largest impact for Morven North (74.06 km^2, ~4.12% of the Morven North Benthic Subtidal Ecology Study Area) and Morven South (62.59 km^2, ~4.39% of the Morven South Benthic Subtidal Ecology Study Area). Recovery of sandy sediments is rapid, typically within months to a few tidal cycles for surface features, with progressive infill of jack-up and anchor footprints and recolonisation of disturbed sands expected. These highly localised effects are not likely to be increased, or combine with the potential ICCIs identified, to result in an effect of greater significance. This potential ICCI effect is not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 8.10 of Volume 2, Chapter 8: Benthic Subtidal Ecology of the Morven North and Morven South EIA Reports.
Increased SSC and associated deposition	4, 5, 7	✓	✓	✓	Short duration increases in SSCs and localised deposition from sandwave clearance and disposal, foundation drilling, cable trenching, repair and reburial, and cable removal during decommissioning, effects are limited to the vicinity of works.	Potential ICCI from increased storm intensity, stronger waves, and increased wave height that could compound intermittent, event driven resuspension, namely short duration increases in SSCs and localised deposition.	Impacts from increased SSC and associated deposition are considered in Section 8.11 of Volume 2, Chapter 8: Benthic Subtidal Ecology of the Morven North and Morven South EIA Reports. For all phases, SSC-related impacts remain low in magnitude, highly localised, short-duration, and within the adaptive capacity of the IEFs, resulting in effects of minor adverse significance. With projected increases in the frequency and intensity of extreme weather, short lived resuspension events may occur more often, however these remain intermittent, event scaled and temporally isolated, so any ICCI interaction is not expected to persist beyond brief portions of a tidal cycle and is not likely to increase effect magnitude or extent. Overall, there is very limited potential for significant in-combination effects. This potential ICCI effect is not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 8.10 of Volume 2, Chapter 8: Benthic Subtidal Ecology of the Morven North and Morven South EIA Reports.

Impact identified in topic assessments	Relevant climate risk(s)	Phase			Potential Impact(s) identified	Potential ICCI identified	Discussion	ICCI significance		Mitigation measures
		C	O	D				Morven North	Morven South	
Long-term habitat loss	2	✓	✓	✓	Permanent change of seabed habitat at discrete footprints beneath wind turbine and OSP foundations, scour protection, cable protection and crossings, these persist through O&M and, if elements are left in situ, beyond decommissioning.	Potential ICCI from warming trends and acidification that directly affect benthic receptors and alter living environments, potentially influencing colonisation and community composition on artificial substrates in-combination with project footprints.	Impacts from long-term benthic habitat loss are considered in Section 8.11 of Volume 2, Chapter 8: Benthic Subtidal Ecology of the Morven North and Morven South EIA Reports. The magnitude of impacts for all receptors (including all IEFs) is predicted to be low, resulting in effects of minor adverse significance. Long-term habitat loss effects are highly localised and confined to discrete hard-substrate footprints, representing a very low proportion of the Morven North Benthic Subtidal Ecology Study Area (2.05 km^2, ~0.11% of area) and Morven South Benthic Subtidal Ecology Study Area (1.82 km^2, ~0.13% of area). Structures will be persistent throughout the O&M phase and, where protection is left in situ, beyond decommissioning. Under projected climate change, warming and acidification may alter colonisation and species composition on the installed hard substrates, however these biological shifts occur over small, discrete footprints, so the magnitude and extent of the combined effect remain low and do not elevate significance. This potential ICCI effect is not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 8.10 of Volume 2, Chapter 8: Benthic Subtidal Ecology of the Morven North and Morven South EIA Reports.
Increased risk of introduction and spread of invasive non-native species (INNS)	2	✓	✓	✓	Risk of introducing or spreading INNS via vessel hull fouling, niche areas and ballast water movements during construction, O&M and decommissioning, together with creation of new hard substrates, foundations and protection, that can provide colonisation opportunities.	Potential ICCI from warmer sea temperatures and ocean acidification that can facilitate establishment, survival and spread of INNS, which in-combination with artificial hard substrate availability could influence community composition and competition outcomes.	Impacts from increased risk of introduction and spread of INNS are considered in Section 8.11 of Volume 2, Chapter 8: Benthic Subtidal Ecology of the Morven North and Morven South EIA Reports. The magnitude of impacts for all receptors (including all IEFs) is predicted to be low, resulting in effects of minor adverse significance. Warmer conditions may increase propagule pressure and establishment potential. This, in-combination with the colonisation of hard structures may lead to native species being out competed and alter local ecology. However, the footprints are spatially limited, while biosecurity measures that will be put in place, outlined in Volume 4, Annex 1, Appendix 1.2: Invasive Non-Native Species Management Plan and Biosecurity Plan, will reduce introduction pathways, and any ecological shifts would remain localised and not significant in EIA terms for Morven North and Morven South. This identified ICCI effect is not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 8.10 of Volume 2, Chapter 8: Benthic Subtidal Ecology of the Morven North and Morven South EIA Reports, and Volume 4, Annex 1, Appendix 1.2: Invasive Non-Native Species Management Plan and Biosecurity Plan.
Volume 2, Chapter 9: Fish and Shellfish Ecology										
Temporary habitat loss and disturbance	2	✓	✓	✓	Temporary, direct loss and disturbance of subtidal habitats from sandwave clearance and disposal, cable trenching, jack-up spudcan footprints, anchor placements, UXO clearance, and small areas of legacy cable removal. Similar but smaller scale disturbance during O&M from cable repair and remedial burial, and localised disturbance during decommissioning when removing infrastructure.	Potential ICCI from warming and acidification shifting fish and shellfish baselines, including sandeel and other forage fish, with possible changes in spawning timing and prey availability that could, in-combination with temporary construction or maintenance footprints, influence local utilisation of disturbed seabed.	Impacts from temporary habitat loss and disturbance are considered in Section 9.11 of Volume 2, Chapter 9: Fish and Shellfish Ecology of the Morven North and Morven South EIA Reports. For all phases, the magnitude of impacts for all receptors (including all IEFs) is predicted to be low, resulting in effects of minor adverse significance. The construction phase is expected to generate largest impact Morven North (74.06 km^2, ~4.12% of the Morven North Fish and Shellfish Ecology Study Area) and Morven South (62.59 km^2, ~4.38% of the study are Morven South Fish and Shellfish Ecology Study Area), however effects are localised, intermittent, and highly reversible, with sandy sediments typically recovering from trenching and local depressions within months to a few tidal cycles to a couple of years, and sandeel, flatfish and shellfish showing good recoverability (Jensen *et al.,* 2004; Stenberg *et al.,* 2011; Van Deurs *et al.,* 2012). No designated sites fall within the temporary habitat Zone of influence (ZoI). These highly localised effects are not likely to be increased, or combine with the potential ICCIs identified, to result in an effect of greater significance. This potential ICCI effect is not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 9.10 of Volume 2, Chapter 9: Fish and Shellfish Ecology of the Morven North and Morven South EIA Reports.

Impact identified in topic assessments	Relevant climate risk(s)	Phase			Potential Impact(s) identified	Potential ICCI identified	Discussion	ICCI significance		Mitigation measures
		C	O	D				Morven North	Morven South	
Underwater sound impacting fish and shellfish receptors	2, 4	✓	×	✓	Underwater sound from piling, together with any UXO clearance, can cause injury or disturbance to fish and shellfish receptors. The impact is primarily associated with the construction phase. Decommissioning activities could include removal of foundations, cables and cable protection which may produce underwater sound.	Potential ICCI from ocean acidification and warming that can alter sound propagation and attenuation, and increased storm intensity elevating ambient noise levels.	Impacts from underwater sound impacting fish and shellfish receptors are considered in Section 9.11 of Volume 2, Chapter 9: Fish and Shellfish Ecology of the Morven North and Morven South EIA Reports. The magnitude of impact is anticipated to be low, with effects of minor adverse significance. Injury and disturbance ranges are limited and event scaled, exposures are short in duration and spatially confined to the vicinity of activities, with residual effects not significant in EIA terms. These highly localised effects are not likely to be increased, or combine with the potential ICCIs identified, to result in an effect of greater significance. This potential ICCI effect is not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 9.10 of Volume 2, Chapter 9: Fish and Shellfish Ecology of the Morven North and Morven South EIA Reports.
Increased SSC and associated deposition	4, 5, 7	✓	✓	✓	Short duration increases in SSC and localised deposition arising from sandwave clearance and disposal, foundation drilling, cable trenching, repair and remedial burial, and small areas of cable removal during decommissioning, effects are limited to the vicinity of works.	Potential ICCI from increased storm intensity, stronger waves, and increased wave height that could compound intermittent, event driven resuspension, namely short duration increases in SSCs and localised deposition.	Impacts from increased SSC and associated deposition are considered in Section 9.11 of Volume 2, Chapter 9: Fish and Shellfish Ecology of the Morven North and Morven South EIA Reports. The magnitude of impacts for all receptors (including all IEFs) during construction is low, and negligible for the other phases, with a minor adverse significance. Exposures are short, and effects are spatially confined to works areas. There are no designated sites for fish and shellfish within the ZoI for this impact, therefore conservation objectives for designated fish receptors are not impeded, and offshore increases in SSC at the Morven North and Morven South boundaries will not cause barriers to migration for Annex II diadromous fish associated with east coast Special Areas of Conservation (SAC). With projected increases in the frequency and intensity of extreme weather, short lived resuspension events may occur more often, however these remain intermittent, event scaled and temporally isolated, so any ICCI interaction is not expected to persist beyond brief portions of a tidal cycle nor elevate magnitude or extent. Overall, there is very limited potential for significant in-combination effects. This potential ICCI effect is not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 9.10 of Volume 2, Chapter 9: Fish and Shellfish Ecology of the Morven North and Morven South EIA Reports.
Long-term habitat loss	2	✓	✓	✓	Permanent change of seabed habitat at discrete footprints beneath wind turbine and OSP foundations, associated scour protection, cable protection and cable crossings, these persist through O&M and, if elements are left in situ, beyond decommissioning, reducing the area of soft-sediment habitats utilised by fish and shellfish.	Potential ICCI from warming trends and acidification that may shift fish and shellfish baselines, alter habitat suitability and prey composition, and, in-combination with installed hard-substrate footprints, influence local utilisation of habitats and community composition.	Impacts from long-term habitat loss are considered in Section 9.11 of Volume 2, Chapter 9: Fish and Shellfish Ecology of the Morven North and Morven South EIA Reports. Effects are highly localised to discrete hard-substrate footprints, of long-term duration and low reversibility, however, the effects represent a very small proportion of the Morven North Fish and Shellfish Ecology Study Area and Morven South Fish and Shellfish Ecology Study Area. There are no designated sites for fish and shellfish within the ZoI for this impact, therefore conservation objectives for designated fish receptors are not impeded, and offshore long-term footprints at the Morven North and Morven South boundaries will not cause barriers to migration for Annex II diadromous fish associated with east coast SACs. The magnitude of the impact is deemed to be low, however precautionary minor adverse significance of effect is applied where IEFs have conservation designations, for example priority marine feature status. Under projected climate change, warming and acidification may alter colonisation on installed hard substrates and associated fish aggregation, nevertheless these biological shifts occur over small, discrete footprints, so magnitude and extent remain low and do not elevate significance. These highly localised effects are not likely to be increased, or combine with the potential ICCIs identified, to result in an effect of greater significance. This potential ICCI effect is not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 9.10 of Volume 2, Chapter 9: Fish and Shellfish Ecology of the Morven North and Morven South EIA Reports.

Impact identified in topic assessments	Relevant climate risk(s)	Phase			Potential Impact(s) identified	Potential ICCI identified	Discussion	ICCI significance		Mitigation measures
		C	O	D				Morven North	Morven South	
Colonisation of hard structures and associated fish aggregation	2	✓	✓	✓	Installation of hard structures, wind turbine and OSP foundations with associated scour protection, and discrete areas of cable protection and crossings, introduces artificial hard substrate into soft-sediment environments. Colonisation of these surfaces by benthic and biofouling communities can alter local prey resources and habitat structure, with potential for fish aggregation in the vicinity of infrastructure.	Potential ICCI from warming trends and ocean acidification that can shift colonising assemblages, community composition and prey availability, with, in-combination with installed hard-substrate footprints, localised modulation of utilisation of habitats and aggregation behaviour.	Impacts from colonisation of hard structures and associated fish aggregation are considered in Section 9.11 of Volume 2, Chapter 9: Fish and Shellfish Ecology of the Morven North and Morven South EIA Reports. For all phases, the magnitude of impacts for all receptors (including all IEFs) is predicted to be low, resulting in effects of minor adverse significance. Effects are highly localised to discrete hard-substrate footprints that persist through O&M, and, if elements are left in situ, beyond decommissioning. Under projected climate change, warming and acidification may alter colonisation patterns and aggregation responses, nevertheless these biological shifts occur over small, discrete areas, so magnitude and extent remain low and do not elevate significance. These highly localised effects are not likely to be increased, or combine with the potential ICCIs identified, to result in an effect of greater significance. This potential ICCI effect is not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 9.10 of Volume 2, Chapter 9: Fish and Shellfish Ecology of the Morven North and Morven South EIA Reports.
Volume 2, Chapter 10: Marine Mammals										
Injury and disturbance from underwater sound generated from piling	2, 4	✓	X	X	Underwater noise impacts from piling of wind turbine and OSP foundations, detonation of any confirmed UXO, and site investigation surveys generates elevated underwater sound that can lead to auditory injury and behavioural disturbance in marine mammals.	Warming and ocean acidification can modify sound propagation and attenuation, and increased storm intensity can elevate ambient noise levels.	Impacts from underwater sound are considered in Section 10.11 of Volume 2, Chapter 10: Marine Mammals of the Morven North and Morven South EIA Reports. The magnitude of impact is anticipated to be negligible to low, with effects of negligible to minor adverse significance. Event-based exposures are short in duration and spatially confined to the vicinity of the sound producing works, with injury and disturbance ranges controlled by designed-in and standard good practice measures set out in Section 10.10 of Volume 2, Chapter 10: Marine Mammals of the Morven North and Morven South EIA Reports. Potential ICCI influences, namely small changes to sound propagation under warmer, more acidic conditions and transient elevation of ambient noise during storms, would not materially extend ranges or duration beyond those already assessed, and do not change effect significance. This potential ICCI effect is not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 10.10 of Volume 2, Chapter 10: Marine Mammals of the Morven North and Morven South EIA Reports.
Effects on marine mammals due to changes in prey availability	2, 4, 5, 7	✓	✓	✓	Indirect effects on marine mammals via changes to prey availability and distribution arising from project activities.	Potential ICCI from warming, ocean acidification, increased storm intensity, changes to wind patterns and increased wave height, which can alter prey baselines, seasonal timing, and local prey fields, in-combination with the small, discrete project footprints.	Effects on marine mammals due to changes in prey availability are considered in Section 10.11 of Volume 2, Chapter 10: Marine Mammals of the Morven North and Morven South EIA Reports. The magnitude of impact is anticipated to be negligible to low, with effects of negligible to minor adverse significance. It is known that climatic changes may compound anthropogenic pressures, although predicting future trajectories of marine mammal populations without comprehensive data is challenging. However, marine mammals are mobile and adaptable, and can switch prey or forage more widely, therefore any in-combination climate interaction does not increase the magnitude, extent or duration of effects to a level of significance for marine mammal receptors across construction, O&M, or decommissioning. This potential ICCI effect is not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in 10.10 of Volume 2, Chapter 10: Marine Mammals of the Morven North and Morven South EIA Reports.

Impact identified in topic assessments	Relevant climate risk(s)	Phase			Potential Impact(s) identified	Potential ICCI identified	Discussion	ICCI significance		Mitigation measures
		C	O	D				Morven North	Morven South	
Volume 2, Chapter 11: Offshore Ornithology										
Changes in prey availability due to temporary habitat loss/disturbance	1, 2, 3, 4, 5, 6, 7, 8	✓	✓	✓	Direct disturbance to birds may occur during all project phases through temporary increases in vessel activity and underwater sound, alongside short-term, localised shifts in prey distribution and availability.	Potential ICCI from projected climate hazards (e.g. Increases in average and extreme air temperatures (both in winter and summer), increases in sea surface temperatures and ocean acidification, changes to rainfall patterns, leading to increased annual precipitation, and increased frequency and intensity of extreme weather (i.e. storms) could represent additional stresses that reduce species resilience. When these broader climate-driven changes interact with indirect effects such as reduced prey availability or loss of suitable habitat, impacts on chick survival may arise (Oswald *et al.,* 2008; Hakkinen *et al.,* 2022).	Impacts from changes in prey availability due to temporary habitat loss/disturbance are considered in Section 11.11 of Volume 2, Chapter 11: Offshore Ornithology of the Morven North and Morven South EIA Reports. Climate change is widely recognised as a key driver of future seabird population declines (Davies *et al.,* 2023). While some degree of in-combination interaction with climate hazards is acknowledged, these hazards originate independently of Morven North and Morven South and would occur regardless of whether they proceed. Across all phases, project-related effects are predicted to be low in magnitude, short in duration and spatially restricted to the immediate work areas, with an effect of negligible to minor adverse significance. Environmental conditions are expected to return to baseline shortly after activities conclude, and a non-significant influence on prey resources to ornithological receptors is anticipated. In contrast, climate-driven changes in sea temperature have the potential to influence fish populations at multiple biological levels. As waters warm, availability of cold-adapted species such as mackerel, sandeel and herring may decline as they shift northwards, while warm-adapted species become more prevalent. These shifts will alter prey availability for seabirds that rely on these fish. Prey availability at the sea surface may also be reduced during storm conditions or become harder for seabirds to detect due to increased turbidity, potentially contributing to mass mortality events. However, Morven North and Morven South do not introduce new climate stressors, nor do they intensify existing ones in a way that would materially affect seabird populations. Many of the species considered are wide-ranging and behaviourally flexible, enabling them to adjust to temporary changes in prey distribution or foraging conditions. As such, the predicted project-related effects are not considered to make a significant or measurable contribution to an ICCI. In a broader context, delaying projects such as Morven North and Morven South would prolong the UK's reliance on fossil fuels, thereby exacerbating climate change and its associated pressures on seabird populations. Taking this into account, the potential ICCI effect is assessed as not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 11.10 of Volume 2, Chapter 11: Offshore Ornithology of the Morven North and Morven South EIA Reports.

Impact identified in topic assessments	Relevant climate risk(s)	Phase			Potential Impact(s) identified	Potential ICCI identified	Discussion	ICCI significance		Mitigation measures
		C	O	D				Morven North	Morven South	
Displacement and barrier effects	1, 2, 3, 4, 5, 6, 7, 8	×	✓	×	The presence of wind turbines and associated offshore infrastructure may also lead to displacement or barrier effects, requiring birds to travel further during migration or spend longer locating suitable foraging areas.	Potential ICCI from projected climate hazards (e.g. Increases in average and extreme air temperatures (both in winter and summer), increases in sea surface temperatures and ocean acidification, changes to rainfall patterns, leading to increased annual precipitation, and increased frequency and intensity of extreme weather (i.e. storms) could represent additional stresses that reduce species resilience. When these broader climate-driven changes interact with indirect effects such as reduced prey availability or loss of suitable habitat, impacts on chick survival may arise (Oswald *et al.,* 2008; Hakkinen *et al.,* 2022).	Impacts from displacement and barrier effects are considered in Section 11.11 of Volume 2, Chapter 11: Offshore Ornithology of the Morven North and Morven South EIA Reports. The magnitude of impacts are anticipated to be negligible to low, with effects of negligible to minor adverse significance. Climate change is widely recognised as a key driver of future seabird population declines (Davies *et al*., 2023). While some degree of in-combination interaction with climate hazards is acknowledged, these hazards originate independently of the respective Morven North and Morven Southand would occur regardless of whether they proceed. Displacement and barrier effects are similarly limited to the Morven North and Morven South boundaries, with only minor increases in flight distances and negligible energetic consequences. In contrast, climate-driven changes in extreme weather events can have substantial consequences, with strong winds and heavy rainfall during the breeding season leading to widespread breeding failure in species such as kittiwake and common guillemot (Mallory *et al.,* 2009; Mitchell *et al.,* 2020). Increased wind speeds can raise the energetic cost of flying and diving (Kogure *et al.,* 2016), reducing foraging efficiency for species such as gannet and guillemot. Storm surges and heavy rain can destroy nests, while rising sea levels may reduce nesting habitat for low-lying species such as terns (Ratcliffe *et al.,* 2008). Storm-driven turbidity can also reduce prey visibility at the sea surface, contributing to mass mortality events. However, Morven North and Morven South do not introduce new climate stressors, nor do they intensify existing ones in a way that would materially affect seabird populations. Many of the species considered are wide-ranging and behaviourally flexible, enabling them to adjust to migration or foraging behaviours. As such, the predicted project-related effects are not considered to make a significant or measurable contribution to an ICCI. In a broader context, delaying projects such as Morven North and Morven South would prolong the UK's reliance on fossil fuels, thereby exacerbating climate change and its associated pressures on seabird populations. Taking this into account, the potential ICCI effect is assessed as not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 11.10 of Volume 2, Chapter 11: Offshore Ornithology of the Morven North and Morven South EIA Reports.
Volume 2, Chapter 12: Commercial Fisheries										
Reduction in access to, or exclusion from, established fishing grounds	4	✓	✓	✓	Temporary reduction in access to established fishing grounds within Morven North and Morven South during construction and decommissioning, and intermittently during O&M due to maintenance activities, temporary safety zones and increased project vessel presence.	Potential ICCI from increased frequency and intensity of extreme weather (i.e. storms), limiting fishing opportunities.	Impacts from reduction in access to, or exclusion from, established fishing grounds are considered in Section 12.11 of Volume 2, Chapter 12: Commercial Fisheries of the Morven North and Morven South EIA Reports. The magnitude of impact is anticipated to be negligible to low, with effects of minor adverse significance. Increasing storm frequency and intensity has the potential to directly disrupt fishing activity in the North Sea, influencing when and where vessels can operate safely. If storm events become more common, these weather-related constraints could compound the temporary access restrictions associated with Morven North and Morven South, creating additional pressures on commercial fisheries during certain periods. However, the projected rate of change in the relevant climate variables is expected to be gradual, occurring over many years. Fishers operating at the regional scale are generally adaptable, with the ability to adjust their timing, routes and choice of fishing grounds in response to both environmental conditions and operational constraints, therefore the potential ICCI effect is assessed as not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 12.10 of Volume 2, Chapter 12: Commercial Fisheries of the Morven North and Morven South EIA Reports.

Impact identified in topic assessments	Relevant climate risk(s)	Phase			Potential Impact(s) identified	Potential ICCI identified	Discussion	ICCI significance		Mitigation measures
		C	O	D				Morven North	Morven South	
Disturbance of commercially important fish and shellfish resources	2	✓	✓	✓	Project activities may disturb, or temporarily displace, commercially exploited fish and shellfish resources through underwater sound, seabed disturbance, and associated changes in SSC during construction and decommissioning, and through intermittent maintenance activities and long-term habitat change effects during O&M. These effects may reduce the availability of target species locally, which could disrupt normal fishing practices and contribute to short-term redistribution of fishing activity.	Potential ICCI from increases in sea surface temperatures and ocean acidification that could cause geographical shifts in fish species distributions, thereby increasing the relative importance of the Central and Northern North Sea as a fishing ground. Temperature changes could also affect abundance of fish and shellfish stocks.	Impacts from reduction in access to, or exclusion from established fishing grounds are considered in Section 12.11 of Volume 2, Chapter 12: Commercial Fisheries of the Morven North and Morven South EIA Reports. The magnitude of impact is anticipated to be low, with effects of minor adverse significance. Rising sea temperatures and changes in acidity may influence the distribution of commercially important species in the North Sea. Evidence indicates that Nephrops and many shellfish species are relatively tolerant to temperature change, meaning moderate warming is unlikely to significantly affect these stocks. For scallops, current research is mixed and inconclusive. Whitefish species such as haddock are more sensitive to warming seas, and suitable habitat may shift northwards as temperatures rise, increasing the importance of northern fishing grounds (Garrett and Pinnegar, 2022; OSPAR, 2023; European Environment Agency, 2024; Sailley et.al., 2025). If climate change continues without mitigation, fish stocks may undergo major distribution shifts, with implications for fisheries management. However, the rate of change in relevant climate variables is expected to be slow and incremental. Further, impacts from Morven North and Morven South may be offset in the longer term by fishing management measures (e.g. spatial closures) in the region. The potential ICCI effect is assessed as not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 12.10 of Volume 2, Chapter 12: Commercial Fisheries of the Morven North and Morven South EIA Reports.
Volume 2, Chapter 13: Shipping and Navigation										
Increased navigational and maritime safety risks	4	✓	✓	✓	Increased vessel to vessel collision risk resulting from displacement (third-party to third-party, and third-party to project vessel), vessel to structure allision risk, reduced access to local ports and harbours, reduction of under keel clearance as a result of subsea infrastructure, and reduction of Search and Rescue (SAR) capability.	Potential ICCI from more frequent adverse weather events, such as storms, heatwaves and strong winds, which can alter vessel distribution, restrict access to local ports, increase the likelihood of vessel-to-vessel collisions or vessel-to-structure allisions, and reduce the effectiveness of emergency response operations.	Impacts from increased navigational and maritime safety risks are considered in Section 13.11 of Volume 2, Chapter 13: Shipping and Navigation of the Morven North and Morven South EIA Reports. Interactions between shipping activities are managed through embedded design measures and through established management plans that set out procedures for all operational activities, including promulgation of information, marking on charts, buoyage, safety zones, guard vessels where required, compliance with COLREGs and SOLAS via the Navigation Safety Plan and Vessel Management Plan, and development of an Emergency Response Co-operation Plan and SAR checklist, with under keel clearance managed within MGN 654 tolerances. As a result, all assessed impacts were determined to be tolerable and either As Low As Reasonably Practicable (ALARP) or broadly acceptable. The effects associated with Morven North and Morven South are therefore not expected to increase to a significant level when considered in-combination with assessed climate risks. The identified ICCI effects are assessed as not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 13.10 of Volume 2, Chapter 13: Shipping and Navigation of the Morven North and Morven South EIA Reports.
Volume 2, Chapter 14: Marine Archaeology										
Increased SSC and sediment deposition, and alteration to sediment transport regimes	2, 4, 6, 7, 8	✓	✓	✓	Increased SSC and associated deposition leading to indirect impacts on marine archaeology receptors, alteration of sediment transport regimes leading to indirect impacts.	Potential ICCI from more frequent and intense storms, higher wave conditions and changes to tidal ranges. These changes could increase seabed mobility, erosion and scour, leading to greater rates of burial or exposure of marine archaeological receptors and accelerating their deterioration over time.	Impacts from increased SSC and sediment deposition, and alteration to sediment transport regimes are considered in Section 14.11 of Volume 2, Chapter 14: Marine Archaeology of the Morven North and Morven South EIA Reports. The magnitude of impact is anticipated to be low, with effects of minor adverse significance. The baseline indicates that neither the Morven North Marine Archaeology Study Area or Morven South Marine Archaeology Study Area contain designated marine archaeology sites, with very low to negligible potential for submerged prehistoric remains and only a small number of known or possible receptors identified through geophysical and geotechnical surveys. Although climate-driven changes to the marine environment may affect archaeological receptors over the medium to long-term (DECC, 2016), the measures in place, specifically the development and implementation of a Written Scheme of Investigation (WSI) and a Protocol for Archaeological Discoveries (PAD) (Volume 4, Annex 6), ensure that Morven North and Morven South will not contribute to an ICCI. Consequently, the identified ICCI effects are assessed as not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 14.10 of Volume 2, Chapter 14: Marine Archaeology of the Morven North and Morven South EIA Reports.

Impact identified in topic assessments	Relevant climate risk(s)	Phase			Potential Impact(s) identified	Potential ICCI identified	Discussion	ICCI significance		Mitigation measures
		C	O	D				Morven North	Morven South	
Volume 2, Chapter 16: Other Sea Users and Communications										
Displacement of recreational activities	1, 2, 3, 4, 5	✓	✓	✓	Localised, temporary displacement of recreational sailing and motor cruising, and recreational fishing.	Potential ICCI from increased occurrences of favourable weather that affect public behaviour and patterns of use leading to an increase in recreational users and pressure on the available sea space (either intermittent, short-term influxes or a long-term trend).	Impacts from displacement of recreational activities are considered in Section 16.11 of Volume 2, Chapter 16: Other Sea Users and Communications of the Morven North and Morven South EIA Reports. The magnitude of impact is anticipated to be low, with effects of negligible significance. While the direction of climate influence differs to more favourable conditions potentially increasing recreational activity, the resulting interaction remains limited because displacement is driven by temporary, localised safety measures and the baseline indicates low recreational use within the Morven North and Morven South boundaries. The closest general boating area is located at Montrose, approximately 74km west of the Morven North and 93km west of Morven South. This identified ICCI effect is not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 16.10 of Volume 2, Chapter 16: Other Sea Users and Communications of the Morven North and Morven South EIA Reports.
Volume 2, Chapter 20: Human Health										
Reduced employment and income for affected fishing communities	2, 4	✓	✓	✓	Project related reductions in access to, or disruption of, fishing activity can affect employment and income for some fishing communities, acting as a pathway to physical and mental health effects (including for dependants), particularly for vulnerable groups and communities where livelihoods are strongly linked to commercial fishing.	Potential ICCI from climate driven changes associated with warming and acidification affecting marine ecosystems and fisheries baselines, and storms affecting fishing effort and safe operating windows, reduce resilience and adaptive capacity in fishing communities, such that project related disruption to access, or displacement of fishing effort, could contribute to a greater adverse employment and income effect for affected communities than under baseline conditions.	Impacts from reduced employment and income for affected fishing communities are considered in Section 20.11 of Volume 2, Chapter 20: Human Health of the Morven North and Morven South EIA Reports. Minor adverse effects may occur through disruption in access to fishing grounds; although these are classified as not significant in EIA terms for Morven North and Morven South, with magnitude characterised as low and sensitivity for vulnerable groups characterised as high. Climate risks that act as additional background pressures on fishing viability could plausibly increase vulnerability in those communities most reliant on fishing. However, on the basis of the human health assessment's conclusions already reached for Morven North and Morven South, and the way the health pathway is framed as effects affecting a small minority of the population, with overall regional and national baseline change described as slight, the ICCI interaction is not expected to elevate the effect beyond the minor adverse. Therefore, this identified ICCI effect is not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 20.10 of Volume 2, Chapter 20: Human Health of the Morven North and Morven South EIA Reports.
Decarbonisation; increased energy security, affordability, and decreased fuel poverty	1, 4	×	✓	×	Renewable energy generation lowers greenhouse gas emissions and helps avoid climate-related health impacts such as extreme temperatures, increased disease risk, food insecurity and climate-related injury or mortality (Costello ***et al.,*** 2009). Morven North and Morven South also support decarbonisation while improving energy security and affordability, reducing the likelihood of fuel poverty. This provides clear health benefits, especially for vulnerable groups most affected by energy insecurity and price volatility.	Potential ICCI where climate driven changes associated with increased average and extreme temperatures increase health vulnerability and energy demand, and increased frequency and intensity of storms increase the risk of disruption to supply chains.	Impacts from decarbonisation; increased energy security, affordability, and decreased fuel poverty are considered in Section 20.11 of Volume 2, Chapter 20: Human Health of the Morven North and Morven South EIA Reports. Energy insecurity and fuel poverty can contribute to adverse health outcomes, while climate risks add further pressures that may heighten vulnerability, increase energy demand and worsen the effects of disruption. In this context, the public health benefits of decarbonisation and enhanced energy security become increasingly important, helping to build resilience and adaptive capacity, particularly for vulnerable groups. Given the relatively small national-level contribution of Morven North and Morven South, the in-combination climate change interaction is not expected to increase the effect beyond a minor beneficial level. The identified ICCI effect is therefore not significant.	Not significant	Not significant	No further mitigation measures are required in addition to those measures set out in Section 20.10 of Volume 2, Chapter 20: Human Health of the Morven North and Morven South EIA Reports.

5 Summary

5.1.1.1 An ICCI assessment has been undertaken for Morven North and Morven South. The potential ICCI do not result in any greater LSE[1] than assessed in the relevant topic chapters of the Morven North and Morven South EIA Reports or have been assessed as not being significant.

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