Morven South

Morven South Offshore Wind Array Project

Environmental Impact Assessment Report

Volume 2, Chapter 11: Offshore Ornithology

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Table of contents

List of tables

List of figures

11 Offshore Ornithology

11.1 Introduction

11.1.1.1 This chapter of the Morven South Offshore Wind Array Project (hereafter "Morven South") Environmental Impact Assessment (EIA) Report (hereafter, the "EIA Report") presents the assessment of the Likely Significant Effects (LSE1) (as per the EIA Regulations, as defined in Volume 1, Chapter 2: Policy and Legislation) on Offshore Ornithology. Specifically, this chapter considers the potential impacts of Morven South seaward of Mean High Water Springs (MHWS) during the construction, operations and maintenance and decommissioning phases.

11.1.1.2 The assessment presented in this chapter has relied upon, or has informed, the following technical chapters and reports:

- Volume 2, Chapter 8: Benthic Subtidal Ecology;
- Volume 2, Chapter 9: Fish and Shellfish Ecology;
- Volume 3, Annex 11.1: Offshore Ornithology Baseline Characterisation Report;
- Volume 3, Annex 11.2: Offshore Ornithology Collision Risk Modelling Report;
- Volume 3, Annex 11.3: Offshore Ornithology Collision Risk Modelling Report: Migratory;
- Volume 3, Annex 11.4: Offshore Ornithology Displacement Modelling Report (Matrix Approach);
- Volume 3, Annex 11.5: Offshore Ornithology Displacement Modelling Report (SeabORD);
- Volume 3, Annex 11.6: Offshore Ornithology Regional Population Viability Analysis.

11.1.1.3 The offshore ornithology chapter considers any seabirds that are present at some point in their life cycle in the study areas defined for offshore ornithology (see Section 11.2), as well as non-seabird species using the study areas during migratory flights. The overarching term 'seabird' is used to refer to species that depend on the marine environment for survival at some point in their life cycle. Therefore, in addition to the true seabirds, consideration is given to seaducks, divers and grebes where applicable because of their additional reliance on marine areas, especially in the nonbreeding season.

11.1.1.4 Offshore ornithology was reported on in the Scoping Report for the Morven Option Lease Agreement Site (hereafter "the Morven Site Scoping Report") (Morven Offshore Wind Limited (MvOWL), 2023). As described in Volume 1, Chapter 4: Site Selection and Consideration of Alternatives, the Morven Option Lease Agreement Site (hereafter "Morven Site") has since been divided into two smaller projects, Morven South and Morven North.

11.1.1.5 The potential impacts to offshore ornithology are considered to generally be the same (or less) for Morven South as identified in the Morven Site Scoping Report. Consequently, there has been no change in the methodology or impacts that were scoped in or out in the Morven Site Scoping Report for offshore ornithology. The advice provided by the Marine Directorate Licensing Operations Team (MD-LOT) in the Morven Site Scoping Opinion (MD-LOT, 2023) relevant to Morven South, has therefore been considered for the development of this chapter.

11.1.1.6 This chapter presents and assesses up-to-date parameters for Morven South and explains if and how any assessment aspects differ from the information set out in the Morven Site Scoping Report.

11.2 Study areas

11.2.1.1 Two study areas have been defined for offshore ornithology:

- The Morven South Offshore Ornithology Study Area;
- The Morven South and Morven North Regional Offshore Ornithology Study Area (hereafter the "Regional Offshore Ornithology Study Area").

11.2.1.2 The Morven South Offshore Ornithology Study Area is shown in both study areas are defined as follows:

- The Morven South Offshore Ornithology Study Area includes the Morven South Boundary, plus a buffer extending 4km from the Morven South Boundary. This buffer has been defined to incorporate the area covered by the Digital Aerial Surveys (DAS) used to characterise the baseline environment at Morven South. The Morven South Offshore Ornithology Study Area is what was defined as Morven South Offshore Ornithology Baseline Characterisation Study Area in Chapter 3, Annex 11.1: Offshore Ornithology Baseline Characterisation Report.
- The Regional Offshore Ornithology Study Area encompasses a wide area generally coinciding with the northern and southern North Sea as defined by the regional seas identified by JNCC for implementing UK nature conservation strategy (JNCC, 2004). This captures the areas utilised by various seabird populations that may utilise the Morven South Offshore Ornithology Study Area throughout the annual cycle. Consideration of the Regional Offshore Ornithology Study Area provides a wider context incorporating species-specific foraging ranges, migration routes and wintering areas. The spatial extent of the Regional Offshore Ornithology Study Area therefore varies depending on different ecological factors (e.g. age cohort, season, etc.) for individual species. In addition, a number of areas in the North Sea that are considered important for birds are also discussed as part of the wider baseline characterisation (i.e. Wee Bankie and Marr Bank).

11.2.1.3 The study areas for offshore ornithology for the Morven Site were presented and agreed during the scoping process for the Morven Site. The underlying principles used to define the study area(s) for Morven South have not changed, other than the limits have been applied relative to the Morven South Boundary, rather than the Morven Site. The study areas for Morven South for offshore ornithology were presented to and confirmed by the Marine Directorate Licencing Operations Team (MD-LOT) via a 'Targeted Consultation Exercise' undertaken in Quarter 1, 2025 and as detailed in Table 11.7.

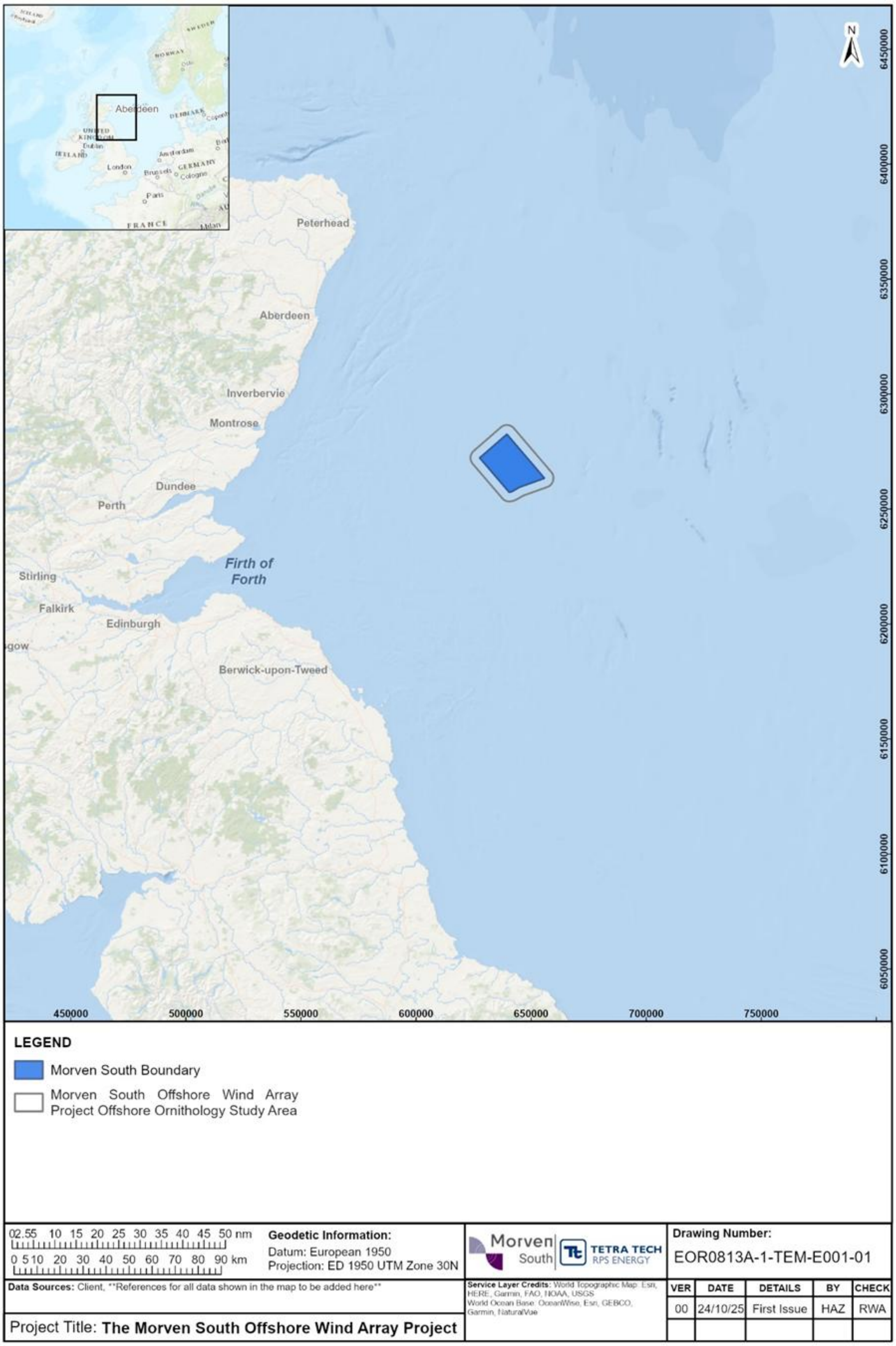

Figure 11.1: The Morven South Offshore Ornithology Study Area

11.3 Legislative and policy context

11.3.1.1 Policy and legislation on renewable energy infrastructure is presented in Volume 1, Chapter 2: Policy and Legislation. Policy and legislation specific to offshore ornithology is contained in the draft updated Sectoral Marine Plan (SMP) for Offshore Wind Energy (Scottish Government, 2025), the Scottish National Marine Plan (NMP) (Scottish Government, 2015) and the United Kingdom (UK) Marine Policy Statement (MPS) (Department for Environment, Food & Rural Affairs (DEFRA), 2011).

11.3.1.2 A summary of the legislative, provisions relevant to offshore ornithology are provided in Table 11.1 to Table 11.4 below, with other relevant policy provisions set out in Table 11.5 to Table 11.6.

Table 11.1: Summary of provisions within The Habitats Regulations (The Conservation of Offshore Marine Habitats and Species Regulations (2017); The Conservation of Habitats and Species Regulations (2017); The Conservation of Habitats and Species (Amendment) (European Union (EU) Exit) Regulations (2019)) of relevance to offshore ornithology

Summary of relevant legislation	How and where considered in the EIA report
The Habitats Regulations require that where a plan or project that is not directly connected with, or necessary to the management of a European site, but likely to have a significant effect on a European site (either individually or in combination with other plans or projects), it shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives.	The potential impacts on ornithology features of European sites are considered from an EIA perspective within this report. Assessment of potential Likely Significant Effects (LSE[2]) on the qualifying interest features of Special Protection Areas (SPAs) are provided in Chapter 2.2 Report to Inform Appropriate Assessment Part 3: SPA and Ramsar Site Assessments.

Table 11.2: Summary of provisions within The Nature Conservation (Scotland) Act (2004) of relevance to offshore ornithology

Summary of relevant legislation	How and where considered in the EIA report
The Act sets out a series of measures which are designed to conserve biodiversity and to protect and enhance the biological and geological natural heritage of Scotland.	This EIA Report as a whole demonstrates that Morven South will comply with the Act and provides information to public bodies and office holders to enable them to fulfil their obligations under the Act.

Table 11.3: Summary of provisions within The Wildlife and Countryside Act (1981) and Wildlife and Natural Environment (Scotland) Act (2011) of relevance to offshore ornithology

Summary of relevant legislation	How and where considered in the EIA report
The Wildlife and Countryside Act 1981 is the primary legislation protecting animals, plants and certain habitats in the UK, including all wild birds and their nests, eggs and chicks. Wildlife and Natural Environment (Scotland) Act 2011 makes amendments to the 1981 Act which concern the management of Sites of Specific Scientific Interests (SSSIs) and the enforcement of wildlife crime.	This EIA Report as a whole demonstrates that Morven South will comply with the Act and provides information to public bodies and office holders to enable them to fulfil their obligations under the Act. Where relevant consideration has been given to SSSIs with ornithological qualifying features that may be relevant to Morven South. These SSSIs generally are coincident in extent with SPAs, and support SPA qualifying features.

Table 11.4: Summary of provisions within The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations (2017) and The Marine Works (Environmental Impact Assessment) Regulations (2007) of relevance to offshore ornithology

Summary of relevant legislation	How and where considered in the EIA report
The EIA Regulations set out when environmental impact assessments are required and the procedures for carrying out and reporting of environmental impact assessments.	It is noted that Morven South does meet the criteria for carrying out an environmental impact assessment, and this EIA Report is therefore set out to meet the requirements of the Regulations

Table 11.5: Summary of provisions within The Scottish National Marine Plan of relevance to offshore ornithology

Summary of relevant policy	How and where considered in the EIA report
Section 11, Part 1: Objectives and Marine Planning Policies Sustainable development of offshore wind, wave and tidal renewable energy in the most suitable locations.	The choice of location for Morven South is discussed in Volume 1, Chapter 4: Site Selection and Consideration of Alternatives.
Policy GEN 9 Natural Heritage Development and use of the marine environment must: (a) Comply with legal requirements for protected areas and protected species. (b) Not result in significant impact on the national status of Priority Marine Features. (c) Protect and, where appropriate, enhance the health of the marine area.	This EIA Report sets out how Morven South will comply with all relevant legal requirements. No ornithological features are classified as Priority Marine Features and so they are not discussed further in this Chapter, but may be considered in other Chapters as necessary. Designed-in measures taken to protect the marine area relevant to ornithology are set out in Table 11.26.
Living within Environmental Limits A strategic approach to mitigating potential impacts and cumulative impacts on the marine environment forms an integral part of marine planning and decision making, whilst issues arising in the coastal interface should align between marine and terrestrial processes.	A Cumulative Effect Assessment (CEA) has been undertaken and is outlined in Section 11.12 and 11.13 which can be used to inform the Scottish Government's strategic approach to planning and decision making.

Table 11.6: Summary of provisions within the Draft Updated Sectoral Marine Plan of relevance to offshore ornithology

Summary of relevant policy	How and where considered in the EIA report
The Plan aims to identify sustainable plan options for the future development of commercial-scale offshore wind energy in Scotland.	Morven South is located within the East 1C Plan Option Area. The location of Morven South has therefore been informed by the Plan Development Process.
Within the East 1C Plan Option Area and the whole East region, a key environmental risk is the impact on bird populations. There is potential risk due to the effects resulting from collision risk and displacement. The Draft Updated SMP identified these key seabird species with kittiwake, guillemot, razorbill, gannet, puffin, herring gull, great black-	The potential impact on bird populations (including those species specifically mentioned within the draft updated SMP) from Morven South alone, cumulatively and in-combination with other projects is assessed in this chapter (alone and cumulatively) and Chapter 2.2 Report to Inform Appropriate Assessment Part 3: SPA and Ramsar Site Assessments (alone and in-combination).

Summary of relevant policy	How and where considered in the EIA report
backed gull and taiga bean geese specifically mentioned.	
The draft updated SMP concluded there is potential for negative environmental impacts at both the plan and project level. Assessments should consider and address any impacts following the mitigation hierarchy.	The potential impacts have been considered and relevant designed-in measures or secondary mitigation has been proposed (if relevant). Designed-in measures are presented within Section 11.10 and any secondary mitigation, if required, is presented for each impact and species within Section 11.11.

11.4 Consultation

11.4.1.1 The approach to consultation for Morven South is set out in Volume 1, Chapter 5: Consultation. A summary of the issues raised during consultation activities undertaken to date specific to offshore ornithology is presented in Table 11.7, together with how these issues have been considered in the production of this offshore ornithology EIA Report chapter. Further detail is presented within Volume 3, Annex 5.1: Consultation.

Table 11.7: Summary of key consultation issues raised during consultation activities undertaken for Morven South of relevance to offshore ornithology

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
11 August 2021	NatureScot, Marine Directorate Licensing and Operations Team (MD-LOT), Marine Scotland Science (MSS) and Royal Society for the Protection of Birds (RSPB) meeting on survey scope	Discussed approach to baseline data review and development of offshore survey scopes for offshore ornithology.	The discussions have informed the DAS baseline surveys and the development of the baseline charactersation of Morven South.
19 April 2023	NatureScot Advice on impact pathways during Scoping workshop	NatureScot were generally in agreement with the impacts the Applicant proposed to scope in or scope out, but suggested there is consideration of vessel movement.	Consideration of vessel movements has been incorporated into the impact assessments presented in section 11.11.
03 July 2023	NatureScot – email correspondence	The consultation aimed to clarify NatureScot's guidance on Offshore Ornithology Impact Pathways for Offshore Wind Developments, specifically regarding alternative approaches to biological defined minimum population scale (BDMPS) for assessing cumulative impacts on guillemots and razorbills during the non-breeding season. The Applicant asked NatureScot to provide details on what "other agreed approaches" meant in the Guidance Note, beyond BDMPS, for cumulative assessment of guillemots and razorbills in the non-breeding season. • NatureScot's Position on Guillemots: advised against using BDMPS for guillemot cumulative assessment in the non-breeding season. Instead, recommended applying the breeding season approach of mean-max foraging range plus one standard deviation, based on Buckingham *et al*. (2022) tracking data.	The Applicant has agreed a bespoke approach for guillemot based on additional pre-application consultation undertaken in October 2025. For razorbill the approach proposed by NatureScot has been followed

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
		• NatureScot's Position on Razorbills: For razorbills, NatureScot confirmed that the BDMPS region remains appropriate for screening cumulative impacts during the non-breeding season. • NatureScot clarified that for guillemots, the alternative agreed approach is the breeding season foraging range method (mean-max + 1 SD), while for razorbills, the existing BDMPS region should continue to be used for cumulative impact screening in the non-breeding season.	
24 August 2023	NatureScot: Advice on EIA Scoping Report	NatureScot are content with the proposed study area approach, as described in Section 8.4.2 of the Scoping Report.	The proposed approach to defining study areas in Chapter 6: Scoping Report for the Morven Option Lease Agreement Site has been followed. Study areas relevant to the assessment of offshore ornithological features are defined in Section 11.2.
		In general, NatureScot agree with the proposed scoping in and out of impact pathways, as detailed in table 8.25, Section 8.4.6 of the Scoping Report. However, NatureScot does not agree with the impact heading 'indirect temporary habitat loss and disturbance'. They note the importance of making clear the link between habitat loss, change and disturbance and changes in prey availability, rather than only considering habitat loss and disturbance as a temporary effect. They suggest it may be more appropriate to title the impact heading 'changes in prey availability'.	This advice has been followed. The impact originally titled 'indirect temporary habitat loss and disturbance' has been renamed 'changes in prey availability due to temporary habitat loss/disturbance' and has been assessed during all phases of Morven South.
		It would be beneficial to look at the conclusions from the benthic subtidal ecology and fish and shellfish ecology assessments in relation to potential impacts on birds, for both temporary and long-term habitat loss/change. NatureScot therefore recommend including a summary of the conclusions from the benthic and fish and shellfish EIA chapters in the	This advice has been followed. The assessment of changes in prey availability due to temporary habitat loss/disturbance in Section 11.11.3 discusses the conclusions of Volume 2, Chapter 8: Benthic Subtidal Ecology and Volume 2, Chapter 9: Fish and Shellfish Ecology

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
		ornithology chapter as inter-related effects, with clear links between the receptor chapters.	
		As well as the data sources listed in Table 8.22 of the Scoping Report, NatureScot recommend that the E1 and E2 regional developer surveys being undertaken as part of the Sectoral Marine Plan ornithology working groups recommendations may also provide useful contextual data.	This advice has been followed. The results of the E1 and E2 regional developer surveys have been incorporated into Volume 3, Annex 11.1: Offshore Ornithology Baseline Characterisation Report with a summary also provided in Section 11.7.1 of this chapter.
		NatureScot are broadly content with the methods for the DAS, including duration, timing and frequency of the surveys. The survey findings are broadly as they would expect for this location, though they note that the peak of 49 Manx shearwater in July is interesting. NatureScot note that a aircraft flying altitude of 400 m has the potential to cause disturbance of sensitive species and possible compatibility issues with any future post-consent monitoring surveys. They recommend that the presence of sensitive species should be confirmed when the full two years of survey are completed.	The Applicant welcomes agreement on the aerial survey methodology. Additional consultation has been undertaken with NatureScot in relation to the altitude of surveys (please see responses to consultation undertaken on 27 March 2024) with agreement on these points reached.
		NatureScot note that the survey coverage analysis of 10% is at the lower end of what they would expect. From initial reports, they have not identified any issues to suggest that 10% coverage is inadequate, but this should be confirmed when the full two years of survey are completed.	Additional consultation has been undertaken with NatureScot in relation to this point (please see responses to consultation undertaken on 27 March 2024) with agreement on these points reached.
		NatureScot note that availability bias does not seem to have been undertaken for common guillemot, razorbill and puffin as yet, so the figures provided will underestimate abundance and density for these diving species.	Availability bias has been incorporated into the calculation of abundance estimates presented throughout the application. Please see Volume 3, Annex 11.1: Offshore Ornithology Baseline Characterisation Report for further information

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
		NatureScot advise that an explanation of how birds recorded to species groups will be attributed to species level and how accounting for availability bias will be carried out should be provided prior to submission of the EIA Report. Regarding availability bias, NatureScot expect that species-specific correction factors are applied to the number of each auk species recorded on the sea's surface. They accept factors from Thaxter *et al.* (2010) for common guillemot and razorbill, from Spencer (2012) for puffin, and using Barlow *et al.* (1988).	Birds only identified at a species group level have been attributed to species level and incorporated into the calculation of abundance estimates presented throughout the application. Please see Volume 3, Annex 11.1: Offshore Ornithology Baseline Characterisation Report for further information. Availability bias has also been incorporated into the calculation of abundance metrics for relevant species using correction factors from the references provided by NatureScot.
		The ratio of records that were identified to species level are usually used to adjust density estimates to take account of unidentified birds. NatureScot advise that this ratio approach is likely to be more accurate if the number of unidentified birds is low compared to the number of identified birds. If the number of unidentified birds was consistently high in surveys, NatureScot expect this to be discussed and an approach agreed with them.	Birds identified at a species group level have been attributed to species level and incorporated into the calculation of abundance estimates presented throughout the application. Please see Volume 3, Annex 11.1: Offshore Ornithology Baseline Characterisation Report for further information following the approach described by NatureScot. This follows the approach supported by NatureScot (please see pre-application consultation conducted on 27 March 2024).
		NatureScot have accepted Berwick Bank wind farm's definitions of seasons, which clarifies how to use BDMPS with NatureScot's definitions of seasons. The key points are: (1) non-breeding season apportioning is dependent on information within BDMPS (Furness, 2015), and where Furness (2015) seasons overlap with NatureScot main breeding seasons, the Furness (2015) seasons should be foreshortened; (2) the non-breeding season subsumes the 'attendance' periods defined in NatureScot guidance; and (3) NatureScot recommend following their Guidance Note 8 concerning displacement when considering dispersal peaks for auks, and would welcome further discussion once DAS outputs	The assessment and supporting analyses have defined seasons as recommended by NatureScot. For the breeding season this therefore uses the seasons as defined by NatureScot (2020) with Furness (2015) used to define non-breeding seasons. Where there is overlap priority has been given to the breeding season. For Morven South consultation in relation to dispersal peaks of auks has been undertaken for

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
		are available concerning these dispersal peaks for auks and whether the date of August surveys results in data being part of the non-breeding season displacement assessment.	guillemot and razorbill. In relation to defining seasons for common guillemot and razorbill, the Applicant has undertaken additional consultation with NatureScot with seasons for these species based on NatureScot's advice as part of this additional targeted consultation (please see consultation undertaken on 14th April 2025)
		For collision risk modelling, NatureScot recommend the use of the 2022 update to sCRM tool shiny app (Caneco and Humphries, 2022). They also advise that Option 3 models are no longer required, only Option 2. They expect deterministic outputs for each collision risk species as well as stochastic outputs for Option 2.	The collision risk model recommended by NatureScot has been used with only Option 2 outputs presented (see Volume 3, Annex 11.2: Offshore Ornithology Collision Risk Modelling Report for the full methodology).
		NatureScot refer to their Guidance Note 7 concerning collision risk modelling, where they advise that the wind farm scenarios to be modelled are the Most Likely Scenario (MLS) and Worst Case Scenario (WCS). If the Maximum Design Scenario (MDS) is equivalent to the MLS, then the WCS is expected to be modelled as well.	This advice has been followed, Volume 3, Annex 11.2: Offshore Ornithology Collision Risk Modelling Report presents collision risk estimates for both the Worst Case Scenario and Most Likely Scenario.
		NatureScot note that they are currently reviewing their avoidance rate guidance in light of the Ozsanlav-Harris *et al.* (2023) review and that, while they do not expect significant changes, an updated version of their guidance note will be available shortly (from the time of writing).	The collision risk modelling parameters recommended by NatureScot as part of their guidance note series have been used to inform the collision risk modelling conducted in Volume 3, Annex 11.2: Offshore Ornithology Collision Risk Modelling Report
		NatureScot support a qualitative approach to assessing collision impacts on migratory birds using the information presented in WWT and MacArthur Green (2014). The anticipated (at the time of writing) ScotMER report 'Strategic study of collision risk for birds on migration and further development of the stochastic collision risk modelling tool' should be used once available.	Please see additional comments from NatureScot in January 2025 in this table.

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
		Concerning displacement and mortality rates, NatureScot acknowledge the increasing evidence-base on species-specific displacement levels and that developers may seek and present emerging sources of empirical evidence to provide support for additional, alternative displacement assessment. Where these alternatives vary with current guidance, their use should be justified, and NatureScot anticipate that the evidence should be derived from relevant studies at multiple comparable developments and have been subject to peer review and/or formal ratification.	The assessments of displacement presented throughout the application incorporate the displacement and mortality rates recommended by NatureScot in NatureScot (2023f) and those advocated by the Applicant. Justification for their use is provided in Volume 3, Annex 11.4 Offshore Ornithology Displacement Modelling Report (Matrix Approach).
		NatureScot expect apportioning during the breeding season to be undertaken following the NatureScot theoretical approach (NatureScot, 2018), with the exception of kittiwake, common guillemot, razorbill and shag, where the apportioning tool developed by Marine Scotland should be used (Butler *et al.*, 2020).	Apportioning for all species has used the approach described in NatureScot (2018) as the Butler *et al.* (2020) is currently unavailable, this was agreed with NatureScot during further consultation on 27 March 2024 (see below). Please see in Chapter 2.2.1 Report to Inform Appropriate Assessment: Apportioning for a detailed description of the methodology applied.
		Regarding population viability analysis (PVA), NatureScot note a clarification of the wording in their Guidance Note 11, Section 2.1: 'We advise that the impacts of collision and distributional responses, such as displacement, will need to be considered in the context of relevant SPA breeding colonies particularly where the assessed effects result in a decrease to the adult annual survival rate of 0.02 percentage point change or higher.'	The assessments presented in Chapter 2.2 Report to Inform Appropriate Assessment Part 3: SPA and Ramsar Site Assessments follow this approach. In this chapter, the 0.02 threshold has been applied to the relevant biogeogprahic population.
		NatureScot advise that they no longer require PVA over a 50 year period, and will be changing the guidance accordingly.	Noted, PVA for Morven South has considered a 35 year lifetime. Please also see pre-application advice from NatureScot received on 02 July 2025.
		NatureScot supports the use of the Cumulative Effects Framework (CEF) tool, which is expected to be available shortly (at the time of writing) and thus is expected to be in place for use in the EIA Report for this project.	At the time of undertaking the assessments, the Cumulative Effects Framework was unavailable for consideration within the assessments

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			conducted for Morven South and therefore it has not been possible to follow this advice.
		NatureScot agree with the screening process that scoped in transboundary effects for marine ornithology, discussed in Section 8.4.11 of the Scoping Report and Section 1.2.3.16 of Appendix 1.	An assessment of transboundary impacts is provided in Section 11.14 and follows that described in Chapter 6: Scoping Report for the Morven Option Lease Agreement Site.
		NatureScot state that the designed-in measures relevant to offshore ornithology, described in Section 8.4.7 and table 8.27 of the Scoping Report, and Appendix 2, are appropriate.	Designed-in measures are provided in Section 11.10 and includes those identified in Chapter 6: Scoping Report for the Morven Option Lease Agreement Site.
		NatureScot have comments on the MM-34 mitigation and monitoring commitment -Appropriate lighting and marking of wind turbines and offshore substation platforms: (1) With respect to nocturnal species impacts of lighting could be an issue. Species such as European storm petrel, Leach's storm-petrel and Manx shearwater may be attracted to and/or disorientated by artificial light sources. Note the presence of 49 Manx shearwaters in the DAS survey report for July 2021; (2) As well as lighting on turbines and other structures, this includes lighting on servicing or construction vessels, particularly if construction will be a 24/7 operation. Such effects could impact assessment of collision and/or displacement. NatureScot recommend considering the findings from the Marine Scotland commissioned review to inform the assessment of the risk of collision and displacement in petrels and shearwaters from offshore wind developments in Scotland; and (3) NatureScot recommend that protocols are built into construction and operation phases for monitoring and handling of any birds attracted by lighting, as well as associated recording of any such incidents including context (e.g. weather).	An assessment of the potential impacts of attraction to lighting associated with wind turbines is provided in Section 11.11.8 and includes consideration of impacts on migratory Manx shearwater, European storm petrel and Leach's storm-petrel.
		Natural England recognises that ornithology advice from Nature Scot differs slightly from that provided by Natural England. We direct the	The assessments presented in Volume 2, Chapter 11: Offshore Ornithology and Chapter 2.2 Report

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
24th August 2023	Natural England Advice on EIA Scoping Report	applicant to our "Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards Phase III: Expectations for data analysis and presentation at examination for offshore wind applications." We do not expect the applicant to carry out two separate offshore ornithology assessments but there may be instances where a different assessment is needed to be able to adequately assess in-combination effects on English seabirds.	to Inform Appropriate Assessment Part 3: SPA and Ramsar Site Assessments follow NatureScot advice. Calculation of impacts following Natural England's advice is provided in Volume 3, Annex 5.2: Offshore Ornithology Impact Estimates using Natural England Approaches.
		Natural England advises that common guillemot from the Farne Islands SPA and the Flamborough and Filey Coast SPA should be screened in for potential impacts during the non-breeding season. Whilst Furness (2015) indicates that non-breeding individuals are likely to stay relatively close to their breeding colony in the nonbreeding season, there is limited empirical evidence currently exists to support this, to quantify the extent over which this operates, and whether it applies to the same extent for all colonies. Natural England advises that to assess the potential impacts on the Farne Islands SPA and Flamborough and Filey Coast SPA common guillemot in the non-breeding season, the traditional approach of apportioning birds to the relevant SPA using the BDMPS populations as prescribed by Furness (2015). We recognise that this advice differs from that provided by NatureScot / Marine Scotland, who advise that the breeding season mean-max, +1SD foraging ranges should also be used in the non-breeding season for this species, which we do not wish to contradict. However, we consider a specific exception to this advice should be made when considering impacts on the Farne Islands SPA and Flamborough and Filey Coast SPA, due to the potential for the Berwick Bank OWF to contribute to the in-combination impacts that multiple North Sea developments are already exerting on this SPA feature. We note that other Scottish projects already appear in the English in-combination assessments for this species, so	Calculation of impacts following Natural England's advice is provided in Volume 3, Annex 5.2: Offshore Ornithology Impact Estimates using Natural England Approaches and includes consideration of the Farne Islands SPA and Flamborough and Filey Coast SPA. As guillemot at these two SPAs are not identified when following NatureScot's recommended screening criteria they are not included in this report or the Chapter 2.2 Report to Inform Appropriate Assessment Part 3: SPA and Ramsar Site Assessments.

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		this exception would facilitate the inclusion of Morven in future assessments.	
		The applicant states that it was not possible to distinguish between razorbill and common guillemot at all times. Natural England advises that common guillemot from English SPAs are incorporated in apportioning and assessment of LSE. Of particular note are the Farne Islands SPA and Flamborough and Filey Coast SPA. Where there is uncertainty over species identification, Natural England advises that two scenarios are carried through the assessment: 1) that birds identified to "razorbill or common guillemot" are assessed as razorbill and 2) that birds identified to "razorbill or common guillemot" are assessed as common guillemot.	The Applicant has responded to this comment as part of pre-application advice highlighting that this issue is not unique to Morven South and on previous projects Natural England have accepted the ratio approach to attributing unidentified auks to species level (with this having been applied in the assessments for offshore wind farms since at least Round 3 in English waters). On previous projects where the number of unidentified auks has been high, additional processing of survey imagery has been undertaken to reduce the proportion of unidentified birds. This approach has been applied for Morven South and therefore the Applicant considers that it is appropriate to apply the ratio approach. The Applicant has invited Natural England to provide justification for their proposed approach in light of their advice to other projects but has not received a response (please see Volume 3, Annex 5.1: Consultation). The Applicant has therefore applied the ratio approach in line with the approach taken on all other previous offshore wind farm applications.
25 August 2023	RSPB Scotland: Response to Scoping Report	RSPB Scotland raises issues with the bio-season definitions from Furness (2015) with regards to gannet and kittiwake. The issue raised is that the 'migration-free' seasonal definition excludes the early and later months of the season that would be included in a full breeding season.	Following the advice of MD-LOT and NatureScot , the breeding season for all species has been defined based on the seasonal definitions provided in NatureScot (2018) which have more correspondence with the full breeding season as defined by Furness (2015) and therefore follow the advice of RSPB Scotland.

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		RSPB Scotland welcomes the use of foraging ranges from Woodward *et al.* (2019) to derive connectivity with SPA colonies, and also recommend that site-specific data is examined and site-specific values are used where they exceed generic values. The exceptions to this are common guillemot and razorbill. In the case of these species, for all designated sites south of the Pentland Firth, the RSPB advise using the mean max (MM) plus one standard deviation (SD) discounting Fair Isle values.	The screening process applied in Chapter 1: Morven Option Lease Agreement Site: HRA Stage 1 Screening Report and the subsequent update to this process provided in Chapter 2: Report to Inform Appropriate Assessment Part 1: Introduction aligns with the approach suggested by the RSPB
		RSPB Scotland advise the use of a 98% avoidance rate for breeding gannets rather than NatureScot's advised 99.2% avoidance rate. Similarly, they recommend a 60% displacement rate for gannet during the breeding season, rather than the 70% rate recommended by NatureScot.	Following the advice of MD-LOT and NatureScot, avoidance rates from Ozsanlav-Harris (2023) have been applied. Monthly collision risk estimates are provided in Volume 3, Annex 11.2 Offshore Ornithology Collision Risk Modelling Report and be corrected to a 98% avoidance rate if required. Following the advice of MD-LOT and NatureScot, a 70% displacement rate has been applied for gannet. Displacement matrices for gannet, which include a 60% displacement rate, as requested by the RSPB, are presented in Volume 3, Annex 11.4, Offshore Ornithology Displacement Modelling Report (Matrix Approach).
		RSPB Scotland recommend that displacement and barrier effect impact pathways during construction and demolition should be scoped in as opposed to omitted. The key species for consideration are auks (common guillemot, razorbill, puffin), gannet, and kittiwake.	Displacement and barrier effects are not considered in the construction or decommissioning phases following NatureScot advice (NatureScot, 2023f). Displacement in the construction and decommissioning phases will be considered within Section 11.11.2: Direct temporary habitat loss/disturbance. The

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			Applicant notes that NatureScot agree with the impact pathways scoped into the assessment.
		Positive feedback concerning the scoping-in of the impact of lighting for construction, operation and decommissioning phases. Due to constraints as to when DAS can be undertaken, RSPB Scotland advise that regard should be given to whether the surveys accurately reflect the density of birds with crepuscular and nocturnal flight tendencies.	An assessment of the potential impacts of attraction to lighting associated with wind turbines is provided in Section 11.11.8. Please see Section 11.7.8 for a discussion on the limitations of the baseline surveys undertaken for Morven South.
		RSPB Scotland recommend including the uncertainty in the assessment of significance of impacts when describing likely significant effects (LSE).	Uncertainty is incorporated into various elements of the assessments presented in this chapter with a precautionary approach applied throughout. For example, Volume 3, Annex 11.2 Offshore Ornithology Collision Risk Modelling Report, Volume 3, Annex 11.4 Offshore Ornithology Displacement Modelling Report (Matrix Approach) provide results for both statistical uncertainty (e.g. confidence intervals), parameterize biological uncertainty through the use of different sources for various parameters. It is therefore considered that this advice has been addressed.
		RSPB Scotland advocate for the inclusion of a non-technical summary (NTS). They recommend the summary includes explanations of what significance, interpretations, and information about how the mitigation hierarchy has been followed. They suggest a series of short summary tables presented annual mortality for relevant species for the development in isolation, annual mortality for relevant species for the development in cumulation, predicted population size of relevant SPA colonies after the lifetime of the proposed development, and predicted population size of relevant SPA colonies after the lifetimes of proposed development and other developments in cumulation. Predicted	The Non-Technical Summary includes a summary of assessment conclusions for offshore ornithological receptors for both the project alone and cumulatively provided in Section 11.16. The collision risk and displacement mortality for all species using various parameter combinations is provided both within relevant sections of this chapter (in Section 11.11) and supporting annexes (Chapter 3, Annex 11.2 Offshore Ornithology Collision Risk Modelling Report,

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		population size should be also be presented as a percentage (min-max) of what it would have been in the absence of the proposed development.	Chapter 3, Annex 11.3 Offshore Ornithology Collision Risk Modelling Report: Migratory and Chapter 3, Annex Offshore Ornithology Displacement Modelling Report (Matrix Approach). Summary tables for SPA features are provided where relevant in Chapter 2.2 Report to Inform Appropriate Assessment Part 3: SPA and Ramsar Site Assessments. Where population modelling is required, outputs stating the size of relevant populations are provided in all cases. Much of the information requested (e.g. mortality figures, SPA population sizes, etc.) is however not appropriate for inclusion in a non-technical document such as the Non-Technical Summary as not only is it technical information but requires additional contextual information which, if not included, risks misinterpretation.
30 November 2023	Marine Directorate – Licensing Operations Team (MD-LOT): Scoping Opinion	The Scottish Ministers are broadly content with the study areas presented in Section 8.4.2 of the Scoping Report. In line with NatureScot representation, they advise that species foraging ranges must be considered when identifying the wider study area necessary for a particular seabird species in the breeding season.	Study areas relevant to the assessment of offshore ornithological features are defined in Section 11.2. The Regional Offshore Ornithology Study Area includes consideration of species-specific foraging ranges in line with this advice.
		The Scottish Ministers are largely content with the data sources presented in Section 8.4.3 of the Scoping Report. They highlight the NatureScot representation that additional survey results may provide useful contextual data.	Data sources used to inform the characterisation of the baseline are provided in Section 11.6 and Chapter 3, Annex 11.1 Offshore Ornithology Baseline Characterisation Report and include the regional survey data identified by NatureScot.
		Regarding DAS, the Scottish Ministers advise that the presence of sensitive species should be confirmed upon completion of two full years of survey. They advise that the advice from NatureScot regarding survey	Chapter 3, Annex 11.1 Offshore Ornithology Baseline Characterisation Report includes a full description of the DAS methodology and the

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		coverage analysis and availability bias should be fully considered and implemented in the EIA report. The Scottish Minister's also highlight RSPB Scotland's representation concerning the representation of birds with crepuscular and nocturnal flight tendencies, and request that this is considered when compiling the EIA Report.	methods applied in the calculation of abundance estimates, including availability bias which aligns with advice provided by NatureScot. Chapter 3, Annex 11.1 Offshore Ornithology Baseline Characterisation Report identifies the conservation status of all species recorded in the Morven South Offshore Ornithology Baseline Characterisation Study Area (as defined in Chapter 3, Annex 11.1 Offshore Ornithology Baseline Characterisation Report) which is used to identify Valued Ornithological Receptors. The site-specific surveys conducted to support the assessments presented in this chapter follow best practice and follow a survey methodology consistent with baseline surveys conducted for recent offshore wind farm applications in UK waters. Of those species that may be more vulnerable outside of those periods covered by baseline surveys (e.g. shearwaters, petrels), none are expected to occur at Morven South in numbers that may lead to a likely significant effect. However, consideration of impacts resulting from the attraction of birds to light associated with Morven South is provided in Section 11.11.8.
		The Scottish Ministers broadly agree with the impacts proposed to be scoped in and out (presented in Tables 8.25 and 8.26 of the Scoping Report), in line with Natural England and NatureScot representations. It is advised that the NatureScot representation regarding changes in prey availability and potential impacts on prey species and their habitats are considered and implemented in the EIA Report, by making clear links	The impact originally titled 'indirect temporary habitat loss and disturbance' has been renamed 'changes in prey availability due to temporary habitat loss/disturbance' with the assessment of this impact including discussion on the conclusions of Volume 2, Chapter 8: Benthic

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		between the benthic and the fish and shellfish assessments in relation to potential impacts on birds.	Subtidal Ecology and Volume 2, Chapter 9: Fish and Shellfish Ecology.
		Regarding approach to assessment, the Scottish Ministers advise that the NatureScot representation regarding abundance data, seasonality, collision risk modelling, displacement and mortality rates, apportioning, and population viability analysis must be fully implemented. In addition, any evidence sources presented to support additional, alternative displacement assessment which is not in line with current guidance should be justified with evidence from relevant studies that have been peer-reviewed and formally ratified. The Scottish Ministers highlight the NatureScot representation regarding the update to NatureScot Marine Ornithology Guidance Note 11 on population viability analysis, which should be considered when compiling the EIA report.	The recommendations of NatureScot within the scoping opinion and subsequent consultation exercises have been fully implemented into this chapter and supporting technical appendices. In addition, where the Applicant has presented an alternative assessment, alongside NatureScot's advocated assessment approach, this is fully evidenced in either this chapter or supporting technical appendices.
		Natural England ornithology advice differs in some respects from NatureScot advice, as detailed in Natural England representation. The Scottish Ministers do not expect the Developer to carry out two separate offshore ornithological assessments and expect that NatureScot guidance is followed. The Scottish Ministers do, however, highlight the Natural England advice that there may be instances where a different assessment is needed to adequately assess in-combination effects on English seabirds. Any differences in approaches between Natural England and NatureScot should be acknowledged when compiling the EIA report.	The Applicant has provided impacts calculated following Natural England's recommended assessment approach in Volume 3, Annex 5.2: Offshore Ornithology Impact Estimates using Natural England Approaches. The assessments conducted in this chapter follow NatureScot guidance.
		The Scottish Ministers highlight the RSPB Scotland representation regarding bio-seasons for kittiwakes and gannets, foraging ranges for common guillemot and razorbill, avoidance and displacement rates for gannets and displacement and barrier effects.	Please see previous responses to the RSPB Scotland: Scoping Opinion response on 25 August 2023 in this table for specific points. Where possible advice from RSPB Scotland has been incorporated into the assessments and underlying analyses presented in this chapter and

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		RSPB Scotland advice should be fully considered but it is expected that NatureScot guidance is followed in relation to assessment approach where there are differences in advice.	supporting technical appendices. However, where this differs from the advice of NatureScot, NatureScot has been followed.
		The Scottish Ministers are broadly content with the designed in mitigation and monitoring measures presented in Table 8.27 of the Scoping Report and in Appendix 2. Regarding the Developer's commitment to light and mark the WTGs and OSPs, the Scottish Ministers request that NatureScot representation regarding lighting and the potential effects on nocturnal species, as well as the effects of 24 hour construction activities, on ornithological receptors is fully considered in the EIA report.	An assessment of the potential impacts of attraction to lighting associated with wind turbines has been considered in this chapter and is provided in Section 11.11.8.
		The Scottish Minsters are content with the approach to potential cumulative impacts outlined in Section 8.4.9 of the Scoping Report, and support the use of the Cumulative Effects Framework tool, if available when compiling the EIA report.	Cumulative assessments, where required are provided in Section 11.13. The Cumulative Effects Framework was unavailable for use in the assessments presented in this chapter.
		The Scottish Ministers agree with Appendix 1 of the Scoping Report that transboundary impacts on offshore ornithology should be scoped in to the EIA report. The Scottish Ministers' views on these aspects are supported by the NatureScot representation.	Transboundary impacts have been scoped into this chapter with an assessment of these impacts provided in Section 11.14.
27 March 2024	NatureScot: Response to request for further advice on receipt of the MD-LOT Scoping Opinion	NatureScot are content with the DAS, both in the sense that the disturbance to diver or duck species from low flight height is unlikely to be of concern, and that analysis of 12% of the data is acceptable.	The Applicant welcomes agreement on these points.
		While NatureScot support using the ratio approach to assign unidentified auks to species, this method is considered more accurate when numbers of unidentified birds are low. Therefore, as numbers of unidentified auks are quite high in this case, we would expect the limitations of the ratio approach to be acknowledged in the EIAR.	Following NatureScot advice the limitations of the ratio approach are discussed in Section 11.7.8.
		NatureScot confirm they are content with the approach to availability bias, advising that they accept correction factors derived from Thaxter *et*	The methodology applied to calculating abundance estimates is provided in Chapter 3,

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		al. (2010) for common guillemot and razorbill and from Spencer (2012) for puffin.	Annex 11.1 Offshore Ornithology Baseline Characterisation Report and follows that recommended by NatureScot.
		Regarding the question of whether data from the August DAS would fall into the breeding or non-breeding season for displacement assessment, NatureScot advise that they are currently considering the post-breeding/dispersal period for common guillemot and razorbill at other east coast offshore wind sites and so will be able to provide more advice shortly. In the meantime, they recommend looking at auk jumping dates at east coast colonies where such data is available, to inform discussion about whether August counts should be included in the breeding or non-breeding season.	This response has been superseded by additional consultation exercises, please see responses on 28 May 2025.
		NatureScot confirm a number of queries regarding SeabORD. NatureScot confirm it is acceptable to use the current version of SeabORD in the absence of the CEF and to use the distance decay method. They advise contacting MD-LOT regarding access to SeabORD. NatureScot confirm that sub-colonies that are part of an SPA should be combined to allow more SPAs to be modelled at the same time. To refine a list of sites to be assessed, NatureScot recommend considering: the proximity to the colony, colony size, available tracking data, and the outcomes of apportioning. Scaling factors to overcome issues involved with running the SeabORD application are acceptable. However, in general, SeabORD should be run for a whole population where feasible and it must be run for at least half of a population. NatureScot agree with the approach using displacement matrices and SeabORD within the PVA modelling to allow for comparison of results. SeabORD should be used for the displacement assessment of kittiwake, common guillemot, razorbill and puffin, but in the chick rearing period only.	The application of SeabORD in relation to Morven South is provided in Chapter 3, Annex 11.5 Offshore Ornithology Displacement Modelling Report (SeabORD). NatureScot's most recent advice (23 June 2025) is that the matrix approach should be used as the main assessment method. and therefore all previous comments before this are superseded by that advice.

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		Regarding the proposal that SeabORD is run for the project alone and not for the cumulative assessment, due to the current version of the tool only supporting five Offshore Renewable Developments (ORDs), NatureScot confirm they are currently discussing this with MD-LOT and will pass on any conclusions about a way forward as soon as they are reached.	The application of SeabORD in relation to Morven South is provided in Chapter 3, Annex 11.5 Offshore Ornithology Displacement Modelling Report (SeabORD). NatureScot's most recent advice (23 June 2025) is that the matrix approach should be used as the main assessment method and therefore all previous comments related to this point are superseded by that advice.
		NatureScot agree that until the Butler tool is updated as part of the CEF, to enable Seabirds Count data to be utilised, the tool cannot be used. Instead, NatureScot suggest a theoretical apportioning approach should be applied, and that apportioning allocated to sites with sufficient tagging data may be re-apportioned depending on the results of tracking analysis. NatureScot refer to their interim guidance note on apportioning (NatureScot, 2018).	The apportioning approach applied for Morven South is detailed in Chapter 2.2.1 Report to Inform Appropriate Assessment: Apportioning and follows the approach recommended in NatureScot (2018) and incorporates further advice provided by NatureScot on 28 January 2025 and 28 May 2025.
		NatureScot expect a new report on demographic rates, in relation to productivity and survival, to be ready within the next few weeks (from the time of writing).	This report has not yet been published.
		If the CEF is not available at the time of the MvOWL assessment, NatureScot confirm that MvOWL would not be required to redo assessments following the publication of the CEF.	The CEF has not yet been published and has therefore not been used to inform the assessments conducted for Morven South.
		NatureScot confirm that (at the time of writing) they have not produced any guidance on how to include Highly Pathogenic Avian Influenza (HPAI) in impact assessments. As the aerial survey work includes the HPAI outbreak years, it will be important to consider the current status of seabird populations at SPA colonies. NatureScot refer to recent data from key seabird colonies coordinated by the RSPB.	The potential effects on Highly Pathogenic Avian Influenza on species of relevance to Morven South has been considered in Section 11.7.8, incorporated into the assessments in Section 11.11 through each species recoverability as defined in Table 11.21 and in Chapter 3, Annex 11.1 Offshore Ornithology Baseline Characterisation Report.

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28 January 2025	NatureScot: Ornithology Advice Pre-application Consultation	NatureScot confirm that the proposed approach to the identification of Valuable Ornithological Receptors (VORs), based on the abundance of each species within Morven South plus a 4 km buffer and the conservation importance of each species, alongside expert judgement, is acceptable.	The approach to the identification of VORs is provided in Section 11.7.3 and Chapter 3, Annex 11.1 Offshore Ornithology Baseline Characterisation Report.
		NatureScot confirm that the approach to defining seasons, using NatureScot advice for the breeding season and splitting the non-breeding season based on seasons defined in Furness (2015), with priority given to the breeding season where overlaps exist, is acceptable. For clarity, they define seasons as follows: breeding season: birds are strongly associated with nest site – nesting, egg laying, provisioning young; non-breeding season: birds are more widely dispersed and not strongly associated with nest site. This period subsumes the 'attendance' periods defined in NatureScot guidance. Non-breeding season apportioning is dependent on information within BDMPS (Furness, 2015). When Furness (2015) seasons overlap with NatureScot breeding seasons, Furness (2015) seasons should be foreshortened.	Seasonal definitions for all species are provided in Section 11.7.4and have been defined following NatureScot guidance received during pre-application consultation exercises.
		NatureScot confirm that they agree with the approach to give precedence to abundance estimates (densities and population estimates) calculated using MRSea throughout all analyses, with design-based methods approaches used if MRSea estimates are unavailable.	The assessments presented in this chapter have followed this approach.
		NatureScot agree with the approach to deriving density values for sCRM using bootstrapping with 1000 iterations, presented with uncertainty estimates.	Collision risk modelling, the methodology for which is provided in Chapter 3, Annex 11.2 Offshore Ornithology Collision Risk Modelling Report has followed this approach.
		NatureScot agree that the current version of SeabORD should be used, in the absence of the CEF, during the chick-rearing period for guillemot, razorbill, puffin and kittiwake. They recommend contacting MD-LOT if any issues arise when using SeabORD and for any updates on availability of different versions.	The application of SeabORD in relation to Morven South is provided in Chapter 3, Annex 11.5 Offshore Ornithology Displacement Modelling Report (SeabORD). NatureScot's most recent

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			advice (23 June 2025) is that the matrix approach should be used as the main assessment method.
		NatureScot agree with the approach to displacement analysis using the displacement matrix approach. NatureScot currently advise using the displacement/mortality rates presented in Guidance Note 8 (NatureScot, 2023f). It is acceptable for developers to present an alternative approach as well. NatureScot note the recent and upcoming work on displacement, for example the ImpUDis project, which will be used to inform any updates to guidance in due course.	The methodology applied and results of the displacement matrix approach are provided in Chapter 3, Annex 11.4 Offshore Ornithology Displacement Modelling Report (Matrix Approach) and follows the recommendations of NatureScot in NatureScot (2023f).
		NatureScot support the proposed methodology for collision risk modelling (CRM), and the use of the guidance from JNCC (2024b), and expect this guidance to be followed including all relevant parameters. If alternative parameters are used, this should only be done for comparison with the recommended approach and alternative figures should be accompanied by clear explanations for the rationale behind them.	The methodology applied and results of collision risk modelling are provided in Chapter 3, Annex 11.2: Offshore Ornithology Collision Risk Modelling Report and follows the updated advice of NatureScot in NatureScot (2025b). In addition, the Applicant has presented collision risk estimates calculated using alternative sources for a number of parameters. These are also detailed in Chapter 3, Annex 11.2: Offshore Ornithology Collision Risk Modelling Report with justification for their use, as requested by MD-LOT provided.
		NatureScot confirm that the proposed approach to migratory CRM (mCRM) is acceptable; that is, using the beta version of the mCRM for migratory waterbirds and the migratory front approach for migratory seabirds (to include species of skua, tern, petrel and little gull). They note that the first two of the three work packages that make up the project 'Strategic study of collision risk for birds on migration and further development of the stochastic collision risk modelling tool', 'Strategic review of birds on migration in UK waters' and 'Stochastic CRM tool for	The methodology applied and results of collision risk modelling for migratory waterbirds and seabirds is provided in Chapter 3, Annex 11.3: Offshore Ornithology Collision Risk Modelling Report: Migratory. The approach applied has followed NatureScot guidance.

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		migratory species', can be used. NatureScot recommend contacting Marine Directorate for further clarification about the third work package which is still under development and not yet available, but may become available within a suitable timeframe.	
		NatureScot support the approach to apportioning using their Interim Guidance on apportioning impacts from marine renewable developments to breeding seabird populations in SPAs note and Seabirds Count data. NatureScot would welcome discussion about NEEOG (North East and East Ornithology Group) work about how to consider puffin in the non-breeding season, once the results are available. NatureScot note that puffin were recorded in Morven DAS in the non-breeding season, and that it will therefore be important to consider puffin in the non-breeding season for Morven. They expect project alone and cumulative assessments to be undertaken for non-breeding seasons.	The methodology applied and results of the apportioning approach applied for Morven South are provided in Chapter 2.2.1 Report to Inform Appropriate Assessment: Apportioning. The approach applied follows NatureScot guidance. Impacts on puffin are considered in all seasons, where relevant, in Sections 11.11 and 11.13. The anticipated work on puffin in the non-breeding season has not been published and therefore it has not been possible to incorporate it into the assessment presented.
		NatureScot confirm that for apportioning the distance of the colony should be measured as the distance between the geometric centre of the development to the geometric centre of the colony, and that this approach must be taken for both Morven South and Morven North.	The methodology applied and results of the apportioning approach applied for Morven South are provided in Chapter 2.2.1 Report to Inform Appropriate Assessment: Apportioning. The approach applied follows NatureScot guidance including in relation to the measurement of distances.
		NatureScot have reservations regarding the approach to estimate the proportion of immature birds present of a number of species during site-specific surveys in the breeding season. However, they accept its use dependent on sufficiently good identification rates for the specific immature age classes and that the results are not less precautionary than the standard approach (i.e. equal or higher adult proportions), and would welcome confirmation of this.	The methodology applied and results of the apportioning approach applied for Morven South are provided in Chapter 2.2.1 Report to Inform Appropriate Assessment: Apportioning including in relation to the estimation of the proportion of immature birds.

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		NatureScot advise that immature birds should be removed when undertaking breeding season apportioning of impacts to SPAs. NatureScot recommend the following adult proportion rates, derived using a stable age proportion and taken from Furness (2015), should be used: kittiwake – 0.53; common guillemot/razorbill - 0.57; puffin - 0.55; gannet - 0.55; fulmar – 0.62; great black-backed gull - 0.44; great skua - 0.41. When apportioning breeding season impacts from the project to SPAs, NatureScot advise sabbatical birds should also be removed using the following rates: large gulls – 0.35; kittiwake - 0.1; auks - 0.07; gannet - 0.1; shag - 0.35. During the non-breeding season sabbatical birds do not need to be removed, as all birds are non-breeders. In summary, NatureScot advise that breeding season mortalities should first be multiplied by the adult proportion and then by (1 – sabbatical rate) to provide the number of mortalities to breeding adults.	The methodology applied and results of the apportioning approach applied for Morven South are provided in Chapter 2.2.1 Report to Inform Appropriate Assessment: Apportioning. The NatureScot approach provided for all species in this report includes the estimation of the proportion of immature birds based on NatureScot guidance.
		NatureScot confirm that the proposed approach to population viability analysis (PVA), including the proposed threshold for PVA of an increase in baseline mortality rate of 0.02 percentage points, follows their current guidance. NatureScot note that a review and update of seabird demographic rates for use in PVA has been undertaken and is due to be published shortly (from the time of consultation) by JNCC. NatureScot advise that, as Morven consists of two separate applications (Morven South and Morven North), project-alone PVAs, mortality and increases in baseline mortality, and thresholds will need to be considered separately for each application. NatureScot also advise that, as Morven North and South are separate projects, each will need to be included in the others' list of offshore wind farms for in-combination assessment.	The methodology applied and results of the apportioning approach applied for Morven South are provided in Chapter 3, Annex 11.6: Offshore Ornithology Regional Population Viability Analysis and follows NatureScot guidance. Morven North and Morven South are separate projects and therefore the threshold for identifying if cumulative and in-combination assessments are required (any impact greater than 0.2 birds/annum) is applied to each project individually. The presence of one project has no influence on the impacts associated with the other and therefore will have no influence on the decision on whether the requirement for cumulative and in-combination assessments is required on an individual project basis. Morven

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		NatureScot suggest it may be useful to further discuss the possibility that separation of the Morven project into two may affect whether each project meets the threshold for in-combination assessment for some species.	North is considered within the cumulative assessment of Morven South where required.
		NatureScot provide an Annex describing their current advice for PVA. For project alone impacts, the Annex describes how PVA is required for all sites and species where the project alone impacts equal or exceed a 0.02 percentage point change in combined breeding and non-breeding season adult survival rate. For in-combination impacts, the Annex describes how PVA is generally required where in-combination impacts equal or exceed a 0.02 percentage point change in combined breeding and non-breeding season adult survival rate. The exception to this is where the project contribution to the in-combination impact is less than 0.2 birds per annum.	The methodology applied and results of population modelling conducted for Morven South are provided in Chapter 3, Annex 11.6 Offshore Ornithology Regional Population Viability Analysis and follows NatureScot guidance.
		NatureScot would not recommend using data from DAS that is older than 5 years at the point of application. As such, NatureScot recommend that the earliest data that could be used would be from October 2021. This means the only data that should be used is that from October 2021 to September 2023.	The seasonal extents and how these align with this advice have been discussed further with NatureScot in additional consultation exercises and an agreed approach identified. Please see consultation response on 14th April 2025.
05 March 2025	MD-LOT and NatureScot: consultation meeting titled 'Morven South and Morven North: Identification of Valued Ornithological Receptors'	NatureScot advise that the most contemporaneous counts should be used for regional populations, colony counts and seabird data. The DAS timings (2021-2023) will align with many of the colony counts in the Seabirds Count census (2015-2021). Where a Seabirds Count colony count date does not align with DAS (counts from 2013-2020), an updated count from the Seabird Monitoring Programme database that is most contemporaneous with the DAS should be used where possible, to align colony counts with the snapshot of birds recorded in the DAS.	Following NatureScot advice, the most contemporaneous counts have been used to calculate populations required in this chapter and relevant supporting technical appendices.
		NatureScot further advised to use recent counts such as the RSPB work after the HPAI outbreak, to provide more context to population	Following NatureScot advice, the most contemporaneous counts have been used to

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
		importance classification and an indication of whether colonies are decreasing or increasing after HPAI outbreaks.	calculate populations required in this chapter and relevant supporting technical appendices. The potential effects on Highly Pathogenic Avian Influenza on species of relevance to Morven South has been considered in Section 11.7.8, incorporated into the assessments in Section 11.11 through each species recoverability as defined in Table 11.21 and in Chapter 3, Annex 11.1: Offshore Ornithology Baseline Characterisation Report.
		NatureScot confirm that the results from VOR identification during baseline characterisation look acceptable. They query the inclusion of terns and receive confirmation that terns and petrels will be included in the migratory CRM report and that further screening will be done based on the corridors defined in WWT and MacArthur Green (2014).	The methodology used to identify VORs is provided in Chapter 3, Annex 11.1: Offshore Ornithology Baseline Characterisation Report. The inclusion of species in the assessment of each impact is detailed in the individual impact assessment sections of this chapter (Section 11.11, Chapter 3, Annex 11.2: Offshore Ornithology Collision Risk Modelling Report, Chapter 3 Annex 11.3: Offshore Ornithology Collision Risk Modelling Report: Migratory or Chapter 3, Annex 11.4: Offshore Ornithology Displacement Modelling Report (Matrix Approach).
		NatureScot were presented with information concerning auk seasonal definitions, with peak abundances of common guillemot and razorbill being towards the end of the breeding season seasonal definitions. NatureScot confirm it would be valuable to review fledging dates at nearby colonies to determine whether these peaks relate to post-breeding dispersal.	The Applicant provided NatureScot with additional information in relation to the definition of seasonal extents for common guillemot and razorbill with NatureScot responding in April 2025 (see below) with an approach agreed on 28 May 2025.

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
		NatureScot advise that if the peak is found to relate to post-breeding dispersal, that the Applicant should consider a post-breeding dispersal period as a separate season for common guillemot, and extending the post-breeding season for razorbill to include earlier months. NatureScot advise further consultation to confirm the influence on seasonal definitions for common guillemot and razorbill.	
13 March 2025 (letter issued)	MD-LOT Targeted Consultation Letter	The Applicant provided a targeted consultation letter on 13 March 2025 which described the proposed Morven North and Morven South Offshore Ornithology Study Areas and the CEA approach following the decision to divide the Morven Site into Morven North and Morven South.	The Morven South Offshore Ornithology Study Area and the Morven North and Morven South Regional Offshore Study Area defined in Section 11.2 align with those defined within the 13 March 2025 targeted consultation letter.
14 April 2025	NatureScot: Response to queries about the auk non-breeding season	Regarding displacement analyses, NatureScot reviewed evidence concerning the possibility that peak abundances of common guillemot and razorbills at Morven South and Morven North occurring late in the breeding season represents post-breeding dispersal. NatureScot provisionally advise two approaches that can be taken for defining seasonal extents for common guillemot: (1) including August in the non-breeding season; and (2) including the July and August months with peak abundance estimates from DAS as a post-breeding season. For razorbill, NatureScot advise that the approach should involve extending the post-breeding season to include the months in which peak abundance was recorded.	This advice has been followed throughout this chapter (specifically Section 11.11) and in supporting technical appendices (specifically Chapter 3, Annex 11.4: Offshore Ornithology Displacement Modelling Report (Matrix Approach)) with seasons defined for both common guillemot and razorbill based on the likely presence or otherwise of post-breeding birds. Additional consultation was undertaken in relation to this point on 28 May 2025 with an approach agreed for common guillemot
		NatureScot accept that this approach for common guillemot means there will not be any assessment for common guillemot during this post-breeding season within the Report to Inform Appropriate Assessment (RIAA), and they therefore consider that it should be addressed through the EIA with commentary provided, including full consideration of the mitigation hierarchy if predicted impacts are significant in EIA terms.	This advice has been followed throughout this chapter (specifically Section 11.11) and in supporting technical appendices (specifically Chapter 3, Annex 11.4: Offshore Ornithology Displacement Modelling Report (Matrix Approach)) with seasons defined for both common guillemot and razorbill based on the

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
			likely presence or otherwise of post-breeding birds. Additional consultation was undertaken in relation to this point on 28 May 2025 with an approach agreed for common guillemot
		In addition, NatureScot would welcome an alternative 'Applicant's approach', should the Applicant want to pursue one, that considers July as part of the breeding and non-breeding season for common guillemot and razorbill, in which the number of breeding birds is assumed to be equal to those present in June and the remaining birds are considered to be the non-breeding population.	This advice has been followed throughout this chapter (specifically Section 11.11) and in supporting technical appendices (specifically Chapter 3, Annex 11.4: Offshore Ornithology Displacement Modelling Report (Matrix Approach)) with seasons defined for both common guillemot and razorbill based on the likely presence or otherwise of post-breeding birds. Additional consultation was undertaken in relation to this point on 28 May 2025 with an approach agreed for common guillemot
		Following on from earlier consultation associated with a five year cut-off for baseline data (see consultation undertaken on 28 January 2025), NatureScot agree to the inclusion of DAS data from September 2021 in displacement analyses. Additionally, should July and/or August 2021 be included as part of the non- or post-breeding season for common guillemot and/or razorbill, then the inclusion of DAS data from those months would also be acceptable to ensure a full season of data is captured.	This advice has been followed throughout this chapter (specifically Section 11.11) and in supporting technical appendices (specifically Chapter 3, Annex 11.4: Offshore Ornithology Displacement Modelling Report (Matrix Approach)) with seasons defined for both common guillemot and razorbill based on the likely presence or otherwise of post-breeding birds. Additional consultation was undertaken in relation to this point on 28 May 2025 with an approach agreed for common guillemot
28 May 2025	Consultation meeting with NatureScot titled 'Morven North and South HRA	Preliminary apportioned impacts to key SPAs were presented. It was noted that predicted impacts for common guillemot were driven by increased populations in July and August. The Applicant had defined a post-breeding season for common guillemot following previous NatureScot advice and had applied the same apportioning in the post-	The Applicant has followed NatureScot's advice in relation to seasonal definitions for common guillemot throughout the assessments presented in this chapter incorporating months into the post-breeding season where the populations recorded

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
	consultation meeting with NatureScot'	breeding season as advised for the non-breeding season. For Morven South, the impact on SPAs at which common guillemot is a qualifying feature were assessed as zero due to the project's location and application of NatureScot advice in relation to apportioning. NatureScot confirmed that July should be incorporated into the post-breeding season for common guillemot due to the high populations recorded during site-specific surveys. NatureScot agreed with the application of the apportioning approach in the non-breeding season to the post-breeding season. The conclusion of no impact from Morven South on SPAs for common guillemot was accepted by NatureScot. NatureScot flagged the need for further consultation on the approach to cumulative and in-combination assessment due to the division of the Morven area into two separate projects (Morven South and Morven North)	during baseline surveys at Morven South suggest post-breeding dispersal of birds.
23 June 2025	NatureScot – email correspondence	Upon completion of the SeabORD modelling approach for displacement the report for Morven North was provided to NatureScot outlining the methodology applied for both Morven North and Morven South. The Applicant queried whether the outputs from SeabORD should be included as part of the application and whether the outputs should be incorporated into the assessment of displacement. NatureScot advised that their current advice with respect to the MATLAB version of the SeabORD model is that, where feasible, SeabORD outputs should be presented to provide additional context to the displacement assessment, but the matrix approach should be used as the main assessment method for all species and seasons	The SeabORD modelling approach included methodology applied and outputs obtained is provided in Volume 3, Annex 11.5: Offshore Ornithology Displacement Modelling Report (SeabORD) but has not been used to inform the assessments in this chapter with the conclusions presented using the matrix approach.
		The Applicant proposed an approach to the cumulative and in-combination assessments to account for the overlap between the 2km buffers associated with the displacement assessments for Morven North and Morven South. This issue was developed to account for the double-counting of birds which occurs in the area of overlap.	Subsequent to this consultation, the Applicant has continued to consider the approach to cumulative and in-combination assessments and has decided to simply sum the impacts from Morven North and Morven South accepting that this will represent an over-estimate of the

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
		NatureScot agreed that the approaches proposed were logical and acceptable, caveating that additional cumulative scenarios were required.	potential impact on a cumulative and in-combination basis. This assessment is provided in section 11.13.
02 July 2025	NatureScot – email correspondence	NatureScot advised through their quarterly updates that they no longer required a 25-year period to be calculated for Population Viability Analysis, as an outcome of the Scottish Renewables Ornithological Impact Assessment Streamlining Project.	Population Viability Analysis has been undertaken incorporating 35 year and 50 year scenarios. Outputs are provided in Volume 3, Annex 11.6: Offshore Ornithology Regional Population Viability Analysis.
11 July 2025	NatureScot – email correspondence	The Applicant requested advice in relation to the impact pathways that should be considered for fulmar. NatureScot advised that displacement and attraction to light should be considered for fulmar. NatureScot advised that as fulmar has not been assessed in previous applications it may not be possible for this project to undertake a cumulative assessment for this species.	Potential impacts from displacement and attraction to light have been considered for fulmar As fulmar has not been considered in previous applications, cumulative assessments for the species are not possible and are therefore not included in this chapter.
21 July 2025	MD-LOT Targeted Consultation Letter (response to letter sent 13 March 2025)	MD-LOT reviewed the information contained in the letter and noted the Applicant's proposed way forward. MD-LOT was of the view that there were no additional aspects for MvOWL to consider however, as a result of the revised consenting strategy, MD-LOT advised discussing further with NatureScot with regards to the cumulative and in-combination assessments.	The Morven North Offshore Ornithology Study Area and the Morven North and Morven South Regional Offshore Study Area defined in Section 11.2 align with those defined within the 13 March 2025 letter. Further consultation with NatureScot regarding the cumulative approach took place on 18 August 2025, detailed below.
18 August 2025	Consultation meeting with NatureScot and MD-LOT titled 'Morven North and	The approach to CEA was discussed for Morven North and Morven South and it was agreed that a "Morven Programme" Scenario considering Morven North, Morven South, MHPGC Project and MBBAGC Project (as relevant to each impact) would be included in the offshore ornithology assessment. It was agreed that the Morven Programme Assessment would be undertaken to provide further context specifically for the	The approach which was agreed with NatureScot and MD-LOT has been implemented. The methodology for whole project, Morven Programme and cumulative effects assessment has been described in Section 11.12.1 of this report, with further detail set out in Volume 1, Chapter 6: EIA Methodology. The results of the

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
	Morven South approach to CEA'.	offshore ornithology assessment, and would not form the basis of the CEA conclusions, which would be assessed as a separate scenario.	Morven Programme assessment (Scenario 3) and CEA (Scenario 4) have been presented in Section 11.13.
19 August 2025	NatureScot – email correspondence	NatureScot queried the use of a distance measured from the centre of the project to the centre of the SPA as incorporated into the apportioning exercise undertaken for the project. NatureScot requested that apportioning values be calculated for all SPAs by increasing the foraging distance used for each species so that all SPAs are included when using a centre to centre measurement	The Applicant responded to NatureScot's email with a further letter on 19 September 2025, and NatureScot responded on 29 September 2025. A follow up meeting was held with NatureScot on the 23 October 2025 to discuss this issue.
01 October 2025	NatureScot, MD-LOT – email correspondence	The Applicant issued a letter to NatureScot and MD LOT outlining significant discrepancies identified within the NEEOG cumulative ornithology database. This database, developed to provide a consistent set of cumulative collision and displacement totals for offshore wind assessments, was found to contain outdated, incorrect, or inconsistent population and impact values for several offshore wind projects. The Applicant requested NatureScot's advice on the implications of these issues and sought confirmation that their proposed approach, to use updated, project specific assessment data rather than the uncorrected NEEOG database values, was acceptable for the cumulative assessments for Morven North and Morven South.	The Applicant has used impact estimates collated from project-specific documentation for all relevant projects as part of the cumulative assessments presented in Section 11.13.
02 October 2025	NatureScot – email correspondence	The Applicant requested NatureScot's advice in relation to the conversion factor to apply to convert population counts of razorbill from individuals into breeding pairs/individuals. Burnell *et al.* (2023) applied an updated correction factor based on information from the Isle of May and the Applicant asked NatureScot to confirm whether this correction factor should now be applied. NatureScot confirmed that the correction factor from Burnell *et al.* (2023) should be used to correct population counts of razorbill	Population counts of razorbill have been calculated applying the correction factor from Burnell *et al.* (2023), as described in Chapter 3, Annex 11.1 Offshore Ornithology Baseline Characterisation Report.

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
23 October 2025	Consultation meeting with NatureScot	The Applicant presented information sent to NatureScot on 16 October 2025 to inform a discussion on the approach to apportioning for guillemot in all seasons	The post-breeding and non-breeding regional populations for guillemot have been defined to incorporate all colonies that fall within a newly defined BDMPS region based on tracking data from Buckingham *et al.* (2023).

11.5 Scope of the assessment

11.5.1 Impacts scoped into the assessment

11.5.1.1 The scope of this EIA Report has been developed in consultation with relevant statutory and non-statutory consultees as detailed in Table 11.7. The identification of impact pathways has taken into account guidance from NatureScot (2023e). Taking into account the scoping and consultation process, Table 11.8 summarises the potential impacts which have been scoped into this assessment.

Table 11.8: Potential impacts scoped into the offshore ornithology assessment

C= Construction, O= Operations and Maintenance, D= Decommissioning phases

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

Potential impact	Phase			Activity
	C	O	D	
Direct temporary habitat loss/disturbance	✓	✓	✓	Construction/decommissioning activities (increased vessel activity and underwater sound)
				Maintenance of operational wind turbines (increased vessel activity and underwater sound)
Changes in prey availability due to temporary habitat loss/disturbance	✓	✓	✓	Construction/decommissioning activities (increased vessel activity and underwater sound)
				Maintenance of operational wind turbines (increased vessel activity and underwater sound)
				Physical presence of structures (changes in hydrological energy, wave exposure, suspension of sediments, etc.)
Collision with rotating blades	x	✓	x	Physical presence of structures
Displacement	x	✓	x	Physical presence of structures
Combined collision and displacement	x	✓	x	Physical presence of structures
Barrier effects	x	✓	x	Physical presence of structures
Attraction to light	✓	✓	✓	Lighting of structures

11.5.2 Impacts scoped out of the assessment

11.5.2.1 A summary of the impacts scoped out, together with justification for scoping them out and whether the approach has been agreed with key stakeholders through either scoping or consultation, is presented in Table 11.9. The scoping out of these impacts has been agreed with key stakeholders through the scoping exercise (see Table 11.7, 19 April 2023 and 24 August 2023).

Table 11.9: Impacts scoped out of the assessment for offshore ornithology

C= Construction, O= Operations and Maintenance, D= Decommissioning phases

"✓" denotes the impact has been scoped out for this phase, "✗" denotes the impact has not been scoped out for this phase

Potential impact	Phase			Justification
	C	O	D	
Permanent habitat loss	✓	✓	✓	As agreed through the scoping exercise, this impact has been scoped out given that the area affected by permanent habitat loss due to the presence of Morven South components on the seabed is considered to be negligible when compared to the foraging areas that may be utilised by bird species that may interact with Morven South.
Accidental pollution	✓	✓	✓	As agreed through the scoping exercise, this impact has been scoped out given that it is considered that the likelihood of any accidental pollution impact occurring is very low. As part of recent Scoping Opinions for offshore wind farm projects in Scottish waters, the Scottish Ministers have agreed that this impact should be scoped out (see for example Marine Scotland, 2022). For projects where assessments have been undertaken it has been agreed that through the implementation of mitigation measures that complete mortality within the equivalent extent of a windfarm's array plus buffer area is considered very unlikely to occur, and a major pollution incident that may impact any species at a population level is considered very unlikely. Please also see the designed-in measures for Morven South in Table 11.26, specifically MM-5 and MM-6.

11.6 Approach to baseline characterisation

11.6.1.1 The offshore ornithology baseline environment has been characterised through site specific data and a literature review of key desktop datasets and reports (see Table 11.10). This list is not exhaustive; further datasets and reports are covered in more detail within Volume 3, Annex 11.1: Offshore Ornithology Baseline Characterisation Report.

11.6.2 Relevant guidance

11.6.2.1 Baseline characterisation of the Morven South Offshore Ornithology Study Area has had due regard to the methodologies and approaches set out in the following guidance documents:

- Guidelines for ecological impact assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Version 1.3 – updated September 2024 (Chartered Institute of Ecology and Environmental Management (CIEEM), 2024);
- Guidance Note 9: Guidance to support Offshore Wind Applications: Seasonal periods for Birds in the Scottish Marine Environment (NatureScot, 2020);
- Guidance Note 2: Guidance to support Offshore Wind Applications: Advice for Marine Ornithology Baseline Characterisation Surveys and Reporting (NatureScot, 2023a);
- Guidance Note 3: Guidance to support Offshore Wind applications: Marine Birds – Identifying theoretical connectivity with breeding site Special Protection Areas using breeding season foraging ranges (NatureScot, 2023b);
- Guidance Note 4: Guidance to Support Offshore Wind Applications: Ornithology - Determining Connectivity of Marine Birds with Marine Special Protection Areas and Breeding Seabirds from Colony SPAs in the Non-Breeding Season (NatureScot, 2023c);

- Guidance Note 5: Guidance to support Offshore Wind Applications: Recommendations for marine bird population estimates (NatureScot, 2023d);
- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase I: Expectations for pre-application baseline data for designated nature conservation and landscape receptors to support offshore wind applications (Natural England, 2022a);
- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase II: Expectations for pre-application engagement and best practice guidance for the Evidence Plan process (Natural England, 2022b);
- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase III: Expectations for data analysis and presentation at examination for offshore wind applications (Natural England, 2022c);
- Environmental Impact Assessment for Offshore Renewable Energy projects (British Standards Institute (BSI) (2015).

11.6.3 Desktop study

11.6.3.1 Information on offshore ornithology within the study areas defined in Section 11.2 was collected through a detailed desktop review of existing studies and datasets. These are summarised in Table 11.10 below.

Table 11.10: Summary of key desktop reports used to characterise the offshore ornithology baseline

Title	Data type	Year	Author
Seabird Monitoring Programme. An ongoing annual monitoring programme, established in 1986, of 25 species of seabird that regularly breed in Britain and Ireland	Bird counts and productivity data at breeding colonies	2025	British Trust for Ornithology (BTO) and Joint Nature Conservation Committee (JNCC)
Seabirds Count. A census of breeding seabirds in Britain and Ireland (2015-2021)	Bird counts and population trends of seabird breeding populations in the UK	2023	Burnell *et al.*
Ornithology and Marine Megafauna Digital Aerial Surveys. Morven South. 33 Month Report. January 2021-September 2023.	Digital aerial data	2024	APEM
Seabird Tracking Database.	Seabird tracking data	2024	BirdLife International
Digital video aerial surveys of seabirds and marine megafauna at SSE Regional Survey: 18-month Report April 2022 to August 2023.	Digital aerial data	2023	HiDef Aerial Surveying Limited
Guidance note 3 – Guidance to support offshore wind applications: Marine birds – identifying theoretical connectivity with breeding site Special Protection Areas using breeding season foraging ranges.	Tracking data, foraging range data	2023	NatureScot
The Seabird Monitoring Programme Report 1986–2023.	Seabird population trends	2024	Harris *et al.*

Title	Data type	Year	Author
Seabird Population Trends and Causes of Change: 1986-2015 Report.	Census results and Seabird Monitoring Programme (SMP) samples	2021	JNCC
Guidance note 9 - Guidance to support offshore wind applications: Seasonal periods for birds in the Scottish marine environment.	Seasonal abundance and distribution data	2020	NatureScot
Identifying important at-sea areas for seabirds using species distribution models and hotspot mapping.	Tracking data	2020	Cleasby *et al.*
Desk-based revision of seabird foraging ranges used for HRA screening.	Data on foraging ranges, literature review	2019	Woodward *et al.*
Non-breeding season populations of seabirds in UK waters.	Population data, literature review	2015	Furness
An analysis of the numbers and distribution of seabirds within the British Fishery Limit aimed at identifying areas that qualify as possible marine SPAs.	Population data, literature review	2010	Kober *et al.*
UK seabird colony counts in 2023 following the 2021–22 outbreak of Highly Pathogenic Avian Influenza	Report	2024	Tremlett *et al.*
Declines in UK breeding populations of seabird species of conservation concern following the outbreak of high pathogenicity avian influenza (HPAI) in 2021–2022	Report	2024	Tremlett *et al.*
2024 RSPB North East and East Seabird Tracking and Population Counts	Population data	2024	O’Donovan *et al.*
Flight heights, behaviours, distribution, and overlap with offshore wind farms of Kittiwakes breeding at Buchan Ness to Collieston SPA in 2024	Tracking data	2025	Bennett *et al.*
2024 results for the East Caithness Cliffs seabird colony census	Population data	2025	Zisman and Swann
2024 results for the North Caithness Cliffs seabird colony census	Population data	2025	Zisman and Swann

11.6.4 Identification of designated sites

11.6.4.1 All designated sites within the Regional Offshore Ornithology Study Area and qualifying interest features that could be affected by the construction, operations and maintenance and decommissioning phases of Morven South have been identified.

11.6.4.2 This includes all designated sites of international (e.g. SPAs or Ramsar sites) and national (e.g. SSSIs) importance which directly overlap with one of the study areas or have features which connect to the study areas.

11.6.4.3 On a precautionary basis, connectivity was established during the breeding season if a site (for which a species is a qualifying feature) is within foraging range of the Morven South Offshore Ornithology Study Area (using mean maximum + 1 Standard Deviation (SD) (Woodward *et al*., 2019).

11.6.4.4 Additional designated sites are included within Chapter 2.2: Report to Inform Appropriate Assessment Part 3: SPA and Ramsar Site Assessments for the non-breeding period (migration and winter), and are identified in Table 11.13 following the methodology applied in the Chapter 1: Morven Option Lease Agreement Site: HRA Stage 1 Screening Report to identify LSE[2].

11.6.5 Site specific surveys

11.6.5.1 In order to inform the EIA Report, site specific surveys were undertaken, as agreed with the statutory bodies (see Table 11.7, 11 August 2021).

11.6.5.2 A summary of the surveys undertaken to inform the offshore ornithology assessment of effects is outlined in Table 11.11 and further detail of the survey methodologies and results is included within Volume 3, Annex 11.1: Offshore Ornithology Baseline Characterisation Report.

Table 11.11: Summary of site specific surveys

Title	Extent of survey	Overview of survey	Survey contractor	Date	Reference to further information
Digital Aerial Surveys	The Morven Site Scoping Offshore Ornithology Study Area, encapsulating the Morven South Offshore Ornithology Study Area.	DAS to characterise the distribution and abundance of seabirds within the Morven Site Scoping Offshore Ornithology Study Area, and therefore the Morven South Offshore Ornithology Study Area.	APEM	January 2021 to September 2023	Volume 3, Annex 11.1: Offshore Ornithology Baseline Characterisation Report.

11.6.5.3 The DAS for the Morven Site were undertaken between January 2021 and September 2023. However, following pre-application consultation with NatureScot (Volume 3, Annex 5.1: Consultation), it was advised that, due to the planned application date of the project, only data from October 2021 to September 2023 should be used for baseline characterisation to avoid data being older than the five-year cut-off at application. The reduced dataset (between October 2021 and September 2021) dataset has been used to inform collision risk modelling (as this modeling was undertaking using monthly densities). For displacement analysis, the additional months in 2021 (June to September) were incorporated to allow for the use of full seasons for each species, in consultation with NatureScot (28 May 2025; Table 11.7). This dataset was also used to inform the baseline characterisation presented in Volume 3, Annex 11.1: Offshore Ornithology Baseline Characterisation Report. The months used for each species within the displacement analysis and further discussion on this approach is provided in Volume 3, Annex 11.4: Offshore Ornithology Displacement Modelling Report (Matrix Approach).

11.7 Baseline environment

11.7.1 Overview of baseline environment

11.7.1.1 Table 11.12 presents the results of the site-specific DAS undertaken across the Morven South Offshore Ornithology Study Area between June 2021 and September 2023. A full description of the results of the site specific baseline DAS is provided in Volume 3, Annex 11.1 Offshore Ornithology Baseline Characterisation Report. Table 11.12 also presents the results of the DAS undertaken as part of the regional surveys covering part of the Scottish North Sea (HiDef Aerial Surveying Limited, 2023). The areas covered by both these surveys are presented in Figure 11.2.

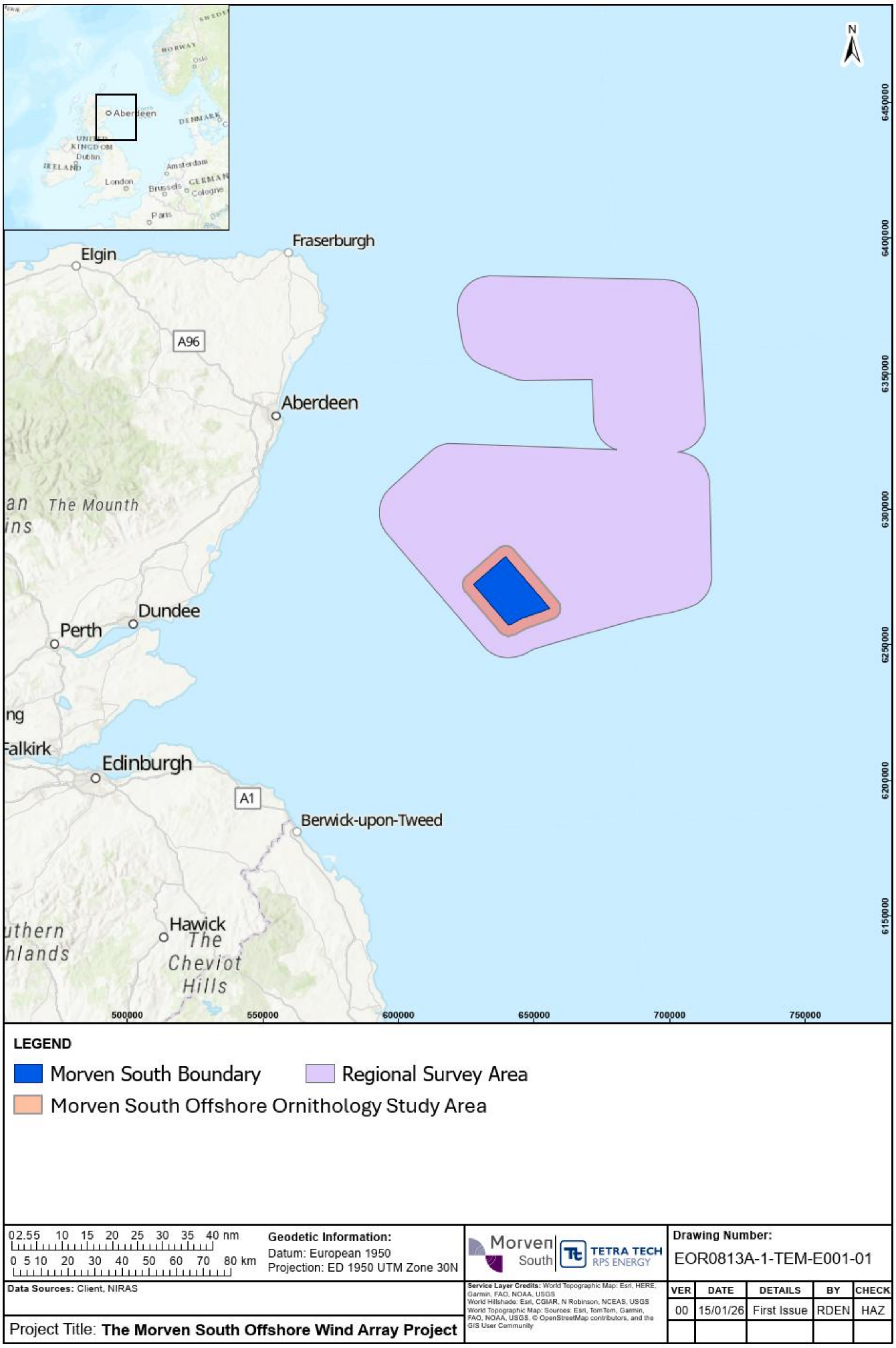

Figure 11.2: The Morven South Offshore Ornithology Study Area covered by site specific Digital Aerial Surveys and regional survey area

Table 11.12: Summary of the abundance and distribution of seabird species recorded during site specific baseline Digital Aerial Surveys and regional Digital Aerial Surveys covering part of the Scottish North Sea

Species	Summary of site-specific abundance and distribution	Summary of regional abundance and distribution
Kittiwake (*Rissa tridactyla*)	Kittiwakes were recorded in all but one of the DASs undertaken across the Morven South Offshore Ornithology Study Area. The peak count of 3,586 birds occurred in June 2021. The species was most abundant towards the end of the breeding season (June and July) in 2021 and 2022 with the peak population in 2023 occurring in May 2023 (274 birds). Outside of the breeding season the abundance of the species was generally lower than that recorded in the breeding season. The distribution of kittiwake varies across surveys with no obvious trends between years or seasons.	Kittiwakes were recorded in all the surveys undertaken as part of the regional surveys covering part of the Scottish North Sea (HiDef Aerial Surveying Limited, 2023) with the highest numbers during the breeding season. The distribution of kittiwake in the breeding season was often centred on the western side of the survey area, especially during surveys undertaken in 2022, and therefore not overlapping with the Morven South Offshore Ornithology Study Area. In the non-breeding seasons there was no obvious trend in the distribution of kittiwake across the survey area
Black-headed gull (*Chroicocephalus ridibundus*)	Black-headed gulls were not recorded in the baseline DAS undertaken across the Morven South Offshore Ornithology Study Area.	Black-headed gulls were recorded in one of the surveys undertaken as part of the regional surveys covering part of the Scottish North Sea (HiDef Aerial Surveying Limited, 2023) with four birds recorded during the July 2023 survey. These birds were recorded in the northern part of the survey area outside of the Morven South Offshore Ornithology Study Area.
Little gull (*Hydrocoloeus minutus*)	Little gulls were not recorded in the baseline DAS undertaken across the Morven South Offshore Ornithology Study Area.	Little gulls were not recorded in the surveys conducted as part of the regional surveys in the Scottish North Sea (HiDef Aerial Surveying Limited, 2023).
Common gull (*Larus canus*)	Common gulls were recorded in four of the baseline DAS undertaken across the Morven South Offshore Ornithology Study Area. The peak population occurred in August 2022 (41 birds). Of the four surveys during which the species was recorded, three were during the non-breeding season (October and November 2021 and November 2022) and one was in the breeding season (August 2022). Due to the small number of birds recorded there were no obvious trends in the distribution of birds across the Morven South Offshore Ornithology Study Area.	Common gulls were recorded in nine of the surveys undertaken as part of the regional surveys covering part of the Scottish North Sea (HiDef Aerial Surveying Limited, 2023). Less than ten birds were recorded in each survey with a peak of seven birds in June 2023. Common gull were not recorded in the Morven South Offshore Ornithology Study Area.

Species	Summary of site-specific abundance and distribution	Summary of regional abundance and distribution
Great black-backed gull (*Larus marinus)*	Great black-backed gulls were recorded within the Morven South Offshore Ornithology Study Area in eight of the baseline DAS. Birds were only recorded in the non-breeding season defined for the species (September to March), with no birds recorded in the breeding season (April to August). Peak numbers occurred in December 2022 (34 birds). Due to the small number of birds recorded there were no obvious trends in the distribution of great black-backed gull across the Morven South Offshore Ornithology Study Area.	Great black-backed gulls were recorded in eight of the surveys undertaken as part of the regional surveys covering part of the Scottish North Sea (HiDef Aerial Surveying Limited, 2023). The number of birds was below 20 birds in all surveys except January (60 birds) and February (41 birds) 2023. Birds were only recorded in the Morven South Offshore Ornithology Study Area in the April 2023 survey.
Herring gull (*Larus argentatus*)	Herring gulls were recorded within the Morven South Offshore Ornithology Study Area in five of the baseline DAS. The peak population in the non-breeding season (September to March) occurred in October 2022 and September 2023 (nine birds). In the breeding season (April to August), the peak population was recorded in June 2021 (nine birds). In all months, the number of birds recorded was too low to detect any trends in the distribution of the species in the Morven South Offshore Ornithology Study Area.	Herring gulls were recorded in 12 of the surveys undertaken as part of the regional surveys covering part of the Scottish North Sea (HiDef Aerial Surveying Limited, 2023). Less than 20 birds were recorded in all surveys except June and July 2022 (43 birds in both surveys), November 2022 (24 birds) and June 2023 (119 birds). Birds occurred in the Morven South Offshore Ornithology Study Area in the breeding season, although there was no trend in the distribution of this species. The species was not recorded during a number of non-breeding months but did occur in the Morven South Offshore Ornithology Study Area in the February 2023 survey
Lesser black-backed gull (*Larus fuscus)*	Lesser black-backed gulls were not recorded in the baseline DAS undertaken across the Morven South Offshore Ornithology Study Area.	Lesser black-backed gulls were recorded in five of the surveys undertaken as part of the regional surveys covering part of the Scottish North Sea (HiDef Aerial Surveying Limited, 2023). Less than ten birds were recorded in each survey with a peak of five birds in June 2023. Lesser black-backed gulls were not recorded in the Morven South Offshore Ornithology Study Area.
Sandwich tern (*Thalasseus sandvicensis)*	Sandwich terns were not recorded in the baseline DAS undertaken across the Morven South Offshore Ornithology Study Area.	Sandwich terns were not recorded in the surveys conducted as part of the regional surveys in the Scottish North Sea (HiDef Aerial Surveying Limited, 2023).

Species	Summary of site-specific abundance and distribution	Summary of regional abundance and distribution
Little tern (*Sternula albifrons*)	Little terns were not recorded in the baseline DAS undertaken across the Morven South Offshore Ornithology Study Area.	Little terns were not recorded in the surveys conducted as part of the regional surveys in the Scottish North Sea (HiDef Aerial Surveying Limited, 2023).
Roseate tern (*Sterna dougallii*)	Roseate terns were not recorded in the baseline DAS undertaken across the Morven South Offshore Ornithology Study Area.	Roseate terns were not recorded in the surveys conducted as part of the regional surveys in the Scottish North Sea (HiDef Aerial Surveying Limited, 2023).
Common tern (*Sterna hirundo*)	Common terns were not recorded in the baseline DAS undertaken across the Morven South Offshore Ornithology Study Area.	Common terns were recorded in five of the surveys undertaken as part of the regional surveys covering part of the Scottish North Sea (HiDef Aerial Surveying Limited, 2023). Birds were recorded in May, July, August and September with less than 20 birds recorded in each survey. Common terns were not recorded in the Morven South Offshore Ornithology Study Area during any survey.
Arctic tern (*Sterna paradisaea*)	Arctic terns were recorded in four of the DAS undertaken across Morven South Offshore Ornithology Study Area. Throughout the survey programme birds were only recorded in May, July and August. These months span the pre-breeding, breeding and post-breeding seasons defined for the species in Table 11.16. Morven South is however, beyond the foraging range of Arctic tern from any breeding colonies and therefore these birds are considered to be birds migrating to or from breeding grounds. In the pre-breeding season (April to May), birds were recorded in May 2022 (17 birds). In the post-breeding season (August to October), birds were recorded in August 2022 (2,810 birds). Birds were also recorded in August 2021 (24 birds) and July 2023 (8 birds).	Arctic terns were recorded in five of the surveys undertaken as part of the regional surveys covering part of the Scottish North Sea (HiDef Aerial Surveying Limited, 2023). Birds were recorded in May, July, August and September with less than five birds in all surveys except July 2022 when 45 birds were recorded. Arctic terns were recorded in the Morven South Offshore Ornithology Study Area during the July 2022 and August 2023.
Great skua (*Stercorarius skua*)	Great skuas were recorded in one of the baseline DAS undertaken across the Morven South Offshore Ornithology Study Area. This record occurred during the September 2023 survey with a single bird recorded, translating into a population estimate of eight birds.	Great skuas were recorded in three of the surveys undertaken as part of the regional surveys covering part of the Scottish North Sea (HiDef Aerial Surveying Limited, 2023). Birds were recorded in June (three birds), July (five birds) and August (one bird) 2022. No great skuas were recorded in the Morven South Offshore Ornithology Study Area.

Species	Summary of site-specific abundance and distribution	Summary of regional abundance and distribution
Arctic skua (*Stercorarius parasiticus*)	Arctic skuas were recorded in one of the baseline DAS undertaken across the Morven South Offshore Ornithology Study Area. This record occurred during the September 2021 survey (16 birds) which forms part of the post-breeding season for the species.	Arctic skuas were recorded in only two of the months surveyed as part of the regional surveys (HiDef Aerial Surveying Limited, 2023), with two birds in July 2022 and one bird in August 2023. One of the birds in July 2022 was recorded in the Morven South Offshore Ornithology Study Area.
Little auk (*Alle alle*)	Little auks were not recorded in the baseline DAS undertaken across the Morven South Offshore Ornithology Study Area.	Little auks were recorded in three of the surveys undertaken as part of the regional surveys covering part of the Scottish North Sea (HiDef Aerial Surveying Limited, 2023). A single bird was recorded in November 2022, January 2023 and February 2023. No little auks were recorded in the Morven South Offshore Ornithology Study Area.
Common guillemot (*Uria aalge*)	Common guillemots were recorded in all of the baseline DAS undertaken across the Morven South Offshore Ornithology Study Area. The species was most abundant towards the end of the breeding season and the start of the non-breeding season (June to August) in both years although this was more pronounced in 2022. It is considered that these populations represent post-breeding dispersal movements from breeding colonies. The peak population was recorded in August 2022 (20,180 birds). Outside of this period the abundance of the species was considerably lower. During the breeding season, densities were generally higher in the northern sector of the Morven South Offshore Ornithology Study Area, especially between May and July. There was no obvious trend in the distribution of common guillemot in the non-breeding season	Common guillemots were recorded in all of the surveys undertaken as part of the regional surveys covering part of the Scottish North Sea (HiDef Aerial Surveying Limited, 2023) with the highest numbers during the breeding season, although numbers were lower in the second year of surveys. A peak count of 28,036 birds was recorded in the July 2022 survey. In the breeding season common guillemots were abundant throughout the survey area including the Morven South Offshore Ornithology Study Area. There was a westerly bias in the distribution in May 2022 with this occurring more regularly in the second breeding season. In the August 2022 and 2023 surveys there was a northerly bias in the distribution of common guillemot with birds tending to occur further from the coast and exhibited a more offshore distribution in the non-breeding season
Razorbill (*Alca torda)*	Razorbills were recorded in all but two of the baseline DAS undertaken across the Morven South Offshore Ornithology Study Area. The species was most abundant towards the end of the breeding season and the start of the non-breeding season (July and August) of 2021 and 2022 with the peak population	Razorbills were recorded in all of the surveys undertaken as part of the regional surveys covering part of the Scottish North Sea (HiDef Aerial Surveying Limited, 2023) with the highest numbers during the breeding season, although numbers were

Species	Summary of site-specific abundance and distribution	Summary of regional abundance and distribution
	recorded in August 2022 (6,075 birds). Outside of this period the abundance of the species was considerably lower with the exception of June 2021 and November 2022. There was no obvious trend in the distribution of razorbill on a seasonal or annual basis	lower in the second year of surveys. A peak count of 3,095 birds was recorded in the July 2022 survey. The species was widespread throughout the survey area during the July 2022 survey whereas there was a westerly bias in the distribution of razorbill during the July 2023 survey which did not overlap with the Morven South Offshore Ornithology Study Area. In the remaining surveys undertaken in the breeding season there was no obvious trend in the distribution of the species, with far fewer birds present, when compared to the July surveys, with birds not always recorded in the Morven South Offshore Ornithology Study Area. There was also no obvious trend in the distribution of the species in the non-breeding season with birds recorded in the Morven South Offshore Ornithology Study Area in some surveys
Black guillemot (*Cepphus grylle*)	Black guillemots were recorded in one of the baseline DAS undertaken across the Morven South Offshore Ornithology Study Area. A single bird was recorded in the August 2023 survey translating to a population of eight birds.	Black guillemots were not recorded in the surveys conducted as part of the regional surveys in the Scottish North Sea (HiDef Aerial Surveying Limited, 2023).
Puffin (*Fratercula arctica)*	Puffins were recorded in 22 of the baseline DAS undertaken across the Morven South Offshore Ornithology Study Area. The species was most abundant towards the end of the breeding season and the start of the non-breeding season (mid-August and September) in 2021 and 2022 with the highest populations in 2023 occurring in May and June. Outside of these periods, population estimates were considerably lower. The peak population in the breeding season (mid-April to August) occurred in June 2021 (318 birds). The peak population in the non-breeding season (mid-August to March) occurred in September 2022 (907 birds). There was no obvious trend in the distribution of puffin on a seasonal or annual basis	Puffins were recorded in all of the surveys undertaken as part of the regional surveys covering part of the Scottish North Sea (HiDef Aerial Surveying Limited, 2023) with the highest numbers during the breeding season, although numbers were lower in the second year of surveys. A peak count of 1,023 birds was recorded in the July 2022 survey. In the July 2022 survey, there was a southerly bias in the distribution of the species whereas in the August 2022 survey there was a northerly bias in the distribution of the species. In other breeding season months (April, May and June) there was no obvious trend in the distribution of the species. Very few puffins were recorded in the November 2022 and January 2023 surveys with no obvious trend in the distribution of puffin in all surveys conducted in the non-breeding season

Species	Summary of site-specific abundance and distribution	Summary of regional abundance and distribution
Red-throated diver (*Gavia stellata)*	Red-throated divers were recorded in three of the baseline DAS undertaken across the Morven South Offshore Ornithology Study Area. Single birds were recorded in the May 2022, July 2022 and May 2023 surveys translating into population estimates of eight birds in each month.	Red-throated divers were recorded in six of the surveys undertaken as part of the regional surveys covering part of the Scottish North Sea (HiDef Aerial Surveying Limited, 2023). Birds were recorded in April, July, September and October 2022 and May and June 2023 with one bird in all surveys except April and September 2022 when two birds were recorded. Red-throated divers were not recorded in the Morven South Offshore Ornithology Study Area.
European storm petrel (*Hydrobates pelagicus)*	European storm petrels were not recorded in the baseline DAS undertaken across the Morven South Offshore Ornithology Study Area.	European storm petrels were recorded in three of the surveys undertaken as part of the regional surveys covering part of the Scottish North Sea (HiDef Aerial Surveying Limited, 2023). One bird was recorded in both the July 2022 and May 2023 surveys with 27 birds recorded in August 2023. European storm petrels were not recorded within the Morven South Offshore Ornithology Study Area in any survey.
Leach's petrel (*Hydrobates leucorhous*)	Leach's petrels were not recorded in the baseline DAS undertaken across the Morven South Offshore Ornithology Study Area.	Leach's petrels were recorded in one of the surveys undertaken as part of the regional surveys covering part of the Scottish North Sea (HiDef Aerial Surveying Limited, 2023). One bird was recorded in the July 2022 survey. Leach's petrels were not recorded within the Morven South Offshore Ornithology Study Area in any survey.
Fulmar (*Fulmarus glacialis)*	Fulmars were recorded in all of the baseline DAS undertaken across the Morven South Offshore Ornithology Study Area. The species was most abundant in the post-and non-breeding seasons of 2021 and in June 2022. The peak population estimated in the breeding season (April to September) occurred in August 2021 (714 birds). The peak population estimated in the post-breeding season (October) occurred in October 2021 (635 birds) with the peak population in the non-breeding season (November) in November 2021 (659 birds). The peak population in the pre-breeding season (December to March) occurred January 2023 (285 birds).	Fulmars were recorded in all of the surveys undertaken as part of the regional surveys covering part of the Scottish North Sea (HiDef Aerial Surveying Limited, 2023). Over 100 birds were recorded in all surveys except the April 2023 survey with a peak of 1,306 birds in September 2022. There was no obvious trend in the distribution of fulmars in the majority of surveys. In the September and November 2022 and August 2023 surveys there was a northerly bias in the distribution of fulmars.

Species	Summary of site-specific abundance and distribution	Summary of regional abundance and distribution
	There was no obvious trend in the distribution of fulmar on a seasonal or annual basis	
Manx shearwater (*Puffinus puffinus)*	Manx shearwaters were recorded in two of the baseline DAS undertaken across the Morven South Offshore Ornithology Study Area. Birds were recorded during the July 2021 and July 2023 surveys (population estimates of 147 and 17 birds respectively).	Manx shearwaters were recorded in three of the surveys undertaken as part of the regional surveys covering part of the Scottish North Sea (HiDef Aerial Surveying Limited, 2023). Eight birds were recorded in the July 2022 survey, one bird in June 2023 and three in July 2023.
Gannet (*Morus bassanus)*	Gannets were recorded in all but one of the baseline DAS conducted across the Morven South Offshore Ornithology Study Area. The abundance of the species was generally higher in the breeding season increasing from April to a peak in either June or August and then declining into the post-breeding season. The abundance of the species was considerably lower between December and February. The peak population estimated in the breeding season (March to September) occurred in July 2021 (1,397 birds). The peak population estimated in the post-breeding season (October to November) occurred in October 2021 (166 birds), and the peak population in the pre-breeding season (December to February) occurred in December 2022 (46 birds). There was no obvious trend in the distribution of gannet on a seasonal or annual basis	Gannets were recorded in all of the surveys undertaken as part of the regional surveys covering part of the Scottish North Sea (HiDef Aerial Surveying Limited, 2023) with the highest numbers in the breeding season, although fewer birds in the second year of surveys. A peak count of 884 birds was recorded in May 2022. There was no obvious trend in the distribution of gannet in any survey
Cormorant (*Phalacrocorax carbo)*	Cormorants were not recorded in baseline DAS undertaken across the Morven South Offshore Ornithology Study Area.	Cormorants were not recorded in the surveys conducted as part of the regional surveys in the Scottish North Sea (HiDef Aerial Surveying Limited, 2023).
Shag (*Gulosus aristotelis)*	Shags were not recorded in baseline DAS undertaken across the Morven South Offshore Ornithology Study Area.	Shags were not recorded in the surveys conducted as part of the regional surveys in the Scottish North Sea (HiDef Aerial Surveying Limited, 2023).

11.7.2 Designated sites

11.7.2.1 Designated sites with offshore ornithology qualifying interest features with connectivity with Morven South are described in Table 11.13.

Table 11.13: Designated sites and qualifying interest features with connectivity with Morven South

Designated site	Closest distance to Morven South (km)[1]	Qualifying interest feature(s)
Buchan Ness to Collieston Coast SPA	103	Kittiwake
Copinsay SPA	271	Kittiwake
Coquet Island SPA	132	Fulmar Kittiwake Puffin
East Caithness Cliffs SPA	234	Kittiwake Fulmar Razorbill (non-breeding seasons only)
Fair Isle SPA	318	Fulmar Gannet (non-breeding seasons only) Puffin (non-breeding season only)
Farne Islands SPA	103	Kittiwake Puffin
Fetlar SPA	432	Fulmar
Flamborough and Filey Coast SPA	243	Fulmar Gannet (non-breeding seasons only) Kittiwake Razorbill (non-breeding seasons only) Puffin
Forth Islands SPA	106	Gannet Kittiwake Razorbill Puffin
Foula SPA	389	Fulmar Puffin (non-breeding seasons only)
Fowlsheugh SPA	84	Herring gull Kittiwake Common guillemot

[1] Measured as the distance between the edge of the Morven South Boundary to the edge of the colony.

Designated site	Closest distance to Morven South (km)[1]	Qualifying interest feature(s)
		Razorbill
Hermaness, Saxa Vord and Valla Field SPA	425	Fulmar Gannet (non-breeding seasons only) Puffin (non-breeding seasons only)
Hoy SPA	278	Fulmar Kittiwake
North Caithness Cliffs SPA	253	Fulmar Kittiwake Puffin
Northumberland Marine SPA	93	Fulmar Kittiwake Razorbill Puffin
Noss SPA	385	Fulmar Gannet (non-breeding seasons only)
Outer Firth of Forth and St Andrews Bay Complex SPA	66	Kittiwake Herring gull (non-breeding) Guillemot Razorbill Puffin Gannet Red-throated diver Slavonian grebe Eider Shag Long-tailed duck Common scoter Velvet scoter Goldeneye Red-breasted merganser
St Abb's Head to Fast Castle SPA	103	Kittiwake Razorbill
St Kilda SPA	473	Gannet (non-breeding seasons only)
Troup, Pennan and Lion's Heads SPA	143	Kittiwake
West Westray SPA	318	Kittiwake

11.7.3 Important Ecological Features

11.7.3.1 In accordance with CIEEM guidelines (2024), Important Ecological Features (IEF) have been identified for assessment within this chapter. For offshore ornithology, IEFs are termed Valued Ornithological Receptors (VORs). All seabird features recorded within the Morven South Offshore Ornithology Study Area have been evaluated and a conservation value assigned based on the criteria set out in Table 11.14.

11.7.3.2 The defining characteristics and the classification of VORs within the Morven South Offshore Ornithology Study Area are provided in Table 11.15. This process is described in detail in Volume 3, Annex 11.1: Offshore Ornithology Baseline Characterisation Report. Table 11.15 also provides the justifications for the importance rankings and conclusion on whether a species is identified as a VOR and therefore is taken forward for impact assessment. A VOR was identified where the numbers present within the Morven South Offshore Ornithology Baseline Characterisation Study Area breached the 1% threshold of the regional population (adults and immatures) in any season. It is considered that any impacts on species occurring in numbers of less than 1% of the relevant regional population will not be significant. This criterion is not however applied as a definitive threshold. In addition, expert judgement is used to identify species for which this threshold may not be applicable and therefore ensure that species are not erroneously omitted from further assessment. This is especially relevant to migratory seabirds (species of tern, petrel, skua and little gull) which are identified as VORs despite generally having not been recorded in high enough numbers to warrant inclusion when applying the criteria discussed above. Traditional survey methods are unlikely to capture the movements of migratory seabirds due to the ephemeral nature of their movements. As these species could have been under-recorded, extra consideration has been given to potential impacts on this species during migratory periods.

Table 11.14: Defining criteria for the conservation status and population importance of Valued Ornithological Receptors

Category	Defining criteria	
	Conservation status	**Population importance**
Negligible	All species of lowest conservation status (e.g. Green-listed species listed on the Birds of Conservation Concern (BoCC) 5 (Stanbury *et al.*, 2021)).	Not recorded during baseline and regional surveys of the Morven South Offshore Ornithology Study Area.
Local	Any other species of conservation status (e.g. Amber-listed species listed on the BoCC 5 (Stanbury *et al.*, 2021)) not covered in the categories below.	A species that is present at Morven South in numbers lower than 1% of the regional population.
Regional	Species red-listed on the BoCC 5 (Stanbury *et al.*, 2021); Species that are the subject of a specific action plan within the UK or species considered to be of principal importance for biodiversity and conservation in Scotland as listed on the Scottish Biodiversity List (Nature Conservation (Scotland) Act 2004).	A species that is present at Morven South in numbers greater than 1% of the regional population.

Category	Defining criteria	
	Conservation status	**Population importance**
National	Species listed on Schedule 1 of the Wildlife and Countryside Act 1981 not already covered by International criteria; Species listed on Annex I of the EU Birds Directive; Bird species that form part of an SSSI that may potentially interact with Morven South at some stage of their life cycle; Species for which at least 50% of the UK breeding or non-breeding population is found at ten or fewer sites; An impact on an ecologically sensitive species (<300 breeding pairs or <900 wintering individuals in the UK).	A species that is present at Morven South in numbers greater than 1% of the national population.
International	Bird species that form part of a cited interest of an SPA or Ramsar site that may potentially interact with Morven South at some stage of their life cycle including those listed as assemblage features; Species for which at least 20% of the European breeding or non-breeding population is found in the UK.	A species that is present at Morven South in numbers greater than 1% of the international biogeographic population.

Table 11.15: Valued Ornithological Receptors within the Morven South Offshore Ornithology Study Area

Species	Conservation status	SPA connectivity	Population importance in the breeding season	Population importance in the post-breeding/pre-breeding season	Population importance in the non-breeding season	Conservation value	Taken forward for impact assessment
Kittiwake	International (SPA connectivity)	Yes	Local	Local	N/A[2]	International	Yes – SPA connectivity
Black-headed gull	Regional (Scottish Biodiversity List)	No	Negligible	N/A[2]	Negligible	Regional	No – species not recorded during baseline DAS
Little gull	National (Annex I)	No	Negligible	N/A[2]	Negligible	National	Yes – migratory species
Common gull	Regional (BoCC Red-list)	No	Local	N/A[2]	Local	Regional	No – peak estimates did not surpass population importance thresholds
Great black-backed gull	Regional (BoCC Red-list)	No	Negligible	N/A[2]	Local	Regional	Yes – species considered to have a regional conservation value. Species recorded during multiple baseline DAS
Herring gull	International (SPA connectivity)	Yes	Local	N/A[2]	Local	International	No – peak estimates did not surpass population importance thresholds
Lesser black-backed gull	International (SPA connectivity)	Yes	Negligible	Negligible	Negligible	International	No – species not recorded during baseline DAS
Sandwich tern	National (Annex I)	No	Negligible	Negligible	N/A[2]	National	Yes – migratory species

[2] N/A is used when the species does not have that specific season as part of it's annual cycle as defined by Furness (2015).

Species	Conservation status	SPA connectivity	Population importance in the breeding season	Population importance in the post-breeding/pre-breeding season	Population importance in the non-breeding season	Conservation value	Taken forward for impact assessment
Little tern	National (Annex I; Schedule 1)	No	Negligible	Negligible	N/A[2]	National	Yes – migratory species
Roseate tern	National (Annex I; Schedule 1)	No	Negligible	Negligible	N/A[2]	National	Yes – migratory species
Common tern	National (Annex I)	No	Negligible	Negligible	N/A[2]	National	Yes – migratory species
Arctic tern	National (Annex I)	No	Negligible	National	N/A[2]	National	Yes – migratory species
Great skua	International (SPA connectivity)	Yes	Negligible	Local	N/A[2]	International	Yes – migratory species
Arctic skua	Regional (BoCC Red-list)	No	Negligible	Local	N/A[2]	Regional	Yes – migratory species
Little auk	Negligible	No	N/A[2]	N/A[2]	Negligible	Negligible	No – species not recorded during baseline DAS
Common guillemot	International (SPA connectivity)	Yes	Regional	N/A[2, 3]	Regional	International	Yes – SPA connectivity, species recorded in the majority of baseline DAS, peak populations surpass importance thresholds
Razorbill	International (SPA connectivity)	Yes	Regional	Regional	Local	International	Yes – SPA connectivity, species recorded in the

[3] For baseline characterisation purposes, the generic seasonal definitions presented in NatureScot (2020) and Furness (2015) have been used. Subsequent to baseline characterisation, further consideration is given to seasonal definitions in order to ensure assessments are representative of the populations recorded at Morven South.

Species	Conservation status	SPA connectivity	Population importance in the breeding season	Population importance in the post-breeding/pre-breeding season	Population importance in the non-breeding season	Conservation value	Taken forward for impact assessment
							majority of baseline DAS, peak populations surpass importance thresholds
Black guillemot	Negligible (BoCC Green-list)	No	Local	N/A[2]	Negligible	Local	No – species recorded in two baseline DAS. Population did not surpass importance thresholds
Puffin	International (SPA connectivity)	Yes	Local	N/A[2]	Local	International	Yes – SPA connectivity, species recorded in the majority of baseline DAS
Red-throated diver	National (Annex I; Schedule 1)	No	Negligible	Local	Negligible	National	No – species recorded in three baseline DAS. Population did not surpass importance thresholds
European storm petrel	International (SPA connectivity)	Yes	Negligible	Negligible	N/A[2]	International	Yes – migratory species
Leach's petrel	International (SPA connectivity)	Yes	Negligible	Negligible	N/A[2]	International	Yes – migratory species
Fulmar	International (SPA connectivity)	Yes	Local	Local	Local	International	Yes – SPA connectivity, species recorded in the majority of baseline DAS
Manx shearwater	Regional (Scottish Biodiversity List)	Yes	Negligible	Regional	N/A[2]	Regional	Yes – peak estimates surpass population importance thresholds

Species	Conservation status	SPA connectivity	Population importance in the breeding season	Population importance in the post-breeding/pre-breeding season	Population importance in the non-breeding season	Conservation value	Taken forward for impact assessment
Gannet	International (SPA connectivity)	Yes	Local	Local	N/A[2]	International	Yes – SPA connectivity, species recorded in the majority of baseline DAS
Cormorant	Negligible (BoCC Green-list)	No	Negligible	N/A[2]	Negligible	Negligible	No – species not recorded during baseline DAS
Shag	National (Annex I)	No	Negligible	N/A[2]	Negligible	National	No – species not recorded during baseline DAS

11.7.4 Seasonality

11.7.4.1 The behaviour and abundance of bird populations vary across an annual cycle, contingent on the biological seasons relevant to different seabird species. The VORs included in the assessment showed seasonality in their distribution and abundance during the site-specific surveys, which reflected the timing of the breeding and non-breeding seasons and migratory periods (i.e. pre- and post-breeding). These distinct biological seasons are acknowledged in order to assess the significance of each bird species within Morven South during each specific time period.

11.7.4.2 Seasons used within the assessment were defined according to the breeding, non-breeding and migratory periods (autumn and spring migration) from NatureScot (2020) and Furness (2015) with the breeding season taking precedence where overlaps between seasonal extents exist.

11.7.4.3 For common guillemot and razorbill, the seasonal definitions in the aforementioned references have been used as a basis for defining seasons but these seasonal definitions have been refined through pre-application consultation with NatureScot (see Table 11.7) based on trends in site-specific abundance estimates. Where the seasonal definitions presented in NatureScot (2020) begin or end within a month, the middle of the month was used as the cut off for inclusion in either the breeding or relevant non-breeding season. This is relevant to kittiwake, gannet and puffin as part of the analyses undertaken in Volume 3, Annex 11.4: Offshore Ornithology Displacement Modelling Report (Matrix Approach). Months were assigned to a season based on the day that the site-specific DAS from which abundance estimates were calculated was flown (for example for kittiwake if the DAS was within the first 15 days of April it would be within the pre-breeding season, or in the last 15 days of April it would be within the breeding season). Timings of each survey can be found in Volume 3, Annex 11.1: Offshore Ornithology Baseline Characterisation Report. For all other species where seasons begin or end within a month these definitions are retained in Table 11.16. Seasons relevant to each species are shown in Table 11.16 with grey shading used to indicate where a season is not relevant to a specie.

11.7.4.4 Further information on the derivation of seasons is presented in Volume 3 Annex 11.1: Offshore Ornithology Baseline Characterisation Report.

Table 11.16: Seasonal definitions considered in this report.

Species	Source	Seasonal definitions			
		Breeding	Post-breeding	Non-breeding	Pre-breeding
Kittiwake	NatureScot (2020); Furness (2015)	May to August	September to December	N/A[2]	January to April
Little gull	NatureScot (2020)	Breeding season not relevant to Morven South.	N/A[2]	August to mid-April	N/A[2]
Great black-backed gull	NatureScot (2020); Furness (2015)	April to August	N/A[2]	September to March	N/A[2]
Sandwich tern	NatureScot (2020); Furness (2015)	mid-April to mid-September	July to September	N/A[2]	March to May

Species	Source	Seasonal definitions			
		Breeding	Post-breeding	Non-breeding	Pre-breeding
Little tern	NatureScot (2020); Furness (2015)	mid-May to August	late July to early September	N/A[2]	mid-April to May
Roseate tern	NatureScot (2020); Furness (2015)	mid-May to August	August to September	N/A[2]	late April to May
Common tern	NatureScot (2020); Furness (2015)	May to mid-September	late July to early September	N/A[2]	April to May
Arctic tern	NatureScot (2020); Furness (2015)	May to August	July to September	N/A[2]	April to May
Great skua	NatureScot (2020); Furness (2015)	mid-April to mid-September	August to October	November to February	March to mid-April
Arctic skua	NatureScot (2020); Furness (2015)	May to August	August to October	N/A[2]	April to May
Common guillemot	Please see Volume 3, Annex 11.4: Offshore Ornithology Displacement Modelling Report (Matrix Approach)	April to June 2022 and 2023	July and August 2022 and July 2023	August 2021 to March 2022 and September 2022 to March 2023	N/A[2]
Razorbill	Please see Volume 3, Annex 11.4: Offshore Ornithology Displacement Modelling Report (Matrix Approach)	April to June 2022 and April to July 2023	July to October 2021 and 2022	November to December 2021 and 2022	January to March 2022 and 2023
Puffin	NatureScot (2020); Furness (2015)	April to August	N/A[2]	September to March	N/A[2]
European storm petrel	NatureScot (2020); Kober *et al.* (2010)	May to October	November to December	N/A[2]	January to April

Species	Source	Seasonal definitions			
		Breeding	Post-breeding	Non-breeding	Pre-breeding
Leach's petrel	NatureScot (2020); Kober *et al.* (2010)	May to October	November to December[4]	N/A[2]	January to May[4]
Fulmar	NatureScot (2020); Furness (2015)	April to September	October	November	December to March
Manx shearwater	NatureScot (2020); Furness (2015)	April to mid-October	August to October	N/A[2]	March to May
Gannet	NatureScot (2020); Furness (2015)	April to September	October to November	N/A[2]	December to March

11.7.5 Reference populations

11.7.5.1 Regional population estimates for the breeding, non-breeding, wintering, pre-breeding and post-breeding seasons have been defined in Table 11.17 identified as VORs in Volume 3, Annex 11.1: Offshore Ornithology Baseline Characterisation Report for which quantitative impact assessments have been undertaken in sections 11.11 and 11.13. These populations are calculated using the BDMPS relevant for each species (Furness, 2015). Population estimates for the breeding population were based on SPA and non-SPA sites located within the species' foraging range (using Woodward *et al*., 2019) of Morven South. Breeding Colony counts were extracted from the SMP online database (BTO *et al*., 2024).

11.7.5.2 During the breeding season, in addition to seabirds associated with breeding colonies, there will be immature birds and 'sabbatical' birds (mature seabirds not breeding in a given year) present within the region. Population counts therefore must be adjusted to account for these components of the population. A full description of the methodology applied to calculate regional populations is provided in Volume 3, Annex 11.1: Offshore Ornithology Baseline Characterisation Report.

[4] Data not available for Leach's petrel therefore the seasonal definitions are assumed to be the same as the closely related European storm petrel

Table 11.17: Regional, national and international reference populations for Valued Ornithological Receptors (All population estimates are for individual birds)

Species	Breeding					Post-breeding		Non-breeding		Pre-breeding	
	Regional BDMPS (adults only) (breeding individuals)	Regional BDMPS (adults and immature birds) (individuals)	National (adults only) (breeding individuals)	National (adults and immature birds) (individuals)	International (breeding individuals)	Regional BDMPS (all birds)	National (all birds)	Regional BDMPS (all birds)	National (all birds)	Regional BDMPS (all birds)	National (all birds)
Kittiwake	306,472	576,167	431,826	811,833	7,588,796	829,937	1,741,523			627,816	1,319,342
Great black-backed gull	No breeding birds within foraging range		22,530	50,918	304,000-330,000			91,399	143,521		
Arctic tern	No breeding birds within foraging range		60,902	96,225	2,000,000	163,930	235,328			163,930	235,328
Common guillemot	102,367	178,118	1,696,290	2,951,545	24,120,000			474,821	2,756,526		
Razorbill	51,046	88,821	335,843	584,367	1,250,746-2,477,612	591,874	1,198,788	218,622	560,044	591,874	1,198,788
Puffin	246,752	449,089	949,358	1,936,690	24,000,000-28,000,000			231,957	536,514		
Fulmar	515,156	834,553	639,016	1,035,206	14,000,000	957,502	1,785,696	568,736	1,125,103	957,502	1,785,696
Gannet	309,372	559,963	675,716	1,223,046	1,171,178	456,298	1,002,252			248,385	910,273

11.7.6 Baseline mortality rates

11.7.6.1 The impact of additional mortality due to wind farm effects is assessed in terms of the change in the baseline mortality rate which could result. It has been assumed that all age classes are equally at risk of effects, with each age class affected in proportion to its presence in the population. Therefore, a weighted average baseline mortality rate has been calculated for those species screened in for quantitative assessment of displacement or collision impacts. This is therefore appropriate for use in assessments for all age classes.

11.7.6.2 Age specific survival rates for each species from Horswill and Robinson (2015) were entered into a matrix population model. Updated productivity values were provided by JNCC/British Trust for Ornithology (BTO) (JNCC *et al*., 2024a), with the UK average over the course of 2010 to 2019 calculated and used.

11.7.6.3 Not all species and colonies had updated counts after 2014, and so the national average from Horswill and Robinson (2015) was used if no updated rates from JNCC/BTO were made available. Productivity values were used to calculate the expected proportions in each age class.

11.7.6.4 Each age class survival rate was multiplied by its proportion and the total for all ages summed to give the average survival rate for all ages. The average mortality rate was subsequently calculated by subtracting the survival rate from 1. The demographic rates, age class proportions and average mortality rates calculated are presented in Table 11.18.

11.7.6.5 Baseline mortality rates for migratory seabird and waterbird species represent adult baseline mortality rates from relevant literature sources (Robinson, 2005) and are quoted where relevant in Section 11.11.4. For the purposes of this chapter migratory waterbirds refers to species of ducks, geese, waders and terrestrial birds that are features of UK SPA and therefore primarily incorporates true waterbirds in addition to a small number of terrestrial birds. Migratory seabirds refer to species of tern, petrel, skua and little gull (full assessment methods for these migratory birds is provided in Volume 3, Annex 11.3: Offshore Ornithology Collision Risk Modelling Report: Migratory).

Table 11.18: Demographic rates from JNCC/BTO (JNCC *et al.*, 2024a) and Horswill and Robinson (2015) and population age ratios calculated from population models used to estimate average mortality for use in impact assessment

Species	Parameter	Age class (years)					Adult	Annual productivity	Average annual mortality
		0 to 1	1 to 2	2 to 3	3 to 4	4 to 5			
Kittiwake	Annual survival rate	0.790	0.854	0.854	0.854	N/A	0.854	0.619	0.156
	Proportion in population	0.160	0.126	0.107	0.090	N/A	0.517	N/A	N/A
Great black-backed gull	Annual survival rate	0.798	0.930	0.930	0.930	0.930	0.930	1.061	0.095
	Proportion in population	0.188	0.134	0.112	0.094	0.078	0.394	N/A	N/A
Herring gull	Annual survival rate	0.798	0.834	0.834	0.834	0.834	0.834	0.498	0.171
	Proportion in population	0.132	0.110	0.096	0.084	0.073	0.505	N/A	N/A
Common guillemot	Annual survival rate	0.560	0.792	0.917	0.939	0.939	0.939	0.583	0.133
	Proportion in population	0.153	0.084	0.065	0.058	0.053	0.587	N/A	N/A
Razorbill	Annual survival rate	0.630	0.630	0.895	0.895	N/A	0.895	0.532	0.172
	Proportion in population	0.155	0.099	0.064	0.059	N/A	0.623	N/A	N/A
Puffin	Annual survival rate	0.709	0.709	0.709	0.760	0.805	0.906	0.555	0.176
	Proportion in population	0.155	0.113	0.082	0.060	0.046	0.544	N/A	N/A
Fulmar	Annual survival rate	0.260	N/A	N/A	N/A	N/A	0.936	0.410	0.221
	Proportion in population	0.233	N/A	N/A	N/A	N/A	0.767	N/A	N/A
Gannet	Annual survival rate	0.424	0.829	0.891	0.895	0.895	0.919	0.766	0.193
	Proportion in population	0.201	0.084	0.069	0.061	0.054	0.531	N/A	N/A

11.7.7 Future baseline scenario

11.7.7.1 The EIA Regulations require the following to be included within the EIA Report: "a description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort, on the basis of the availability of environmental information and scientific knowledge."

11.7.7.2 In the event that Morven South does not come forward, an assessment of the future baseline conditions has been carried out and is described within this section.

11.7.7.3 The UK holds internationally important populations of seabirds (Mitchell *et al*., 2004). UK seabird populations have shown a marked decline over the last two decades (JNCC, 2020; Mitchell *et al*., 2020), with over a third of species experiencing declines in breeding abundance of up to 30% or more since the early 1990s (Mitchell *et al*., 2020).

11.7.7.4 A recent study suggests that, in terms of number of species affected and the average impact, the key three threats to seabird populations globally are invasive species (165 species across all the most threatened groups), bycatch in fisheries (100 species but with the greatest average impact) and climate change (96 species affected) (Dias *et al*., 2019; Mitchell *et al*., 2020).

11.7.7.5 Most seabird species in the UK are at the southern limit of their range in the northeast Atlantic and therefore an increase in global temperatures could result in a shift in species' range with the potential for overall declines in population size (Frederiksen *et al*., 2007, 2013; Mitchell *et al*., 2020). In the UK and Ireland, climate change is considered to be the likely primary cause of decline in seabird populations in the future, with anticipated depletion of breeding conditions for most species either indirectly, through changes in prey abundance, or directly, during extreme weather events (Mitchell *et al*., 2020).

11.7.7.6 Fisheries management will also likely impact on future seabird populations in the UK and Ireland. For many years, seabird species have benefitted from bycatch and fisheries discards; for scavenging species such as herring gull, kittiwake, great skua and fulmar, population levels may already be above those that naturally occurring food sources would sustain (Votier *et al*., 2004; Frederiksen *et al*., 2013). The introduction between 2015 and 2019 of the Common Fisheries Policy Landings Obligation ('discard ban') will likely reduce the discard available and ultimately put more pressure on scavenging species.

11.7.7.7 The UK and Scottish Governments recently announced the closure of sandeel fisheries in all Scottish waters and the English North Sea (DEFRA, 2024; Scottish Government, 2024a). The European Union initially contested the closure under the UK-EU Trade and Cooperation Agreement but in May 2025 an arbitration panel ruled that the UK is not legally obligated to reverse the closure in English waters, and the closure in Scottish waters was fully upheld (Cabinet Office and DEFRA, 2025). The intention of the closure was to improve the sandeel population, and therefore also benefit predators including seabirds such as kittiwake, puffin, and common guillemot that feed on sandeels. The closure may therefore reduce the pressure on these species.

11.7.7.8 Therefore, without Morven South, seabird populations would be expected to continue to follow their current population trends, which in many cases is a continuation of declining populations. Climate change is considered to be the likely primary cause of decline in seabird populations in the future. It is believed that the absence of Morven South would further delay the transition of the UK from reliance on fossil fuels and therefore further contribute towards climate change impacts and declining seabird populations.

11.7.8 Data limitations and assumptions

11.7.8.1 Baseline characterisation of the Morven South Offshore Ornithology Study Area and resulting assessments of significance use site-specific data (DAS) conducted over a period of 24 months (October 2021 to September 2023). As sampling is undertaken once a month for a period of 24 months, it may be considered to represent a snapshot of each month. Indeed, seabird numbers may fluctuate both spatially and temporally in response to environmental conditions. However, the sampling regime adopted at Morven South is identical to other baseline characterisation surveys at offshore wind farms projects which have been previously agreed by Statutory Nature Conservation Bodies (SNCBs) as suitable for baseline characterisation. The approach to baseline characterisation of Morven South was also agreed with NatrueScot (see Table 11.7, 24 August 2023).

11.7.8.2 The level of precision of the abundance estimates is crucial as reliable abundance underpins the robustness of the predictions and the assessment of the effects on the VORs. To characterise the baseline conditions, model-based estimates using the MRSea package (originally developed by Scott-Hayward *et al*., 2013) were produced to predict numbers across the survey area alongside 95% confidence intervals to provide consideration of variation around the average value. Design based estimates for bird numbers and densities in each month were also generated. These were compared to the MRSea estimates to provide additional validation of the MRSea outputs and estimates for months where low raw abundances prevented the use of the MRSea model. Full details are presented in Volume 3, Annex 11.1: Offshore Ornithology Baseline Characterisation Report.

11.7.8.3 As part of any site-specific baseline digital aerial survey programme undertaken to support offshore wind farm applications, there will inevitably be a proportion of birds for which identification to species level is not possible. This is especially relevant to auk species, which appear similar when they are sitting on the sea surface, a behaviour exhibited frequently by this species group. There are long established approaches developed and applied when estimating abundance metrices (population estimates and densities) to incorporate these unidentified birds into the abundance estimates calculated for relevant species. These approaches apply ratios based on the proportions of contributory species identified during surveys and have been applied across all offshore wind farms since at least Round 3 in English waters. NatureScot have advised that the ratio approach should be applied for abundance estimates calculated for Morven South (see Section 11.4). In addition, on recent Round 4 projects in English waters (specifically the Mona Offshore Wind Project and the Morgan Generation Assets), the proportion of unidentified auks has been higher than would perhaps be expected. For these projects additional processing of raw survey data was undertaken to improve auk ID rates, with this analysis and subsequent abundance estimates accepted by Natural England (Morgan Offshore Wind Limited, 2024). This analysis step has been applied for Morven South and therefore the Applicant considers that it is appropriate to apply the ratio approach.

11.7.8.4 The current H5N1 strain of Highly Pathogenic Avian Influenza (HPAI) was first recorded in the UK in summer 2021 (Falchieri *et al*., 2022). Although existing systematic reviews indicate that diseases are seldom a key factor leading to the extinction of vertebrates, diseases can cause population crashes, leading to measurable declines in populations (Young and VanderWerf, 2023). Thousands of seabird mortalities attributed to HPAI were reported across the UK in 2022, with minimum losses of almost 20,000 individuals in Scotland alone (NatureScot, 2023i), and by the end of 2022, 17 of the 25 UK breeding seabird species had tested positive for HPAI (Tremlett *et al*., 2024a; Tremlett *et al*., 2024b). Since 2022, seabird populations have been largely unaffected by HPAI, and although a small number of cases continue to be reported, the number of mortalities is negligible compared to 2022.

11.7.8.5 The impact of the short, medium and long-term effects of the 2022 HPAI outbreak on seabird colony abundance and vital rates (productivity and survival) on UK breeding colonies is unclear. It is also unclear yet how the distribution and abundance of seabirds at sea was affected during the 2022 summer outbreak. The disease has affected 61 bird species, including species such as gannet, razorbill, common guillemot, puffin, Manx shearwater, fulmar and small and large gull species (Pearce-Higgins *et al*., 2023). The impact has affected gannet and great skua especially (Pearce-Higgins *et al*., 2023), with the United Kingdom supporting over 50% of the global gannet population and 60% of the global great skua population (JNCC, 2021).

11.8 Methodology for assessment of effects

11.8.1 Overview

11.8.1.1 The offshore ornithology assessment of effects has predominantly followed the methodology set out in Volume 1, Chapter 6: EIA Methodology. There are minor variations in definitions of magnitude for offshore ornithology and specific to the offshore ornithology assessment of effects, the following guidance documents have also been considered:

- Guidelines for ecological impact assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Version 1.3 - updated September 2024 (CIEEM, 2024);
- Guidance Note 1: Guidance to support Offshore Wind Applications: Marine Ornithology – Overview (NatureScot, 2025a);
- Guidance Note 2: Guidance to support Offshore Wind Applications: Advice for Marine Ornithology Baseline Characterisation Surveys and Reporting (NatureScot, 2023a);
- Guidance Note 3: Guidance to support Offshore Wind applications: Marine Birds – Identifying theoretical connectivity with breeding site Special Protection Areas using breeding season foraging ranges (NatureScot, 2023b);
- Guidance Note 4: Guidance to Support Offshore Wind Applications: Ornithology – Determining Connectivity of Marine Birds with Marine Special Protection Areas and Breeding Seabirds from Colony SPAs in the Non Breeding Season (NatureScot, 2023c);
- Guidance Note 5: Guidance to support Offshore Wind Applications: Recommendations for marine bird population estimates (NatureScot, 2023d);
- Guidance Note 6: Guidance to support Offshore Wind Applications – Marine Ornithology Impact Pathways for Offshore Wind Developments (NatureScot, 2023e);
- Guidance Note 7: Guidance to support Offshore Wind Applications: Marine Ornithology – Advice for assessing collision risk of marine birds (NatureScot, 2025b);
- Guidance Note 8: Guidance to support Offshore Wind applications: Marine Ornithology Advice for assessing the distributional responses, displacement and barrier effects of Marine birds (NatureScot, 2023f);
- Guidance Note 9: Guidance to support Offshore Wind applications: Marine Ornithology Advice for Seasonal Definitions for Birds in the Scottish Marine Environment (NatureScot, 2020);
- Guidance Note 10: Guidance to support Offshore Wind applications: Marine Ornithology Advice for apportioning impacts to breeding colonies (NatureScot, 2023g);
- Guidance Note 11: Guidance to support Offshore Wind Applications: Marine Ornithology – Recommendations for Seabird Population Viability Analysis (PVA) (NatureScot, 2023h);
- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase I: Expectations for pre-application baseline data for designated nature conservation and landscape receptors to support offshore wind applications (Natural England, 2022a);
- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase II: Expectations for pre-application engagement and best practice guidance for the Evidence Plan process (Natural England, 2022b);
- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase III: Expectations for data analysis and presentation at examination for offshore wind applications (Natural England, 2022c);
- Environmental Impact Assessment for Offshore Renewable Energy projects (British Standards Institute (BSI) (2015);
- UK Planning Inspectorate Advice Note Twelve: Transboundary Impacts (PINS, 2024a);
- Advice Note Seventeen: Cumulative Effects Assessment (PINS, 2024b).

11.8.1.2 In addition, the offshore ornithology assessment of effects has considered the legislative framework as defined by:

- The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 and the Conservation of Offshore Marine Habitats and Species Regulations 2017

- European Commission ('EC') Directive 2009/147/EC (codified version of 79/409/EC) on the Conservation of Wild Birds (the 'Birds Directive');
- Ramsar Convention on Wetlands of International Importance 1971;
- Wildlife and Countryside Act 1981.

11.8.2 Assessment criteria

11.8.2.1 The approach for determining the significance of effects for offshore ornithology is a two-stage process that involves defining the magnitude of the potential impacts and the sensitivity of the receptors. This section describes the criteria applied in this chapter to assign values to the magnitude of potential impacts and the sensitivity of the receptors. The terms used to define magnitude and sensitivity are based (but not identical) on those which are described in further detail in Volume 1, Chapter 6: EIA Methodology. There are minor variations in definitions for offshore ornithology following specific guidance (set out above).

11.8.2.2 The criteria for defining magnitude in this chapter are outlined in Table 11.19.

Table 11.19: Definition of terms relating to the magnitude

Magnitude of impact	Definition
High	A change in the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific protected site that is predicted to irreversibly alter the population in the short to long term and to alter the long-term viability of the population and/or the integrity of the protected site. Impacts felt long-term. Impacts predicted to be reversed in the long-term (i.e. more than five years) following cessation of the project activity.
Medium	A change in the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific protected site that occurs in the short and long-term, but which is not predicted to alter the long-term viability of the population and/or the integrity of the protected site. Impacts felt medium to long-term. Impacts predicted to be reversed in the medium-term (i.e. no more than five years) following cessation of the project activity.
Low	A change in the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific protected site that is sufficiently small-scale or of short duration to cause no long-term harm to the feature/population. Impacts present for a short to medium duration. Impacts predicted to be reversed in the short-term (i.e. no more than one year) following cessation of the project activity.
Negligible	Very slight or no change from the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific protected site. Impacts present for a short duration (temporary/intermittently). Impacts predicted to be reversed rapidly (i.e. no more than circa six months) following cessation of the project related activity.

11.8.2.3 In addition, where an impact can be quantified (e.g. through the use of collision risk modelling or displacement analysis), the magnitude of an impact is considered in relation to the change in the baseline mortality of the relevant population for a species. Where the impact magnitude represents more than a 0.02 percentage point increase in the baseline mortality of the relevant population, further analyses, such as population modelling, may then be used to help determine the significance of the effect, as recommended by NatureScot (2023h). Impacts are likely to be greatest during those periods in which birds are constrained to specific areas (e.g. foraging ranges during the breeding season) and not during periods when birds are not spatially constrained and can therefore exploit much larger areas (e.g. during non-breeding seasons). The assessment looks at each bioseason individually to account for this biological difference.

11.8.2.4 The criteria for defining sensitivity in this chapter incorporates the recoverability, vulnerability and conservation value of a receptor. The definitions used to determine the recoverability of each VOR are presented in Table 11.20 with the parameters supporting these definitions presented in Table 11.21. The recent effects of HPAI has caused changes to many seabird populations (see Section 11.7.8 and Table 11.21). However, the overall recoverability defined for the purposes of assessment is based on the longer-term population trends and not the impacts caused by HPAI, which are as yet unknown. The exception to this is great skua, where the impact of HPAI has been particularly significant and as such the species recoverability score has been downgraded.

11.8.2.5 Identification of vulnerability to specific impacts has used information from Wade *et al*. (2016), Bradbury *et al*. (2014) and Maclean *et al*. (2009), with values presented in Table 11.22.

Table 11.20: Definition of recoverability

Recoverability	Definition
High	A species with a low to high reproductive potential and a stable or increasing UK trend in breeding abundance and productivity.
Medium	A species with a low reproductive potential and a stable or increasing UK long-term trend in breeding abundance and productivity.
Low	A species with a low reproductive potential and a declining UK long-term trend in breeding abundance and productivity or uncertainty regarding the long-term trend (due to data availability).

Table 11.21: Information used to determine recoverability of Valued Ornithological Receptors

Species	Clutch size (no. of eggs)	Age at first breeding	UK national trend (Burnell *et al.*, 2023) (% change in national counts)			Scottish national trend (Burnell *et al.*, 2023) (% change in national counts)			HPAI surveys (Wilson *et al.*, 2024) (% change in national counts)	Overall recoverability
			1969-70 to 1985-88	1985-88 to 1998-2002	1998-2002 to 2015-2021	1969-70 to 1985-88	1985-88 to 1998-2002	1998-2002 to 2015-2021	2015-21/2023	
Kittiwake	2	4	24	-26	-43	4	-21	-57	8	Low
Little gull	2 to 3	2 to 3	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Medium
Great black-backed gull	2 to 3	4	-7	-3	-52	-4	-4	-63	-20	Low
Herring gull	3	4	-48	-26	-44	-42	-28	-44	-7	Low
Sandwich tern	1 to 2	3	+41	-15	+4	-7	-53	-5	-35	Medium
Little tern	2 to 3	3	+58	-26	-25	+21	-14	-29	n/a	Low
Roseate tern	1 to 2	2	-66	-83	+114	-87	-22	-100	-21	High
Common tern	2 to 3	3	+9	+2	-9	+58	-21	-24	-42	Medium
Arctic tern	1 to 2	4	+50	-37	-35	+53	-40	-54	-2	Low
Great skua	2	7	+148	+26	+14	+148	+26	+14	-76	Medium[5]
Arctic skua	2	4	+226	-37	-66	+226	-37	-66	-28	Low

[5] Whilst this species has increasing population trends for the time periods for which data are available, the recent outbreak of HPAI in the UK has significantly reduced the population of this species and therefore its recoverability is downgraded from High to Medium.

Species	Clutch size (no. of eggs)	Age at first breeding	UK national trend (Burnell *et al.*, 2023) (% change in national counts)			Scottish national trend (Burnell *et al.*, 2023) (% change in national counts)			HPAI surveys (Wilson *et al.*, 2024) (% change in national counts)	Overall recoverability
			1969-70 to 1985-88	1985-88 to 1998-2002	1998-2002 to 2015-2021	1969-70 to 1985-88	1985-88 to 1998-2002	1998-2002 to 2015-2021	2015-21/2023	
Common guillemot	1	5	+80	+32	-11	+82	+24	-31	-6	Medium
Razorbill	1	4	+18	+23	+18	+11	+15	-2	n/a	High
Puffin	1	5	+15	+13	-14	+7	+6	-21	n/a	Medium
European storm petrel	1	4	n/a	n/a	+41	n/a	n/a	+48	n/a	High
Leach's petrel	1	5	n/a	n/a	-79	n/a	n/a	-79	n/a	Low
Fulmar	1	9	+77	-3	-37	+77	-3	-37	n/a	Low
Manx shearwater	1	5	n/a	n/a	+133	n/a	n/a	+163	n/a	High
Gannet	1	5	+39	+40	+39	+32	+47	+40	-25	High

Table 11.22: Information used to determine vulnerability of Valued Ornithological Receptors

Species	Vulnerability to collision	Vulnerability to displacement associated with structures	Vulnerability to displacement associated with vessels and helicopters	Habitat flexibility	Vulnerability to barrier effects
Kittiwake	High	Low	Low	Medium	Low
Little gull	Medium	Very low	Very low	Medium	Low
Great black-backed gull	Very high	Low	Very low	Medium	Low
Sandwich tern	Very high	Low	Low	Moderate	Very low
Little tern	Moderate	Low	Low	Low	Very low
Roseate tern	High	Low	Low	Moderate	Very low
Common tern	Moderate	Low	Low	Moderate	Very low
Arctic tern	Moderate	Low	Low	Moderate	Very low
Great skua	High	Very low	Very low	Medium	Low
Arctic skua	High	Very low	Very low	Medium	Low
Common guillemot	Very low	High	Medium	Medium	High
Razorbill	Very low	High	Medium	Medium	High
Puffin	Very low	Medium	Medium	Medium	High
European storm petrel	Low	Very low	Very low	High	Not available
Leach's petrel	Low	Very low	Very low	High	Not available
Fulmar	Very low	Very low	Very low	High	Low
Manx shearwater	Very low	Very low	Very low	High	Not available
Gannet	High	High	Very low	High	Very low

11.8.2.6 The conservation value of ornithological receptors is identified for the majority of species in Volume 3, Annex 11.1 Offshore Ornithology Baseline Characterisation Report and takes into account two factors: the conservation status of a species and the population importance of a species at Morven South. The conservation status of a species has been defined taking into account the conservation metrics included in Table 11.14. Population importance has been defined by comparing the populations of each species recorded during site-specific surveys to relevant populations (e.g. regional, national and international from Table 11.17) in those seasons relevant to each species. These criteria are defined in Volume 3, Annex 11.1 Offshore Ornithology Baseline Characterisation Report and in Table 11.14. The conservation value of each species is provided in Table 11.15.

11.8.2.7 The criteria for defining sensitivity in this chapter are outlined in Table 11.23 below.

Table 11.23: Definition of terms relating to the sensitivity of the receptor

Sensitivity of the receptor	Description
Very High	Bird species has National or International conservation value, very high vulnerability to impact and has no ability to recover.
High	Bird species has National or International conservation value, medium vulnerability to impact and has low recoverability.
	Bird species has Regional conservation value, high vulnerability to impact and has low recoverability.
Medium	Bird species has National or International conservation value, low to medium vulnerability to impact and has medium to high recoverability.
	Bird species has National or International conservation value, low vulnerability to impact and has low recoverability.
	Bird species has Regional conservation value, high vulnerability to impact and has medium recoverability.
	Bird species has Regional conservation value, medium vulnerability to impact and has medium recoverability.
	Bird species has Regional conservation value, low vulnerability to impact and has medium recoverability.
Low	Bird species has Regional conservation value, low to medium vulnerability to impact and high recoverability.
	Bird species has Local or Negligible conservation value, medium to high vulnerability to impact and has medium to high recoverability.
Negligible	Bird species has Local or Negligible conservation value, low vulnerability to impact and has medium to high recoverability.
	Bird species is not vulnerable to impacts.

11.8.2.8 The significance of the effect upon offshore ornithology is determined by correlating the magnitude of the impact and the sensitivity of the receptor. The particular method employed for this assessment is presented in Table 11.24.

11.8.2.9 In cases where a range is suggested for the significance of effect, there remains the possibility that this may span the significance threshold (i.e. the range is given as minor to moderate). In such cases the final significance is based upon the expert's professional judgement as to which outcome delineates the most likely effect, with an explanation as to why this is the case.

11.8.2.10 For the purposes of this assessment:

- a level of effect of moderate or more will be considered a 'significant' effect in terms of the EIA Regulations;
- a level of effect of minor or less will be considered 'not significant' in terms of the EIA Regulations.

11.8.2.11 Effects of moderate significance or above are therefore considered important in the decision-making process, whilst effects of minor significance or less warrant little, if any, weight in the decision-making process.

Table 11.24: Matrix used for the assessment of the significance of the effect

Sensitivity of receptor	Magnitude of impact			
	Negligible	Low	Medium	High
Negligible	Negligible	Negligible to minor	Negligible to minor	Minor
Low	Negligible to minor	Negligible to minor	Minor	Minor to moderate
Medium	Negligible to minor	Minor	Moderate	Moderate to major
High	Minor	Minor to moderate	Moderate to major	Major
Very high	Minor	Moderate to major	Major	Major

11.8.3 Designated sites

11.8.3.1 Where Natura 2000 sites (i.e. nature conservation sites in Europe designated under the Habitats or Birds Directives) or sites in the UK that comprise the National Site Network (collectively termed 'European sites') are considered, this chapter makes an assessment of the LSE[1] on the qualifying interest feature(s) of the European sites described within Section 11.7.2 of this chapter. The full assessment of the potential impacts on the site deferred to the Morven South: HRA: Report to Inform Appropriate Assessment (RIAA).

11.8.3.2 With respect to locally designated sites and national designations (other than European sites), where these sites fall within the boundaries of a European site and where qualifying interest features are the same, only the European site has been taken forward for assessment (i.e. a separate assessment for the local or national site is not undertaken). This is because potential impacts on the integrity and conservation status of the locally or nationally designated site are assumed to be inherent within the assessment of the European site. However, where a local or nationally designated site falls outside the boundaries of a European site, but within the Regional Offshore Ornithology Study Area as relevant to the species of relevance, an assessment of the LSE[1] on the overall site is made in this chapter using the EIA methodology.

11.9 Parameters for assessment

11.9.1 Maximum Design Scenario

11.9.1.1 The Maximum Design Scenarios (MDSs) identified in Table 11.25 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. These scenarios have been selected from the details provided in Volume 1, Chapter 3: Project Description.

11.9.1.2 Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the Project Design Envelope (PDE) (e.g. different infrastructure layout to that assessed here), be taken forward in the final design scheme.

Table 11.25: Maximum Design Scenario considered for the assessment of potential impacts on offshore ornithology

C= construction, O= operations and maintenance, D= decommissioning phases; "✓" is used to denote the phase the potential impact can occur, "✗" outlines there is no impact within this project phase

Potential impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
Direct temporary habitat loss/disturbance	✓	✓	✓	**Habitat loss** **Construction phase** Installation of wind turbine foundations, Offshore Substation Platforms (OSPs) foundations, inter-array and interconnector cables in the Morven South Boundary of up to 347.7km^2. Up to 62,596,300m^2 of subtidal habitat loss/disturbance in total across Morven South. Maximum duration of the offshore construction phase is up to five years. • Jack-up events: up to 1,939,200m^2 of disturbance from the use of jack-up vessels during foundation installation, with up to three jack-up events at each of 95 wind turbines and three jack-up events at each of five Offshore Substation Platforms (OSPs). • Cable installation (including sandwave clearance and pre-lay preparation including boulder and debris clearance): up to 13,680,000m^2 of disturbance comprising: – Inter-array cables sandwave clearance: up to 1,260,000m^2 disturbance from installation of up to 420km of inter-array cables (assumes 15% requires sandwave clearance with a 20m width of disturbance). – Inter-array cables boulder clearance: up to 7,140,000m^2 disturbance from installation of up to 420km of inter-array cables (assumes 85% requires boulder clearance with a 20m width of disturbance). – Interconnector cables sandwave clearance: up to 792,000m^2 disturbance from installation of up to 264km of interconnector cables (assumes 15% requires sandwave clearance with a 20m width of disturbance). – Interconnector cables boulder clearance: up to 4,488,000m^2 disturbance from installation of up to 264km of interconnector cables	Represents the maximum density of wind turbines and structures across the maximum Morven South Boundary that would cause greatest extent of disturbance to birds or the greatest duration of impact.

Potential impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				(assumes 85% requires boulder clearance with a 20m width of disturbance). • Sandwave clearance material deposition: Up to 46,239,000m^2 of habitat disturbance associated with the deposition of sandwave clearance material comprising: – 26,539,800m^2 from deposition of 13,269,900m^3 of sandwave clearance material associated with seabed preparation for wind turbine and OSP foundations. – 19,699,200m^2 from deposition of 9,849,600m^3 of sandwave clearance material associated with seabed preparation for inter-array and inter-connector cables. • Anchor placements: up to 684,000m^2 of habitat disturbance from 500m^2 anchor sets (5 anchors per set) every 500m per inter-array/inter-connector cable link during installation. • Cable removal: Up to 100,000m^2 from the removal of 5,000m of disused cables with a width of disturbance of 20m. **Operations and maintenance phase** Disturbance and displacement from presence of operations, wind turbines and associated operations and maintenance activity, including increased vessel, helicopter and inspection drone activity: • Presence of up to 95 operating wind turbines and five OSPs occupying the Morven South Boundary of up to 347.7km^2 • Minimum spacing of 1,000m between wind turbines • Operational lifetime of up to 35 years. Up to 7,967,400m^2 of temporary subtidal habitat disturbance in total across Morven South. O&M phase up to 35 years.	

Potential impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				• Up to 777,000m^2 of temporary habitat disturbance due to jack-ups at wind turbines and OSPs over the lifetime of Morven South for the following: – Up to 75 major component replacements for wind turbines; – Up to 48 major component replacements (one every three years over the lifetime per OSP) for OSPs; – 18 access ladder replacements and up to 70 modifications to/replacement of J-tubes for wind turbines; – 12 access ladder replacements and up to 147 modifications to/replacement of J-tubes for OSPs • Up to 5,152,000m^2 of temporary habitat disturbance due to inter-array cable maintenance associated with: – 2,352,000m^2 from 7 reburial events affecting up to 16,800m of cable per reburial event – 2,800,000m^2 from 14 repair events (two every five years) affecting up to 10,000m per cable repair event – Assuming 20m width seabed disturbance for repair and remedial burial. • Up to 2,038,400m^2 of temporary habitat disturbance due to interconnector cable maintenance: – 1,478,400m^2 from 7 reburial events affecting up to 10,560m per reburial event – 560,000m^2 from 14 repair events (one event per interconnector every 25 years) affecting up to 2,000m of cable per repair event – Assuming 20m width seabed disturbance for repair and remedial burial. **Decommissioning phase** Temporary subtidal habitat loss/disturbance due to: • Cable removal: disturbance from the removal of 420km of inter-array cables and 264km of interconnector cables.	

Potential impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				• Anchor placements: habitat disturbance from anchor placements during cable removal. • Jack- up events: disturbance from the use of jack-up vessels during foundation removal.	
				Underwater sound **Construction phase** Piling Concurrent piling with up to two vessels, at a minimum distance of 1km and a maximum distance of 27.65km, piling at 73 foundations comprising: • 67 wind turbines: – 16m diameter monopiles; – Maximum hammer energy of 6,600kJ; – Maximum duration of 24h piling per monopile, with a maximum of two foundations per day (concurrently); – Total of 34 days of concurrent piling. • Four AC collector OSPs: – 16m diameter monopiles; – Maximum hammer energy of 6,600kJ; – Maximum duration of 24h piling per monopile, with a maximum of two foundations per day (concurrently); – Total of two days of concurrent piling. • One bridge-linked HVDC converter OSP (treated as one location, with two foundations): – Two six-legged jacket foundations (bridge linked); – 24 x 5m (modelled as 5.3m) diameter pin piles per foundation, which equals 48 piles for the two foundations; – Maximum hammer energy of 4,000kJ;	Represents the maximum underwater sound impacts from impact piling for each of the relevant infrastructure foundation options.

Potential impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				– Maximum duration of 9h piling per pin pile, with an average of two piles per day. – Total of 12 days of piling (based on four piles per day) • Total duration of piling = 34 + 2 + 12 = 48 days UXO clearance UXO removal: potential for high order clearance of up to 15 UXOs across Morven South ranging from 25kg up to 554kg with 132kg the most likely (common) maximum. • Clearance of up to 15 UXOs within the site boundary; • Maximum charge weight of 554kg Net Explosive Quantity (NEQ); • Most likely charge weight of 132kg NEQ; • Maximum of one detonation within 24 hours; • Total duration of UXO clearance campaign 15 days (excluding downtime for e.g. weather); • Clearance during daylight hours only.	
				Vessel movements **Construction phase** Vessel movements • Up to 1,149 installation vessel movements (return trips) during construction (165 main installation and support vessels, 104 tug/anchor handlers, 81 cable lay installation and support vessels, 65 guard vessel, 85 survey vessels, 25 seabed preparation vessels, 544 CTVs and 80 scour protection installation vessels) • Up to a total of 41 construction vessels on site at any one time • Up to 75 return helicopter movements per year by up to two helicopters on site at any one time. **Operation and maintenance phase**	Represents the maximum number of vessel and helicopter movements that would cause greatest visual and noise disturbance and displacement to birds from the Morven South Boundary.

Potential impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				• Up to 294 operations and maintenance vessel movements (return trips) each year • Up to a total of 15 operations and maintenance vessels on site at any one time • Up to 1,660 helicopter return trips per year with up to two on site at any one time **Decommissioning phase** • Vessels used for a range of decommissioning activities such as removal of foundations • Noise from vessels assumed to be as per vessel activity described for construction phase above	
Changes in prey availability due to temporary habitat loss/disturbance	✓	✓	✓	**Construction phase** As described in Volume 2, Chapter 9: Fish and Shellfish Ecology for: • Temporary habitat loss and disturbance of habitats • Underwater sound impacting fish and shellfish receptors • Increased suspended sediment concentrations (SSCs) and associated sediment deposition • Long-term habitat loss **Operations and maintenance phase** As described in Volume 2, Chapter 9: Fish and Shellfish Ecology for: • Temporary habitat loss and disturbance of habitats • Increased SSCs and associated sediment deposition • Long-term habitat loss **Decommissioning phase** As described in Volume 2, Chapter 9: Fish and Shellfish Ecology for: • Temporary habitat loss and disturbance of habitats • Underwater sound impacting fish and shellfish receptors	As described in Volume 2, Chapter 9: Fish and Shellfish Ecology

Potential impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				• Increased SSCs and associated sediment deposition • Long-term habitat loss	
Collision with rotating blades	×	✓	×	**Operations and maintenance** Presence of up to 95 wind turbines within the Morven South Boundary Minimum lower blade tip height of 34m above Lowest Astronomical Tide (LAT) Maximum blade tip height of 293m above LAT Maximum rotor diameter of 250m Maximum chord width of 6.8m Average rotor speed of 6.1rpm (with maximum speed of 8.0rpm) Operational lifetime of up to 35 years.	The potential for collision risk is derived from wind turbines parameters including rotor diameter, chord width, rotor speed and minimum lower blade tip height. The parameters associated with the most numerous wind turbine parameters (95) represents the MDS because it will result in the greatest potential for collision risk.
Displacement	×	✓	×	**Operations and maintenance phase** Presence of up to 95 operating wind turbines and five OSPs occupying the Morven South Boundary of up to 347.7km^2 Minimum spacing of 1,000m between wind turbines	Represents the maximum density and number of wind turbines and structures across the maximum Morven South Boundary that would cause greatest extent of disturbance and displacement to birds or the greatest duration of impact.
Barrier effects	×	✓	×	**Operations and maintenance phase** Presence of up to 95 operating wind turbines and five OSPs occupying the Morven South Boundary of up to 347.7km^2 Minimum spacing of 1,000m between wind turbines	Maximum density and number of wind turbines and structures across the Morven South Boundary, which maximises the potential barrier to foraging grounds and migration routes for bird species.
Attraction to light	✓	✓	✓	**Construction phase** • Up to a total of 41 construction vessels on site at any one time **Operations and maintenance phase** • Presence of up to 95 operating wind turbines and five OSPs occupying the Morven South Boundary of up to 347.7km^2	Maximum density and number of wind turbines and structures across the Morven South Boundary, offering the maximum amount of light transmission to which birds may be attracted.

Potential impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				• Minimum spacing of 1000m between wind turbines • Up to a total of 15 operations and maintenance vessels on site at any one time **Decommissioning phase** • Vessels used for a range of decommissioning activities such as removal of foundations	

11.10 Designed-in measures and mitigation

11.10.1.1 As part of the project design process, a number of measures (primary and tertiary) have been adopted to reduce the potential for impacts on offshore ornithology (see Table 11.26). For the purposes of the EIA process, the term 'designed-in measure' is used to include the following measures (adapted from IEMA, 2016 and IEMA, 2024):

11.10.1.2 Measures included as part of the design of Morven South. These include modifications to the location or design of Morven South, which are integrated into the application for consent. These measures are considered standard industry practice for this type of development and are referred to as primary mitigation in IEMA, 2016 and IEMA, 2024.

11.10.1.3 Measures required to meet legislative requirements, or actions that are generally standard practice used to manage commonly occurring environmental effects. These measures are secured through the conditions of the marine licences and referred to as tertiary mitigation in IEMA, 2016 and IEMA, 2024.

11.10.1.4 As there is a commitment to implementing these measures, they are considered inherently part of the design of Morven South and have therefore been considered in the assessment presented in Section 11.11 (i.e. the determination of magnitude and therefore significance assumes implementation of these measures).

11.10.1.5 The requirement for any additional mitigation measures is dependent on the significance of the effects on offshore ornithology. Where likely significant effects have been identified, further mitigation measures (referred to as secondary mitigation in IEMA, 2016 and IEMA, 2024) have been identified to reduce the significance of effect to acceptable levels following the initial assessment. These are measures that could further prevent, reduce and, where possible, offset any adverse effects on the environment. These measures are set out, where relevant, in Section 11.11.

11.10.1.6 All designed-in measures and mitigation are detailed in Volume 3, Annex 6.3: EIA Commitments Register.

Table 11.26: Designed-in (primary and tertiary) measures adopted as part of Morven South

Reference number	Designed-in measures adopted as part of Morven South	Justification	Primary or tertiary
MM-5	Development of and adherence to an Invasive Non-Native Species Management Plan, and Biosecurity Plan.	To reduce the risk of introduction and spread of invasive non-native species during all phases of Morven South as far as practicable. The Biosecurity Plan and Invasive Non-Native Species Management Plan will control invasive non-native species and their potential impact on marine ecology receptors.	Tertiary
MM-32	Development of and adherence to an Environmental Management Plan.	The EMP will ensure appropriate environmental controls are in place for Morven South, and the agreed procedures to mitigation and potential risk to the receiving environment. Measures will cover a wide range of management measures including environmental awareness training, auditing, reporting procedures and waste management. It is expected that the EMP will include a Marine Pollution Contingency Plan (MPCP) and an Invasive Non-Native	Tertiary

Reference number	Designed-in measures adopted as part of Morven South	Justification	Primary or tertiary
		Species Management Plan (INNSMP). The EMP is also expected to limit potential environmental damage from small quantities of drill fluids which may be released and as regulated by the UK Registration, Evaluation, Authorisation and Restriction of Chemicals REACH Regulations. The EMP provides a means to ensure the efficient management and communication of commitments made for the management of the potential environmental impacts.	
MM-6	Development and adherence to a Marine Pollution Contingency Plan (MPCP).	To reduce the potential for release of pollutants from construction, operation and maintenance and decommissioning which could directly or indirectly impact marine ecology receptors, an MPCP will be developed. The MPCP will include planning for accidental spills, addressing all potential contaminant releases and include key emergency details, and will be in line with appropriate regulations and guidelines.	Tertiary
MM-7	Development of and adherence to a Navigation Safety Plan and Vessel Management Plan (NSPVMP).	An NSPVMP will be developed to reduce the risk introduced due to the presence of project vessels. The NSPVMP will describe the measures related to navigational safety, including information on Safety Zones, charting, construction buoyage, temporary lighting and marking and means of notification of Morven South activity to other sea users (e.g. via Notices to Mariners). It will confirm the types and numbers of vessels engaged in Morven South and consider vessel coordination, including indicative transit route planning. To ensure Morven South project vessels are suitably managed to minimise the likelihood of involvement in incidents and maximise the ability to assist in the event of a third-party incident. The NSPVMP will include the requirement for Morven South vessels to comply with international marine regulations as adopted by the Flag State, including the International Regulations for Preventing Collisions at Sea (COLREGs) (International Maritime Organization (IMO), 1972/77) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974) through the NSPVMP. The plan will reduce disturbance of seabird species as far as practicable, by avoiding bird populations or migratory routes and allow the identification of standard routes.	Primary
MM-34	Development of, and adherence to a Lighting and Marking Plan (LMP).	To reduce impacts on offshore ornithology. The LMP will detail compliance with legal requirements including IALA G1162 (IALA, 2021), and will assist with SAR operations and will ensure that appropriate	Tertiary

Reference number	Designed-in measures adopted as part of Morven South	Justification	Primary or tertiary
		lighting and marking of wind turbines and offshore substation platforms will be established in accordance with Civil Aviation Authority (CAA) regulations and guidance (CAP 393 and the Air Navigation Order (ANO)) and in accordance with the Civil Aviation Authority CAA and the Defence Infrastructure Organisation (DIO), which is responsible for the safeguarding of Ministry of Defence (MOD) assets. Secured through the LMP. The approach to Aids to Navigation will be outlined in the LMP. Adopting the LMP and therefore reducing lighting to be compliant with MM-34 will provide the minimum amount and intensity of lighting that Morven South can legally have whilst remaining compliant with mandatory Health and Safety lighting requirements	
MM-43	A minimum lower blade tip height clearance of 34m LAT.	To reduce impact to seabirds as most seabirds fly close to the sea surface. Increasing the clearance between blade tip and sea surface reduces potential for collision. This minimum blade tip height clearance is considered appropriately conservative so as to reduce the risk of bird collisions in the specific circumstances of Morven South.	Primary

11.11 Assessment of significant effects

11.11.1.1 The potential impacts arising from the construction, operations and maintenance (O&M) and decommissioning phases of Morven South are listed in Table 11.25, along with the MDS against which each impact has been assessed.

11.11.1.2 An assessment of the likely significance of the effects of Morven South on offshore ornithology receptors caused by each identified impact is given below.

11.11.2 Direct temporary habitat loss/disturbance

11.11.2.1 There is potential for temporary, direct benthic habitat loss as a result of activities during the construction, operations and maintenance, and decommissioning phases of Morven South (e.g. seabed preparation, UXO detonation, drilling, inter-array and interconnector cables installation and removal, vessel movements). These activities have the potential to affect the foraging efficiency of diving birds.

11.11.2.2 In addition to this direct habitat loss, temporary disturbance as the result of activities during the construction, operations and maintenance, and decommissioning phases of an offshore wind farm has the potential to displace seabirds from an area of sea in which the activity is occurring.

11.11.2.3 In relation to offshore wind farm development, disturbance is defined as an interruption to a bird's normal pattern of activity caused by anthropogenic activity (JNCC *et al.*, 2022). This may lead to a reduction in the number of seabirds occurring within or immediately adjacent to the disturbance event. Disturbance can be considered as a temporary indirect habitat loss, as it results in birds unable to utilise the habitat in the area from which they have been disturbed for a given period of time. Upon cessation of the disturbance event birds can return to the area from which they were disturbed. The project design includes a Navigation Safety and Vessel Management Plan which will reduce disturbance of seabird species as far as practicable by avoiding bird populations and/or migratory routes (see MM-7 in Table 11.26).

11.11.2.4 The loss of habitat means that displaced birds may move to areas already occupied by other birds and thus may face higher intra- or inter-specific competition due to a higher density of individuals competing for the same resources. Alternatively, displaced birds may be forced to move into areas of lower quality (e.g. areas of lower prey availability) or travel longer distances to reach habitat of a suitable quality. This could therefore affect their demographic fitness (i.e. survival rates and breeding productivity), as well as potentially impacting on other birds in areas that displaced birds move to (for example, by increasing competition for resources).

11.11.2.5 The assessment for direct temporary habitat loss/disturbance is based on a qualitative approach, considering the magnitude of impact and the sensitivity of the receptor. The species considered for direct temporary habitat loss/disturbance are identified in Table 11.27 based on the species' vulnerability and habitat flexibility (Wade *et al*., 2016; Bradbury *et al*., 2014) and importance of the population at Morven South (see Table 11.14 and Volume 3, Annex 11.1 Offshore Ornithology Baseline Characterisation Report).

11.11.2.6 Common guillemot, razorbill, and puffin are identified for consideration in relation to direct temporary habitat loss/disturbance. All other species were excluded on the basis there is no potential for a significant effect as a result of direct temporary habitat loss/disturbance (Table 11.27).

Table 11.27: Identification of valuable ornithological receptors for which assessments in relation to direct temporary habitat loss/disturbance is required

VOR	Vulnerability to disturbance impacts	Habitat flexibility	Importance of population at Morven South (see Table 11.14 and Table 11.15)	Displacement analysis required (Yes/No)
Kittiwake	Low	Moderate	Local	No, low vulnerability, moderate habitat flexibility, species recorded in locally important numbers at Morven South.
Little gull	Very low	Moderate	Negligible	No, very low vulnerability, moderate habitat flexibility, species not recorded in baseline surveys.
Great black-backed gull	Very low	Moderate	Local	No, very low vulnerability, moderate habitat flexibility, species recorded in locally important numbers at Morven South.
Sandwich tern	Low	Moderate	Local	No, low vulnerability, moderate habitat flexibility, species recorded in locally important numbers at Morven South.
Little tern	Low	Low	Negligible	No, low vulnerability, species not recorded in baseline surveys.
Roseate tern	Low	Moderate	Negligible	No, low vulnerability, moderate habitat flexibility, species not recorded in baseline surveys.
Common tern	Low	Moderate	Negligible	No, low vulnerability, moderate habitat flexibility, species not recorded in baseline surveys.
Arctic tern	Low	Moderate	National	No, low vulnerability, moderate habitat flexibility. Although species recorded in nationally important numbers occurrence is considered to represent passage birds, that will not utilise the Morven South Boundary as there are no breeding colonies within foraging range.
Great skua	Very low	Moderate	Local	No, very low vulnerability, moderate habitat flexibility, species recorded in locally important numbers at Morven South.
Arctic skua	Very low	Moderate	Negligible	No, very low vulnerability, moderate habitat flexibility, species not recorded in baseline surveys.
Common guillemot	Moderate	Moderate	Regional	Yes, moderate vulnerability, species recorded in regionally important numbers during baseline surveys.

VOR	Vulnerability to disturbance impacts	Habitat flexibility	Importance of population at Morven South (see Table 11.14 and Table 11.15)	Displacement analysis required (Yes/No)
Razorbill	Moderate	Moderate	Regional	Yes, moderate vulnerability, species recorded in regionally important numbers during baseline surveys
Puffin	Moderate	Moderate	Local	Yes, moderate vulnerability, species recorded in locally important numbers during baseline surveys.
European storm petrel	Very low	High	Negligible	No, very low vulnerability, high habitat flexibility, species not recorded in baseline surveys.
Leach's petrel	Very low	High	Negligible	No, very low vulnerability, high habitat flexibility, species not recorded in baseline surveys.
Fulmar	Very low	High	Local	No, very low vulnerability, high habitat flexibility, species recorded in locally important numbers at Morven South.
Manx shearwater	Very low	High	Regional	No, very low vulnerability, high habitat flexibility
Gannet	Very low	High	Local	No, very low vulnerability, high habitat flexibility, species recorded in locally important numbers at Morven South.

Construction phase

Magnitude of impact

11.11.2.7 Disturbance events during construction activities will disturb and displace birds for the duration of the construction period. Disturbance and temporary loss of habitat (including habitat becoming temporarily unsuitable due to disturbance) will occur intermittently throughout the construction period. The construction period is expected to take up to five years, with activities and locations varying within this time. Any impacts resulting from disturbance and displacement from construction activities are considered likely to be short-term, temporary, and reversible in nature, lasting only for the duration of construction activity, with birds expected to return to the area once construction activities have ceased.

11.11.2.8 The MDS (Table 11.25) gives the scenario that would lead to the greatest amount of temporary habitat loss and disturbance during the construction and decommissioning phases. In addition, no significant adverse effects are expected on fish, shellfish or benthic invertebrate populations as a result of construction or decommissioning activities (see Volume 2, Chapter 8: Benthic Subtidal Ecology and Volume 2, Chapter 9: Fish and Shellfish Ecology chapter). Therefore, it is expected that disturbance and subsequent displacement would be the main impact pathway for offshore ornithology receptors.

11.11.2.9 The project design includes a Navigation Safety Plan and Vessel Management Plan which will reduce disturbance of seabird species as far as practicable by avoiding bird populations and/or migratory routes (see MM-7 in Table 11.26). This will reduce the magnitude of impact upon all receptors.

11.11.2.10 The impact is predicted to be of local spatial extent, intermittent, and of medium-term duration (although only a small proportion of the total area will be affected at any one time, with individual elements of construction having much shorter durations), and will affect any birds in the vicinity of these activities directly. The construction disturbance and temporary loss of habitat impacts will also be of high reversibility. The magnitude is therefore considered to be negligible for all species being considered for disturbance and temporary loss of habitat impacts (common guillemot, razorbill, and puffin).

Sensitivity of the receptor

11.11.2.11 In terms of behavioural response to disturbance associated with vessels and helicopters, common guillemot is considered to have medium vulnerability, being assigned a score of 3 (out of 5) by Wade *et al*. (2016).

11.11.2.12 Common guillemot raise a single chick per year and breed from the age of five onwards, typically living on average for 13 years (Burnell *et al*., 2023). Common guillemot have undergone decreases of approximately 31% in Scotland as measured between the Seabird 2000 (1998 to 2002) and Seabirds Count (2015 to 2021) censuses (Burnell *et al*. 2023; Table 11.21). Surveys managed by the RSPB in 2023 have recorded indicative decreases of 6% across a number of sites in UK in 2023 when compared against a pre-HPAI baseline (Tremlett *et al*., 2024a; Tremlett *et al*., 2024b). However, common guillemot are deemed to have a high recoverability given their increasing trend in abundance and productivity in the UK (JNCC, 2020).

11.11.2.13 Common guillemot is a qualifying interest for several SPAs likely to be connected to Morven South (within the mean-max + SD foraging range) (Table 11.13), with several non-SPA colonies within range, and so the species is considered to be of international conservation value.

11.11.2.14 In terms of behavioural response to disturbance associated with vessels and helicopters, razorbill is considered to have medium vulnerability, being assigned a score of 3 (out of 5) by Wade *et al*. (2016).

11.11.2.15 Razorbill raise a single chick per year and breed from the age of four onwards, typically living on average for 23 years (Burnell *et al*., 2023). The Scottish population of razorbill has decreased by approximately 2% as measured between the Seabird 2000 (1998 to 2002) and Seabirds Count (2015 to 2021) censuses (Burnell *et al*. 2023; Table 11.21). Razorbill are deemed to have a high recoverability given their increasing trend in abundance and productivity in the UK (JNCC, 2020).

11.11.2.16 Razorbill is a qualifying interest for several SPAs likely to be connected Morven South (within the mean-max + SD foraging range) (Table 11.13), with several non-SPA colonies within range and so the species is considered to be of international conservation value.

11.11.2.17 In terms of behavioural response to disturbance associated with vessels and helicopters, puffin is considered to have medium vulnerability, being assigned a score of 3 (out of 5) by Wade *et al*. (2016).

11.11.2.18 Puffin raise a single chick per year and breed from the age of five onwards, with a maximum recorded age of 42 years (Burnell *et al*., 2023). In a UK context the puffin population increased by 13% between the Seabird Colony Register (1985-1988) and the Seabird 2000 (1998–2002) censuses but has since shown a 21% decline as measured between the Seabird 2000 (1998–2002) and Seabirds Count (2015–2021) censuses (Burnell *et al*. 2023. Puffin are however deemed to have a medium recoverability (JNCC, 2020).

11.11.2.19 Puffin is a qualifying interest for several SPAs likely to be connected Morven South (within the mean-max + SD foraging range) (Table 11.13), with several non-SPA colonies within range and so the species is considered to be of international conservation value.

11.11.2.20 For the receptors assessed (common guillemot, razorbill, and puffin), all are deemed to be of medium vulnerability, high recoverability, and international value. The sensitivity of the receptors is therefore considered to be medium.

Significance of the effect

11.11.2.21 Overall, for the receptors, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will therefore be of **negligible or minor adverse** significance, which is not significant in EIA terms with **negligible** selected due to the limited amount of disturbed habitat compared to the overall area of habitat available to affected species.

Secondary mitigation and residual effect

11.11.2.22 No mitigation measures for offshore ornithology are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

Operations and maintenance phase

11.11.2.23 Temporary disturbance to birds due to activities associated with operational activities at offshore wind farms (e.g. vessel movements) is considered to be of a lower intensity than during construction/decommissioning phases. It is limited to maintenance activities as well as vessel and helicopter trips to and from the site and accommodation platforms, as well as post-construction monitoring survey activity. The maximum design scenario for the wind farm considered for operations and maintenance disturbance is outlined in Table 11.25.

11.11.2.24 In many cases, operations and maintenance disturbance may be indistinguishable from displacement, as birds of particular species may be susceptible to both impacts. A bird that has already been displaced from the wind farm may not be affected temporarily by operations and maintenance disturbance.

11.11.2.25 Conversely, operations and maintenance temporary disturbance may exacerbate the impact of displacement if it occurs in an area to which birds have been displaced (e.g. supply vessels en route to and from Morven South). As it is not easy to predict the long-term displacement reactions of birds to wind turbines, the impacts of temporary operations and maintenance disturbance have been considered in isolation.

11.11.2.26 Regular maintenance of wind turbines will occur throughout the year. Periodic inspection of the cable will be undertaken by remotely operated vehicles and/or geophysical survey to check that cables have not been exposed due to seabed movements, in which case remedial burial work or other cable protection methods will be required.

Magnitude of impact

11.11.2.27 It is expected that there will be daily boat movements within the Morven South area during operations and maintenance, with up to 15 crew vessels predicted on the site. Operational vessels are likely to be much less intrusive to seabird species than those associated with construction activities involving fewer vessels and more limited in terms of noise emission. Impacts are therefore likely to be of a lower magnitude than disturbance during construction, with birds likely to be affected in a smaller radius around the activity.

11.11.2.28 The ultimate consequence of temporary disturbance may be increased mortality to an extent similar (although likely more restricted in spatial extent) to displacement impacts, with birds during the breeding season more likely to be susceptible to such impacts.

11.11.2.29 The project design includes a Navigation Safety and Vessel Management Plan which will reduce disturbance of seabird species as far as practicable by avoiding bird populations and/or migratory routes (see MM-7 in Table 11.26). This will reduce the magnitude of impact upon all receptors.

11.11.2.30 As such, the impact is predicted to be of local spatial extent, intermittent, of long-term duration, and of high reversibility within the context of any international, national, or regional population. It is predicted that the impact will affect the receptors directly. If it is assumed that the magnitude of loss is similar to identified displacement impacts although reduced in spatial scale, it is considered to be negligible for all species.

Sensitivity of the receptor

11.11.2.31 The overall sensitivity of receptors is considered to be of the same levels as those relating to disturbance in the construction phase (see paragraph 11.11.2.11 to 11.11.2.20 onwards). Although scientific evidence on the effects of wind farm maintenance activities is lacking, there is no reason to suggest that any receptor will react differently to operations and maintenance activity as opposed to construction phase activity.

Significance of the effect

11.11.2.32 An impact of negligible magnitude on medium sensitivity receptors will be of **negligible or minor adverse** significance, which is not significant in EIA terms with **negligible** selected due to the limited amount of disturbed habitat compared to the overall area of habitat available to affected species.

Secondary mitigation and residual effect

11.11.2.33 No mitigation measures for offshore ornithology are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

Decommissioning phase

Magnitude of impact

11.11.2.34 Decommissioning activities within Morven South are equal to or less than those carried out during the construction phase within the Morven South (see paragraph 11.11.2.7 onwards). Therefore, for the purpose of this assessment it is assumed that the level of direct temporary habitat loss/disturbance is likely to be similar, if not less, and the potential impact is deemed to be reversible in the short-term as birds are likely to return when activities have been completed.

Sensitivity of the receptor

11.11.2.35 The overall sensitivity of receptors is considered to be of the same levels as those relating to disturbance in the construction phase (see paragraph 11.11.2.11 to 11.11.2.20 onwards).

Significance of the effect

11.11.2.36 Overall, for the receptors, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will therefore be of **negligible or minor adverse** significance, which is not significant in EIA terms with **negligible** selected due to the limited amount of disturbed habitat compared to the overall area of habitat available to affected species.

Secondary mitigation and residual effect

11.11.2.37 No mitigation measures for offshore ornithology are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

11.11.3 Changes in prey availability due to temporary habitat loss/disturbance

11.11.3.1 There is potential for temporary, direct benthic habitat loss and disturbance to sediments as a result of activities during all phases (e.g. seabed preparation, Unexploded Ordnance (UXO) detonation, drilling, inter-array cable installation and repair/reburial and removal of infrastructure). This has potential to affect the foraging efficiency of diving birds as well as indirect effects from impacts on fish, shellfish and bivalve prey.

11.11.3.2 Seabirds may be indirectly disturbed and displaced during the construction, operations and maintenance, and decommissioning phases as a result of direct impacts on habitat and increased SSCs (for example from turbine installation), which may result in the loss of a food resource to birds within the Morven South Boundary. The increase in suspended sediments may also reduce the ability of birds to capture prey in the water column.

11.11.3.3 As a result, displaced seabirds may move to areas already occupied by other birds and thus face higher intra/inter-specific competition due to a higher density of individuals competing for the same resource. Alternatively, displaced birds may be forced to move into areas of lower quality (e.g. areas of lower prey availability). Such disturbance and resulting displacement could ultimately affect their demographic fitness (i.e. survival rates and breeding productivity) as well as potentially impacting on other birds in areas that displaced birds move to.

11.11.3.4 The potential impacts on fish, shellfish and bivalve prey are provided in Volume 2, Chapter 8: Benthic Subtidal Ecology and Volume 2, Chapter 9: Fish and Shellfish Ecology chapter and include temporary subtidal habitat loss/disturbance and increased SSCs and associated sediment deposition. The project design seeks to reduce the impacts of pollution on benthic and fish and shellfish receptors through the inclusion of designed-in measures, specifically MM-5 and MM-6 in Table 11.26.

11.11.3.5 For EIA purposes, the assessment for changes in prey availability due to temporary habitat loss/disturbance considers all VORs except migratory seabirds (species of tern, skua, petrel, and little gull), as these species will not be exploiting Morven South for foraging purposes.

Construction phase

11.11.3.6 Potential impacts on prey species during the construction and decommissioning phases of Morven South, as identified in Volume 2, Chapter 8: Benthic Subtidal Ecology and Volume 2, Chapter 9: Fish and Shellfish Ecology, may have indirect effects on offshore ornithology receptors.

11.11.3.7 Detailed assessments of the following potential construction impacts have been undertaken in Volume 2, Chapter 8: Benthic Subtidal Ecology and Volume 2, Chapter 9: Fish and Shellfish Ecology for key seabird prey species (including cod, sprat, herring, mackerel and sandeel species and bivalves):

- Temporary habitat loss and disturbance of habitats.
- Underwater sound impacting fish and shellfish receptors.
- Increased SSCs and associated sediment deposition.
- Long-term habitat loss.

11.11.3.8 Herring and sandeel are sensitive to offshore wind development (including underwater sound). Both species are listed as main prey items for several seabird species (Cramp and Simmons, 1983). Volume 2, Chapter 9: Fish and Shellfish Ecology determined Morven South to be largely unsuitable for herring and sandeel and therefore effects of habitat loss/disturbance on these species are expected to be limited within Morven South, given the abundance of similar substrate types and the extensive nature of fish spawning grounds across the Morven South Fish and Shellfish Ecology Study Area.

11.11.3.9 Volume 2, Chapter 8: Benthic Subtidal Ecology and Volume 2, Chapter 9: Fish and Shellfish Ecology detail the findings of the desktop studies in the Morven South Benthic Subtidal Ecology Study Area and the Morven South Fish and Shellfish Ecology Study Area. Both chapters assessed the sensitivity of the receptors and the magnitudes of the impacts in order to ascertain the significance of the effects.

11.11.3.10 Details of the fish, shellfish and bivalve ecology assessment are summarised in Table 11.28. Justifications for this assessment will not be repeated in this chapter. Evidence, modelling and justifications for these assessments are provided in Volume 2, Chapter 8: Benthic Subtidal Ecology and Volume 2, Chapter 9: Fish and Shellfish Ecology.

Table 11.28: Significance of effects of construction impacts on fish, shellfish and bivalve ecology

Potential impact	Species	Significance of effect
Temporary habitat loss and disturbance of habitats	All species	Minor adverse
Underwater sound impacting fish and shellfish receptors	All species	Minor adverse
Increased SSCs and associated sediment deposition	All species	Minor adverse
Long-term habitat loss	All species	Minor adverse

11.11.3.11 An assessment of the significance of indirect effects on sensitive receptors (i.e. those resulting from the influence of construction activity on prey species) was made on the basis of knowledge of the prey species targeted by each species, as well as their level of inflexibility of habitat use (Wade *et al*., 2016). The results of these analyses were evaluated against the indirect impacts on seabird prey resource and habitats as detailed in Volume 2, Chapter 8: Benthic subtidal ecology and Volume 2, Chapter 9: Fish and Shellfish Ecology and prior information from operational wind farms.

Magnitude of impact

11.11.3.12 For all fish, shellfish and bivalve species, of minor adverse significance of effect was determined for all impacts identified in Table 11.28. Due to the nature of the impact, these minor adverse effects on prey species will be extremely localised and will be of negligible magnitude when considered against the wide areas over which seabirds forage.

11.11.3.13 The project design seeks to reduce the impacts of pollution on benthic and fish and shellfish receptors through the inclusion of designed-in measures, specifically MM-5 and MM-6 in Table 11.26.

11.11.3.14 The impact is predicted to be of local spatial extent, short to long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptors in Table 11.29 indirectly. The magnitude is therefore considered to be negligible.

Sensitivity of the receptor

11.11.3.15 The sensitivity of all receptors to changes in prey availability due to temporary habitat loss/disturbance is presented in Table 11.29. The vulnerability of each receptor is taken from its habitat flexibility, with high habitat flexibility indicating low vulnerability as the species can utilise a wide variety of habitats. If a species has low habitat flexibility, it would be deemed to have high vulnerability.

Table 11.29: Sensitivity of all receptors to changes in prey availability due to temporary habitat loss/disturbance

Receptor	Conservation value	Habitat flexibility	Recoverability	Sensitivity
Kittiwake	International	Medium	Low	High
Great black-backed gull	Regional	Medium	Low	Medium
Common guillemot	International	Medium	Medium	Medium
Razorbill	International	Medium	High	Medium
Puffin	International	Medium	Medium	Medium
Fulmar	International	High	Low	Medium
Gannet	International	High	High	Medium

11.11.3.16 All receptors are deemed to be of low to moderate vulnerability, low to high recoverability and regional or international value. The sensitivity of the receptor is therefore, considered to be medium (great black-backed gull, common guillemot, razorbill, puffin, fulmar and gannet) to high (kittiwake).

Significance of the effect

11.11.3.17 Overall, for kittiwake the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

11.11.3.18 Overall, for all other receptors the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **negligible or minor adverse** significance, with **negligible** considered more applicable based on the limited impact expected on fish and shellfish receptors, which is not significant in EIA terms.

Secondary mitigation and residual effect

11.11.3.19 No mitigation measures for offshore ornithology are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

Operations and maintenance phase

11.11.3.20 The indirect impacts on seabird prey resource and habitats are detailed in Volume 2, Chapter 8: Benthic Subtidal Ecology and Volume 2, Chapter 9: Fish and Shellfish Ecology. Principal impacts on these resources and habitats are likely to be from the creation of hard substrate around inter-array and interconnector cables and increases in sedimentation in the water column.

11.11.3.21 Detailed assessments of the following potential operations and maintenance phase impacts have been undertaken in Volume 2, Chapter 8: Benthic Subtidal Ecology and Volume 2, Chapter 9: Fish and Shellfish Ecology for key seabird prey species (including cod, sprat, herring, mackerel and sandeel species and bivalves) and include:

- Temporary habitat loss and disturbance of habitats.
- Increased suspended SSCs and associated sediment deposition.
- Long-term habitat loss.

11.11.3.22 Details of the fish, shellfish and bivalve ecology assessment are summarised in Table 11.30. Justifications for this assessment will not be repeated in this chapter. Evidence, modelling and justifications for these assessments are provided in Volume 2, Chapter 8: Benthic subtidal ecology and Volume 2, Chapter 9: Fish and Shellfish Ecology.

Table 11.30: Significance of effects of construction impacts on fish, shellfish and bivalve ecology

Potential impact	Species	Significance of effect
Temporary habitat loss and disturbance of habitats	All species	Minor adverse
Increased SSCs and associated sediment deposition	All species	Minor adverse
Long-term habitat loss	All species	Minor adverse

Magnitude of impact

11.11.3.23 For all fish, shellfish and bivalve species, an effect of minor adverse or negligible significance was determined for all the impacts during operations and maintenance identified in Table 11.30. Due to the localised nature of the impact, these minor adverse effects on prey species will be extremely localised and will be of negligible magnitude when considered against the wide areas over which seabirds forage.

11.11.3.24 The project design seeks to reduce the impacts of pollution on benthic and fish and shellfish receptors through the inclusion of designed-in measures, specifically MM-5 and MM-6 in Table 11.26.

11.11.3.25 The impact is predicted to be of local spatial extent, short to long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore considered to be negligible.

Sensitivity of the receptor

11.11.3.26 The sensitivity of all receptors to changes in prey availability due to temporary habitat loss/disturbance is presented in Table 11.29.

11.11.3.27 All receptors are deemed to be of low to moderate vulnerability, low to high recoverability and regional or international value. The sensitivity of the receptor is therefore, considered to be medium (great black-backed gull, common guillemot, razorbill, puffin, fulmar and gannet) to high (kittiwake).

Significance of the effect

11.11.3.28 Overall, for all kittiwake the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

11.11.3.29 Overall, for all other receptors the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **negligible or minor adverse** significance, with **negligible** considered more applicable based on the limited impact expected on fish and shellfish receptors, which is not significant in EIA terms.

Secondary mitigation and residual effect

11.11.3.30 No mitigation measures for offshore ornithology are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

Decommissioning phase

11.11.3.31 Decommissioning activities associated with Morven South are equal to or less than those carried out during the construction phase. Therefore, for the purpose of this assessment it is assumed that the level of disturbance is likely to be similar and the potential impact is deemed to be reversible in the short-term as birds are likely to return when activities have been completed.

Magnitude of impact

11.11.3.32 Due to the localised nature of the decommissioning works, the impact is predicted to be of local spatial extent, short-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore considered to be negligible.

Sensitivity of the receptor

11.11.3.33 The sensitivity of all receptors to changes in prey availability due to temporary habitat loss/disturbance is presented in Table 11.29.

11.11.3.34 All receptors are deemed to be of low to moderate vulnerability, low to high recoverability and regional or international value. The sensitivity of the receptor is therefore, considered to be medium (great black-backed gull, common guillemot, razorbill, puffin, fulmar and gannet) to high (kittiwake).

Significance of the effect

11.11.3.35 Overall, for all kittiwake the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

11.11.3.36 Overall, for all other receptors the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **negligible or minor adverse** significance, with **negligible** considered more applicable based on the limited impact expected on fish and shellfish receptors, which is not significant in EIA terms.

Secondary mitigation and residual effect

11.11.3.37 No mitigation measures for offshore ornithology are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

11.11.4 Collision with rotating blades

11.11.4.1 During the operations and maintenance phase of Morven South, the turning rotors of the wind turbines may present a risk of collision for seabirds. Stationary structures, such as the tower, nacelle, or when rotors are not operating, are not expected to result in a material risk of collision. When a collision occurs between the turning rotor blade and the bird, it is assumed to result in direct mortality of the bird, which could potentially result in population level impacts.

11.11.4.2 As part of the project design a commitment to a minimum blade tip height of 34m (LAT) has been made (MM-43) which significantly reduces the collision risk to birds due to the skewed nature of bird flight height distribution (Table 11.26). The majority of flight activity of birds at Morven South will occur below the minimum blade tip height as incorporated into the project design for Morven South.

11.11.4.3 The ability of seabirds to detect and manoeuvre around wind turbine blades is a factor that is considered when modelling and assessing the collision risk. In response to this, it is standard practice to calculate differing levels of avoidance for different species or species groups. Avoidance rates are applied to collision risk models to predict levels of impact more realistically, based on available literature and expert advice about seabird behaviour and their flight response to wind turbines.

11.11.4.4 Species differ in their susceptibility to collision risk, depending on their flight behaviour and avoidance responses, and the vulnerability of their populations (Bradbury *et al*., 2014; Wade *et al*., 2016). As sensitivity to collision differs considerably between species, species were screened and progressed for assessment of significance on the basis of the importance of the population of each species recorded within the Morven South Offshore Ornithology Study Area and consideration of their perceived risk from collision (Bradbury *et al*., 2014; Wade *et al*., 2016) (Table 11.22).

11.11.4.5 Three regularly occurring seabird species were identified as potentially at risk of collision due to their recorded abundance in the Morven South Offshore Ornithology Study Area and their vulnerability to collision (Bradbury *et al*., 2014; Wade *et al*., 2016). Species included were kittiwake, great black-backed gull, and gannet. Modelling for these species is provided in Volume 3, Annex 11.2: Offshore Ornithology Collision Risk Modelling Report.

11.11.4.6 Additionally, consideration was given to species that may not have been accurately captured during traditional baseline DAS. This included migratory seabirds (such the VORs from Table 11.15; little gull, terns, skuas and petrels) and migratory waterbirds (such as swans, ducks, waders, divers and grebes), with modelling for these species groups provided in Volume 3, Annex 11.3: Offshore Ornithology Collision Risk Modelling Report: Migratory. The magnitude of change was determined by calculating the estimated annual number of collisions with the wind turbines and the resulting percentage increase in the mortality rate (and/or decrease in survival rate) of the relevant population using UK waters taken from Woodward *et al*. (2023).

11.11.4.7 Collision risk modelling for kittiwake, great black-backed gull and gannet was undertaken using the Stochastic Collision Risk Model (sCRM) (Caneco and Humphries, 2022) which is based on the stochLAB R package as recommended by JNCC *et al*. (2024b) and NatureScot (2025b). The full methodology is provided in Volume 3, Annex 11.2: Offshore Ornithology Collision Risk Modelling Report.

11.11.4.8 Collision risk modelling for migratory waterbirds was conducted using the R code associated with the stochastic migration collision risk model (mCRM) shiny app developed by HiDef Aerial Surveying for Marine Scotland Science (HiDef, 2022) as advised by NatureScot in pre-application consultation (see Section 11.4). The full methodology is provided in Volume 3, Annex 11.3: Offshore Ornithology Collision Risk Modelling Report: Migratory.

11.11.4.9 For migratory seabirds, collision risk modelling has been undertaken using the Band (2012) CRM, following the approach based on the approach presented in WWT Consulting and MacArthur Green (2014) and as used on previous projects (e.g. Morgan Offshore Wind Project). The full methodology is provided in Volume 3, Annex 11.3: Offshore Ornithology Collision Risk Modelling Report: Migratory.

11.11.4.10 Collision risk modelling has incorporated draft guidance on recommended avoidance rates, bird size, flight speed, flight type, and nocturnal activity scores from NatureScot (NatureScot, 2025). Throughout the document, outputs have been presented alongside other parameter values (e.g. Oszanlav-Harris *et al*., 2023; Skov *et al*., 2018) to capture the uncertainty in various parameter values. In addition, the collision risk estimates presented in this section for gannet incorporate NatureScot guidance on macro-avoidance (NatureScot, 2025b). Specifically, for NatureScot's position, the collision risk estimates in the post- and pre-breeding seasons have been reduced by 70% to account for macro-avoidance behaviour. For the Applicant's position, collision risk estimates in all seasons have been reduced by 70% to account for macro-avoidance behaviour.

11.11.4.11 Seasonal collision risk estimates are compared against the baseline mortality of the relevant seasonal regional population calculated in Table 11.17. Annual impacts for each species are compared against the baseline mortality of the largest seasonal regional population in Table 11.17.

Operations and maintenance phase

Kittiwake

Magnitude of impact

11.11.4.12 In all three seasons (breeding, post breeding, and pre-breeding) and on an annual basis, the estimated percentage point increase in baseline mortality remains well below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). This conclusion is applicable when modelling using the parameters advocated by both NatureScot and the Applicant (Table 11.31) and therefore additional analysis including PVA modelling is not required.

11.11.4.13 The total collision risk impact is predicted to result in a very slight change to the baseline mortality of the biogeographic population of kittiwake. The impact is predicted to be of local spatial extent, long-term duration, continuous, and of high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be negligible.

Table 11.31: Assessment of predicted collision risk estimates for kittiwake on seasonal and annual bases against the baseline mortality of relevant regional populations

Season	Parameters associated with approach	Regional baseline population (no. of birds)	Baseline mortality	Collision mortality (no. of birds)	Change in baseline mortality (% point change)
NatureScot's approach					
Breeding	Flight speed = 13.1m/s Avoidance rate = 99.29%	576,167	0.156	6.6	0.001
Post-breeding		829,937		1.6	<0.001
Pre-breeding		627,816		2.0	<0.001
Annual		829,937		10.2	0.001
Applicant's approach					
Breeding	Flight speed = 8.71m/s Avoidance rate = 99.79%	576,167	0.156	1.5	<0.001
Post-breeding		829,937		0.4	<0.001
Pre-breeding		627,816		0.5	<0.001
Annual		829,937		2.4	<0.001

Sensitivity of the receptor

11.11.4.14 Kittiwake was rated as relatively highly vulnerable to collision impacts by Wade *et al*. (2016) due to the proportion of flights likely to occur at potential risk height and percentage of time in flight. Therefore, kittiwake is considered to have high vulnerability to collision.

11.11.4.15 Despite a higher reproductive potential than most seabird species (i.e. typically laying two eggs and breeding at four years old) (Robinson, 2005), the species is deemed to have a low recoverability given the continuing decline in abundance observed between 1986 and 2023 in Scotland and the UK (Burnell *et al*., 2023; Table 11.21). During this period, breeding productivity has declined primarily as the result of food shortages, although it has stabilised in recent years (JNCC, 2020). Kittiwake have undergone decreases of approximately 57% in Scotland as measured between the Seabird 2000 (1998–2002) and Seabirds Count (2015–2021) censuses (Burnell *et al*. 2023). Surveys managed by the RSPB in 2023 have recorded indicative increases of 8% across a number of sites in the UK in 2023 when compared against a pre-HPAI baseline (Tremlett *et al*., 2024a; Tremlett *et al*., 2024b). Overall, kittiwake is deemed to have low recoverability.

11.11.4.16 Kittiwake is a qualifying interest for multiple SPAs likely to have connectivity with Morven South (within the mean-max + SD foraging range) (Table 11.13), with several non-SPA colonies also within range. Therefore, the species is considered to be of international conservation value.

11.11.4.17 Kittiwake is deemed to be of high vulnerability, low recoverability, and international conservation value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect

11.11.4.18 Overall, for kittiwake, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Secondary mitigation and residual effect

11.11.4.19 No mitigation measures for kittiwake are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

Great black-backed gull

Magnitude of impact

11.11.4.20 No great black-backed gulls were recorded at Morven South in the breeding season (see Volume 3, Annex 11.1 Offshore Ornithology Baseline Characterisation Report) and therefore there are expected to be no collisions during this season. In the non-breeding season and on an annual basis, the estimated percentage point increase in baseline mortality remains well below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). This conclusion is applicable when modelling using the parameters advocated for by both NatureScot and the Applicant and therefore additional analysis including PVA modelling is not required.

11.11.4.21 The total collision risk impact is predicted to result in a very slight change to the baseline mortality of the biogeographic population of great black-backed gull. The impact is predicted to be of local spatial extent, long-term duration, continuous, and of high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be negligible.

Table 11.32: Assessment of predicted collision risk estimates for great black-backed gull on seasonal and annual bases against the baseline mortality of relevant regional populations

Season	Parameters associated with approach	Regional baseline population (no. of birds)	Baseline mortality	Collision mortality (no. of birds)	Change in baseline mortality (% point change)
NatureScot's approach					
Breeding	Flight speed = 13.7m/s Avoidance rate = 99.4%	0	0.095	0	0
Non-breeding		8,666		1.5	0.002
Annual		8,666		1.5	0.002
Applicant's approach					
Breeding	Flight speed = 9.8m/s Avoidance rate = 99.91%	0	0.095	0	0
Non-breeding		8,666		0.2	<0.001
Annual		8,666		0.2	<0.001

Sensitivity of the receptor

11.11.4.22 Great black-backed gull was rated as one of the most vulnerable seabird species to collision impacts by Wade *et al*. (2016) due to the proportion of flights likely to occur at potential risk height and percentage of time in flight. Therefore, great black-backed gull is considered to have very high vulnerability to collision.

11.11.4.23 Great black-backed gull lay an average of two to three eggs and breed from the age of four onwards, typically living on average for 20 years (Burnell *et al*., 2023). Populations of great black-backed gull have undergone decreases of 63% in Scotland since the early 2000s (Burnell *et al*., 2023; Table 11.21), with a continuing decline in abundance observed between 1986 and 2023 in Scotland

and the UK (Burnell *et al*., 2023; Table 11.21). Surveys managed by the RSPB in 2023 have recorded indicative declines of 20% across a number of sites in Britain in 2023 when compared against a pre-HPAI baseline (Tremlett *et al*., 2024a; Tremlett *et al*., 2024b). Therefore, overall, great black-backed gull is considered to have low recoverability.

11.11.4.24 Great black-backed gull is considered to be of regional conservation value due to the abundance of the species recorded during site-specific surveys.

11.11.4.25 Great black-backed gull is deemed to be of very high vulnerability, low recoverability, and regional value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect

11.11.4.26 Overall, for great black-backed gull, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Secondary mitigation and residual effect

11.11.4.27 No mitigation measures for great black-backed gull are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

<u>Gannet</u>

Magnitude of impact

11.11.4.28 In all three seasons (breeding, post breeding, and pre-breeding) and on an annual basis, the estimated percentage point increase in baseline mortality remains well below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). This conclusion is applicable when modelling using the parameters advocated for by both NatureScot and the Applicant (Table 11.33) and therefore additional analysis including PVA modelling is not required.

11.11.4.29 The total collision risk impact is predicted to result in a very slight change to the baseline mortality of the biogeographic population of gannet. The impact is predicted to be of local spatial extent, long-term duration, continuous, and of high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be negligible.

Table 11.33: Assessment of predicted collision risk estimates for gannet on seasonal and annual bases against the baseline mortality of relevant regional populations

Season	Parameters associated with approach	Regional baseline population (no. of birds)	Baseline mortality	Collision mortality (no. of birds)	Change in baseline mortality (% point change)
NatureScot's approach					
Breeding	Flight speed = 14.9m/s Avoidance rate = 99.29%	559,963	0.193	12.7	0.002
Post-breeding		456,298		0.2	<0.001
Pre-breeding		248,385		0.2	<0.001
Annual		559,963		13.1	0.002
Applicant's approach					
Breeding		559,963	0.193	3.4	0.001

Season	Parameters associated with approach	Regional baseline population (no. of birds)	Baseline mortality	Collision mortality (no. of birds)	Change in baseline mortality (% point change)
Post-breeding	Flight speed = 13.33m/s Avoidance rate = 99.29%	456,298		0.2	<0.001
Pre-breeding		248,385		0.2	<0.001
Annual		559,963		3.8	0.001

Sensitivity of the receptor

11.11.4.30 Although the latest scientific guidance showed the species to display a high level of macro-avoidance (Peschko *et al*., 2021), the species is rated as relatively vulnerable to collision impacts by Wade *et al*. (2016). Therefore, gannet is considered to have high vulnerability to collision.

11.11.4.31 Gannet have low reproductive potential given a typical age of first breeding at five years and typically laying only a single egg per breeding season. Although gannet has a low reproductive potential, the species has demonstrated a consistent increasing trend in abundance since the 1990s (JNCC, 2020; Burnell *et al*., 2023; Table 11.21). It is of note that the species has suffered from the outbreak of avian flu during the 2022 breeding season (Pearce-Higgins *et al*., 2023), with declines of 25% recorded at certain sites in the UK in 2023 when compared against a pre-HPAI baseline (Tremlett *et al*., 2024a; Tremlett *et al*., 2024b). Although gannet has a low reproductive potential and HPAI has led to some short-term declines, the overall population has shown steady growth. Therefore, the species is deemed to have a high recoverability given the consistent increasing trend in abundance since the 1990s (JNCC, 2020).

11.11.4.32 Gannet is a qualifying interest for multiple SPAs likely to be connected to Morven South (within the mean-max + SD foraging range) (Table 11.13), with a large non-SPA colony within close proximity (Monreith Cliffs and Scar Rocks). The species is therefore considered to be of international conservation value.

11.11.4.33 Gannet is deemed to be of high vulnerability, high recoverability, and of international value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect

11.11.4.34 Overall, for gannet, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Secondary mitigation and residual effect

11.11.4.35 No mitigation measures for gannet are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

Migratory waterbirds

Magnitude of impact

11.11.4.36 At the defined avoidance rates (see Table 11.34), the predicted collision risk estimates for all species is below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h).

11.11.4.37 The annual collision risk impact is predicted to result in a very slight change to the baseline mortality rate of the assessed migratory waterbird species. The impact is predicted to be of local spatial extent, long-term duration, continuous, and of high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be negligible.

11.11.4.38 The impact is predicted to be of local spatial extent, long-term duration, continuous and of high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be negligible.

Table 11.34: Assessment of predicted collision risk estimates for migratory waterbirds on an annual basis against the baseline mortality of relevant biogeographic populations

Species	Scientific name	Avoidance rate	Annual collision estimate (mean no. of collisions)	Population using UK waters (Woodward *et al.*, 2023) (no. of birds)	Mortality Rate	Increase in mortality rate (percentage point change)
Svalbard light-bellied brent goose	*Branta bernicla hrota*	0.999	0.018	13,400	0.10	<0.001
Svalbard barnacle goose	*Branta leucopsis*	0.999	0.184	43,500	0.09	<0.001
Taiga bean goose	*Anser fabalis*	0.999	0.004	970	0.23	<0.001
Pink-footed goose	*Anser brachyrhynchus*	1	0	510,000	0.17	<0.001
Whooper swan	*Cygnus cygnus*	0.988	0.782	39,990	0.20	0.002
Shelduck	*Tadorna tadorna*	0.985	1.785	77,500	0.11	0.002
Shoveler	*Spatula clypeata*	0.985	0.753	22,960	0.42	0.003
Wigeon	*Mareca penelope*	0.985	14.490	544,000	0.47	0.003
Mallard	*Anas platyrhynchos*	0.985	36.681	823,600	0.37	0.004
Pintail	*Anas acuta*	0.985	0.570	20,942	0.34	0.003
Tufted duck	*Aythya fuligula*	0.985	3.978	155,000	0.29	0.003
Scaup	*Aythya marila*	0.985	0.126	7,000	0.19	0.002
Eider	*Somateria mollissima*	0.985	1.186	133,400	0.11	0.001

Species	Scientific name	Avoidance rate	Annual collision estimate (mean no. of collisions)	Population using UK waters (Woodward *et al.*, 2023) (no. of birds)	Mortality Rate	Increase in mortality rate (percentage point change)
Velvet scoter	*Melanitta fusca*	0.985	0.180	4,510	0.23	0.004
Common scoter	*Melanitta nigra*	0.985	3.652	146,700	0.22	0.002
Long-tailed duck	*Clangula hyemalis*	0.985	0.448	12,800	0.27	0.004
Goldeneye	*Bucephala clangula*	0.985	0.830	30,000	0.23	0.003
Goosander	*Mergus merganser*	0.985	0.964	17,420	0.18	0.006
Red-breasted merganser	*Mergus serrator*	0.985	0.338	15,840	0.18	0.002
Nightjar	*Caprimulgus europaeus*	0.995	0.116	7,700	0.30	0.002
Corncrake	*Crex crex*	0.995	0.016	1,696	0.71	0.001
Spotted crake	*Porzana porzana*	0.995	0.004	251	0.30	0.002
Great crested grebe	*Podiceps cristatus*	0.995	0.003	1,380	0.28	<0.001
Slavonian grebe	*Podiceps auritus*	0.995	0.014	1,614	0.40	0.001
Oystercatcher	*Haematopus ostralegus*	0.999	1.272	620,389	0.12	<0.001
Lapwing	*Vanellus vanellus*	0.999	6.740	3,942,500	0.30	<0.001
Golden plover	*Pluvialis apricaria*	0.999	3.772	3,267,600	0.27	<0.001
Grey plover	*Pluvialis squatarola*	0.999	0.200	124,000	0.14	<0.001
Ringed plover	*Charadrius hiaticula*	0.999	0.226	241,920	0.23	<0.001
Dotterel	*Eudromias morinellus*	0.999	0	390	0.27	<0.001
Whimbrel	*Numenius phaeopus*	0.999	0.782	624,000	0.11	<0.001

Species	Scientific name	Avoidance rate	Annual collision estimate (mean no. of collisions)	Population using UK waters (Woodward *et al.*, 2023) (no. of birds)	Mortality Rate	Increase in mortality rate (percentage point change)
Curlew	*Numenius arquata*	0.999	0.342	141,100	0.10	<0.001
Bar-tailed godwit	*Limosa lapponica*	0.999	1.160	680,000	0.29	<0.001
Turnstone	*Arenaria interpres*	0.999	0.444	260,000	0.14	<0.001
Knot	*Calidris canutus*	0.999	0.504	360,000	0.16	<0.001
Ruff	*Calidris pugnax*	0.999	0.004	3,100	0.48	<0.001
Sanderling	*Calidris alba*	0.999	0.294	200,000	0.17	<0.001
Dunlin	*Calidris alpina*	0.999	3.010	2,025,777	0.26	<0.001
Purple sandpiper	*Calidris maritima*	0.999	0.064	33,521	0.21	<0.001
Snipe	*Gallinago gallinago*	0.999	4.995	2,331,000	0.52	<0.001
Redshank	*Tringa totanus*	0.999	0.368	230,000	0.26	<0.001
Wood sandpiper	*Tringa glareola*	0.999	0	54	0.46	<0.001
Greenshank	*Tringa nebularia*	0.999	0.002	1,080	0.26	<0.001
Red-throated diver	*Gavia stellata*	0.995	0.144	40,697	0.16	<0.001
Black-throated diver	*Gavia arctica*	0.995	0.006	1,883	0.18	<0.001
Great northern diver	*Gavia immer*	0.995	0.020	11,000	0.13	<0.001
Bittern	*Botaurus stellaris*	0.995	0.006	714	0.30	0.001
Osprey	*Pandion haliaetus*	0.995	0.004	665	0.15	0.001
Marsh harrier	*Circus aeruginosus*	0.995	0.014	2,576	0.26	0.001
Hen harrier	*Circus cyaneus*	0.995	0.024	2,176	0.19	0.001

Species	Scientific name	Avoidance rate	Annual collision estimate (mean no. of collisions)	Population using UK waters (Woodward *et al.*, 2023) (no. of birds)	Mortality Rate	Increase in mortality rate (percentage point change)
Short-eared owl	*Falco columbarius*	0.995	0.160	14,880	0.31	0.001
Merlin	*Falco columbarius*	0.989	0.104	8,256	0.38	0.001

Sensitivity of the receptor

11.11.4.39 Although migratory waterbirds have not been significantly studied in the offshore environment, vulnerability to collisions is likely to be generally low, since most migration will occur on a broad front and also above rotor height, although during periods of poor weather this risk may increase.

11.11.4.40 Recoverability of populations of migrants may vary considerably, smaller wader species with a relatively favourable conservation status (e.g. dunlin) faring better than larger species with lower reproductive rates (e.g. Eurasian curlew).

11.11.4.41 On a precautionary basis and for the purposes of this assessment these species are assumed to have medium sensitivity to collision.

Significance of the effect

11.11.4.42 Overall, for migratory waterbirds, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **negligible to minor adverse** significance with **negligible** selected due to the limited increase in baseline mortality for all species, which is not significant in EIA terms.

Secondary mitigation and residual effect

11.11.4.43 No mitigation measures for migratory waterbirds are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

Migratory seabirds

Magnitude of impact

11.11.4.44 Although a number of migratory seabird species were identified as VORs within Table 11.15, only one, Arctic tern was identified as requiring further consideration in Volume 3, Annex 11.3: Offshore Ornithology Collision Risk Modelling Report: Migratory. Migratory seabirds are known to migrate close to shore within set bands (e.g. 10-20 km), Morven South is outwith any of these bands. However, as described within Volume 3, Annex 11.3: Offshore Ornithology Collision Risk Modelling Report: Migratory, due to the number of Arctic tern present within the site-specific DAS, a mCRM was undertaken.

11.11.4.45 For Arctic tern, predictions using a range of avoidance rates are provided in Volume 3, Annex 11.3: Offshore Ornithology Collision Risk Modelling Report: Migratory. At a 99.02% avoidance rate, as recommended by JNCC *et al*. (2024), the predicted collision risk estimate is zero collisions.

11.11.4.46 The impact is predicted to be of local spatial extent, medium to long-term duration, continuous and highly reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be negligible.

Sensitivity of the receptor

11.11.4.47 Arctic tern has a high vulnerability to collision driven by the high proportion of time the species spends in flight. However, the species spends a limited proportion of this time at risk height (Wade *et al*., 2016).

11.11.4.48 Despite a higher reproductive potential than most seabird species (i.e. laying one to two eggs and breeding at four years old) (Robinson, 2005), the species is deemed to have a low recoverability given the continuing decline in abundance observed between 1986 and 2023 in Scotland and the UK (Burnell *et al*., 2023; Table 11.21). Surveys managed by the RSPB in 2023 have recorded indicative decreases of 2% across a number of sites in Britain in 2023 when compared against a pre-HPAI baseline (Tremlett *et al*., 2024a; Tremlett *et al*., 2024b). Overall, Arctic tern is deemed to have low recoverability.

11.11.4.49 Arctic tern is deemed to be of high vulnerability, low recoverability, and of national value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect

11.11.4.50 Overall, for Arctic tern, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Secondary mitigation and residual effect

11.11.4.51 No mitigation measures for Arctic tern are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

11.11.5 Displacement

11.11.5.1 The operations and maintenance phase of Morven South may lead to disturbance and displacement of birds. The MDS is represented by the maximum density of wind turbines and structures across the maximum Morven South Boundary that would cause the greatest extent of disturbance and displacement to birds, or the greatest duration of impact. The MDS is summarised in Table 11.25.

11.11.5.2 Disturbance as the result of activities during the operations and maintenance phase of an offshore wind farm has the potential to displace seabirds from an area of sea in which the activity is occurring. In relation to offshore wind farm development, displacement is defined as a reduction in the number of seabirds occurring within or immediately adjacent to an offshore wind farm (Furness *et al*., 2013).

11.11.5.3 As the result of disturbance, displaced birds may move to areas already occupied by other birds and thus face higher intra- or inter-specific competition due to a higher density of individuals competing for the same resource. Alternatively, displaced birds may be forced to move into areas of lower quality (e.g. areas of lower prey availability). Such disturbance and resulting displacement could ultimately affect their demographic fitness (i.e. survival rates and breeding productivity) as well as potentially impacting on other birds in areas that displaced birds move to.

11.11.5.4 During the operations and maintenance phase, the presence of operational wind turbines has the potential to directly disturb seabirds leading to displacement from the Morven South Boundary including an area of variable size or buffer around it (Dierschke *et al*., 2016). Therefore, the presence of wind turbines at Morven South has the potential to directly disturb and displace seabirds that would normally reside within and around the area of sea.

11.11.5.5 The displacement assessment for Morven South within this chapter is based on the use of the Displacement Matrix approach (JNCC *et al*., 2022), which was agreed during consultation with NatureScot (see Table 11.7, 28 January 2025). As sensitivity to displacement differs considerably between seabird species, species were screened and progressed for the Matrix approach using 'Disturbance Sensitivity' and 'Habitat Specialization' scores from Bradbury *et al*. (2014) and Wade *et al*. (2016) as recommended by JNCC *et al*. (2022). In addition to the species' sensitivity rating, the importance of a species abundance as recorded during baseline surveys of Morven South was considered as to whether species were progressed to the matrix stage (Volume 3, Annex 11.4: Offshore Ornithology Displacement Modelling Report (Matrix Approach)). Additionally any species for which the assessment of displacement is recommended by NatureScot was included.

11.11.5.6 For each of the species considered (kittiwake, common guillemot, razorbill, puffin and gannet), displacement impacts were quantified for the population derived within Morven South Boundary plus 2 km buffer as recommended by NatureScot (2023f).

11.11.5.7 Since displacement sensitivity varies between species, the displacement rates and associated mortality rates used to assess the effects of the operations and maintenance phase of Morven South have been derived from previous studies, guidance documents and advice received from NatureScot. The displacement rates applied as part of the Applicant's and NatureScot's positions are provided in Table 11.35. Evidence to support the rates applied for the Applicant's position is provided within Section 4 of Volume 3, Annex 11.4: Offshore Ornithology Displacement Modelling Report (Matrix Approach).

11.11.5.8 There is limited empirical evidence on which mortality rate to use when assessing the impacts of displacement of offshore wind farms, however, the current guidance from NatureScot is to consider mortality rates of 1, 3 or 5% depending on the species and season (NatureScot, 2023f). Van Kooten *et al*. (2019) studied the effects of displacement on seabirds using energy-budget models for two scenarios using habitat utilisation maps and a fixed 10% mortality rate. The evidence from this study suggests that a 1% mortality rate for displaced birds is more appropriate than the potentially over-precautionary 10% mortality rate. Similarly, Searle *et al*. (2014; 2018) used time and energy budget models to investigate the effects of displacement and barrier effects on breeding populations of seabirds, including auks during the chick rearing period. The study reported changes in time and energy budgets which could impact future survival of auks, however the simulations concluded that the displacement effects were unlikely to result in a mortality rate increase of over 0.5%. The Applicant's position therefore applies a 1% mortality rate for all species in all seasons (Table 11.35).

Table 11.35: Displacement and mortality rates applied for each species

Species	Displacement rate (%)		Mortality rate (%)		
	NatureScot	Applicant	NatureScot		Applicant
			Breeding season	Non-breeding season	All seasons
Kittiwake	30	30	1 and 3	1 and 3	1
Guillemot	60	50	3 and 5	1 and 3	1
Razorbill	60	50	3 and 5	1 and 3	1
Puffin	60	50	3 and 5	1 and 3	1

Species	Displacement rate (%)		Mortality rate (%)		
	NatureScot	Applicant	NatureScot		Applicant
			Breeding season	Non-breeding season	All seasons
Gannet	70	70	1 and 3	1 and 3	1
Fulmar	20	10	1 and 3	1 and 3	1

11.11.5.9 The full approach of the displacement assessment is detailed in Volume 3, Annex 11.4: Offshore Ornithology Displacement Modelling Report (Matrix Approach).

11.11.5.10 Seasonal displacement mortality estimates are compared against the baseline mortality of the relevant seasonal regional population calculated in Table 11.17. Annual impacts for each species are compared against the baseline mortality of the largest seasonal regional population in Table 11.17.

Operations and maintenance phase

Kittiwake

Magnitude of impact

11.11.5.11 In all three seasons (breeding, post breeding and pre-breeding) and on an annual basis the estimated percentage point increase in baseline mortality of kittiwake remains well below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). This conclusion is applicable when modelling using the displacement and mortality rates advocated by both NatureScot and the Applicant (Table 11.36) and therefore additional analysis including PVA modelling is not required.

11.11.5.12 The total displacement impact is predicted to result in a very slight change to the baseline mortality of the biogeographic population of kittiwake. The impact is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be negligible.

Table 11.36: Assessment of predicted displacement mortality for kittiwake on seasonal and annual bases against the baseline mortality of relevant regional populations

Season	Displacement rate (%)	Mortality rate (%)	Regional baseline population (no. of birds)	Baseline mortality	Displacement mortality (no. of birds)	Change in baseline mortality (% point change)
NatureScot's approach						
Breeding	30	1 to 3	576,167	0.156	1.2 to 3.5	<0.001 to 0.001
Post-breeding			829,937		0.8 to 2.5	<0.001 to <0.001
Pre-breeding			627,816		0.3 to 1.0	<0.001 to <0.001

Season	Displacement rate (%)	Mortality rate (%)	Regional baseline population (no. of birds)	Baseline mortality	Displacement mortality (no. of birds)	Change in baseline mortality (% point change)
Annual			829,937		2.4 to 7.1	<0.001 to 0.001
Applicant's approach						
Breeding	30	1	576,167	0.156	1.2	<0.001
Post-breeding			829,937		0.8	<0.001
Pre-breeding			627,816		0.3	<0.001
Annual			829,937		2.4	<0.001

Sensitivity of the receptor

11.11.5.13 In terms of behavioural response to offshore wind farm structures, kittiwake is considered to have low vulnerability to displacement, with a score of 2 (out of 5) assigned by Wade *et al*. (2016).

11.11.5.14 Despite a higher reproductive potential than most seabird species (i.e. typically laying two eggs and breeding at four years old) (Robinson, 2005), the species is deemed to have a low recoverability given the continuing decline in abundance observed between 1986 and 2023 in Scotland and the UK (Burnell *et al*., 2023; Table 11.21). During this period, breeding productivity has declined primarily as the result of food shortages, although it has stabilised in recent years (JNCC, 2020). Kittiwake have undergone decreases of approximately 57% in Scotland as measured between the Seabird 2000 (1998 to 2002) and Seabirds Count (2015 to 2021) censuses (Burnell *et al*. 2023). Surveys managed by the RSPB in 2023 have recorded indicative increases of 8% across a number of sites in the UK in 2023 when compared against a pre-HPAI baseline (Tremlett *et al*., 2024a; Tremlett *et al*., 2024b). Overall, kittiwake is deemed to have low recoverability.

11.11.5.15 Kittiwake is a qualifying interest for multiple SPAs likely to have connectivity with Morven South (within the mean-max + SD foraging range) (Table 11.13), with several non-SPA colonies also within range. Therefore, the species is considered to be of international conservation value.

11.11.5.16 Kittiwake is deemed to be of low vulnerability, low recoverability, and international conservation value. The sensitivity of the receptor is therefore considered to be medium.

Significance of the effect

11.11.5.17 Overall, for kittiwake the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of negligible to minor adverse significance, which is not significant in EIA terms. A conclusion of negligible adverse significance is based on both the negligible magnitude of the predicted impacts across all seasons and on an annual basis as well as the species' limited vulnerability to displacement impacts.

Secondary mitigation and residual effect

11.11.5.18 No mitigation measures for kittiwake are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

Common guillemot

Magnitude of impact

11.11.5.19 When applying the Applicant's displacement and mortality rates, the 0.02 percentage point threshold is surpassed in the post-breeding season and on an annual basis.

11.11.5.20 When applying NatureScot's displacement and mortality rates, the estimated percentage point increase in baseline mortality of common guillemot is above the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h) in the breeding and post-breeding seasons and on an annual basis. In the non-breeding season, the 0.02 percentage point threshold is also surpassed when considering the upper end of the NatureScot approach with a higher mortality rate (3%) (Table 11.37).

11.11.5.21 As the increase in baseline mortality of common guillemot exceeded 0.02 percentage points in the breeding, post-breeding, and non-breeding season and on an annual scale when considering the upper end of the NatureScot Approach, PVA has been carried out for these scenarios (Table 11.38). Further information on the PVA is presented in Volume 3, Annex 11.6 Offshore Ornithology Regional Population Viability Analysis.

Table 11.37: Assessment of predicted displacement mortality for common guillemot on seasonal and annual bases against the baseline mortality of relevant regional populations

Season	Displacement rate (%)	Mortality rate (%)	Regional baseline population (no. of birds)	Baseline mortality	Displacement mortality (no. of birds)	Change in baseline mortality (% point change)
NatureScot's approach						
Breeding	60	3 to 5	178,118	0.133	15.0 to 25.1	0.008 to 0.014
Post-breeding		1 to 3	474,821		53.9 to 161.6	0.011 to 0.034
Non-breeding		1 to 3	474,821		15.0 to 45.0	0.003 to 0.009
Annual		3 to 5 (breeding) 1 to 3 (post- and non-breeding)	474,821		83.9 to 231.7	0.018 to 0.049
Applicant's approach						
Breeding	50	1	178,118	0.133	4.2	0.002
Post-breeding			474,821		44.9	0.009
Non-breeding			474,821		12.5	0.003
Annual			474,821		61.6	0.013

11.11.5.22 The PVA model conducted for common guillemot when applying the annual impact calculated using NatureScot's upper displacement and mortality rates indicates a median Counterfactual of Population Size(CPS) of 0.981; i.e. the population after 35 years, would be 1.9% smaller than the CPS with a 50th percentile value of 45.8 (Table 11.38). In terms of the population size, this means that the median of the impacted population fell within the 45th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario is still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the Counterfactual of Growth Rate (CGR) is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.999 which translates to a growth rate 0.1% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would only result in a slight reduction in the growth rate currently seen in the regional population and would therefore be undetectable against natural population fluctuations.

11.11.5.23 PVA modelling was not required for the Applicant's scenario as the predicted impact did not exceed the 0.02 percentage point threshold as defined by NatureScot (NatureScot, 2023h).

11.11.5.24 Under all scenarios the counterfactual scenario predicts a positive population growth rate and in under the impacted scenario the population growth rate for common guillemot remains positive meaning the population will continue to grow despite the presence of Morven South.

11.11.5.25 The differences between the impacted and unimpacted scenarios for the post-breeding and non-breeding impact scenarios are naturally less pronounced than those associated with the annual impact as the same population is used in all seasons for common guillemot. As it has been concluded that the outputs for the annual impact scenarios do not suggest any changes in the regional common guillemot population that are detectable against natural fluctuations this conclusion is considered to be equally applicable to the impacts predicted in the breeding, post-breeding and non-breeding seasons.

11.11.5.26 The populations of guillemot estimated at Morven South from site-specific surveys that have been used to inform displacement analyses were estimated incorporating availability bias factors from Thaxter 2010). This approach was agreed with NatureScot in pre-application consultation (Table 11.7). Dunn *et al*. (2024) presents updated monthly availability bias factors for guillemot for July to March. The correction factors provided in Dunn *et al*. (2024) are lower than those applied to estimate the population estimates used in the assessments presented above and likely represent an over-estimate of the number of guillemot present at Morven South between July and March.

11.11.5.27 Under all scenarios, these results indicate that this level of impact on common guillemot would not significantly affect the population and would only result in a slight reduction in the growth rate currently seen in the population and would therefore be undetectable against natural population fluctuations. The impact is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. Therefore, the magnitude of impact is considered to be negligible.

Table 11.38: Summary of population viability analysis results for common guillemot displacement impacts after 35 years

Scenario	Predicted Mortality (no. of birds)	Increase in baseline mortality (% point change)	Median population size (no. of birds)	Growth Rate (Annual GR)	Change in population (%)	Median CGR	Median CPS	Quantile – unimpacted: 50%impacted
Post-breeding								
Baseline	-	-	1,707,774	1.0254	140.62	-	-	-
NatureScot Upper	161.6	0.034	1,685,094	1.0250	137.43	1.000	0.987	46.9
Annual								
Baseline	-	-	1,707,774	1.0254	140.62			
NatureScot Upper	231.7	0.049	1,676,127	1.0248	135.97	0.999	0.981	45.8

Sensitivity of the receptor

11.11.5.28 In terms of behavioural response to wind farm structures, common guillemot is considered to have high vulnerability to displacement, being assigned a score of 4 (out of 5) by Wade *et al*. (2016).

11.11.5.29 Common guillemot raise a single chick per year and breed from the age of five onwards, typically living on average for 13 years (Burnell *et al*., 2023). Common guillemot have undergone decreases of approximately 31% in Scotland as measured between the Seabird 2000 (1998 to 2002) and Seabirds Count (2015 to 2021) censuses (Burnell *et al*. 2023; Table 11.21). Surveys managed by the RSPB in 2023 have recorded indicative decreases of 6% across a number of sites in UK in 2023 when compared against a pre-HPAI baseline (Tremlett *et al*., 2024a; Tremlett *et al*., 2024b). However, common guillemot are deemed to have a medium recoverability given their increasing trend in abundance and productivity in the UK (JNCC, 2020).

11.11.5.30 Common guillemot is a qualifying interest for several SPAs likely to be connected to Morven South (within the mean-max + SD foraging range) (Table 11.13), with several non-SPA colonies within range, and so the species is considered to be of international conservation value.

11.11.5.31 Common guillemot is deemed to be of high vulnerability, medium recoverability, and international value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect

11.11.5.32 Overall, for common guillemot, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of minor adverse significance, which is not significant in EIA terms.

Secondary mitigation and residual effect

11.11.5.33 No mitigation measures for common guillemot are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

<u>Razorbill</u>

Magnitude of impact

11.11.5.34 In all four seasons (breeding, post breeding, non-breeding and pre-breeding,) and on an annual basis the estimated percentage point increase in baseline mortality associated with the impacts predicted for razorbill remains below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). This conclusion is applicable when modelling using the displacement and mortality advocated by both NatureScot and the Applicant and therefore additional analysis including PVA modelling is not required.

11.11.5.35 The populations of razorbill estimated at Morven South from site-specific surveys that have been used to inform displacement analyses were estimated incorporating availability bias factors from Thaxter 2010). This approach was agreed with NatureScot in pre-application consultation (Table 2.1). Dunn *et al*. (2024) presents updated monthly availability bias factors for razorbill for July to January. The correction factors provided in Dunn *et al*. (2024) are lower than those applied to estimate the population estimates used in the assessments presented above with the exception of January and therefore these populations likely represent an over-estimate of the number of razorbill present at Morven South between July and December.

11.11.5.36 The total displacement impact is predicted to result in a very slight change to the baseline mortality of the biogeographic population of razorbill. The impact is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be negligible.

Table 11.39: Assessment of predicted displacement mortality for razorbill on seasonal and annual bases against the baseline mortality of relevant regional populations

Season	Displacement rate (%)	Mortality rate (%)	Regional baseline population (no. of birds)	Baseline mortality	Displacement mortality (no. of birds)	Change in baseline mortality (% point change)
NatureScot's approach						
Breeding		3 to 5	88,821		1.0 to 1.7	0.001 to 0.002
Post-breeding		1 to 3	591,874		17.6 to 52.8	0.003 to 0.009
Non-breeding		1 to 3	218,622		2.4 to 7.3	0.001 to 0.003
Pre-breeding	60	1 to 3	591,874	0.172	0.5 to 1.6	<0.001 to <0.001
Annual		3 to 5 (breeding) 1 to 3 (non-breeding seasons)	591,874		21.6 to 63.4	0.004 to 0.011
Applicant's approach						
Breeding			88,821		0.3	<0.001
Post-breeding			591,874		14.7	0.002
Non-breeding	50	1	218,622	0.172	2.0	0.001
Pre-breeding			591,874		0.4	<0.001
Annual			591,874		17.4	0.003

Sensitivity of the receptor

11.11.5.37 Razorbill is considered to have a high vulnerability to displacement from offshore wind farms (Wade *et al*., 2016).

11.11.5.38 Razorbill raise a single chick per year and breed from the age of four onwards, typically living on average for 23 years (Burnell *et al*., 2023). The Scottish population of razorbill has decreased by approximately 2% as measured between the Seabird 2000 (1998 to 2002) and Seabirds Count (2015 to 2021) censuses (Burnell *et al*. 2023; Table 11.21). Razorbill are deemed to have a high recoverability given their increasing trend in abundance and productivity in the UK (JNCC, 2020).

11.11.5.39 Razorbill is a qualifying interest for several SPAs likely to be connected Morven South (within the mean-max + SD foraging range) (Table 11.13), with several non-SPA colonies within range and so the species is considered to be of international conservation value.

11.11.5.40 Razorbill is deemed to be of high vulnerability, high recoverability and international value. The sensitivity of the receptor is therefore, considered to be high.

Significance of the effect

11.11.5.41 Overall, for razorbill, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Secondary mitigation and residual effect

11.11.5.42 No mitigation measures for razorbill are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

Puffin

Magnitude of impact

11.11.5.43 In both the breeding and non-breeding seasons and on an annual basis the estimated percentage point increase in baseline mortality of puffin remains well below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). This conclusion is applicable when modelling using the displacement and mortality advocated by both NatureScot and the Applicant and therefore additional analysis including PVA modelling is not required.

11.11.5.44 The total displacement impact is predicted to result in a very slight change to the baseline mortality of the biogeographic population of puffin. The impact is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be negligible.

Table 11.40: Assessment of predicted displacement mortality for puffin on seasonal and annual bases against the baseline mortality of relevant regional populations

Season	Displacement rate (%)	Mortality rate (%)	Regional baseline population (no. of birds)	Baseline mortality	Displacement mortality (no. of birds)	Change in baseline mortality (% point change)
NatureScot's approach						
Breeding	60	3 to 5	449,089	0.176	1.9 to 3.2	<0.001 to 0.001
Non-breeding		1 to 3	231,957		2.6 to 7.8	0.001 to 0.003
Annual		3 to 5 (breeding) 1 to 3 (non-breeding season)	449,089		4.5 to 11.0	0.001 to 0.002
Applicant's approach						
Breeding	50	1	449,089	0.176	0.5	<0.001
Non-breeding			231,957		2.2	0.001
Annual			449,089		2.7	0.001

Sensitivity of the receptor

11.11.5.45 In terms of behavioural response to wind farm structures, puffin is considered to have a medium vulnerability to displacement, being assigned a score of 3 (out of 5) by Wade *et al*. (2016).

11.11.5.46 Puffin raise a single chick per year and breed from the age of five onwards, with a maximum recorded age of 42 years (Burnell *et al*., 2023). In a UK context the puffin population increased by 13% between the Seabird Colony Register (1985 to 1988) and the Seabird 2000 (1998 to 2002) censuses but has since shown a 21% decline as measured between the Seabird 2000 (1998 to 2002) and Seabirds Count (2015 to 2021) censuses (Burnell *et al*. 2023. Puffin are however deemed to have a medium recoverability (JNCC, 2020).

11.11.5.47 Puffin is a qualifying interest for several SPAs likely to be connected Morven South (within the mean-max + SD foraging range) (Table 11.13), with several non-SPA colonies within range and so the species is considered to be of international conservation value.

11.11.5.48 Puffin is deemed to be of medium vulnerability, medium recoverability and international value. The sensitivity of the receptor is therefore, considered to be medium.

Significance of the effect

11.11.5.49 Overall, for puffin, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **negligible to minor adverse** significance, which is not significant in EIA terms. A conclusion of **negligible adverse** significance is based on both the negligible magnitude of the predicted impacts across all seasons and on an annual basis as well as the species' high recoverability.

Secondary mitigation and residual effect

11.11.5.50 No mitigation measures for puffin are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

<u>Fulmar</u>

Magnitude of impact

11.11.5.51 In all seasons (breeding, post breeding, non-breeding and pre-breeding) and on an annual basis, the estimated percentage point increase in baseline mortality of fulmar remains below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). This conclusion is applicable when modelling using the displacement and mortality advocated by both NatureScot and the Applicant and therefore additional analysis including PVA modelling is not required.

11.11.5.52 The total displacement impact is predicted to result in a very slight change to the baseline mortality of the biogeographic population of fulmar. The impact is predicted to be of local spatial extent, long-term duration, continuous, and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be negligible.

Table 11.41: Assessment of predicted displacement mortality for fulmar on seasonal and annual bases against the baseline mortality of relevant regional populations

Season	Displacement rate (%)	Mortality rate (%)	Regional baseline population (no. of birds)	Baseline mortality	Displacement mortality (no. of birds)	Change in baseline mortality (% point change)
NatureScot's approach						
Breeding	20	1 to 3	1,035,206	0.221	0.5 to 1.5	<0.001 to <0.001
Post-breeding			957,502		0.5 to 1.5	<0.001 to <0.001
Non-breeding			568,736		0.6 to 1.8	<0.001 to <0.001
Pre-breeding			957,502		0.4 to 1.1	<0.001 to <0.001
Annual			1,035,206		2.0 to 5.9	<0.001 to 0.001
Applicant's approach						
Breeding	10	1	1,035,206	0.221	0.3	<0.001
Post-breeding			957,502		0.2	<0.001
Non-breeding			568,736		0.3	<0.001
Pre-breeding			957,502		0.2	<0.001
Annual			1,035,206		1.0	<0.001

Sensitivity of the receptor

11.11.5.53 In terms of behavioural response to wind farm structures, fulmar is considered to have a very low vulnerability to displacement, being assigned a score of 1 (out of 5) by Wade *et al*. (2016).

11.11.5.54 Fulmar has a low reproductive potential, due to laying a single egg per breeding attempt, and a typical age of recruitment of nine years. The UK population of fulmar increased by 77% between 1969 to 1970 to 1985 to 1988, however since then fulmar populations have decreased in both UK and Scottish contexts (Burnell *et al*., 2023; Table 11.21). Fulmar therefore are deemed to have a low recoverability.

11.11.5.55 Fulmar is a qualifying interest for several SPAs likely to be connected to Morven South (within the mean-max + SD foraging range) (Table 11.13). The species is therefore considered to be of international value. Refer to Table 11.13 for details of SPAs with connectivity to the Morven South with regards to fulmar.

11.11.5.56 Fulmar is deemed to be of low vulnerability, low recoverability, and of international value. The sensitivity of the receptor is therefore considered to be medium.

Significance of the effect

11.11.5.57 Overall, for fulmar the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **negligible to minor a adverse** significance, which is not significant in EIA terms. A conclusion of **negligible adverse** significance is based on both the negligible magnitude of the predicted impacts across all seasons and on an annual basis as well as the species' limited vulnerability to displacement impacts.

Secondary mitigation and residual effect

11.11.5.58 No mitigation measures for fulmar are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

Gannet

Magnitude of impact

11.11.5.59 In all three seasons (breeding, post breeding and pre-breeding) and on an annual basis the estimated percentage point increase in baseline mortality of gannet remains well below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). This conclusion is applicable when modelling using the displacement and mortality advocated by both NatureScot and the Applicant and therefore additional analysis including PVA modelling is not required.

11.11.5.60 The total displacement impact is predicted to result in a very slight change to the baseline mortality of the biogeographic population of gannet. The impact is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be negligible.

Table 11.42: Assessment of predicted displacement mortality for gannet on seasonal and annual bases against the baseline mortality of relevant regional populations

Season	Displacement rate (%)	Mortality rate (%)	Regional baseline population (no. of birds)	Baseline mortality	Displacement mortality (no. of birds)	Change in baseline mortality (% point change)
NatureScot's approach						
Breeding	70	1 to 3	559,963	0.193	2.6 to 7.7	<0.001 to 0.001
Post-breeding			456,298		0.6 to 1.9	<0.001 to <0.001
Pre-breeding			248,385		0.3 to 0.9	<0.001 to <0.001
Annual			559,963		3.5 to 10.5	0.001 to 0.002
Applicant's approach						
Breeding	70	1	559,963	0.193	2.6	<0.001
Post-breeding			456,298		0.6	<0.001

Season	Displacement rate (%)	Mortality rate (%)	Regional baseline population (no. of birds)	Baseline mortality	Displacement mortality (no. of birds)	Change in baseline mortality (% point change)
Pre-breeding			248,385		0.3	<0.001
Annual			559,963		3.5	0.001

Sensitivity of the receptor

11.11.5.61 In terms of behavioural response to wind farm structures, gannet is considered to have a high vulnerability to displacement, being assigned a score of 4 (out of 5) by Wade *et al*. (2016). During the breeding season, gannet showed a strong avoidance of offshore wind farms (Peschko *et al*., 2021).

11.11.5.62 Gannet have low reproductive potential given a typical age of first breeding at five years and typically laying only a single egg per breeding season. However, although gannet has a low reproductive potential, the species has demonstrated a consistent increasing trend in abundance since the 1990s (JNCC, 2020; Burnell *et al*., 2023; Table 11.21). It is of note that the species has suffered from the outbreak of avian flu during the 2022 breeding season (Pearce-Higgins *et al*., 2023), with declines of 25% recorded at certain sites in the UK in 2023 when compared against a pre-HPAI baseline (Tremlett *et al*., 2024a; Tremlett *et al*., 2024b). Although gannet has a low reproductive potential and HPAI has led to some short-term declines, the overall population has shown steady growth. Therefore, the species is deemed to have a high recoverability given the consistent increasing trend in abundance since the 1990s (JNCC, 2020).

11.11.5.63 Gannet is a qualifying interest for several SPAs likely to be connected to Morven South (within the mean-max + SD foraging range) (Table 11.13), with non-SPA colonies within range and so the species is considered to be of international conservation value.

11.11.5.64 Gannet is deemed to be of high vulnerability, high recoverability, and of international value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect

11.11.5.65 Overall, for gannet, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Secondary mitigation and residual effect

11.11.5.66 No mitigation measures for gannet are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

11.11.6 Combined collision and displacement

11.11.6.1 Two species are known to be adversely affected by both displacement and collision during the operations and maintenance phase, these are kittiwake and gannet. For these species, impacts must be combined in order for the magnitude of impact to be understood.

11.11.6.2 It is recognised that assessing these two potential impacts together could amount to double counting, as birds that are subject to displacement could not be subject to potential collision risk as they are already assumed to have not entered Morven South. Equally, birds estimated to be subject to collision risk mortality would not be subjected to displacement mortality as well.

11.11.6.3 Whilst the methods used to estimate collision risk and displacement mortality for gannet go some way to take this into account (through the reduction of gannet densities in collision risk modelling by 70%), a similar approach is not applied for kittiwake due to a lack of appropriate data to inform the quantification of the likely scale of required reduction. As a more refined method to consider displacement and collision together whilst reducing any double counting of impacts is not agreed with SNCBs, the precautionary and highly unlikely approach is presented in this assessment.

11.11.6.4 Outputs from the impact assessments from displacement (Section 11.11.5) and collision risk (Section 11.11.4) combined are tabulated and presented in the following sections.

11.11.6.5 Seasonal impacts are compared against the baseline mortality of the relevant seasonal regional population presented in Table 11.17. Annual impacts for each species are compared against the baseline mortality of the largest seasonal regional population in Table 11.17.

Operations and maintenance phase

Kittiwake

Magnitude of impact

11.11.6.6 In all three seasons (breeding, post breeding and pre-breeding) and on an annual basis, the estimated percentage point increase in baseline mortality of kittiwake remains well below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). This conclusion is applicable when modelling using the parameters advocated by both NatureScot and the Applicant and therefore additional analysis including PVA modelling is not required.

11.11.6.7 The total impact is predicted to result in a very slight change in the baseline mortality of the biogeographic population of kittiwake. The impact is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be negligible.

Table 11.43: Assessment of combined displacement and collision mortality for kittiwake on seasonal and annual bases against the baseline mortality of relevant regional populations

Season	Regional baseline population (no. of birds)	Baseline mortality	Collision mortality (no. of birds)	Displacement mortality (no. of birds)	Total impact (no. of birds	Change in baseline mortality (% point change)
NatureScot's approach						
Breeding	576,167	0.156	6.6	1.2 to 3.5	7.8 to 10.2	0.001 to 0.002
Post-breeding	829,937		1.6	0.8 to 2.5	2.4 to 4.1	<0.001 to <0.001
Pre-breeding	627,816		2.0	0.3 to 1.0	2.3 to 3.0	<0.001 to <0.001
Annual	829,937		10.2	2.4 to 7.1	12.6 to 17.3	0.002 to 0.002
Applicant's approach						

Season	Regional baseline population (no. of birds)	Baseline mortality	Collision mortality (no. of birds)	Displacement mortality (no. of birds)	Total impact (no. of birds	Change in baseline mortality (% point change)
Breeding	576,167	0.156	1.5	1.2	2.7	<0.001
Post-breeding	829,937		0.4	0.8	1.2	<0.001
Pre-breeding	627,816		0.5	0.3	0.8	<0.001
Annual	829,937		2.4	2.4	4.7	0.001

Sensitivity of the receptor

11.11.6.8 As previously described for displacement (paragraph 11.11.5.15) and collision (paragraph 11.11.4.17), kittiwake is deemed to be of overall medium vulnerability, low recoverability and international conservation value. The sensitivity of the receptor is therefore, considered to be high.

Significance of the effect

11.11.6.9 Overall, for kittiwake the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Secondary mitigation and residual effect

11.11.6.10 No mitigation measures for kittiwake are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

<u>Gannet</u>

Magnitude of impact

11.11.6.11 In all three seasons (breeding, post breeding and pre-breeding,) and on an annual basis the estimated percentage point increase in baseline mortality of gannet remains well below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). This conclusion is applicable when modelling using the parameters advocated by both NatureScot and the Applicant and therefore additional analysis including PVA modelling is not required.

11.11.6.12 The total impact is predicted to result in a very slight change to the baseline mortality of the biogeographic population of gannet. The impact is predicted to be of local spatial extent, long-term duration, continuous, and of high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be negligible.

Table 11.44: Assessment of combined displacement and collision mortality for gannet on seasonal and annual bases against the baseline mortality of relevant regional populations

Season	Regional baseline population (no. of birds)	Baseline mortality	Collision mortality (no. of birds)	Displacement mortality (no. of birds)	Total impact (no. of birds	Change in baseline mortality (% point change)
NatureScot's approach						
Breeding	559,963	0.193	12.7	2.6 to 7.7	15.3 to 20.4	0.003 to 0.004
Post-breeding	456,298		0.2	0.6 to 1.9	0.8 to 2.1	<0.001 to <0.001
Pre-breeding	248,385		0.2	0.3 to 0.9	0.5 to 1.1	<0.001 to <0.001
Annual	559,963		13.1	3.5 to 10.5	16.9 to 23.6	0.003 to 0.004
Applicant's approach						
Breeding	559,963	0.193	3.4	2.6	6.0	0.001
Post-breeding	456,298		0.2	0.6	0.8	<0.001
Pre-breeding	248,385		0.2	0.2	0.5	<0.001
Annual	559,963		3.8	3.3	7.2	0.001

Sensitivity of the receptor

11.11.6.13 As previously described for displacement (paragraph 11.11.5.65) and collision (paragraph 11.11.4.33), gannet is deemed to be of overall high vulnerability, high recoverability and International conservation value. The sensitivity of the receptor is therefore, considered to be high.

Significance of the effect

11.11.6.14 Overall, for gannet, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Secondary mitigation and residual effect

11.11.6.15 No mitigation measures for gannet are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

11.11.7 Barrier effects

11.11.7.1 JNCC *et al*. (2022) defines barrier effects as 'A barrier is a physical factor that limits the migration, or free movement of individuals or populations, thus requiring them to divert from their intended path in order to reach their original destination. This effect is expected to increase the energy expenditure of birds if they have to fly around the area in question in order to reach their goal'.

11.11.7.2 Barrier effects are typically considered to affect birds in flight only, either whilst they are on migration between breeding and wintering areas (for example) or between a breeding colony and a foraging area. The latter of these scenarios may impose an additional energetic cost to movements at a key period in the annual cycle when seabirds are making daily commutes between foraging grounds at sea and breeding sites. Additional energetic costs could have long-term implications for individuals, impacting bird fitness (breeding productivity and survival) and for populations.

11.11.7.3 Barrier effects are considered to be less impactful when affecting migratory flights as avoidance of a single wind farm may be trivial relative to the total length and cost of the journey.

11.11.7.4 For breeding seabirds, NatureScot (2023f) consider barrier effects alongside displacement as "distributional responses". This is because it can be difficult to distinguish barrier effects from the effects of displacement for breeding seabirds foraging in the region. NatureScot (2023f) advise that distributional responses are assessed using the matrix approach, and therefore for breeding seabirds, no separate assessment of barrier to movement is carried out, with impacts considered to be included in the assessments carried out in Section 11.11.4.51. This section therefore only considers the impact of the barrier to movement during migratory seasons.

11.11.7.5 All VORs as presented in Table 11.15, are considered in relation to barrier effects and because the magnitude of the effect is likely to be similar amongst bird species moving through the area, receptors are grouped in the assessment of the barrier effect.

Operations and maintenance phase

<u>All receptors</u>

Magnitude of impact

11.11.7.6 In the absence of quantitative information available for individual species, the magnitude is considered qualitatively for all receptors.

11.11.7.7 The diversion of flight lines as a result of a barrier effect created by the presence of Morven South for migratory birds is considered less of an impact than for those barrier effects to daily foraging flights. A number of studies have calculated that the costs of one-off avoidances during migration were small, accounting for less than 2% of available fat reserves (e.g. Masden et al., 2010; Speakman *et al*., 2009).

11.11.7.8 Masden *et al*. (2010) found additional costs, expressed in relation to typical daily energetic expenditures, to be the highest per unit flight for seabirds with high wing loadings, such as gannets. For example, results suggest that increasing gannet flight distance by 2km increases energetic cost by 1.25%. A 10km increase may result in a 4.50% increase in energy expenditure. However, this is based on a foraging range of 160km, where 10km represents a 6.25% increase in distance flown. Scaling this to the mean maximum plus 1 SD foraging range of 709km (Woodward *et al*., 2019), an additional flight distance of 10 km (4.5%) represents a scaled 1.02% increase in expenditure. This minimal increase in energy expenditure is unlikely to result in notable mortalities. Most importantly, Masden *et al*. (2010) found costs of extra flight to avoid a wind farm to appear to be much less than those imposed by low food abundance or adverse weather, although such costs will be additive to these.

11.11.7.9 The impact is predicted to be of local spatial extent, long-term duration, continuous, and high reversibility. It is predicted that the impact will affect the receptor directly. Due to the likely absence of any detectable impact on the fitness of individuals and the demography of the populations, the magnitude is therefore considered to be negligible.

Sensitivity of the receptor

11.11.7.10 The sensitivity of all receptors is identified in Table 11.45 and is based on the information presented in Section 11.8.2. Conservation value for all receptors (except migratory waterbirds) is provided in Table 11.15. Vulnerability scores for all species are based on the information presented in Maclean *et al*. (2009) as presented in Table 11.22. The determination of recoverability for all receptors (except migratory waterbirds) is provided in Table 11.21.

11.11.7.11 The conservation importance and recoverability of populations of migratory waterbirds may vary considerably, with smaller wader species with a relatively favourable conservation status (e.g. dunlin) faring better than larger species with lower reproductive rates (e.g. Eurasian curlew). This is reflected in Table 11.45.

Table 11.45: Sensitivity of all receptors to barrier effects

Receptor	Conservation value	Vulnerability to barrier effects	Recoverability	Sensitivity
Arctic tern	National	Very low	Low	Medium
Kittiwake	International	Low	Low	Medium
Great black-backed gull	Regional	Low	Low	Low
Common guillemot	International	High	High	High
Razorbill	International	High	High	High
Puffin	International	High	High	High
Fulmar	International	Low	Low	Medium
Gannet	International	Very low	High	Low
Migratory waterbirds	Variable by species	Very high to Medium	Variable by species	High to Negligible

Significance of the effect

11.11.7.12 Overall, for all receptors, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be low to high. The effect will, therefore be of **negligible adverse** significance or **minor adverse** significance for all receptors, which is not significant in EIA terms.

Secondary mitigation and residual effect

11.11.7.13 No mitigation measures for offshore ornithology are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

11.11.8 Attraction to light

11.11.8.1 There is the potential for artificial light associated with offshore wind farms to impact birds at the construction, operations and maintenance, and decommissioning stages.

11.11.8.2 The Morven South project design seeks to reduce the impacts of attraction to light through the inclusion of designed-in measures. This relates specifically to MM-34 in Table 11.26, where the decision has been made to adopt the minimum amount and intensity of lighting that Morven South can legally have whilst remaining compliant with mandatory Health and Safety lighting requirements.

11.11.8.3 MM-34 details that appropriate lighting and marking of wind turbines and offshore substation platforms will be established in accordance with Civil Aviation Authority (CAA) regulations and guidance (CAP 393, The ANO) and in accordance with the CAA and the DIO, which are responsible for the safeguarding of Ministry of Defence (MOD) assets.

11.11.8.4 MM-34 will be secured through adherence to a Lighting and Marking Plan (LMP). A LMP has been developed (Volume 4, Chapter 4: Lighting and Marking Plan), setting out the details of the proposed marine navigation lighting and marking. Further details are provided in Volume 4, Chapter 4: Lighting and Marking Plan, and all proposed marine navigation lighting and marking adheres to the requirements in the following guidance documents:

- International Organization of Marine Aids to Navigation (IALA) O-139 Recommendations on the Marking of Man-made Offshore Structures (IALA, 2021 (a)) and G1162 Guidance on the Marking of Man-made Offshore Structures (IALA, 2021 (b));
- IALA R1001 – The IALA Maritime Buoyage System (IALA, 2023);
- Marine Guidance Note (MGN) 654 and Annexes – Offshore Renewable Energy Installations (OREIs) – Guidance on United Kingdom (UK) Navigational Practice, Safety and Emergency Response (Maritime and Coastguard Agency (MCA), 2021).

11.11.8.5 Consideration has also been given to the Standard Marking Schedule for Offshore Installations (Department of Energy and Climate Change (DECC), 2011). In addition to consideration of relevant guidance, the Applicant will consult with relevant stakeholders on the contents of the LMP post-consent, including the MCA, NLB, and CAA.

11.11.8.6 Seabirds may be affected by offshore lighting via phototaxis (attraction to light which could potentially operate over ranges of up to tens of kilometres) and/or disorientation (the alteration of flight paths of birds within tens of metres of artificial light) (Deakin *et al*., 2022).

11.11.8.7 Potential impact effects may be positive: artificial lighting may attract prey close to the sea surface, increasing foraging opportunities and prey availability – many fisheries specifically use artificial light to attract prey (Deakin *et al*., 2022).

11.11.8.8 However, under specific conditions, lights may potentially attract seabirds and/or modify the behaviour of seabirds in their proximity. This may potentially increase collision risk and unnecessary energy expenditure for affected seabirds, for example by causing circling behaviour around very bright light sources (Deakin *et al*., 2022).

11.11.8.9 For offshore wind farms, during the construction and decommissioning phases, construction and support vessels often use large-scale, continuous, broad-spectrum lighting for operational and safety reasons.

11.11.8.10 In the operations and maintenance phase light sources include wind turbines, associated infrastructure, and vessel lighting. It is a requirement for navigational and aviation safety that offshore wind farms include safety lighting. The impacts of artificial lighting in the operations and maintenance phase are expected to be the same as or less than the impacts at the construction phase, as the construction phase is expected to involve greater light levels (Deakin *et al*., 2022).

11.11.8.11 There are significant knowledge gaps regarding the effects of artificial lighting associated with offshore wind farms on seabirds. These include:

- the range over which light attraction may occur (and therefore the size of the light catch basin for wind farms and related activities or infrastructure);
- the extent to which light attraction is exacerbated by particular meteorological conditions (e.g. fog, rain);
- the influence of wavelength and pattern of illumination (flashing/steady);
- the extent to which light attraction differently affects adults and juveniles and for how long after fledging juveniles may remain particularly susceptible to light attraction.

11.11.8.12 Whilst Deakin *et al*. (2022) provides a comprehensive review of seabird attraction to artificial light, the review does not account for the characteristics of lighting associated with offshore wind farms. The review highlights the attraction of seabirds to light sources such as village lights, lighthouses, and hydrocarbon platforms. It is notable that the intensity of light associated with these sources is significantly greater than that associated with an offshore wind farm. This was highlighted by Furness (2018), who determined that lighting on wind turbines is in orders of magnitude lower than light intensities produced by ports, towns, lighthouses, oil and gas platforms, or ships. Furness (2018) concluded that the lights associated with offshore wind turbines are unlikely to have any detectable effect on birds.

11.11.8.13 Furness (2018) found that phototaxis of seabirds only occurs over short distances (hundreds of metres) in response to bright white light close to colonies of these species. It is not seen over large distances or with the moderate light levels used in obstruction or navigation lighting. In addition, no evidence was found to suggest that obstruction or navigation lights affect ability of marine birds to feed at night, or attract marine prey animals to aggregate, or that they could affect predation risk for nocturnal migrant birds. No evidence was found to suggest that obstruction or navigation lights cause displacement of marine birds due to avoidance of light.

11.11.8.14 It is anticipated that lighting associated with Morven South will meet minimum requirements, namely as set out in the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Recommendation O-117 on 'The Marking of Offshore Wind Farms' for navigation lighting and by the Civil Aviation Authority in the Air Navigation Orders (CAP 393 and guidance in CAP 764). As stated in Paragraph 11.11.8.2, the lighting at Morven South is not expected to exceed the minimum legal requirements; this will reduce any potential light attraction impacts for birds as much as possible.

11.11.8.15 Appropriate lighting, in line with MCA (2021) guidance, will ensure the offshore structures are visible for search and rescue and emergency response procedures. In addition, marine navigational lighting for the OSS will be fitted at the platform level on significant peripheral structures.

11.11.8.16 Considering attraction to lit structures, the MDS for Morven South would involve 95 wind turbines and the maximum number of ancillary structures (Table 11.25). For maximum visibility, each structure would be fitted with lighting requirements for aviation and shipping. All project phases are considered as the number of wind turbines will gradually increase or decrease respectively during the construction and decommissioning phases. The indicative lighting design is detailed below:

- Flashing yellow 5s lights on Significant Peripheral Structures (SPS) with nominal 5nm range, 360° visibility, located between 6m and 30m above HAT, all synchronised;
- Flashing yellow 2.5s lights on Intermediate Peripheral Structures (IPS) with nominal 2nm range, 360° visibility, located between 6m and 30m above HAT;
- For ID markers – low level baffled lighting with mean luminance between 5 and 10cd/m^2;
- Aviation warning lights – red 2,000cd dimmable to 200cd when visibility greater than 5km at night, off during day, 360° visibility, synchronised flashing Morse "W";
- SAR lights – red 200cd, off unless requested by MCA, steady when in use, 360° visibility;
- Heli-hoist lights – low intensity green light, off when not safe for heli-hoist, flashing when being prepared, steady when ready, 360° visibility.

11.11.8.17 White light is likely to have the greatest impact on seabirds, as it encompasses all wavelengths of light (Department of Climate Change, Energy, the Environment, and Water (DCCEEW), 2023).

11.11.8.18 Studies investigating how different light wavelengths may affect light attraction for procellariiformes have invariably been carried out on fledglings departing natal colonies, or when carried out on adults, only for individuals returning/departing colonies overland in close proximity to breeding burrows and for high-intensity, short-range light sources. Species of procellariiformes that are considered within this EIA are Manx shearwater, fulmar, European storm petrel and Leach's petrel.

11.11.8.19 These studies therefore have very limited applicability to birds engaged in different behaviours (e.g. migrating, foraging, resting) encountering the far less intense lights of offshore wind farms remote from breeding colonies, and doing so in different contexts (e.g. not encountering them constantly or regularly to visit a burrow to incubate or feed chicks).

11.11.8.20 These studies suggest that Manx shearwater may have greater sensitivity to light of shorter wavelengths (blue/green) than longer wavelengths (red), with responses to red light being the same as to no light (Syposz *et al*., 2021). This is also consistent with the fact that Manx shearwater forage at depths of up to 55m (Shoji *et al*., 2016): light of shorter wavelengths (blue/green) penetrates water to greater depths than that of longer wavelengths (red), so to maximise visual acuity when foraging at depth, Manx shearwater photoreceptors likely have greater sensitivity to blue light over red (Deakin *et al*., 2022).

11.11.8.21 Storm petrels and fulmar dive to a very limited degree (max 5m), so likely have less need for enhanced sensitivity to blue light (Garthe and Furness, 2001; Albores-Barajas *et al*., 2011; Delord *et al*., 2016; Deakin *et al*., 2022). However, petrel vision is most sensitive to light in the short-wavelength blue (400nm to 500nm) region of the visible spectrum (DCCEEW, 2023). Relative to diurnal seabirds, such as gulls and terns, petrels have a higher number of short-wavelength-sensitive cones, and this is thought to be an adaptation that increases prey visibility against blue water for foraging (Hart, 2001; DCCEEW, 2023).

11.11.8.22 Given this likely sensitivity of Procellariiformes to short-wavelength light, the use of red lighting for aviation warning and SAR functions (see indicative lighting design in paragraph 11.11.8.15) is likely to reduce potential light attraction impacts when compared to using white, blue, or green light. This is because white, blue, or green light appears to be more detectable for Procellariiformes, potentially increasing light attraction impacts. In contrast, red light appears less detectable (Syposz *et al*., 2021), suggesting it is less likely to impact birds.

11.11.8.23 Low-intensity, baffled lighting and flashing rather than steady signals are likely to further reduce potential light impacts, as seabirds appear to be more strongly attracted to bright, continuous, and shorter-wavelength light (Rodríguez *et al*., 2017; Deakin *et al*., 2022).

11.11.8.24 The assessment for attraction to light is based on a qualitative approach, considering the magnitude of impact and the sensitivity of the receptor. The species considered for attraction to light are identified in Table 11.46 based on the species vulnerability (Wade *et al*., 2016; Bradbury *et al*., 2014) and abundance at Morven South (see Volume 3, Annex 11.1 Offshore Ornithology Baseline Characterisation Report).

11.11.8.25 In order to identify VORs that require assessment, the amount of flight activity at night exhibited by each species as reported by Wade *et al*. (2016) has been used as a coarse filter. Where a species has a high flight at night score (4 or above), the species is included in the assessments presented in this section.

11.11.8.26 Where a species has a flight at night score of low (1) or moderate (2 or 3), it is considered that an impact pathway does not exist as the species will not exhibit enough activity at night to result in a measurable impact.

11.11.8.27 It is acknowledged that the use of flight activity at night in order to identify VORs that require assessment is not analogous with an attraction to light sources. However, the use of flight activity at night is precautionary, as whilst it may identify species that are not attracted to light for consideration in the assessment, it will not omit those species that might be attracted to light and that therefore may be impacted by light associated with Morven South.

11.11.8.28 As a further precautionary step, Manx shearwater has been screened in for assessment despite a moderate flight activity at night score (3). Whilst Manx shearwater does not meet the criteria for consideration, there is evidence showing that the species is attracted to light, although this evidence pertains only to adults in close proximity to their breeding colony and young on their fledging flights from the colony (Deakin *et al*., 2022).

Table 11.46: Identification of Valued Ornithological Receptors for which assessment in relation to attraction to light is required.

VOR	Flight activity at night	Flight activity at night score	Importance of population at Morven South	Assessment required (Yes/No)
Kittiwake	Moderate	3	Local	No, moderate flight activity at night, only recorded in locally important numbers at Morven South.
Little gull	Moderate	2[6]	Negligible	No, moderate flight activity at night, not recorded at Morven South.
Great black-backed gull	Moderate	3	Local	No, moderate flight activity at night, only recorded in locally important numbers at Morven South.
Sandwich tern	Low	1	Negligible	No, low flight activity at night, not recorded at Morven South.
Little tern	Low	1	Negligible	No, low flight activity at night, not recorded at Morven South.
Roseate tern	Low	1	Negligible	No, low flight activity at night, not recorded at Morven South.
Common tern	Low	1	Negligible	No, low flight activity at night, not recorded at Morven South.
Arctic tern	Low	1	National	No, low flight activity at night.
Great skua	Low	1	Local	No, low flight activity at night, only recorded in locally important numbers at Morven South.
Arctic skua	Low	1	Negligible	No, low flight activity at night, not recorded at Morven South.
Common guillemot	Moderate	2	Regional	No, moderate flight activity at night.
Razorbill	Low	1	Regional	No, low flight activity at night.

[6] Flight activity at night score for little gull is taken from Bradbury *et al.* (2014) as little gull is not included in Wade *et al.* (2016).

VOR	Flight activity at night	Flight activity at night score	Importance of population at Morven South	Assessment required (Yes/No)
Puffin	Low	1	Local	No, low flight activity at night.
European storm petrel	High	4	Negligible	Yes, high flight activity at night, recorded in regionally important numbers at Morven South.
Leach's petrel	High	4	Negligible	Yes, high flight activity at night.
Fulmar	High	4	Local	Yes, high flight activity at night.
Manx shearwater	Moderate	3	Regional	Yes. Whilst the species does not meet the criteria for consideration (only moderate activity at night), there is evidence showing that the species is attracted to light (Deakin *et al.* 2022).
Gannet	Moderate	2	Local	No, moderate flight activity at night, only recorded in locally important numbers at Morven South.

All project phases

11.11.8.29 Precise numbers of birds moving through Morven South are unknown, but in relation to national or international populations, proportions travelling through Morven South during hours of darkness are likely to be low (see Wade *et al*. (2016) for determination of nocturnal activity rates). In addition, most flights would be below potential collision height even if increased abundances occur through phototaxis. The magnitude of impact is considered qualitatively for all receptors.

11.11.8.30 The nature of lighting at Morven South is not considered comparable to the light sources associated with significant recorded attraction events (e.g. those that may occur at lighthouses or other significant light sources), due to lower light intensity, the colour of the light , and the context in which the light may be encountered, thus there is a much lower risk of attraction to light.

11.11.8.31 As stated in paragraphs 11.11.8.2 to 11.11.8.5, the project design seeks to reduce the impacts of attraction to light through the inclusion of designed-in measures.

11.11.8.32 There is no evidence from any existing offshore wind farm that suggests that mass attraction events occur as a result of the typical navigational and aviation lighting for offshore wind farms. Furness (2018) concluded that obstruction or navigation lights on wind turbines will have no significant effects on marine birds.

<u>Fulmar</u>

Magnitude of impact

11.11.8.33 There is limited evidence for the effects of artificial lighting on fulmar including in relation to lighting associated with offshore wind farms. Dupuis *et al*. (2021) state that they did not find any evidence in the literature that the lights of wind turbine fields attract fulmar. Atchoi *et al*. (2020) also state that, to the best of their knowledge, surface-nesting petrels such as fulmars or albatrosses have not been recorded at fallout events nor in light attraction events at sea.

11.11.8.34 There is evidence for Procellariiformes being attracted to and/or disorientated by lit fishing vessels, with significant potential negative impacts (e.g. Arcos and Oro, 2002; Montevecchi, 2006; Ronconi *et al*., 2015). However, Dupuis *et al*. (2021) argue that apparent seabird attraction to fishing boat lights may actually be primarily due to olfaction, with birds more attracted by the fishing activity itself than by the light.

11.11.8.35 The Scottish Government's review of offshore wind farm impacts on petrels and shearwaters (Deakin *et al*., 2022) also highlights the potential for attraction in nocturnally active Procellariiformes, including fulmar, particularly around offshore infrastructure. However, as stated in paragraph 11.11.8.10, the review does not account for the characteristics of lighting associated with offshore wind farms.

11.11.8.36 The impact is predicted to be of local spatial extent, intermittent, and of medium-term duration, and will affect any birds in the vicinity of these activities directly. The impact will also be of high reversibility. The magnitude is therefore considered to be negligible.

Sensitivity of the receptor

11.11.8.37 Fulmar has a high level of nocturnal flight activity (4 out of 5 in Wade *et al*., 2016) which is likely due to the long duration of foraging trips undertaken by the species. However, the vulnerability of this species to lighting effects will be reduced due to the low levels of artificial light generated by Morven South. The species is therefore considered to have low vulnerability.

11.11.8.38 Fulmar has a low reproductive potential, due to laying a single egg per breeding attempt, and a typical age of recruitment of nine years. The UK population of fulmar increased by 77% between 1969 to 1970 to 1985 to 1988. However since then fulmar populations have decreased in both UK and Scottish contexts (Burnell *et al*., 2023; Table 11.21). Fulmar are therefore deemed to have low recoverability.

11.11.8.39 Fulmar is a qualifying interest for several SPAs likely to be connected to Morven South (within the mean-max + SD foraging range) (Table 11.13). The species is therefore considered to be of international value. Refer to Table 11.13 for details of SPAs with connectivity to Morven South with regards to fulmar.

11.11.8.40 Fulmar is deemed to be of low vulnerability, low recoverability, and of international value. The sensitivity of the receptor is therefore considered to be medium.

Significance of the effect

11.11.8.41 Overall, for fulmar, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **negligible to minor adverse** significance, which is not significant in EIA terms. A conclusion of **negligible adverse** significance is based on the limited numbers of the species expected to be present at Morven South and the negligible impact magnitude predicted for the species.

Secondary mitigation and residual effect

11.11.8.42 No mitigation measures for fulmar are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

<u>Manx shearwater</u>

Magnitude of impact

11.11.8.43 As with other seabirds that rear their young underground, Manx shearwater appear to be particularly sensitive to light-induced attraction and disorientation. Adults leave the fully-grown chick to fledge independently, typically just after dark. The chicks use natural light gradients to navigate from the burrows to the sea.

11.11.8.44 Several studies have recorded fledgling Manx shearwater being attracted to artificial lights and subsequently becoming grounded or colliding with structures (e.g. Miles *et al*., 2010; Fontaine *et al*., 2011; Rodríguez *et al*., 2012a–c, 2015a–b; Wilhelm *et al*., 2013; Gineste *et al*., 2017). Such impacts have been significant for some colonies near intense lighting (such as lighthouses or coastal towns). However, overall, Manx shearwater fledgling mortality linked to artificial lighting remains low (Furness, 2018).

11.11.8.45 Furthermore, these light-induced impacts are limited to fledglings during a short period in late summer. Adults are not regularly recorded grounded. Offshore wind farms (including Morven South) are located far from Manx shearwater colonies; for Morven South, the nearest breeding records are of a single pair in 2024 at the Forth Islands (over 100km from Morven South and therefore beyond the range of any associated light), and the nearest SPA with breeding Manx shearwater is St Kilda (over 500km away). These distances mean that fledglings are highly unlikely to encounter artificial lighting associated with Morven South, and adult birds are not expected to be affected (Furness, 2018).

11.11.8.46 Importantly, many examples of artificial lighting impacts for Manx shearwater involve intense light sources such as bonfires, cities, or gas flares. These sources are not comparable to the relatively low-intensity lighting associated with offshore wind farms (Furness, 2018). Offshore wind farm lighting is one or two orders of magnitude less intense than sources such as lighthouses.

11.11.8.47 Whilst Deakin *et al*. (2022) explore potential impacts from offshore wind developments, artificial light is only briefly mentioned, and no information is provided on light characteristics from offshore wind farm developments.

11.11.8.48 The impact is predicted to be of local spatial extent, intermittent, and of medium-term duration, and will affect any birds in the vicinity of these activities directly. The impact will also be of high reversibility. The magnitude is therefore considered to be negligible.

Sensitivity of the receptor

11.11.8.49 Manx shearwater has moderate nocturnal flight activity (3 out of 5 in Wade *et al*., 2016), which could result in a degree of interaction with artificial light, although the risk remains limited.

11.11.8.50 Manx shearwater has relatively low reproductive potential, breeding from 5–6 years of age and producing a single egg per season (Brooke, 2004). However, Manx shearwater populations have remained stable or have increased since the 1990s, especially on predator-free islands, and they appear largely unaffected by the 2022–2023 HPAI outbreaks (Pearce-Higgins *et al*., 2023). Recoverability is therefore considered to be high.

11.11.8.51 Manx shearwater is not a qualifying interest at any SPAs likely to be connected to Morven South (within the mean-max + SD foraging range). However, the peak population recorded at Morven South exceeds population importance thresholds. Therefore, using the Scottish Biodiversity List designation for Manx shearwater, the species is considered to be of regional value.

11.11.8.52 Manx shearwater is considered to have low vulnerability to artificial lighting, high recoverability, and regional value. The sensitivity of the receptor is therefore considered to be low.

Significance of the effect

11.11.8.53 Overall, for Manx shearwater, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be low. The effect will, therefore, be of **negligible to minor adverse** significance, which is not significant in EIA terms. A conclusion of **negligible adverse** has been selected due to the limited numbers of the species expected to be present at Morven South and the negligible impact magnitude predicted for the species.

Secondary mitigation and residual effect

11.11.8.54 No mitigation measures for Manx shearwater are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

European storm petrel and Leach's petrel

Magnitude of impact

11.11.8.55 Adult European storm petrel and Leach's petrel appear to be largely unaffected by artificial lights (Furness, 2018). Additionally, the percentage of flights at risk height are very low for both European storm petrel and Leach's petrel (Wade *et al*., 2016). As a result, Wade *et al*. (2016) give an overall collision risk vulnerability score that is considered to be low for European storm petrel and Leach's petrel.

11.11.8.56 Deakin *et al*. (2022) note that petrels may be particularly at risk from light attraction and disorientation. Although there is substantial evidence indicating that petrels can be strongly and negatively impacted by artificial light, this evidence typically relates to land-based sources or intense coastal lighting. Most examples of effects of artificial light on seabirds are from events or sources that produce particularly bright light, such as bonfires, gas flares, headlights, or cities. These light sources are not analogous to the much less intense lighting associated with offshore wind farms, which is often one or two orders of magnitude less intense (Furness, 2018). It is therefore considered highly unlikely that the lower-intensity, offshore-specific lighting associated with wind farms and construction vessels would result in similar effects.

11.11.8.57 Evidence also suggests that juvenile petrels are at higher risk of light attraction, potentially due to having lesser-developed retinas than adults (Wilhelm *et al*., 2021; Burt, 2022). For example, Burt (2022) found that turning off the lights at a fish plant significantly decreased Leach's petrel strandings at that site, noting that the peak stranding period coincided with the fledging period of Leach's petrel.

11.11.8.58 European storm petrel and Leach's petrel are burrow nesters and produce a single chick. Fledging occurs at night and, like other procellariform seabirds, chicks use natural light gradients to navigate to the sea. Bright artificial light can interfere with this process and can cause grounding and collision (Rodríguez *et al*., 2017, 2022). Some studies have recorded significant numbers of grounded fledglings (Furness, 2018). However, most studies relate to colonies in close proximity to bright lights and show low levels of impact. This impact is restricted to fledglings and limited to a short period in the year. Adults appear to be largely unaffected by artificial lights in general (Furness, 2018).

11.11.8.59 Morven South is located at distances from colonies that mean fledglings would be unlikely to encounter associated artificial light, and adults do not appear to be vulnerable to artificial light (Furness, 2018). The nearest breeding records of European storm petrel to Morven South are on the Forth Islands, where three pairs were recorded in 2021. The Forth Islands are located over 100km from Morven South and therefore beyond the range of any light associated with Morven South. The closest breeding colony of Leach's petrel to Morven South is located in Shetland, at least 350km from Morven South. This is again beyond any zone of influence of lighting associated with Morven South.

11.11.8.60 The impact is predicted to be of local spatial extent, intermittent, and of medium-term duration, and will affect any birds in the vicinity of these activities directly. The impact will also be of high reversibility. The magnitude is therefore considered to be negligible.

Sensitivity of the receptor

11.11.8.61 Leach's petrel and European storm petrel both have high levels of nocturnal flight activity (4 out of 5 in Wade *et al*., 2016), and therefore the have potential to interact with artificial lighting. However, the vulnerability of these species to lighting effects will be reduced due to the low levels of artificial light generated by Morven South and the low likelihood of interaction due to the distance from colonies.

11.11.8.62 Leach's petrel has a low reproductive potential, due to laying a single egg per breeding attempt and their typical age of recruitment of five years. There is limited information on population trends for Leach's petrel but the species is known to have declined by 79% in a national context between 1998-2002 and 2015-2021 (Burnell *et al*., 2023; Table 11.21). Recoverability is therefore considered to be low.

11.11.8.63 European storm petrel also has a low reproductive potential, due to laying a single egg per breeding attempt and their typical age of recruitment of four to six years. There is limited information on population trends for European storm petrel but the species is known to have increased by 41% in a national context between 1998 to 2002 and 2015 to 2021 (Burnell *et al*., 2023; Table 11.21). Recoverability is therefore considered to be high.

11.11.8.64 Therefore, Leach's petrel and European storm petrel are considered to have low vulnerability, low (Leach' petrel) or high (European storm petrel) recoverability, and international value. The sensitivity of both receptors is therefore deemed to be medium.

Significance of the effect

11.11.8.65 Overall, for European storm petrel and Leach's petrel, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **negligible to minor adverse** significance, which is not significant in EIA terms. A conclusion of **negligible adverse** has been selected due to the limited numbers of each species expected to be present at Morven South and the negligible impact magnitude predicted for each species.

Secondary mitigation and residual effect

11.11.8.66 No mitigation measures for European storm petrel and Leach's petrel are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

11.11.9 Proposed monitoring

11.11.9.1 No offshore ornithology monitoring to test the predictions made within the assessment of potential effects on offshore ornithology is considered necessary.

11.12 Whole project assessment, Morven Programme assessment and Cumulative Effects Assessment Methodology

11.12.1 Methodology

11.12.1.1 The Morven Programme comprises four distinct projects: Morven North, Morven South, Morven Hawthorn Pit Grid Connection Project (MHPGC Project), and Morven Branxton Area Grid Connection Project (MBAGC Project).

11.12.1.2 The following assessment scenarios have been considered to identify the LSE[1] of Morven South in combination with other projects on the same receptor, as follows (and summarised in Table 11.47):

- Whole project assessment: to identify the potential impacts associated with Morven South together with each grid connection option in turn, (Scenario 1: MHPGC and Scenario 2: MBAGC Project), each of which would comprise a "Whole Project";
- Morven Programme assessment: to identify potential impacts associated with all four components of the Morven Programme (Morven North, Morven South, MHPGC and MBAGC Project) (Scenario 3);
- CEA: to identify the potential impacts associated with Morven South together with other relevant projects, plans and activities including other components of the Morven Programme, using a tiered approach (Scenario 4).

11.12.1.3 The whole project assessment, Morven Programme assessment and CEA have been undertaken in accordance with the methodology described in Volume 1, Chapter 6: EIA methodology.

Table 11.47: Scenarios to be considered in the Morven South whole project assessment, Morven Programme assessment and cumulative effects assessment for offshore ornithology

Whole project assessment		Morven Programme assessment	Cumulative effects assessment
Scenario 1	**Scenario 2**	**Scenario 3**	**Scenario 4**
Morven South + MHPGC Project	Morven South + MBAGC Project	Morven South + Morven North + MHPGC Project + MBAGC Project	Scenario 3 + Tier 1, Tier 2 and Tier 3 Plans/Projects screened in

11.12.1.4 The projects and plans selected as relevant to the CEA presented within this chapter are based upon the results of a screening exercise (see Volume 3, Annex 6.1: Cumulative Effects Screening). Each project or plan has been considered on a case-by-case basis for screening in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved.

11.12.1.5 In undertaking the CEA for Morven South, it should be noted that other projects and plans under consideration will have differing potential for proceeding to an operational stage and hence a differing potential to ultimately contribute to a cumulative impact alongside Morven South. Therefore, a tiered approach has been adopted, whereby all third-party projects and plans considered have been allocated into 'tiers' reflecting their current stage within the planning and development process. This provides a framework for placing relative weight upon the potential for each project/plan included in the CEA to ultimately be realised, based upon the project/plan's current stage of maturity and certainty in the project/plan's parameters. The tiered approach utilised within the Morven South CEA employs the following tiers:

- Tier 1 assessment – Existing developments either built (operational) or under construction[7]; approved developments awaiting implementation; and permitted/submitted application(s), but not yet determined plus Morven North.

[7] Note that existing developments are included in Tier 1 CEA long list but are generally screened out of the CEA assessments, aside from the following exceptions:

1) Existing developments which were not present at the time of baseline characterisation, where a potential cumulative impact-receptor pathway has been identified.

2) Existing developments are screened into tier 1 assessments for specific topics where there is a large conceptual, temporal and spatial overlap between project impacts. In these instances, the potential for ongoing effects through cumulative impact-receptor pathways throughout project lifetime, across the development phases, means that they are considered within quantitative assessment for these topic CEAs (e.g. offshore ornithology assessments consider the cumulative effects of operational offshore wind farms).

- Tier 2 assessment – All plans/projects assessed under Tier 1, and plans/projects where a scoping report has been submitted and is in the public domain.
- Tier 3 assessment – All plans/projects assessed under Tier 1 and 2, plus plans/projects that are reasonably foreseeable (e.g. projects identified in development plans, projects in other plans and programmes, offshore renewable energy projects that have a Crown Estate Scotland Lease Option Agreement).

11.12.1.6 The specific projects and plans scoped into the CEA for offshore ornithology are outlined in Table 11.48. Tier 2 projects are only included in the following cumulative assessments if information is available to provide either a quantitative or qualitative assessment. In practice, this requires that an assessment has been published for Tier 2 projects. Without an assessment it is not possible to provide an indication as to the impact of the project as information such as baseline characterisation and project design are unavailable. The location of screened in projects and their proximity to Morven South are shown in Figure 11.3. Projects screened out are detailed within Volume 3, Annex 6.2 Cumulative Effects Screening.

11.12.1.7 Tier 3 projects have not yet reached a stage at which detailed information will be available and are therefore not considered in the cumulative assessments presented.

11.12.1.8 It should be noted that the Greater Gabbard, Gunfleet Sands 1 and 2, Humber Gateway, Inner Dowsing, Lynn, London Array, Methil Demo, Scroby Sands and Sheringham Shoal offshore wind farm projects are currently operational however, the operational consents for these projects expires before Morven South becomes operational. These projects are therefore discounted from the CEA as there is no temporal overlap between the operational phases of these projects and Morven South.

11.12.1.9 The potential impacts that have been considered in the CEA (listed in Table 11.49) is a subset of those considered for the Morven South alone assessment. This is because some of the potential impacts identified and assessed for the Morven South alone assessment are localised and temporary in nature or have been assessed to have negligible adverse significance. It is considered therefore, that these potential impacts have limited or no potential to interact with similar changes associated with other plans or projects.

11.12.1.10 These impacts have therefore been scoped out of the whole project, Morven Programme and cumulative effects assessment. These impacts include:

- Direct temporary habitat loss/disturbance;
- Changes in prey availability due to temporary habitat loss/disturbance;
- Barrier effects;
- Attraction to light.

11.12.1.11 Similarly, some of the potential impacts considered within the Morven South alone assessment are specific to a particular phase of development (e.g. construction, operations and maintenance, or decommissioning). Where cumulative effects with other plans or projects only have potential to occur where there is spatial or temporal overlap with Morven South during certain phases of development, impacts associated with a certain phase may be omitted from further consideration where no plans or projects have been identified that have the potential for cumulative effects during this period. The impacts and associated species to be considered in the whole project, Morven Programme and cumulative assessments are therefore:

- collision with rotating blades:
  - kittiwake;
  - great black-backed gull;
  - gannet.
- displacement:
  - kittiwake;
  - common guillemot;

  - razorbill;
  - puffin;
  - fulmar (Morven Programme assessment only);
  - gannet.
- combined collision and displacement:
  - kittiwake;
  - gannet.

11.12.1.12 Projects are considered quantitatively within the assessments presented in Section 11.13 where quantitative information for a project was available at least six months before the application submission date for Morven South. Whilst an additional screening exercise was undertaken three months before the submission date of Morven South to ensure all projects that could contribute to a cumulative effect with Morven South were captured within Volume 3, Annex 6.2: Cumulative Effects Screening it is not possible to incorporate any further projects into the assessments presented in Section 11.13 in a quantitative manner due to the timelines required to conduct such assessments. This however, only affects one project, the Ayre offshore wind farm, the inclusion of which is considered highly unlikely to affect the conclusions reached in Section 11.13.

11.12.1.13 The projects included in and Table 11.48 are therefore those for which quantitative information was available six months prior to the application submission date for Morven South (see section 4.6) to inform the cumulative assessments for these effects.

11.12.1.14 NatureScot have advised that as fulmar has not been considered for displacement impacts in previous offshore wind farm assessments it is not possible to undertake cumulative assessments for this species. Fulmar is therefore considered within the Morven Programme assessment only (Table 11.7, 11 July 2025).

11.12.1.15 There are no collision impacts associated with the MHPGC Project or MBAGC Project. Similarly, there are no displacement impacts associated with the MHPGC Project or MBAGC Project. Whilst there may be disturbance effects associated with the MHPGC Project or MBAGC Project through vessel movements such impacts will be short-term in nature, transient along the length of the projects and highly unlikely to be detectable at the regional population level, and as such will not contribute to any existing cumulative impact. The whole project assessments associated with Scenario 1 and 2 are therefore not required and consideration of the MHPGC Project or MBAGC Project as part of Scenario 3 is also not required. Scenario 3 will therefore incorporate Morven North and Morven South only.

11.12.1.16 Some of the projects considered cumulatively only have potential to impact species during a specific season (e.g. breeding or non-breeding seasons). During the breeding season, projects within a species' foraging range were considered as there is the potential for individuals to have connectivity with Morven South and the other plans/projects specific to each species. Foraging ranges presented in Volume 3, Annex 11.1: Offshore Ornithology Baseline Characterisation Report are used (Woodward *et al*., 2019). Within the non-breeding season all developments within the BDMPS area relevant to a species (Furness, 2015) are included, with the exception of common guillemot and herring gull. For herring gull the mean-maximum foraging range is also used in the non-breeding season following NatureScot guidance in relation to identifying connectivity (NatureScot, 2023c). As such, all 'breeding season' projects are also included within the non-breeding period given that the BDMPS areas defined by Furness (2015) are larger than the breeding foraging ranges. Additional projects not included within a breeding season assessment may be included within the non-breeding season assessment. For guillemot, projects considered in the post-breeding and non-breeding seasons are those located off the east coast of Scotland between the Firth of Forth and Fraserburgh.

Table 11.48: List of other projects and plans considered within the Cumulative Effect Assessment for offshore ornithology

Project/plan	Status	Distance from Morven South (km)	Description of project/plan	Estimated dates of operation (If applicable)	Overlap with Morven South
Tier 1					
Aberdeen Offshore Wind Farm	Operational	95	Consists of up to 11 turbines at a capacity of 96.8MW	2018 – 2043	Operation phase overlaps with Morven South construction and operation and maintenance phases.
INTOG: Aspen	Application submitted/Awaiting decision	111	Proposed for up to 1,008MW	2029 – 2064	Operation phase overlaps with Morven South construction phase, followed by many years of operation phase overlap between the two projects
Beatrice Offshore Wind Farm	Operational	214	Consists of 84 turbines at a capacity of 588MW	2019 – 2044	Operation phase overlaps with Morven South construction and operation and maintenance phases
Berwick Bank	Consented/Pre-construction	34	Up to 307 turbines with a capacity of up to 4,100MW	2030 - 2065	Proposed operation phase overlaps with Morven South construction phase, followed by the Morven South operation and maintenance phase
Blyth Demo Phase 1	Operational	149	Consists of up to 15 turbines at a capacity of 41.5MW	2019 – 2044	Operation phase overlaps with Morven South construction phase and operation and maintenance phase.
Blyth Demo Phase 2&3	Operational	141	Consented for up to 5 floating turbines at a capacity of 58.4MW	2025 – 2050	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Buchan	Application submitted / Awaiting decision	178	Proposed for up to 60 turbines at a capacity of 960MW	2033 - unknown	Operation phase overlaps with Morven South construction phase and operation and maintenance phase

Project/plan	Status	Distance from Morven South (km)	Description of project/plan	Estimated dates of operation (If applicable)	Overlap with Morven South
Caledonia Offshore Wind Farm	Application submitted / Awaiting decision	146	Proposed for up to 150 turbines at a capacity of 2,000MW	2030 – unknown	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
INTOG: Cenos	Applicantion submitted / Awaiting decision	124	Proposed for up to 1,350MW	2032 – unknown	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Dogger Bank A (Creyke Bank A)	Operational	227	Consented for up to 95 turbines at a capacity of 1,200MW	until 2050	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Dogger Bank B (Creyke Bank B)	Under construction	200	Consented for up to 95 turbines at a capacity of 1,200MW	2026 – 2051	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Dogger Bank C	Under construction	245	Consented for up to 87 turbines at a capacity of 1,200MW	2026 – 2061	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Dogger Bank South	Consented/Pre-construction	224	Proposed for up to 200 turbines at a capacity of 3,000MW	2030 – 2061	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Dudgeon	Operational	372	Consists of up to 67 turbines at a capacity of 402MW	until 2042	Operation phase overlaps with Morven South construction phase. Decommissioning begins at the end of the Morven North and Morven South construction window so whether or not there is operation phase overlap depends on

Project/plan	Status	Distance from Morven South (km)	Description of project/plan	Estimated dates of operation (If applicable)	Overlap with Morven South
					the sequence of construction for Morven North and Morven South
Dudgeon Extension Project	Under construction	364	Proposed for up to 30 turbines at a capacity of 402MW	2029 – 2054	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
East Anglia 1	Operational	502	Consists of up to 102 turbines at a capacity of up to 714MW	until 2043	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
East Anglia 1 North	Under construction	486	Consented for up to 67 turbines at a capacity of 800MW	2027 – 2052	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
East Anglia 2	Under construction	465	Consented for up to 75 turbines at a capacity of 900MW	2028 – 2053	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
East Anglia 3	Under construction	494	Consists of up to 172 turbines at a capacity of 1,200MW	2026 – 2052	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Five Estuaries	Consented/Pre-construction	528	Proposed for up 79 turbines at a capacity of 353MW	2030 – 2054	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Galloper	Operational	525	Consists of up to 56 turbines at a capacity of 353MW	until 2046	Operation phase overlaps with Morven South construction phase and operation and maintenance phase

Project/plan	Status	Distance from Morven South (km)	Description of project/plan	Estimated dates of operation (If applicable)	Overlap with Morven South
Green Volt Floating Offshore Wind Farm	Consented/Pre-construction	128	Proposed for up to 35 turbines at a capacity of 560MW	2030 - 2059	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Gunfleet Sands 3 Demo	Operational	541	Consists of 2 turbines at a capacity of 12MW	until 2044	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Hornsea 1	Operational	372	Consists of up to 174 turbines at a capacity of 1,200MW	until 2044	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Hornsea Project 2	Operational	312	Consists of up to 165 turbines at a capacity of 1,300MW	until 2047	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Hornsea Project 3	Under construction	302	Consented for up to 231 turbines at a capacity of 2,850MW	2028 – 2056	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Hornsea Project 4	Consented	326	Proposed for up to 180 turbines at a capacity of 2,600MW	until 2065	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Humber Gateway	Operational	268	Consists of 73 turbines at a capacity of 219MW	until 2038	Operation phase overlaps with Morven North construction phase and operation and maintenance phase

Project/plan	Status	Distance from Morven South (km)	Description of project/plan	Estimated dates of operation (If applicable)	Overlap with Morven South
Inch Cape Offshore Wind Farm	Under construction	70	Consented for up to 72 turbines at a capacity of 1,100MW	2027 - unknown	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Kentish Flats	Operational	565	Consists of up to 30 turbines at a capacity of 90MW	until 2045	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Kentish Flats Extension	Operational	565	Consists of up to 15 turbines at a capacity of 49.5 MW	until 2041	Operation phase overlaps with Morven North construction phase and operation and maintenance phase
Kincardine Offshore Windfarm	Operational	72	Consists of 6 turbines at a capacity of 50MW	until 2046	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Lincs	Operational	364	Consists of 75 turbines at a capacity of 270MW	until 2052	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Moray Offshore Wind Farm (East)	Operational	49	Consists of up to 100 turbines at a capacity of 950MW	until 2046	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Moray Offshore Windfarm (West)	Operational	198	Consented for up to 60 turbines at a capacity of 882MW	until 2048	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Morven North Offshore Wind Array Project	Application submitted/ awaiting decision	0	Proposed for up to 96 turbines at a capacity of 1,500MW	2038 – 2072	Identical timeline to Morven South and, as such, there is complete overlap between the two projects

Project/plan	Status	Distance from Morven South (km)	Description of project/plan	Estimated dates of operation (If applicable)	Overlap with Morven South
Muir Mhòr Offshore Wind Farm	Application submitted/awaiting decision	77	Proposed for a capacity of 798MW	2034 – unknown	One year in which construction phase overlaps with the Morven North and Morven South construction window, followed by overlap between operation phase and the Morven South construction phase, then many years of operation phase overlap between the two projects
Neart na Gaoithe Offshore Wind	Operational	85	Consented for up to 54 turbines at a capacity of 450MW	2025 – 2049	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Norfolk Boreas	Under construction	427	Consented for up to 158 turbines at a capacity of 1,400MW	2030 – 2054	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Norfolk Vanguard (East and West Offshore Windfarms)	Under construction	431	Proposed for up to 200 turbines at a capacity of 1,400MW	2028 – 2052	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
North Falls	Application submitted/awaiting decision	540	Proposed for up to 71 turbines at a capacity of 504MW	2030 – 2054	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Ossian	Application submitted	5	Proposed for up to 3,610MW capacity	2039 - unknown	The Ossian construction phase overlaps with the Morven North and Morven South construction window for six years, before Ossian is operational for a further four years of the Morven North and Morven South construction window. There are then many

Project/plan	Status	Distance from Morven South (km)	Description of project/plan	Estimated dates of operation (If applicable)	Overlap with Morven South
					years of operation phase overlap between the two projects
Outer Dowsing	Consented	335	Proposed for up to 1.5GW capacity	2030 - unknown	Target operation phase overlaps with Morven South construction phase and operation and maintenance phase
Pentland Floating Offshore Wind	Under construction	288	Consented for up to 10 turbines at a capacity of 100MW	2027 – 2055	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Race Bank	Operational	358	Consists of up to 91 turbines at a capacity of 573MW	until 2043	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Rampion	Operational	639	Consists of up to 116 turbines at a capacity of 400MW	until 2043	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Rampion 2 (Rampion Extension)	Under construction	640	Proposed for up to 116 turbines at a capacity of 1,200MW	2030 – 2060	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
INTOG: Salamander	Consented/pre-construction	106	Proposed for up 100MW capacity	2029 - unknown	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
SeaGreen 1	Operational	35	Consists of up to 114 turbines at a capacity of 1,075MW	until 2048	Operation phase overlaps with Morven South construction phase

Project/plan	Status	Distance from Morven South (km)	Description of project/plan	Estimated dates of operation (If applicable)	Overlap with Morven South
SeaGreen 1A	Under construction	52	Consented for up to 36 turbines with no maximum generating capacity	2026 – 2046	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Sheringham Shoal Dudgeon Extension	Under construction	374	Proposed for up to 27 turbines at a capacity of 317MW	2026 – 2056	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Sofia	Under construction	224	Consists of up to 100 turbines at a capacity of 1,400MW	2026 – 2049	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Teesside	Operational	200	Consists of 27 turbines at a capacity of 62MW	until 2038	Operation phase overlaps with six years of the Morven North and Morven South construction window. There will be one year of operation phase overlap between either Morven North or Morven South, depending on the sequence of construction of Morven North and Morven South
Thanet	Operational	575	Consists of up to 100 turbines at a capacity of 300MW	until 2050	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
Triton Knoll	Operational	337	Consists of up to 90 turbines at a capacity of 857MW	until 2047	Operation phase overlaps with Morven South construction phase and operation and maintenance phase
West of Orkney Wind Farm	Applicant submitted	311	Proposed for up to 125 turbines at a capacity of 2,000MW	2030 – 2055	Operation phase overlaps with Morven South construction phase and operation and maintenance phase

Project/plan	Status	Distance from Morven South (km)	Description of project/plan	Estimated dates of operation (If applicable)	Overlap with Morven South
Westermost Rough	Operational	294	Consists of up to 35 turbines at a capacity of 210MW	until 2040	Operation phase overlaps with eight years of the Morven North and Morven South construction window. Operation overlap with the Morven South operation phase depends on the sequence of construction of Morven North and Morven South

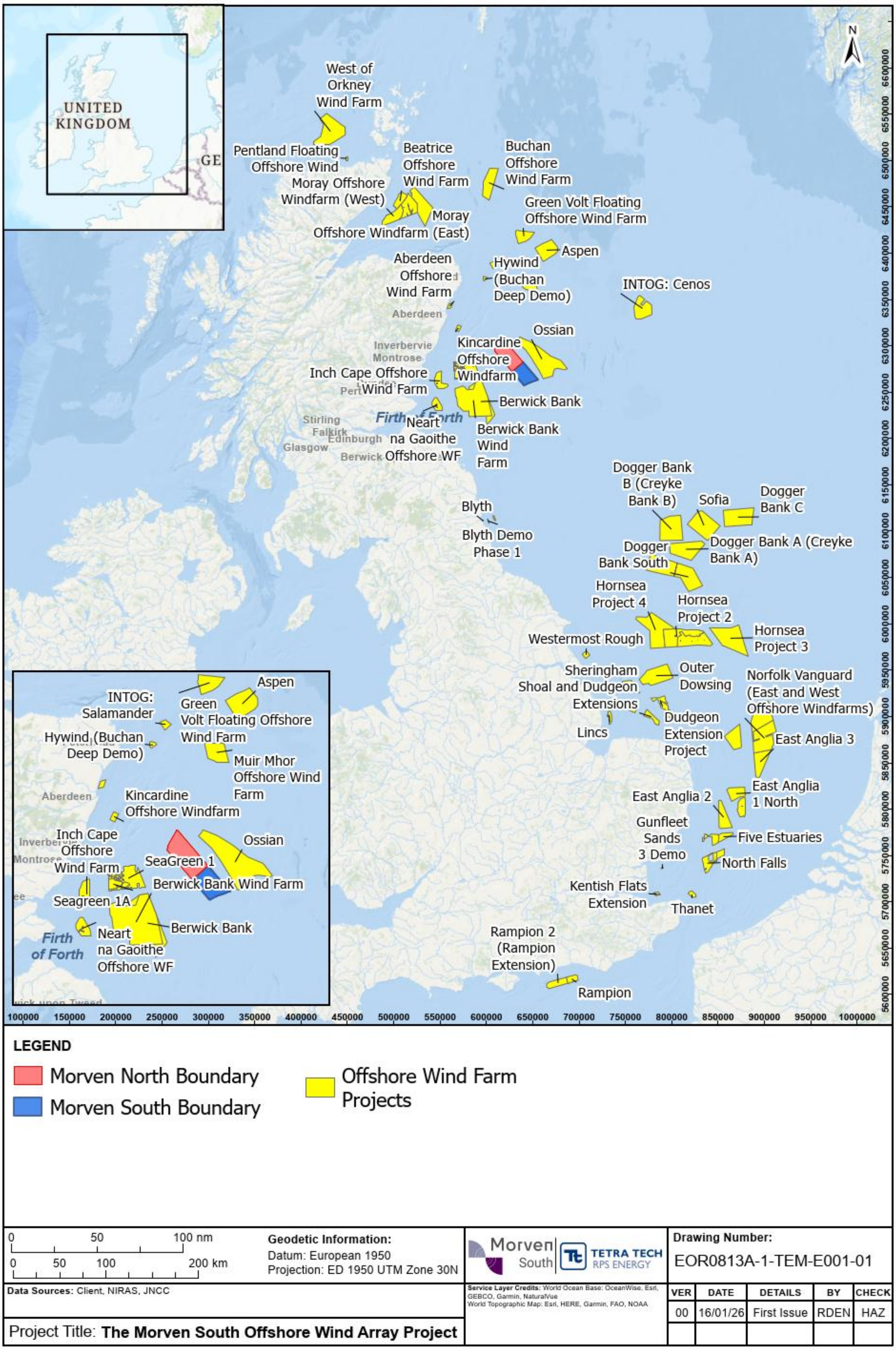

Figure 11.3: Other projects/plans screened into the cumulative effects assessment for offshore ornithology

11.12.2 Maximum Design Scenario

11.12.2.1 The cumulative MDSs identified in Table 11.49 have been selected as those having the potential to result in the greatest potential cumulative effect on an identified receptor or receptor group. The cumulative MDSs have been based on the Morven South alone assessment MDS (Table 11.25), as well as publicly available information on other third party projects and plans that have been screened into the CEA (Table 11.48).

Table 11.49: Maximum Design Scenario considered for the assessment of potential whole project, Morven Programme and cumulative effects on Offshore ornithology

C= Construction, O= Operations and maintenance, D= Decommissioning phases

Potential Cumulative Effect	Phase			Maximum Design Scenario	Justification
	C	O	D		
Collision with rotating blades	x	✓	x	There are no collision risk impacts associated with the MHPGC Project and MBAGC Project and therefore only scenarios 3 and 4 are relevant to the cumulative assessment of collision risk. **Scenario 3** MDS as described for Morven South (Table 11.25), assessed cumulatively with Morven North. **Scenario 4** MDS as described for Morven South (Table 11.25), assessed cumulatively with Morven North, and the following other projects and plans: **Tier 1** • Aberdeen • Aspen • Beatrice • Berwick Bank • Blyth Demo • Buchan • Caledonia • Cenos • Dogger Bank A + B • Dogger Bank C + Sofia • Dogger Bank South • Dudgeon • East Anglia One	There is potential for a cumulative effect from operations and maintenance activities and so a quantitative cumulative effect assessment is required.

Potential Cumulative Effect	Phase			Maximum Design Scenario	Justification
	C	O	D		
				• East Anglia ONE North • East Anglia THREE • East Anglia TWO • Five Estuaries • Galloper • Green Volt • Gunfleet Sands 3 • Hornsea FOUR • Hornsea Project ONE • Hornsea Project THREE • Hornsea Project TWO • Inch Cape • Kentish Flats • Kentish Flats Extension • Kincardine • Lincs • Moray East • Moray West • Muir Mhor • Neart na Gaoithe • Norfolk Boreas • Norfolk Vanguard • North Falls • Ossian • Outer Dowsing	

Potential Cumulative Effect	Phase			Maximum Design Scenario	Justification
	C	O	D		
				• Pentland • Race Bank • Rampion • Rampion 2 • Salamander • SeaGreen (Alpha & Bravo) • Sheringham Shoal and Dudgeon Extensions • Thanet • Triton Knoll • West of Orkney • Westermost Rough	
Displacement	x	✓	x	There are no displacement impacts associated with the MHPGC Project and MBAGC Project and therefore only scenarios 3 and 4 are relevant to the cumulative assessment of displacement.Scenario 3 MDS as described for Morven South (Table 11.25), assessed cumulatively with Morven North, MHPGC and MBAGC Project. **Scenario 4** MDS as described for Morven South (Table 11.25), assessed cumulatively with Morven North, MHPGC Project and MBAGC Project and the following other projects and plans: **Tier 1** • Aberdeen • Aspen • Beatrice	There is potential for a cumulative effect from operations and maintenance activities, so a detailed, quantitative cumulative effect assessment is required.

Potential Cumulative Effect	Phase			Maximum Design Scenario	Justification
	C	O	D		
				• Berwick Bank • Blyth Demo • Buchan • Caledonia • Cenos • Dogger Bank A + B • Dogger Bank C + Sofia • Dogger Bank South • Dudgeon • East Anglia One • East Anglia ONE North • East Anglia THREE • East Anglia TWO • Five Estuaries • Galloper • Green Volt • Gunfleet Sands 3 • Hornsea FOUR • Hornsea Project ONE • Hornsea Project THREE • Hornsea Project TWO • Inch Cape • Kentish Flats • Kentish Flats Extension • Kincardine	

Potential Cumulative Effect	Phase			Maximum Design Scenario	Justification
	C	O	D		
				• Lincs • Moray East • Moray West • Muir Mhor • Neart na Gaoithe • Norfolk Boreas • Norfolk Vanguard • North Falls • Ossian • Outer Dowsing • Pentland • Race Bank • Rampion • Rampion 2 • Salamander • SeaGreen (Alpha & Bravo) • Sheringham Shoal and Dudgeon Extensions • Thanet • Triton Knoll • West of Orkney • Westermost Rough	

11.13 Whole project assessment, Morven Programme assessment and Cumulative Effects Assessment

11.13.1 Overview

11.13.1.1 A description of the significance of whole project, Morven Programme and cumulative effects upon offshore ornithology receptors arising from each identified impact is given below. The whole project assessment, Morven Programme assessment and CEA for Morven South is presented for each species of relevance in Section 11.13.2 for collision with rotating blades, Section 11.13.3 for displacement and Section 11.13.4 for combined collision and displacement.

11.13.1.2 The CEA is limited by the data available upon which to base the assessment. Due to the age of developments in the North Sea and surrounding areas which have the potential to have a cumulative impact upon receptors, few have comparable datasets upon which to base an assessment. However, every effort has been made to obtain quantitative estimates for both displacement and collision from project-specific documentation. For displacement impacts this includes following the approach applied by many previous offshore wind farms using any available population data to calculate mean-peak or peak population estimates for use in displacement analyses.

11.13.2 Collision with rotating blades

11.13.2.1 Morven South, together with other offshore wind farms in the North Sea, may contribute to cumulative collision risk, in the event the operations phases of different projects overlap. Seabirds are highly mobile, therefore they can encounter different offshore wind farms, and be at risk of collisions, across large areas. The MDS presented in Table 11.49 incorporates both Morven South and Morven North in addition to a further 56 offshore wind farms that may impact Offshore ornithology receptors. There are no collision risk impacts associated with the MHPGC Project and MBAGC Project. The whole project assessments associated with Scenario 1 and 2 are therefore not required and consideration of the MHPGC Project or MBAGC Project as part of Scenario 3 is also not required. Scenario 3 will therefore incorporate Morven South and Morven North only.

11.13.2.2 The following species are considered in relation to cumulative collision risk impacts: kittiwake, great black-backed gull, and gannet. The predicted impact for all of these species surpassed the 0.2 birds/annum recommended by NatureScot (pre-application consultation undertaken on 28 January 2025; Table 11.7) as a threshold for when a cumulative assessment is required and therefore assessments are presented for all four species. However, the predicted collision risk estimate associated with Morven South for great black-backed gull in the breeding season was zero and therefore Morven South will not contribute to impacts on this species during this season.

11.13.2.3 As stated, data used within the assessment of cumulative collision risk is based on published information produced by the respective project developers. As such, the input parameters (e.g. avoidance rates) and the collision risk model used (e.g. deterministic) may vary from those put forward in this chapter which is based on the most up to date understanding of collision risk. Where possible collision risk estimates derived for previous projects have been corrected to account for changes in certain parameters (e.g. avoidance rate). However, it is often not possible to correct for changes in other parameters (e.g. flight speed, nocturnal activity) and therefore collision risk estimates for other projects are used as presented in project-specific documentation. Discussion is provided for each species in relation to the effect updating these parameters may have on resulting cumulative totals. The collision risk estimates relevant to each project considered in the cumulative assessment are presented in the following tables for each species:

- Kittiwake - Table 11.50;
- Great black-backed gull - Table 11.53;
- Gannet - Table 11.56.

11.13.2.4 The summaries of the Morven Programme assessments and cumulative assessments for each species for collision are presented in Table 11.51 to Table 11.58.

Kittiwake

11.13.2.5 The predicted impact on kittiwake from the Morven Programme is presented in Table 11.50. In all three seasons (breeding, post breeding and pre-breeding) and on an annual basis the estimated percentage point increase in baseline mortality of kittiwake remains well below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). Additional analysis including PVA modelling is therefore not required.

11.13.2.6 The predicted mean seasonal and annual collision mortality for kittiwake has been compiled for relevant wind farms and is shown in Table 11.50. Projects considered to act cumulatively with Morven South in the breeding season are those within the mean-maximum foraging range (+1SD) of kittiwake from Morven South. In the non-breeding seasons, projects considered to act cumulatively with Morven South are those within the relevant BDMPS area from Furness (2015). The seasonal extents used are consistent with those used in the assessment for Morven South. All collision risk estimates are calculated using an avoidance rate of either 99.23% or 99.29% depending on whether collision risk estimates for each project were calculated deterministically or stochastically (Ozsanlav-Harris *et al*., 2023). Total collision risk estimates presented in brackets in Table 11.50 are those calculated incorporating the collision risk estimates for Morven South calculated when applying the Applicant's parameters.

11.13.2.7 For the cumulative assessment, in all three seasons (breeding, post breeding, and pre-breeding) and on an annual basis, the estimated percentage point increase in baseline mortality exceeds the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h) when applying the collision parameters recommended by NatureScot and the Applicant. As a result PVA modelling has been conducted for all seasons and an annual basis. The outputs of this process are presented in Table 11.51.

Table 11.50: Expected seasonal and annual collision mortality across relevant wind farms for kittiwake. Collision risk estimates are calculated applying NatureScot's recommended parameters. For Morven South and Morven North, the collision risk estimates calculated applying the Applicant's recommended parameters are shown in brackets (grey cells indicate projects that do not contribute alongside Morven South in relevant seasons)

Project	Breeding	Post-breeding	Pre-breeding	Annual
Morven Programme assessment				
Morven North	19.8 (4.5)	2.3 (0.5)	2.8 (0.6)	25.0 (5.6)
Morven South	6.6 (1.5)	1.6 (0.4)	2.0 (0.5)	10.2 (2.4)
Total	26.5 (6.0)	3.9 (0.9)	4.9 (1.1)	35.2 (8.0)
Change in baseline mortality (% point change)	0.004 (0.001)	<0.001 (<0.001)	0.001 (<0.001)	0.004 (0.001)
Tier 1				
Aberdeen	10.1	2.4	0.5	13.1
Aspen	7.3	1.1	2.5	11.0
Beatrice	73.1	8.3	19.8	101.3
Berwick Bank	398.2	115.6	122.7	636.5
Blyth Demo	1.4	1.3	1.1	3.8
Buchan	3.6	1.4	3.3	8.2
Caledonia North	20.0	5.2	1.8	27.1
Caledonia South	43.5	2.8	3.8	50.2
Cenos	8.0	2.9	2.1	13.0
Dogger Bank A + B	198.0	74.9	230.3	503.2
Dogger Bank South	122.5	80.5	101.3	304.2
Dogger Bank C + Sofia	89.8	55.6	165.7	311.2
Dudgeon Extension		3.3	3.0	6.3

Project	Breeding	Post-breeding	Pre-breeding	Annual
East Anglia One		113.3	32.2	145.5
East Anglia ONE North		5.7	12.2	17.9
East Anglia THREE		48.6	24.5	73.1
East Anglia TWO		4.3	10.3	14.6
Five Estuaries		8.0	12.3	20.3
Galloper		18.7	20.6	39.3
Green Volt	5.5	5.6	2.9	14.0
Hornsea Project ONE		5.1	3.0	8.1
Hornsea Project TWO		4.7	2.9	7.6
Hornsea Project THREE		26.9	21.5	48.4
Hornsea FOUR	43.2	9.0	7.8	60.0
Humber Gateway		1.7	1.5	3.1
Inch Cape	27.3	18.9	4.2	50.4
Kentish Flats Extension		0.6	0.6	1.2
Kincardine	14.4	6.3	1.8	22.4
Lincs		0.6	0.6	1.2
Moray East	15.2	0.4	6.1	21.7
Moray West	54.9	16.5	4.9	76.3
Muir Mhor	65.7	0.9	8.3	74.9
Neart na Gaoithe	5.0	13.4	1.2	19.6
Norfolk Boreas		22.6	10.3	32.9
Norfolk Vanguard		11.4	21.0	32.4

Project	Breeding	Post-breeding	Pre-breeding	Annual
North Falls		3.6	11.0	14.6
Ossian	28.5	5.4	6.3	40.3
Outer Dowsing		3.1	14.0	17.1
Pentland	4.9	0.7	0.0	5.6
Race Bank		11.8	3.9	15.7
Salamander	9.0	0.0	0.0	9.0
SeaGreen (Alpha & Bravo)	83.6	105.4	53.9	242.9
Sheringham Shoal Extension		0.8	0.3	1.1
Teesside	41.5	9.0	6.4	56.9
Thanet		0.0	0.0	0.0
Triton Knoll		69.6	48.3	117.9
West of Orkney		16.1	21.6	37.6
Westermost Rough	0.1	0.1	0.1	0.3
Total	1400.9 (470.6)	928.2 (336.5)	1039.0 (373.8)	3368.1 (1,181.0)
Change in baseline mortality (% point change)	0.243 (0.082)	0.112 (0.041)	0.165 (0.060)	0.406 (0.142)

Table 11.51: Summary of Population Viability Analysis results for cumulative collision impacts on kittiwake after 35 years as a result of impacts associated with the cumulative assessment

Scenario	Predicted mortality (no. of birds)	Increase in baseline mortality (% point change)	Median population size (no. of birds)	Growth Rate (Annual GR)	Change in population (%)	Median CGR	Median CPS	Quantile – unimpacted: 50%impacted
Cumulative assessment								
Breeding								
Baseline	-	-	654,774	1.0025	9.28	-	-	-
NatureScot	1,400.9	0.243	591,728	0.9996	-1.32	0.9971	0.9042	40.4
Applicant	470.6	0.082	632,657	1.0016	5.65	0.9990	0.9667	46.7
Post-breeding								
Baseline	-	-	965,263	1.0029	10.66	-	-	-
NatureScot	928.2	0.112	922,275	1.0016	5.61	0.9987	0.9546	46.2
Applicant	336.5	0.041	950,074	1.0024	8.71	0.9995	0.9833	48.7
Pre-breeding								
Baseline	-	-	729,117	1.0029	10.53	-	-	-
NatureScot	1,039.0	0.165	681,760	1.0009	3.35	0.9980	0.9335	44.2
Applicant	373.8	0.060	712,186	1.0022	8.08	0.9993	0.9756	47.7
Annual								
Baseline	-	-	965,263	1.0029	10.66	-	-	-
NatureScot	3,368.1	0.406	815,209	0.9981	-6.44	0.9952	0.8448	36.2
Applicant	1,181.0	0.142	910,026	1.0012	4.36	0.9983	0.9428	45.0

Table 11.52: Morven South cumulative effects assessment for kittiwake in relation to collision with rotating blades

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
Operations and maintenance phase		
Magnitude of impact	The cumulative effects assessment for Scenario 3 considers the relevant elements of the Morven Programme (Morven South and Morven North). The estimated percentage point increase in baseline mortality associated with the impact predicted for the Morven Programme remains below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h) (Table 11.50). This conclusion is applicable when modelling using the parameters advocated by both NatureScot and the Applicant and therefore additional analysis including PVA modelling is not required. The cumulative effect is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be negligible.	The cumulative effects assessment for Scenario 4 considers Morven South together with the Tier 1 (including Morven North), Tier 2 and Tier 3 projects where suitable data to inform the assessment are available. Breeding season The magnitude of the cumulative effect of these projects in the breeding season may result in 1,400.9 (470.6) collisions/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for kittiwake when applying the breeding season impact calculated using NatureScot's and the Applicant's advocated parameters indicates a median Counterfactual of Population Size (CPS) of 0.9042 to 0.9667; (i.e. the population after 35 years, would be 3.33 to 9.58% smaller than the CPS with a 50th percentile value of 40.4 to 46.7 (Table 11.51)). In terms of the population size, this means that the median of the impacted population fell within the 40^{th} to 47^{th} percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario is still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the Counterfactual of Growth Rate (CGR) is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9971 to 0.9990 which translates to a growth rate 0.10 to 0.29% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would be undetectable against natural fluctuations in the growth rate currently seen in the regional population. It is also important to note that the contribution of Morven

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		South to the cumulative total is only 0.47% and is considered to represent an immaterial contribution to the existing cumulative impact. The Scottish breeding population of kittiwake has decreased between the two most recent national censuses with a decline of 57% (Burnell *et al.*, 2023) with this also reflected on a UK scale of 43% (Burnell *et al.*, 2023). Surveys in 2023, aimed at detecting changes in seabird breeding populations due to HPAI showed an overall 8% increase in breeding kittiwakes compared to pre-HPAI counts from monitored sites (Tremlett *et al.*, 2024). Despite the current declining trend in the kittiwake breeding population at both a Scottish and UK scale, the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would accelerate such declines to a measurable extent. As a result the magnitude of impact on the kittiwake population in the breeding season is considered to be of low magnitude. This conclusion is reached by also considering the over-estimation of both the predicted impact and PVA outputs caused by the following factors: • Over-estimation of cumulative impacts. The PVA modelling does not account for changes in the predicted cumulative total due to the decommissioning of projects considered cumulatively. Over the lifetime of Morven South the cumulative impact will reduce significantly when licences for current projects expire and decommissioning occurs. The PVA metrics are therefore highly precautionary. • No consideration has been made for density dependent compensation of demographic parameters within the modelled population, nor immigration, both of which could reduce the magnitude of any population change. • The use of grouped avoidance rates (99.29%) instead of species-specific avoidance rates (99.79%) which over-estimates the collision risk for kittiwake by over three times and the use of flight speeds that do not provide a robust representation of the behaviour of kittiwake in the modelling conducted for projects considered cumulatively (with an approximate 27% reduction if more

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		robust flight speeds are used (Ørsted, 2018)) (see Volume 3, Annex 11.2 Offshore Ornithology Collision Risk Modelling Report for more information). • For a number of recent projects, it has been concluded as part of the Appropriate Assessments conducted that the predicted in-combination impacts are at a magnitude that represents an AEOI on the integrity on a number of SPAs. As a result these projects have been required to submit derogation cases which include compensation measures. For kittiwake this is applicable to Berwick Bank, Buchan, Caledonia North, Caledonia South, Cenos, Dogger Bank South, Dudgeon Extension, East Anglia One North, East Anglia Two, Five Estuaries, Green Volt, Hornsea Three, Hornsea Four, Muir Mhor, Norfolk Boreas, Norfolk Vanguard, North Falls, Ossian, Outer Dowsing, Rampion 2, Salamander, Sheringham Shoal Extension and West of Orkney. The compensatory measures associated with these projects will work to ensure there is no residual effect of these projects on the kittiwake features of relevant SPAs which form part of the regional population used as part of the cumulative assessments for Morven South. The impacts associated with these projects should theoretically be reduced to take account of the proposed compensation measures within the assessments presented above, which would lead to reduced impact magnitudes and improved PVA metrics. Post-breeding season The magnitude of the cumulative effect of these projects in the post-breeding season may result in 928.2 (336.5) collisions/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for kittiwake when applying the post-breeding season impact calculated using NatureScot's and the Applicant's advocated parameters indicates a median CPS of 0.9546 to 0.9833; i.e. the population after 35 years, would be to 1.67 to 4.54 % smaller than the CPS with a 50th percentile value of 46.2 to 48.7 (Table 11.51).

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		In terms of the population size, this means that the median of the impacted population fell within the 46th to 49th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario is still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9987 to 0.9995 which translates to a growth rate 0.05 to 0.13% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would be undetectable against natural fluctuations in the growth rate currently seen in the regional population. However, it is also important to note that the contribution of Morven South to the cumulative total is only 0.17% and is considered to represent an immaterial contribution to the existing cumulative impact. The UK population is the largest contributor to the post-breeding season BDMPS. Despite the current declining trend in the kittiwake breeding population at both a Scottish and UK scale, the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would accelerate such declines to a measurable extent. When taking into account the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the kittiwake population is considered to be of low magnitude. <u>Pre-breeding season</u> The magnitude of the cumulative effect of these projects in the pre-breeding season may result in 1,039.0 (373.8) collisions/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted.

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		The PVA model conducted for kittiwake when applying the pre-breeding season impact calculated using NatureScot's and the Applicant's advocated parameters indicates a median CPS of 0.9335 to 0.9756; i.e. the population after 35 years, would be 2.44 to 6.65% smaller than the CPS with a 50th percentile value of 44.2 to 47.7 (Table 11.51). In terms of the population size, this means that the median of the impacted population fell within the 44th to 47th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario is still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9980 to 0.9993 which translates to a growth rate 0.07 to 0.20% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would be undetectable against natural fluctuations in the growth rate currently seen in the regional population. However, it is also important to note that the contribution of Morven South to the cumulative total is only 0.19% and is considered to represent an immaterial contribution to the existing cumulative impact. The UK population is the largest contributor to the pre-breeding season BDMPS. Despite the current declining trend in the kittiwake breeding population at both a Scottish and UK scale, the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would accelerate such declines to a measurable extent. When taking into account the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the kittiwake population is considered to be of low magnitude. Annual

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		The magnitude of the cumulative effect of these projects on an annual basis may result in 3,368.1 (1,181.0) collisions/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for kittiwake when applying the annual season impact calculated using NatureScot's and the Applicant's advocated parameters indicates a median CPS of 0.8448 to 0.9428; i.e. the population after 35 years, would be 5.72 to 15.52% smaller than the CPS with a 50th percentile value of 36.2 to 45.0 (Table 11.51). In terms of the population size, this means that the median of the impacted population fell within the 36th to 45th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario is still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9952 to 0.9983 which translates to a growth rate 0.17 to 0.48% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would be undetectable against natural fluctuations in the growth rate currently seen in the regional population. However, it is also important to note that the contribution of Morven South to the cumulative total is only 0.30% and is considered to represent an immaterial contribution to the existing cumulative impact. The UK population is the largest contributor to the population used to inform the assessment of the annual impact. Despite the current declining trend in the kittiwake breeding population at both a Scottish and UK scale, the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would accelerate such declines to a measurable extent.

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		When taking into account the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the kittiwake population is of low magnitude.
Sensitivity of receptor	The sensitivity of kittiwake is considered to be as described for the assessment of Morven South alone (see paragraphs 11.11.4.14 to 11.11.4.17). Kittiwake is deemed to be of high vulnerability, low recoverability, and international conservation value. The sensitivity of the receptor is therefore considered to be high.	The sensitivity of kittiwake is considered to be as described for the assessment of Morven South alone (see paragraphs 11.11.4.14 to 11.11.4.17). Kittiwake is deemed to be of high vulnerability, low recoverability, and international conservation value. The sensitivity of the receptor is therefore considered to be high.
Significance of effect	Overall the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect on kittiwake will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.	Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect on kittiwake will, therefore, be of minor to moderate adverse significance. Due to the factors identified above that lead to considerable of over-estimation of the cumulative impact, the limited contribution of Morven South to this total and the PVA results suggesting that the predicted impact will have an insignificant impact on the growth rate of the population, the impact is considered minor. It is therefore deemed appropriate to categorise the impact as having a **minor adverse** significance, which is not significant in EIA terms.
Further mitigation and residual significance	No mitigation measures for kittiwake in relation to collision risk are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.	No mitigation measures for kittiwake in relation to collision risk are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

Great black-backed gull

11.13.2.8 The predicted impact on great black-backed gull from the Morven Programme is presented in Table 11.53. The collision risk associated with Morven North and Morven South in the breeding season is zero collisions. As such, following NatureScot guidance, as the impact is below 0.2 collisions/annum no cumulative assessment is required for great black-backed gull in the breeding season. In the non-breeding season and on an annual basis the estimated percentage point increase in baseline mortality of great black-backed gull remains well below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). Additional analysis including PVA modelling is therefore not required.

11.13.2.9 The predicted mean seasonal and annual collision mortality for great black-backed gull has been compiled for relevant wind farms and is shown in Table 11.56. The contribution of Morven South to the existing cumulative total is zero collisions. As such, following NatureScot guidance, as the impact is below 0.2 collisions/annum no cumulative assessment is required for great black-backed gull in the breeding season. However, consideration of the impact from other projects is still considered in order to calculate the annual impact on the species.

11.13.2.10 Projects considered to contribute to the cumulative impact in the breeding season are those within the mean-maximum foraging range (+1SD) of great black-backed gull from Morven South. In the non-breeding seasons, projects considered to act cumulatively with Morven South are those within the relevant BDMPS area from Furness (2015). The seasonal extents used are consistent with those used in the assessment for Morven South. All collision risk estimates are calculated using an avoidance rate of either 99.36% or 99.4% depending on whether collision risk estimates for each project were calculated deterministically or stochastically (Ozsanlav-Harris *et al*., 2023). Total collision risk estimates presented in brackets in Table 11.56 are those calculated incorporating the collision risk estimates for Morven South calculated when applying the Applicant's parameters.

11.13.2.11 For the cumulative assessment, in the non-breeding season and on an annual basis, the estimated percentage point increase in baseline mortality exceeds the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h) when applying the collision parameters recommended by NatureScot and the Applicant. As a result PVA modelling has been conducted for the non-breeding season and an annual basis. The outputs of this process are presented in Table 11.56.

Table 11.53: Expected seasonal and annual collision mortality across relevant wind farms for great black-backed gull. Collision risk estimates are calculated applying NatureScot's recommended parameters. For Morven South and Morven North, the collision risk estimates calculated applying the Applicant's recommended parameters are shown in brackets (grey cells indicate projects that do not contribute alongside Morven South in relevant seasons)

Project	Breeding	Non-breeding	Annual
Morven programme assessment			
Morven North	0.0 (0.0)	0.9 (0.1)	0.9 (0.1)
Morven South	0.0 (0.0)	1.5 (0.2)	1.5 (0.2)
Total	0.0 (0.0)	2.3 (0.3)	2.3 (0.3)
Change in baseline mortality (% point change)	<0.001 (<0.001)	0.003 (<0.001)	0.003 (<0.001)
Tier 1			
Aberdeen		3.1	3.1
Aspen		9.3	9.3
Beatrice		130.7	130.7
Blyth Demo		6.1	6.1
Buchan		2.9	2.9
Caledonia		15.0	15.0
Dogger Bank A		14.4	14.4
Dogger Bank B		20.8	20.8
Dogger Bank South		4.7	4.7
Dogger Bank C		15.4	15.4
Sofia		18.4	18.4
Dudgeon Extension		1.7	1.7
East Anglia One		52.7	52.7

Project	Breeding	Non-breeding	Annual
East Anglia ONE North		1.2	1.2
East Anglia THREE		44.7	44.7
East Anglia TWO		2.2	2.2
Five Estuaries		9.2	9.2
Galloper		26.4	26.4
Green Volt		8.2	8.2
Hornsea Project ONE		91.3	91.3
Hornsea Project TWO		23.2	23.2
Hornsea Project THREE		34.2	34.2
Hornsea FOUR		10.6	10.6
Humber Gateway		4.9	4.9
Kentish Flats Extension		0.2	0.2
Moray East		7.4	7.4
Moray West		6.8	6.8
Muir Mhor		17.2	17.2
Neart na Gaoithe		1.6	1.6
Norfolk Boreas		38.5	38.5
Norfolk Vanguard		28.0	28.0
North Falls		1.9	1.9
Outer Dowsing		3.4	3.4
Pentland		0.0	0.0
Salamander		3.0	3.0

Project	Breeding	Non-breeding	Annual
Sheringham Shoal Extension		5.6	5.6
Teesside		45.4	45.4
Thanet		0.6	0.6
Triton Knoll		142.3	142.3
West of Orkney		10.9	10.9
Westermost Rough		0.1	0.1
Total	0.0 (0.0)	868.9 (123.1)	868.9 (123.1)
Change in baseline mortality (% point change)	Not required	0.951 (0.135)	0.951 (0.135)

Table 11.54: Summary of Population Viability Analysis results for cumulative collision impacts on great black-backed gull after 35 years as a result of impacts associated with the cumulative assessment

Scenario	Predicted mortality (no. of birds)	Increase in baseline mortality (% point change)	Median population size (no. of birds)	Growth Rate (Annual GR)	Change in population (%)	Median CGR	Median CPS	Quantile – unimpacted: 50% impacted
Cumulative assessment								
Non-breeding								
Baseline	-	-	290,103	1.0208	105.39	-	-	-
NatureScot	868.9	0.951	193,680	1.0090	37.00	0.9885	0.6675	15.5
Applicant	123.1	0.135	274,084	1.0191	94.10	0.9984	0.9447	44.2
Annual								
Baseline	-	-	290,103	1.0208	105.39	-	-	-
NatureScot	868.9	0.951	193,680	1.0090	37.00	0.9885	0.6675	15.5
Applicant	123.1	0.135	274,084	1.0191	94.10	0.9984	0.9447	44.2

Table 11.55: Morven South cumulative effects assessment for great black-backed gull in relation to collision with rotating blades

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
Operations and maintenance phase		
Magnitude of impact	The Cumulative Effects Assessment for Scenario 3 considers the relevant elements of the Morven Programme (Morven South and Morven North). The estimated percentage point increase in baseline mortality associated with the impact predicted for the Morven Programme remains below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h) (Table 11.53). This conclusion is applicable when modelling using the parameters advocated by both NatureScot and the Applicant and therefore additional analysis including PVA modelling is not required. The cumulative effect is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be negligible.	The cumulative effects assessment for Scenario 4 considers Morven South together with the Tier 1 (including Morven North), Tier 2 and Tier 3 projects where suitable data to inform the assessment are available. <u>Breeding season</u> The contribution of Morven South to the existing cumulative total is zero collisions. As such, following NatureScot guidance, as the impact is below 0.2 collisions/annum no cumulative assessment is required for great black-backed gull in the breeding season. <u>Non-breeding season</u> The magnitude of the cumulative effect of these projects in the non-breeding season may result in 868.9 (123.1) collisions/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for great black-backed gull when applying the non-breeding season impact calculated using NatureScot's and the Applicant's advocated parameters indicates a median CPS of 0.6675 to 0.9447; i.e. the population after 35 years, would be 5.53 to 33.25% smaller than the CPS with a 50th percentile value of 15.5 to 44.2 (Table 11.51). In terms of the population size, this means that the median of the impacted population fell within the 15th to 44th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that, if both the NatureScot and Applicant's approach was applied, this level of impact could have an adverse effect on the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		predicted a median CGR of 0.9885 to 0.9984 which translates to a growth rate 0.16 to 1.15 % smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact could be noticeable against natural fluctuations within the population if the upper rate was applied. However, it is also important to note that the contribution of Morven South to the cumulative total is only 0.17% and is considered to represent an immaterial contribution to the existing cumulative impact. The Scottish breeding population of great black-backed gull, which contributes to the non-breeding population, has decreased between the two most recent national censuses with a decline of 63% (Burnell et al., 2023) with this also reflected on a UK scale (52%; Burnell et al., 2023). Surveys in 2023, aimed at detecting changes in seabird breeding populations due to HPAI showed an overall 20% decrease in breeding great black-backed gull compared to pre-HPAI counts from monitored sites (Tremlett et al., 2024). A significant proportion of the non-breeding population of great black-backed gull originates from outside of the UK, particularly the Barents Sea primarily Norway (67% of total BDMPS population) (Furness, 2015). The great black-backed gull population in Norway has shown a short-term decline (Burnell et al., 2023). It is however important to understand the magnitude of over-estimation inherent in the cumulative total predicted in Table 11.53. This over-estimation is the result of the following elements of the assessment process: • The use of grouped avoidance rates (99.4%) instead of species-specific avoidance rates (99.91%) which over-estimates the collision risk for great black-backed gull by over six times and the use of flight speeds that do not provide a robust representation of the behaviour of great black-backed gull in the modelling conducted for projects considered cumulatively (with an approximate 20% reduction if more robust flight speeds are used (Ørsted, 2018)) (see Volume 3, Annex 11.2 Offshore Ornithology Collision Risk Modelling Report for more information). • For the West of Orkney offshore wind farm, it has been concluded as part of the Appropriate Assessments conducted that the predicted in-combination impact

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		is at a magnitude that represents an AEOI on the integrity of the East Caithness Cliffs SPA. As a result this project has been required to a submit derogation case which includes compensation measures for great black-backed gull. The compensatory measures associated with this project will work to ensure there is no residual effect of this project on the great black-backed gull feature of this SPA. The impact associated with this project should theoretically be reduced to take account of the proposed compensation measures within the assessments presented above, which would lead to reduced impact magnitudes and improved PVA metrics. This therefore results in PVA outputs that suggest population trends that are exaggerated. Further to this the PVA model is also affected by other elements of over-estimation including: • Over-estimation of cumulative impacts. The PVA modelling does not account for changes in the predicted cumulative total due to the decommissioning of projects considered cumulatively. Over the lifetime of Morven South, the cumulative impact will reduce significantly when licences for current projects expire and decommissioning occurs. The PVA metrics are therefore highly precautionary. • No consideration has been made for density dependent compensation of demographic parameters within the modelled population, nor immigration, both of which could reduce the magnitude of any population change. The largest contributors to the non-breeding season BDMPS are the Barents Sea and the UK both of which have experienced declines in the short-term (Burnell et al., 2023). Despite the current declining trend in the great black-backed gull breeding population at both a Scottish, UK and international scale, the predicted effect on the growth rate as predicted by PVA modelling is not considered representative and when the factors resulting in an over-estimation of the cumulative impact are taken into account it is considered that the cumulative impact is not of a magnitude that would accelerate such

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		declines to a measurable extent. As a result the magnitude of impact on the great black-backed gull population in the non-breeding season is considered to be of low magnitude. Annual The magnitude of the cumulative effect of these projects on an annual basis may result in 868.9 (123.1) collisions/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for great black-backed gull when applying the annual impact calculated using NatureScot's and the Applicant's advocated parameters indicates a median CPS of 0.6675 to 0.9447; i.e. the population after 35 years, would be 33.25 to 5.53% smaller than the CPS with a 50th percentile value of 15.50 to 44.18 (Table 11.51). In terms of the population size, this means that the median of the impacted population fell within the 15th to 44th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that, if both the NatureScot and Applicant's approach was applied, this level of impact could have an adverse effect on the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9885 to 0.9984 which translates to a growth rate 1.15 to 0.16% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact could be noticeable against natural fluctuations within the population if the upper rate was applied, resulting in an adverse effect on the population rate 1.15% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would be small and could be noticeable against natural fluctuations within the population but would not result in an adverse effect on the population. It is also important to note that the contribution of Morven South to the cumulative total is only 0.17% and is considered to represent an immaterial contribution to the existing cumulative impact.

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		When taking into account the factors that result in an over-estimation of the cumulative impact discussed in relation to the non-breeding season impact above, it is considered that the magnitude of impact on the great black-backed gull population is of low magnitude.
Sensitivity of receptor	The sensitivity of great black-backed gull is considered to be as described for the assessment of Morven South alone (see paragraphs 11.11.4.22 to 11.11.4.25). Great black-backed gull is deemed to be of very high vulnerability, low recoverability, and regional value. The sensitivity of the receptor is therefore considered to be high.	The sensitivity of great black-backed gull is considered to be as described for the assessment of Morven South alone (see paragraphs 11.11.4.22 to 11.11.4.25). Great black-backed gull is deemed to be of very high vulnerability, low recoverability, and regional value. The sensitivity of the receptor is therefore considered to be high.
Significance of effect	Overall the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect on great black-backed gull will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.	Overall the magnitude of the impact is deemed to be of low magnitude and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of minor to moderate adverse significance. Due to the factors identified above that lead to considerable of over-estimation of the cumulative impact, the limited contribution of Morven South to this total and the PVA results suggesting that the predicted impact will have an insignificant impact on the growth rate of the population, the impact is considered minor. It is therefore deemed appropriate to categorise the impact as having a **minor adverse** significance, which is not significant in EIA terms.
Further mitigation and residual significance	No mitigation measures for great black-backed gull in relation to collision risk are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.	No mitigation measures for great black-backed gull in relation to collision risk are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

Gannet

11.13.2.12 The predicted impact on gannet from the Morven Programme is presented in Table 11.56. In all three seasons (breeding, post breeding and pre-breeding) and on an annual basis the estimated percentage point increase in baseline mortality of gannet remains well below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). Additional analysis including PVA modelling is therefore not required.

11.13.2.13 The predicted mean seasonal and annual collision mortality for gannet has been compiled for relevant wind farms and is shown in Table 11.56. Projects considered to act cumulatively with Morven South in the breeding season are those within the mean-maximum foraging range (+1SD) of gannet from Morven South. In the non-breeding seasons, projects considered to act cumulatively with Morven South are those within the relevant BDMPS area from Furness (2015). The seasonal extents used are consistent with those used in the assessment for Morven South. All collision risk estimates are calculated using an avoidance rate of either 99.23% or 99.29% depending on whether collision risk estimates for each project were calculated deterministically or stochastically (Ozsanlav-Harris *et al*., 2023). Total collision risk estimates presented in brackets in Table 11.56 are those calculated incorporating the collision risk estimates for Morven South calculated when applying the Applicant's parameters.

11.13.2.14 For the cumulative assessment, in breeding and post-breeding seasons and on an annual basis, the estimated percentage point increase in baseline mortality exceeds the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h) when applying the collision parameters recommended by NatureScot and the Applicant. The cumulative impact during the pre-breeding season did not surpass the 0.02 percentage point change threshold and therefore PVA modelling was not required to form a conclusion. As a result PVA modelling has been conducted for the breeding and post-breeding seasons and an annual basis. The outputs of this process are presented in Table 11.56.

Table 11.56: Expected seasonal and annual collision mortality across relevant wind farms for gannet. Collision risk estimates are calculated applying NatureScot's recommended parameters. For Morven South and Morven North, the collision risk estimates calculated applying the Applicant's recommended parameters are shown in brackets (grey cells indicate projects that do not contribute alongside Morven South in relevant seasons)

Project	Breeding	Post-breeding	Pre-breeding	Annual
Morven Programme assessment				
Morven North	9.7 (2.7)	0.7 (0.7)	0.2 (0.2)	10.6 (3.5)
Morven South	12.7 (3.4)	0.2 (0.2)	0.2 (0.2)	13.1 (3.8)
Total	22.4 (6.1)	0.9 (0.8)	0.4 (0.3)	23.6 (7.3)
Change in baseline mortality (% point change)	0.004 (0.001)	<0.001 (<0.001)	<0.001 (<0.001)	0.004 (0.001)
Tier 1				
Aberdeen	3.6	0.9	0.0	4.5
Aspen	15.6	1.0	0.9	17.5
Beatrice	43.1	5.0	2.2	50.3
Berwick Bank	109.5	3.5	0.6	113.6
Blyth Demo	3.2	0.3	0.5	4.0

Project	Breeding	Post-breeding	Pre-breeding	Annual
Buchan	2.6	0.4	0.0	3.0
Caledonia	12.5	0.6	0.1	13.2
Cenos	17.1	1.0	0.2	18.4
Dogger Bank A + B	5.3	1.2	0.7	7.2
Dogger Bank South	26.9	12.6	1.9	41.3
Dogger Bank C + Sofia	15.0	1.5	1.5	18.0
Dudgeon	27.3	6.3	2.3	35.8
Dudgeon Extension	0.2	0.4	0.0	0.6
East Anglia One	5.3	26.8	1.2	33.3
East Anglia ONE North	8.0	2.3	0.4	10.7
East Anglia THREE	5.4	6.7	2.0	14.1
East Anglia TWO	6.7	5.3	1.0	13.0
Five Estuaries	2.0	2.3	0.3	4.6
Galloper		5.1	2.1	7.2
Green Volt	9.5	0.1	0.4	10.0
Hornsea Project ONE	4.4	1.1	0.8	6.3
Hornsea Project TWO	7.8	2.3	1.0	11.2
Hornsea Project THREE	6.8	0.9	1.0	8.8
Hornsea FOUR	9.7	1.0	0.4	11.1
Humber Gateway	1.5	0.4	0.8	2.7
Inch Cape	74.0	1.3	1.1	76.4
Kentish Flats Extension		0.0	0.0	0.0
Kincardine	13.9	0.1	0.1	14.2
Lincs	1.9	0.2	0.3	2.4
Moray East	26.4	1.1	0.5	27.9
Moray West	7.4	0.3	0.1	7.8
Muir Mhor	8.5	1.2	0.1	9.8
Neart na Gaoithe	62.3	2.0	2.0	66.3
Norfolk Boreas	9.7	2.7	0.9	13.2
Norfolk Vanguard	5.5	3.9	1.2	10.6
North Falls		0.9	0.7	1.5
Ossian	28.6	1.1	0.1	29.8
Outer Dowsing	1.1	0.4	0.1	1.7
Race Bank	27.9	1.2	0.9	29.9
Rampion		1.9	0.4	2.3
Rampion 2		0.9	0.5	1.4

Project	Breeding	Post-breeding	Pre-breeding	Annual
Salamander	5.1	0.3	0.0	5.4
SeaGreen (Alpha & Bravo)	189.6	4.7	5.0	199.3
Sheringham Shoal Extension	0.0	0.1	0.0	0.1
Teesside	4.6	0.0	0.0	4.6
Thanet		0.0	0.0	0.0
Triton Knoll	32.3	10.5	5.3	48.1
Westermost Rough	0.1	0.0	0.0	0.1
Total	872.8 (856.6)	124.7 (124.6)	42.2 (42.2)	1039.7 (1023.4)
Change in baseline mortality (% point change)	0.156 (0.153)	0.027 (0.027)	0.017 (0.017)	0.186 (0.183)

Table 11.57: Summary of PVA results for cumulative collision impacts on gannet after 35 years as a result of impacts associated with the cumulative assessment

Scenario	Predicted mortality (no. of birds)	Increase in baseline mortality (% point change)	Median population size (no. of birds)	Growth Rate (Annual GR)	Change in population (%)	Median CGR	Median CPS	Quantile – unimpacted: 50%impacted
Cumulative assessment								
Breeding								
Baseline	-	-	1,044,862	1.0122	52.66	-	-	-
NatureScot	872.8	0.156	979,413	1.0103	43.04	0.9982	0.9373	39.2
Applicant	856.6	0.153	979,665	1.0103	43.31	0.9982	0.9383	39.2
Post-breeding								
Baseline	-	-	919,044	1.0125	54.42	-	-	-
NatureScot	124.7	0.027	910,112	1.0122	52.64	0.9997	0.9888	48.6
Applicant	124.6	0.027	909,171	1.0121	52.58	0.9997	0.9889	48.4
Annual								
Baseline	-	-	1,044,862	1.0122	52.66	-	-	-
NatureScot	1,039.7	0.186	966,194	1.0099	41.41	0.9978	0.9257	37.1
Applicant	1,023.4	0.183	967,812	1.0100	41.42	0.9978	0.9268	37.2

Table 11.58: Morven South cumulative effects assessment for gannet in relation to collision with rotating blades

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
Operations and maintenance phase		
Magnitude of impact	The cumulative effects assessment for Scenario 3 considers the relevant elements of the Morven Programme (Morven South and Morven North). The estimated percentage point increase in baseline mortality associated with the impact predicted for the Morven Programme remains below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h) (Table 11.56). This conclusion is applicable when modelling using the parameters advocated by both NatureScot and the Applicant and therefore additional analysis including PVA modelling is not required. The cumulative effect is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be negligible.	The cumulative effects assessment for Scenario 4 considers Morven South together with the Tier 1 (including Morven North), Tier 2 and Tier 3 projects where suitable data to inform the assessment are available. Breeding season The magnitude of the cumulative effect of these projects in the breeding season may result in 872.8 (856.6) collisions/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for gannet when applying the breeding season impact calculated using NatureScot's and the Applicant's advocated parameters indicates a median CPS of 0.9373 to 0.9383; i.e. the population after 35 years, would be 6.17 to 6.27% smaller than the CPS with a 50th percentile value of 39.2 to 39.2 (Table 11.57). In terms of the population size, this means that the median of the impacted population fell within the 39th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario is still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9982 to 0.9982 which translates to a growth rate 0.18% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would be undetectable against natural fluctuations in the growth rate currently seen in the regional population. It is also important to note that the contribution of Morven South to the cumulative total is only 1.46% and is considered to represent an immaterial contribution to the existing cumulative impact.

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		The Scottish breeding population of gannet has increased between the two most recent national censuses with an increase of 40% (Burnell *et al.*, 2023) with this also reflected on a UK scale (39%; Burnell *et al.*, 2023). However, surveys in 2023, aimed at detecting changes in seabird breeding populations due to HPAI showed an overall 25% decrease in breeding gannets compared to pre-HPAI counts from monitored sites (Tremlett *et al.*, 2024). However, this short-term decrease contrasts against a long-term increase in the UK gannet population. As a result the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would lead a measurable change in the UK gannet population. As a result the magnitude of impact on the gannet population in the breeding season is considered to be of low magnitude. It is also worth considering the inherent over-estimation in the cumulative totals for gannet caused by the following factors: • Over-estimation of cumulative impacts. The PVA modelling does not account for changes in the predicted cumulative total due to the decommissioning of projects considered cumulatively. Over the lifetime of Morven South the cumulative impact will reduce significantly when licences for current projects expire and decommissioning occurs. The PVA metrics are therefore highly precautionary. • No consideration has been made for density dependent compensation of demographic parameters within the modelled population, nor immigration, both of which could reduce the magnitude of any population change. • The use of flight speeds that do not provide a robust representation of the behaviour of gannet in the modelling conducted for projects considered cumulatively (see Volume 3, Annex 11.2 Offshore Ornithology Collision Risk Modelling Report for more information). This leads to an approximate over-estimate of 7% at each project.

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		• For a number of recent projects, it has been concluded as part of the Appropriate Assessments conducted that the predicted in-combination impacts are at a magnitude that represents an AEOI on the integrity on a number of SPAs. As a result these projects have been required to submit derogation cases which include compensation measures. For gannet this is applicable to Berwick Bank, Buchan, Caledonia North, Caledonia South, Cenos, Green Volt, Muir Mhor, Ossian and Salamander. The compensatory measures associated with these projects will work to ensure there is no residual effect of these projects on the gannet features of relevant SPAs which form part of the regional population used as part of the cumulative assessments for Morven South. The impacts associated with these projects should theoretically be reduced to take account of the proposed compensation measures within the assessments presented above, which would lead to reduced impact magnitudes and improved PVA metrics. As a result the magnitude of impact on the gannet population in the breeding season is considered to be of negligible magnitude. <u>Post-breeding season</u> The magnitude of the cumulative effect of these projects in the post-breeding season may result in 124.7 (124.6) collisions/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for gannet when applying the post-breeding season impact calculated using NatureScot's and the Applicant's advocated parameters indicates a median CPS of 0.9888 to 0.9889; i.e. the population after 35 years, would be 1.21 to 1.22% smaller than the CPS with a 50th percentile value of 48.4 to 48.6 (Table 11.57). In terms of the population size, this means that the median of the impacted population fell within the 48th to 49th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario is still well within the margin of error of the non-impacted scenario, and therefore there would likely

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9997 to 0.9997 which translates to a growth rate 0.03% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would be undetectable against natural fluctuations in the growth rate currently seen in the regional population. It is also important to note that the contribution of Morven South to the cumulative total is only 0.16% and is considered to represent an immaterial contribution to the existing cumulative impact. As the UK breeding population is the main contributor to the regional post-breeding population of gannet the trends in the regional post-breeding population are considered to be the same as the regional breeding population. When taking into account the outputs of the PVA and the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the gannet population is considered to be of negligible magnitude. <u>Pre-breeding season</u> The magnitude of the cumulative effect of these projects in the pre-breeding season may result in 42.2 (42.1) collisions/annum. This magnitude of impact does not exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has not been conducted. The magnitude of impact in the pre-breeding season on gannet population is considered to be of negligible magnitude. It is also important to note that the contribution of Morven South to the cumulative total is only 0.47% and is considered to represent an immaterial contribution to the existing cumulative impact.

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		As the UK breeding population is the main contributor to the regional pre-breeding population of gannet the trends in the regional pre-breeding population are considered to be the same as the regional breeding population. When taking into account the outputs of the PVA and the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the gannet population is considered to be of negligible magnitude. <u>Annual</u> The magnitude of the cumulative effect of these projects on an annual basis may result in 1,039.7 (1,023.4) collisions/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for gannet when applying the annual impact calculated using NatureScot's and the Applicant's advocated parameters indicates a median CPS of 0.9257 to 0.9268; i.e. the population after 35 years, would be 7.32 to 7.43% smaller than the CPS with a 50th percentile value of 37.1 to 37.2 (Table 11.57). In terms of the population size, this means that the median of the impacted population fell within the 37th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenarios are still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9978 to 0.9978 which translates to a growth rate 0.22% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would be undetectable against natural fluctuations in the growth rate currently seen in the regional population.

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		It is also important to note that the contribution of Morven South to the cumulative total is only 1.26% and is considered to represent an immaterial contribution to the existing cumulative impact. As the UK breeding population is the main contributor to the regional population of gannet used to assess the annual impact the trends in the annual population are considered to be the same as the regional breeding population. When taking into account the outputs of the PVA and the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the gannet population is of negligible magnitude.
Sensitivity of receptor	The sensitivity of gannet is considered to be as described for the assessment of Morven South alone (see paragraphs 11.11.4.26 to 11.11.4.29). Gannet is deemed to be of high vulnerability, high recoverability, and of international value. The sensitivity of the receptor is therefore considered to be high.	The sensitivity of gannet is considered to be as described for the assessment of Morven South alone (see paragraphs 11.11.4.26 to 11.11.4.29). Gannet is deemed to be of high vulnerability, high recoverability, and of international value. The sensitivity of the receptor is therefore considered to be high.
Significance of effect	Overall the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect on gannet will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.	Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect on gannet will, therefore, be of minor adverse significance. Therefore, the cumulative impact of collision on gannet are of **minor adverse** significance, which is not significant in EIA terms.
Further mitigation and residual significance	No mitigation measures for gannet in relation to collision risk are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.	No mitigation measures for gannet in relation to collision risk are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

11.13.3 Displacement

11.13.3.1 There is potential for cumulative displacement as a result of operational activities associated with Morven South cumulatively with other developments. During the operations and maintenance phase, the presence of offshore wind turbines has the potential to directly disturb and displace seabirds that would normally reside within and around the area of sea where offshore wind farms are located. Displacement may contribute to individual birds experiencing fitness consequences, which at an extreme level could lead to the mortality of individuals. Cumulative displacement therefore has the potential to lead to effects on a wider scale.

11.13.3.2 The projects of relevance to the cumulative assessment of displacement are identified in Table 11.49. There are no displacement impacts associated with the MHPGC Project or MBAGC Project. Whilst there may be disturbance effects associated with the MHPGC Project or MBAGC Project such impacts are will be short-term in nature and highly unlikely to be detectable and will not contribute to any existing cumulative impact. The whole project assessments associated with Scenario 1 and 2 are therefore not required and consideration of the MHPGC Project or MBAGC Project as part of Scenario 3 is also not required. Scenario 3 will therefore incorporate Morven South and Morven North only.

11.13.3.3 The level of data available and the ease with which displacement impacts can be combined across the wind farms is quite variable, reflecting the availability of relevant data for other projects and the approach to assessment taken.

11.13.3.4 The Morven Programme assessment has considered all species considered for Morven South alone. The impacts predicted for both projects are provided in the following tables:

- Kittiwake - Table 11.59;
- Common guillemot - Table 11.64;
- Razorbill - Table 11.70;
- Puffin - Table 11.76;
- Fulmar - Table 11.82;
- Gannet - Table 11.83.

11.13.3.5 The Morven Programme assessment has been conducted assuming that the impacts from Morven North and Morven South are simply additive. This is however, an over-simplification resulting in a precautionary analysis. The displacement analysis incorporates mean-peak population estimates from the relevant array area plus a 2km buffer. As the Morven North and Morven South boundaries are adjacent to one another the application of a 2km buffer results in an overlap between the areas incorporated into the displacement analyses for both projects. No attempt has been made to quantify the extent of the over-estimate in the assessments presented in the following sections and therefore the assessments for the Morven Programme, and therefore the cumulative assessment, incorporate a degree of over-estimation for all species.

11.13.3.6 The species assessed for cumulative displacement impacts were kittiwake, common guillemot, razorbill, puffin, and gannet. The predicted impact from Morven South alone for all of these species surpassed the 0.2 birds/annum recommended by NatureScot as a threshold for when a cumulative assessment is required and therefore assessments are presented for all four species. The mean-peak population estimates relevant to each project considered in the cumulative assessment are presented in the following tables for each species:

- Kittiwake - Table 11.60;
- Common guillemot - Table 11.66;
- Razorbill - Table 11.72;
- Puffin - Table 11.77;
- Gannet - Table 11.84.

11.13.3.7 Data used within the assessment of cumulative displacement is based on published information produced by the respective project developers. The assessments undertaken for these projects were conducted based on the recommended approach at the time of application. Whilst the current guidance for displacement assessment requires the use of mean-peak population estimates, this has not always been the case. In order to ensure a consistent approach, where mean-peak population estimates are unavailable, either because a project's assessment was undertaken prior to the use of mean-peak population estimates or because such data are not presented in project-specific documentation, mean-peak population estimates have been calculated using data for the project in question. In some cases, this requires the use of data from project areas other than the now recommended project plus 2km buffer. In these cases, data has been corrected based on the difference between the project area used and the project area plus a 2km buffer with this factor applied to the abundance estimate for the project. The basis of this approach has been used within the assessments for multiple offshore wind farms in UK waters since its first application for the Dogger Bank Creyke Beck and Dogger Bank Teesside projects.

11.13.3.8 In addition, for some projects, mean-peak population estimates are only presented for breeding and non-breeding seasons whereas for some species it is now recommended that the non-breeding season be split into post- and pre-breeding seasons. Where only a non-breeding season mean-peak population estimate is available this has been halved and applied to the post- and pre-breeding season.

11.13.3.9 The summary of the Morven Programme assessment and cumulative assessments for displacement are presented in Table 11.59 to Table 11.87.

Kittiwake

11.13.3.10 The predicted impact from the Morven Programme is presented in Table 11.59. Displacement mortalities presented in brackets in Table 11.59 are those calculated when applying the Applicant's displacement and mortality rates. In all three seasons (breeding, post breeding and pre-breeding) and on an annual basis the estimated percentage point increase in baseline mortality of kittiwake remains well below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). This conclusion is applicable when modelling using the displacement and mortality rates advocated by both NatureScot and the Applicant and therefore additional analysis including PVA modelling is not required.

Table 11.59: Predicted impacts for kittiwake associated with Morven South and Morven North

Project	Breeding	Post-breeding	Pre-breeding	Annual
Morven programme assessment				
Morven North	7.4 to 22.3 (7.4)	1.2 to 3.7 (1.2)	0.4 to 1.2 (0.4))	9.1 to 27.2 (9.1)
Morven South	1.2 to 3.5 (1.2)	0.8 to 2.5 (0.8)	0.3 to 1.0 (0.3)	2.4 to 7.1 (2.4)
Total	8.6 to 25.9 (8.6)	2.1 to 6.2 (2.1)	0.7 to 2.2 (0.7)	11.4 to 34.3 (11.4)
Change in baseline mortality (% point change)	0.001 to 0.004 (0.001)	<0.001 to 0.001 (<0.001)	<0.001 to <0.001 (<0.001)	0.001 to 0.004 (0.001)

11.13.3.11 The estimated cumulative abundance of kittiwake from relevant projects is presented in Table 11.60. The impacts estimated when applying the displacement and mortality rates advocated by both NatureScot and the Applicant are calculated in Table 11.61 with the effect these impacts have on the baseline mortality of the relevant populations also provided.

11.13.3.12 In all three seasons (breeding, post breeding and pre-breeding) and on an annual basis the estimated percentage point increase in baseline mortality of kittiwake exceeds the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). This conclusion is applicable when modelling using the displacement and mortality rates advocated by both NatureScot and the Applicant (Table 11.61) and therefore PVA modelling has been conducted with the outputs provided in Table 11.62.

Table 11.60: Mean-peak population estimates for kittiwake at projects considered cumulatively (grey cells indicate projects that do not contribute alongside Morven South in relevant seasons)

Project	Breeding	Post-breeding	Pre-breeding	Annual
Tier 1				
Aspen	129	43	85	257
Beatrice	916	712	712	2,340
Berwick Bank	21,141	11,190	13,766	46,097
Blyth Demo	41	428	4	473
Buchan	183	105	344	633
Caledonia	2,039	483	115	2,637

Project	Breeding	Post-breeding	Pre-breeding	Annual
Cenos	208	49	49	305
Dogger Bank A	3,479	1,530	6,938	11,947
Dogger Bank B	4,420	1,920	8,544	14,884
Dogger Bank South	10,387	5,214	2,757	18,357
Dogger Bank C	1,739	928	4,854	7,520
Sofia	2,701	1,255	6,689	10,645
Dudgeon		20	80	100
Dudgeon Extension		1,455	138	1,593
East Anglia One		762	279	1,041
East Anglia ONE North		201	201	402
East Anglia THREE		1,504	705	2,208
East Anglia TWO		228	341	569
Five Estuaries		219	573	792
Galloper		391	693	1,084
Green Volt	183	149	83	415
Hornsea Project ONE		21,412	1,190	22,602
Hornsea Project TWO		1,449	2,125	3,574
Hornsea Project THREE		2,416	2,178	4,594
Hornsea FOUR	5,485	1,174	464	7,123
Humber Gateway		17	23	39
Inch Cape	3,866	2,137	836	6,839
Kincardine	669	636	58	1,363
Lincs		32	13	45
Moray East	1,963	131	131	2,224
Moray West	6,902	1,470	1,074	9,446
Morven North	2,480	410	135	3,025
Morven South	394	280	112	786
Muir Mhor	3,252	58	751	4,062
Neart na Gaoithe	2,164	2,016	139	4,319
Norfolk Boreas		2,576	1,056	3,632
Norfolk Vanguard		887	1,635	2,523
North Falls		467	845	1,312
Ossian	3,183	566	581	4,330
Outer Dowsing		993	1,134	2,127

Project	Breeding	Post-breeding	Pre-breeding	Annual
Pentland	546	118	41	705
Race Bank		84	46	130
Salamander	3,718	110	110	3,938
SeaGreen Bravo	4,159	1,342	941	6,442
SeaGreen Alpha	7,213	3,184	1,112	11,509
Sheringham Shoal Extension		150	76	226
Teesside	197	6	13	216
Thanet		33	9	42
Triton Knoll		291	295	586
West of Orkney	1,113	799	1,217	3,128
Total	95,070	74,292	66,298	235,660

Table 11.61: Assessment of predicted cumulative displacement mortality for kittiwake on seasonal and annual bases against the baseline mortality of relevant regional populations

Season	Displacement rate (%)	Mortality rate (%)	Regional baseline population (no. of birds)	Baseline mortality	Displacement mortality (no. of birds)	Change in baseline mortality (% point change)
NatureScot's approach						
Breeding	30	1 to 3	576,167	0.156	285.2 to 855.6	0.050 to 0.149
Post-breeding			829,937		222.9 to 668.6	0.027 to 0.081
Pre-breeding			627,816		198.9 to 596.7	0.032 to 0.095
Annual			829,937		707.0 to 2,120.9	0.085 to 0.256
Applicant's approach						
Breeding	30	1	576,167	0.156	285.2	0.050
Post-breeding			829,937		222.9	0.027
Pre-breeding			627,816		198.9	0.032
Annual			829,937		707.0	0.085

Table 11.62: Summary of Population Viability Analysis results for kittiwake displacement impacts after 35 years as a result of impacts associated with the cumulative assessment

Scenario	Predicted mortality (no. of birds)	Increase in baseline mortality (% point change)	Median population size (no. of birds)	Growth Rate (Annual GR)	Change in population (%)	Median CGR	Median CPS	Quantile – unimpacted: 50%impacted
Cumulative assessment								
Breeding								
Baseline	-	-	654,774	1.0025	9.28	-	-	-
NatureScot Lower	285.2	0.050	642,470	1.0020	7.08	0.9994	0.9797	47.9
NatureScot Upper	855.6	0.149	615,292	1.0008	2.78	0.9982	0.9401	44.0
Applicant	285.2	0.050	642,470	1.0020	7.08	0.9994	0.9797	47.9
Post-breeding								
Baseline	-	-	965,263	1.0029	10.66	-	-	-
NatureScot Lower	222.9	0.027	955,746	1.0026	9.44	0.9997	0.9888	49.2
NatureScot Upper	686.6	0.081	933,213	1.0019	7.02	0.9990	0.9672	47.0
Applicant	222.9	0.027	955,746	1.0026	9.44	0.9997	0.9888	49.2
Pre-breeding								
Baseline	-	-	729,117	1.0029	10.53	-	-	-
NatureScot Lower	198.9	0.032	721,979	1.0025	9.23	0.9996	0.9867	49.1
NatureScot Upper	596.7	0.095	702,092	1.0017	6.30	0.9989	0.9614	46.7

Scenario	Predicted mortality (no. of birds)	Increase in baseline mortality (% point change)	Median population size (no. of birds)	Growth Rate (Annual GR)	Change in population (%)	Median CGR	Median CPS	Quantile – unimpacted: 50%impacted
Applicant	198.9	0.032	721,979	1.0025	9.23	0.9996	0.9867	49.1
Annual								
Baseline	-	-	965,263	1.0029	10.66	-	-	-
NatureScot Lower	707.0	0.085	931,457	1.0019	6.82	0.9990	0.9653	46.9
NatureScot Upper	2,120.9	0.256	867,571	0.9998	-0.59	0.9970	0.8993	41.5
Applicant	707.0	0.085	931,457	1.0019	6.82	0.9990	0.9653	46.9

Table 11.63: Morven South cumulative effects assessment for kittiwake in relation to displacement impacts

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
Operations and maintenance phase		
Magnitude of impact	The cumulative effects assessment for Scenario 3 considers the relevant elements of the Morven Programme (Morven South and Morven North). The estimated percentage point increase in baseline mortality associated with the impact predicted for the Morven Programme remains below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h) (Table 11.59). This conclusion is applicable when modelling using the parameters advocated by both NatureScot and the Applicant and therefore additional analysis including PVA modelling is not required. The cumulative effect is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be negligible.	The cumulative effects assessment for Scenario 4 considers Morven South together with the Tier 1 (including Morven North), Tier 2 and Tier 3 projects where suitable data to inform the assessment are available. Breeding season The magnitude of the cumulative effect of these projects in the breeding season may result in a displacement mortality of 285.2 to 855.6 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 285.2 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for kittiwake when applying the breeding season impact calculated using NatureScot's and the Applicant's advocated parameters indicates a median CPS of 0.9401 to 0.9797; i.e. the population after 35 years, would be 2.03 to 5.99% smaller than the CPS with a 50th percentile value of 44.0 to 47.9 (Table 11.62). In terms of the population size, this means that the median of the impacted population fell within the 44th to 48th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenarios are still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9982 to 0.9994 which translates to a growth rate 0.06 to 0.18% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		be undetectable against natural fluctuations in the growth rate currently seen in the regional population. It should be noted that the contribution of Morven South to the total cumulative impact is only 0.41 to 0.42%. The Scottish breeding population of kittiwake has decreased between the two most recent national censuses with a decline of 57% (Burnell *et al*., 2023) with this also reflected on a UK scale (43%; Burnell *et al*., 2023). Surveys in 2023, aimed at detecting changes in seabird breeding populations due to HPAI showed an overall 8% increase in breeding kittiwakes compared to pre-HPAI counts from monitored sites (Tremlett *et al*., 2024). Despite the current declining trend in the kittiwake breeding population at both a Scottish and UK scale, the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would accelerate such declines to a measurable extent. As a result the magnitude of impact on the kittiwake population in the breeding season is considered to be of low magnitude. This conclusion is reached by also considering the over-estimation of both the predicted impact and PVA outputs caused by the following factors: • Over-estimation of cumulative impacts. The PVA modelling does not account for changes in the predicted cumulative total due to the decommissioning of projects considered cumulatively. Over the lifetime of Morven South the cumulative impact will reduce significantly when licences for current projects expire and decommissioning occurs. The PVA metrics are therefore highly precautionary. • No consideration has been made for density dependent compensation of demographic parameters within the modelled population, nor immigration, both of which could reduce the magnitude of any population change. • For a number of recent projects, it has been concluded as part of the Appropriate Assessments conducted that the predicted in-combination impacts are at a magnitude that represents an AEOI on the integrity on a number

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		of SPAs. As a result these projects have been required to submit derogation cases which include compensation measures. For kittiwake this is applicable to Berwick Bank, Buchan, Caledonia North, Caledonia South, Cenos, Dogger Bank South, Dudgeon Extension, East Anglia One North, East Anglia Two, Five Estuaries, Green Volt, Hornsea Three, Hornsea Four, Muir Mhor, Norfolk Boreas, Norfolk Vanguard, North Falls, Ossian, Outer Dowsing, Rampion 2, Salamander, Sheringham Shoal Extension and West of Orkney. The compensatory measures associated with these projects will work to ensure there is no residual effect of these projects on the kittiwake features of relevant SPAs which form part of the regional population used as part of the cumulative assessments for Morven South. The impacts associated with these projects should theoretically be reduced to take account of the proposed compensation measures within the assessments presented above, which would lead to reduced impact magnitudes and improved PVA metrics. <u>Post-breeding season</u> The magnitude of the cumulative effect of these projects in the post-breeding season may result in a displacement mortality of 222.9 to 686.6 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 222.9 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for kittiwake when applying the post-breeding season impact calculated using NatureScot's and the Applicant's advocated parameters indicates a median CPS of 0.9672 to 0.9888; i.e. the population after 35 years, would be 1.12 to 3.28% smaller than the CPS with a 50th percentile value of 47.0 to 49.2 (Table 11.62). In terms of the population size, this means that the median of the impacted population fell within the 49th to 47th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenarios are still well

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9990 to 0.9997 which translates to a growth rate 0.03 to 0.10% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would be undetectable against natural fluctuations in the growth rate currently seen in the regional population. It should be noted that the contribution of Morven South to the total cumulative impact is only 0.36 to 0.37%. The UK population is the largest contributor to the post-breeding season BDMPS. Despite the current declining trend in the kittiwake breeding population at both a Scottish and UK scale, the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would accelerate such declines to a measurable extent. When taking into account the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the kittiwake population is of negligible magnitude. Pre-breeding season The magnitude of the cumulative effect of these projects in the pre-breeding season may result in a displacement mortality of 198.9 to 596.7 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 198.9 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted.

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		The PVA model conducted for kittiwake when applying the pre-breeding season impact calculated using NatureScot's and the Applicant's advocated parameters indicates a median CPS of 0.9614 to 0.9867; i.e. the population after 35 years, would be 1.13 to 3.86% smaller than the CPS with a 50th percentile value of 46.7 to 49.1 (Table 11.62). In terms of the population size, this means that the median of the impacted population fell within the 47th to 49th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenarios are still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9989 to 0.9996 which translates to a growth rate 0.04 to 0.11% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would be undetectable against natural fluctuations in the growth rate currently seen in the regional population. It should be noted that the contribution of Morven South to the total cumulative impact is only 0.15 to 0.17%. The UK population is the largest contributor to the pre-breeding season BDMPS. Despite the current declining trend in the kittiwake breeding population at both a Scottish and UK scale, the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would accelerate such declines to a measurable extent. When taking into account the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the kittiwake population is of low magnitude. <u>Annual</u> The magnitude of the cumulative effect of these projects annually may result in a displacement mortality of 707.0 to 2,120.9 birds/annum when applying NatureScot's

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 707.0 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for kittiwake when applying the annual impact calculated using NatureScot's and the Applicant's advocated parameters indicates a median CPS of 0.8993 to 0.9653 ; i.e. the population after 35 years, would be 3.47 to 10.07% smaller than the CPS with a 50th percentile value of 41.5 to 46.9 (Table 11.62). In terms of the population size, this means that the median of the impacted population fell within the 41st to 47th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenarios are still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9970 to 0.9990 which translates to a growth rate 0.10 to 0.30% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would be undetectable against natural fluctuations in the growth rate currently seen in the regional population. It should be noted that the contribution of Morven South to the total cumulative impact is only 0.33 to 0.34%. The UK population is the largest contributor to the population used to inform the assessment of the annual impact. Despite the current declining trend in the kittiwake breeding population at both a Scottish and UK scale, the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would accelerate such declines to a measurable extent.

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		When taking into account the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the kittiwake population is of low magnitude.
Sensitivity of receptor	The sensitivity of kittiwake is considered to be as described for the assessment of Morven South alone (see paragraphs 11.11.5.14 to 11.11.5.17). Kittiwake is deemed to be of low vulnerability, low recoverability, and international conservation value. The sensitivity of the receptor is therefore considered to be medium.	The sensitivity of kittiwake is considered to be as described for the assessment of Morven South alone (see paragraphs 11.11.5.14 to 11.11.5.17). Kittiwake is deemed to be of low vulnerability, low recoverability, and international conservation value. The sensitivity of the receptor is therefore considered to be medium.
Significance of effect	Overall the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **negligible adverse** significance, which is not significant in EIA terms. A conclusion of negligible adverse significance is based on both the negligible magnitude of the predicted impacts across all seasons and on an annual basis as well as the species' limited vulnerability to displacement impacts.	Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.
Further mitigation and residual significance	No mitigation measures for kittiwake in relation to displacement are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.	No mitigation measures for kittiwake in relation to displacement are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

Common guillemot

11.13.3.13 The predicted impact from the Morven Programme is presented in Table 11.64. Displacement mortalities presented in brackets in Table 11.64 are those calculated when applying the Applicant's displacement and mortality rates. In all three seasons (breeding, post breeding and non-breeding) and on an annual basis the estimated percentage point increase in baseline mortality of common guillemot exceeds the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). This conclusion is applicable when modelling using the displacement and mortality rates advocated by both NatureScot and the Applicant in the post-breeding and on an annual basis only and therefore PVA modelling has been conducted. PVA outputs for all relevant scenarios are provided in Table 11.65.

Table 11.64: Predicted impacts for common guillemot associated with Morven South and Morven North

Project	Breeding	Post-breeding	Non-breeding	Annual
Morven Programme assessment				
Morven North	74.3 to 123.8 (20.6)	138.5 to 415.4 (115.4)	38.6 to 116.1 (32.2)	251.4 to 655.3 (168.3)
Morven South	15.0 to 25.1 (4.2)	53.9 to 161.6 (44.9)	15.0 to 45.0 (12.5)	83.9 to 231.7 (61.6)
Total	89.3 to 148.8 (24.8)	192.4 to 577.1 (160.3)	53.7 to 161.0 (44.7)	335.5 to 886.9 (229.8)
Change in baseline mortality (% point change)	0.050 to 0.084 (0.014)	0.041 to 0.122 (0.034)	0.011 to 0.034 (0.009)	0.071 to 0.187 (0.048)

Table 11.65: Summary of Population Viability Analysis results for common guillemot displacement impacts after 35 years as a result of impacts associated with the Morven Programme

Scenario	Predicted mortality (no. of birds)	Increase in baseline mortality (% point change)	Median population size (no. of birds)	Growth Rate (Annual GR)	Change in population (%)	Median CGR	Median CPS	Quantile – unimpacted: 50%impacted
Morven Programme assessment								
Breeding								
Baseline	-	-	640,917	1.0254	140.7	-	-	-
NatureScot Lower	89.3	0.050	628,183	1.0248	135.8	0.9994	0.9804	45.6
NatureScot Upper	148.8	0.084	620,012	1.0244	132.9	0.9991	0.9677	42.9
Post-breeding								
Baseline	-	-	1,703,305	1.0253	139.93	-	-	-
NatureScot Lower	192.4	0.041	1,675,648	1.0249	136.26	0.9995	0.9842	46.48
NatureScot Upper	577.1	0.122	1,623,583	1.0239	128.86	0.9986	0.9533	39.80
Applicant	160.3	0.034	1,681,684	1.0249	136.77	0.9996	0.9868	47.22
Non-breeding								
Baseline	-	-	1,704,529	1.0253	139.91	-	-	-
NatureScot Upper	161.0	0.034	1,681,566	1.0249	136.88	0.9996	0.9866	47.10
Annual								
Baseline	-	-	1,703,305	1.0253	139.93	-	-	-
NatureScot Lower	335.5	0.071	1,655,595	1.0245	133.32	0.9992	0.9726	44.04
NatureScot Upper	886.9	0.187	1,582,489	1.0232	122.92	0.9979	0.9292	34.56

Scenario	Predicted mortality (no. of birds)	Increase in baseline mortality (% point change)	Median population size (no. of birds)	Growth Rate (Annual GR)	Change in population (%)	Median CGR	Median CPS	Quantile – unimpacted: 50%impacted
Applicant	229.8	0.048	1,671,314	1.0248	135.38	0.9995	0.9812	45.90

11.13.3.14 The estimated cumulative abundance of common guillemot from relevant projects is presented in Table 11.66. The impacts estimated when applying the displacement and mortality rates advocated by both NatureScot and the Applicant are calculated in Table 11.67 with the effect these impacts have on the baseline mortality of the relevant populations also provided.

11.13.3.15 In all three seasons (breeding, post breeding and non-breeding) and on an annual basis the estimated percentage point increase in baseline mortality of common guillemot exceeds the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). This conclusion is applicable when modelling using the displacement and mortality rates advocated by both NatureScot and the Applicant (Table 11.66) and therefore PVA modelling has been conducted with the outputs provided in Table 11.68.

Table 11.66: Mean-peak population estimates for common guillemot at projects considered cumulatively

Project	Breeding	Post-breeding	Non-breeding	Annual
Tier 1				
Aberdeen	n/a	Not available	215	772
Berwick Bank	74,154	Not available	44,171	118,325
Inch Cape	8,184	Not available	3,912	12,096
Kincardine	632	Not available	8,016	8,648
Morven North	4,126	23,080	6,447	10,573
Morven South	835	8,980	2,498	3,333
Muir Mhor	13,122	Not available	11,863	24,985
Neart na Gaoithe	4,894	Not available	7,618	12,512
Ossian	10,980	Not available	45,893	75,587
Salamander	n/a	Not available	11,779	15,395
SeaGreen Bravo	11,118	Not available	4,112	15,230
SeaGreen Alpha	13,606	Not available	4,688	18,294
Total	141,651	32,060	151,212	329,096

Table 11.67: Assessment of predicted cumulative displacement mortality for common guillemot on seasonal and annual bases against the baseline mortality of relevant regional populations

Season	Displacement rate (%)	Mortality rate (%)	Regional baseline population (no. of birds)	Baseline mortality	Displacement mortality (no. of birds)	Change in baseline mortality (% point change)
NatureScot's approach						
Breeding	60	3 to 5	178,118	0.133	2,549.7 to 4,249.5	1.431 to 2.386
Post-breeding		1 to 3	474,821		192.4 to 577.1	0.041 to 0.122

<table>
<tr><th>Season</th><th>Displacement rate (%)</th><th>Mortality rate (%)</th><th>Regional baseline population (no. of birds)</th><th>Baseline mortality</th><th>Displacement mortality (no. of birds)</th><th>Change in baseline mortality (% point change)</th></tr>
<tr><td>Non-breeding</td><td rowspan="2"></td><td>1 to 3</td><td>474,821</td><td rowspan="2"></td><td>907.3 to 2,721.8</td><td>0.191 to 0.573</td></tr>
<tr><td>Annual</td><td>3 to 5 (breeding)
1 to 3 (post- and non-breeding)</td><td>474,821</td><td>3,724.5 to 7,673.6</td><td>0.784 to 1.616</td></tr>
<tr><td colspan="7">Applicant's approach</td></tr>
<tr><td>Breeding</td><td rowspan="4">50</td><td rowspan="4">1</td><td>178,118</td><td rowspan="4">0.133</td><td>708.3</td><td>0.398</td></tr>
<tr><td>Post-breeding</td><td>474,821</td><td>160.3</td><td>0.034</td></tr>
<tr><td>Non-breeding</td><td>474,821</td><td>756.1</td><td>0.159</td></tr>
<tr><td>Annual</td><td>474,821</td><td>1,645.5</td><td>0.347</td></tr>
</table>

Table 11.68: Summary of Population Viability Analysis results for common guillemot displacement impacts after 35 years as a result of impacts associated with the cumulative assessment

Scenario	Predicted mortality (no. of birds)	Increase in baseline mortality (% point change)	Median population size (no. of birds)	Growth Rate (Annual GR)	Change in population (%)	Median CGR	Median CPS	Quantile – unimpacted: 50%impacted
Cumulative assessment								
Breeding								
Baseline	-	-	640,354	1.0254	140.54	-	-	-
NatureScot Lower	2,549.7	1.431	363,557	1.0089	36.45	0.9839	0.5674	0.1
NatureScot Upper	4,249.5	2.386	247,800	0.9980	-6.90	0.9732	0.3870	0.0
Applicant	708.3	0.398	547,172	1.0208	105.80	0.9955	0.8551	20.18
Post-breeding								
Baseline	-	-	1,704,529	1.0253	139.91	-	-	-
NatureScot Lower	192.4	0.041	1,677,167	1.0249	136.14	0.9995	0.9842	46.64
NatureScot Upper	577.1	0.122	1,624,581	1.0239	128.89	0.9986	0.9533	40.00
Applicant	160.3	0.034	1,680,867	1.0249	136.78	0.9996	0.9867	47.00
Non-breeding								
Baseline	-	-	1,704,529	1.0253	139.91	-	-	-
NatureScot Lower	907.3	0.191	1,580,621	1.0231	122.59	0.9979	0.9277	34.28

Scenario	Predicted mortality (no. of birds)	Increase in baseline mortality (% point change)	Median population size (no. of birds)	Growth Rate (Annual GR)	Change in population (%)	Median CGR	Median CPS	Quantile – unimpacted: 50%impacted
NatureScot Upper	2,721.8	0.573	1,359,041	1.0187	91.36	0.9936	0.7979	10.46
Applicant	756.1	0.159	1,599,641	1.0235	125.40	0.9982	0.9393	36.74
Annual								
Baseline	-	-	1,704,529	1.0253	139.91	-	-	-
NatureScot Lower	3,577.4	0.784	1,250,536	1.0163	76.03	0.9912	0.7340	4.44
NatureScot Upper	7,332.5	1.616	898,236	1.0067	26.46	0.9819	0.5271	0.00
Applicant	1,564.6	0.347	1,486,401	1.0213	109.30	0.9961	0.8725	22.60

Table 11.69: Morven South cumulative effects assessment for common guillemot in relation to displacement impacts

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
Operations and maintenance phase		
Magnitude of impact	The cumulative effects assessment for Scenario 3 considers the relevant elements of the Morven Programme (Morven South and Morven North). When applying both NatureScot's and the Applicant's displacement and mortality rates, the 0.02 percentage point threshold is surpassed (Table 11.65). PVA has therefore conducted for all scenarios. Further information on the PVA is presented in Volume 3, Annex 11.6 Offshore Ornithology Regional Population Viability Analysis. The PVA model conducted when applying the annual impact calculated using NatureScot's displacement and mortality rates indicates a median CPS of 0.9292 to 0.9726; i.e. the population after 35 years, would be 2.7% to 7.1% smaller than the counterfactual population size with a 50th percentile value of 34.6 to 44.0 (Table 11.65). In terms of the population size, this means that the median of the impacted population fell within the 34tht or 44th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario is still well within the margin of error of the non-impacted scenario, and therefore there would likely be no	The cumulative effects assessment for Scenario 4 considers Morven South together with the Tier 1 (including Morven North), Tier 2 and Tier 3 projects where suitable data to inform the assessment are available. <u>Breeding season</u> The magnitude of the cumulative effect of these projects in the breeding season may result in a displacement mortality of 2,549.7.5 to 4,249.5 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 708.3 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for common guillemot when applying the breeding season impact calculated using NatureScot's advocated parameters indicates a median CPS of 0.3870 to 0.5674; i.e. the population after 35 years, would be 43.26 to 61.30% smaller than the CPS with a 50th percentile value of 0.0 to 0.1 (Table 11.68). In terms of the population size, this means that the median of the impacted population fell within the zero percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that this level of impact would have an adverse effect on the population with a clear divergence between the impacted and unimpacted population size. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9732 to 0.9839 which translates to a growth rate 1.61 to 2.68% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would adversely affect the population. However, as noted earlier in section 11.11.5, research examining the displacement effects on common guillemots indicates that a 50% displacement rate is more reflective,

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
	adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9979 to 0.9992 which translates to a growth rate 0.08% to 0.21% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would only result in a slight reduction in the growth rate currently seen in the regional population and would therefore be undetectable against natural population fluctuations. When modelling the annual impact associated with the Applicant's scenario, the comparable metrics are a median CGR of 0.9995 and a median CPS of 0.9812; i.e. the population growth rate would be 0.05% smaller than the counterfactual (unimpacted) growth rate leading to a population that is, after 35 years, 1.9% smaller than the counterfactual population size. The 50th percentile value is 45.9, well within the margin of error of the non-impacted scenario. As concluded above, such a decrease indicates that this level of impact would not adversely affect the population and would only result in a slight reduction in the growth rate currently seen in the regional population and would therefore be	with this rate still regarded as precautionary (RoyalHaskoning, 2013; Peschko *et al.* 2020; APEM, 2022; MacArthur Green, 2023). Consequently, it is anticipated that the Applicant's approach (incorporating a 50% displacement rate alongside a 1% mortality rate) leads to an estimate that aligns more closely with actual conditions. When following the Applicant's approach, the PVA predicted that the CPS was 0.8551 which translates to a reduction in population size of 14.49%, with a 50th percentile value of 20.18. In terms of the population size, this implies that the median of the impacted population fell within the 20th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario was still within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. As stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted that the CGR was 0.9955 which translates to a median reduction of 0.45% in population growth rate after 35 years. Such a decrease indicates that this level of impact would not adversely affect the population. The Scottish breeding population of common guillemot has decreased between the two most recent national censuses with a decline of 31% (Burnell *et al*., 2023) with this also reflected, albeit to a lesser extent on a UK scale (11%; Burnell *et al.,* 2023). However, these decreases come after a longer period of significant increases in both Scotland and the UK. Surveys in 2023, aimed at detecting changes in seabird breeding populations due to HPAI showed an overall 6% decrease in breeding common guillemots compared to pre-HPAI counts from monitored sites (Tremlett *et al.,* 2024). Under all scenarios the counterfactual scenario predicts a positive population growth rate and under the upper estimate of NatureScot's scenario the population growth rate remains positive meaning the population will continue to grow despite the presence of Morven South and the cumulative projects. It should also be noted that the contribution of Morven South to the total annual cumulative impact is only 1.11%.

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
	undetectable against natural population fluctuations. Under all scenarios the counterfactual scenario predicts a positive population growth rate and in under the impacted scenario the population growth rate remains positive meaning the population will continue to grow despite the presence of Morven North and Morven South. The differences between the impacted and unimpacted scenarios for the breeding, post-breeding and non-breeding impact scenarios are natural less pronounced than those associated with the annual impact as the same population is used in all seasons for common guillemot. As it has been concluded that the outputs for the annual impact scenarios do not suggest any changes in the regional common guillemot population that are detectable against natural fluctuations this conclusion is considered to be equally applicable to the impacts predicted in the breeding, post-breeding and non-breeding seasons. Under all scenarios, these results indicate that this level of impact would not significantly affect the population and would only result in a slight reduction in the growth rate currently seen in the population and would therefore be undetectable against natural population fluctuations. The impact is predicted to be of local spatial extent,	Despite the recent declining trend in the common guillemot breeding population at both a Scottish and UK scale, the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would accelerate such declines to a meaningful extent. As a result, based on the Applicant's approach, the magnitude of impact on the common guillemot population annually is considered to be of low magnitude. This conclusion is reached by also considering the over-estimation of both the predicted impact and PVA outputs caused by the following factors: • Over-estimation of cumulative impacts. The PVA modelling does not account for changes in the predicted cumulative total due to the decommissioning of projects considered cumulatively. Over the lifetime of Morven South the cumulative impact will reduce significantly when licences for current projects expire and decommissioning occurs. The PVA metrics are therefore highly precautionary. • No consideration has been made for density dependent compensation of demographic parameters within the modelled population, nor immigration, both of which could reduce the magnitude of any population change. • The populations of guillemot at projects considered cumulatively have been estimated incorporating availability bias factors from Thaxter (2010). Dunn *et al*. (2024) presents updated monthly availability bias factors for guillemot for July to March. The correction factors provided in Dunn *et al*. (2024) are lower than those applied to calculate the population estimates used for projects considered cumulatively. It is therefore considered that these populations likely represent an over-estimate of the number of guillemot present at each project between July and March. • For a number of recent projects, it has been concluded as part of the Appropriate Assessments conducted that the predicted in-combination impacts are at a magnitude that represents an AEOI on the integrity on a number of SPAs. As a result these projects have been required to submit derogation

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
	long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. Therefore, the magnitude of impact is considered to be negligible.	cases which include compensation measures. For common guillemot this is applicable to Berwick Bank and Muir Mhor. The compensatory measures associated with these projects will work to ensure there is no residual effect of these projects on the common guillemot features of relevant SPAs which form part of the regional population used as part of the cumulative assessments for Morven South. The impacts associated with these projects should theoretically be reduced to take account of the proposed compensation measures within the assessments presented above, which would lead to reduced impact magnitudes and improved PVA metrics. Post-breeding season The magnitude of the cumulative effect of these projects in the post-breeding season may result in a displacement mortality of 192.4 to 577.1 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 160.3 birds/annum. This magnitude impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for common guillemot when applying the post-breeding season impact calculated using NatureScot's advocated parameters indicates a median CPS of 0.9533 to 0.9842; i.e. the population after 35 years, would be 1.58 to 4.67% smaller than the CPS with a 50th percentile value of 40.0 to 46.6 (Table 11.68). In terms of the population size, this means that the median of the impacted population fell within the 40th to 46th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that this level of impact would not have an adverse effect on the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9986 to 0.9995 which translates to a growth rate 0.05 to 0.14% smaller than the counterfactual (unimpacted) growth rate. Such a decrease

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		indicates that this level of impact would not adversely affect the population and would be undetectable against natural fluctuations in the growth rate currently seen in the regional population. However, as noted earlier in section 11.11.5, research examining the displacement effects on common guillemots indicates that a 50% displacement rate is more reflective, with this rate still regarded as precautionary (RoyalHaskoning, 2013; Peschko *et al.* 2020; APEM, 2022; MacArthur Green, 2023). Consequently, it is anticipated that the Applicant's approach (incorporating a 50% displacement rate alongside a 1% mortality rate) leads to an estimate that aligns more closely with actual conditions. When following the Applicant's approach, the PVA predicted that the CPS was 0.9867 which translates to a reduction in population size of 1.73%, with a 50th percentile value of 47.0. In terms of the population size, this implies that the median of the impacted population fell within the 47th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario was still within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. As stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted that the CGR was 0.9996 which translates to a median reduction of 0.04% in population growth rate after 35 years. Such a decrease indicates that this level of impact would not adversely affect the population. The Scottish breeding population of common guillemot, of which the post-breeding population is largely comprised, has decreased between the two most recent national censuses with a decline of 31% (Burnell *et al.*, 2023) with this also reflected, albeit to a lesser extent on a UK scale (11%; Burnell *et al.*, 2023). However, these decreases come after a longer period of significant increases in both Scotland and the UK. Surveys in 2023, aimed at detecting changes in seabird breeding populations due to HPAI showed an overall 6% decrease in breeding common guillemots compared to pre-HPAI counts from monitored sites (Tremlett *et al.*, 2024).

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		Despite the recent declining trend in the common guillemot breeding population at both a Scottish and UK scale, the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would accelerate such declines to a measurable extent. When taking into account the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the guillemot population is of low magnitude. Non-breeding season The magnitude of the cumulative effect of these projects in the non-breeding season may result in a displacement mortality of 907.3 to 2,721.8 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 756.1 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for common guillemot when applying the non-breeding season impact calculated using NatureScot's advocated parameters indicates a median 0.7979 to 0.9277; (i.e. the population after 35 years, would be 7.23 to 20.21% smaller than the CPS with a 50th percentile value of 10.5 to 34.3 (Table 11.68). In terms of the population size, this means that the median of the impacted population fell within the 10th to 34th percentile of the unimpacted population (a value of 50 would indicate that they are the same). However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9936 to 0.9979 which translates to a growth rate 0.21 to 0.64% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would be undetectable against natural fluctuations in the growth rate currently seen in the regional population. However, as noted earlier in section 11.11.5, research examining the displacement effects on common guillemots indicates that a 50% displacement rate is more reflective,

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		with this rate still regarded as precautionary (RoyalHaskoning, 2013; Peschko *et al*. 2020; APEM, 2022; MacArthur Green, 2023). Consequently, it is anticipated that the Applicant's approach (incorporating a 50% displacement rate alongside a 1% mortality rate) leads to an estimate that aligns more closely with actual conditions. When following the Applicant's approach, the PVA predicted that the CPS was 0.9393 which translates to a reduction in population size of 6.07%, with a 50th percentile value of 36.7. In terms of the population size, this implies that the median of the impacted population fell within the 36th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario was still within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. As stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted that the CGR was 0.9982 which translates to a median reduction of 0.18% in population growth rate after 35 years. Such a decrease indicates that this level of impact would not adversely affect the population. The Scottish breeding population of common guillemot, of which the non-breeding season population is comprised, has decreased between the two most recent national censuses with a decline of 31% (Burnell *et al*., 2023) with this also reflected, albeit to a lesser extent on a UK scale (11%; Burnell *et al.*, 2023). However, these decreases come after a longer period of significant increases in both Scotland and the UK. Surveys in 2023, aimed at detecting changes in seabird breeding populations due to HPAI showed an overall 6% decrease in breeding common guillemots compared to pre-HPAI counts from monitored sites (Tremlett *et al.*, 2024). Despite the recent declining trend in the common guillemot breeding population at both a Scottish and UK scale, the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would accelerate such declines to a measurable extent.

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		When taking into account the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the guillemot population is of low magnitude. <u>Annual</u> The magnitude of the cumulative effect of these projects on an annual basis may result in a displacement mortality of 3,724.5 to 7,673.6 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 1,645.5 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for common guillemot when applying the breeding season impact calculated using NatureScot's advocated parameters indicates a median CPS of 0.5271 to 0.7340; (i.e. the population after 35 years, would be 26.60 to 47.29% smaller than the CPS with a 50th percentile value of 0.0 to 4.4 (Table 11.68). In terms of the population size, this means that the median of the impacted population fell within the zero to 4^{th} percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that this level of impact would have an adverse effect on the population, with a clear divergence between the impacted and unimpacted population size. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9819 to 0.9912 which translates to a growth rate 0.88 to 1.81% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would adversely affect the population. However, as noted earlier in section 11.11.5, research examining the displacement effects on common guillemots indicates that a 50% displacement rate is more reflective, with this rate still regarded as precautionary (RoyalHaskoning, 2013; Peschko *et al.* 2020; APEM, 2022; MacArthur Green, 2023). Consequently, it is anticipated that the

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		Applicant's approach (incorporating a 50% displacement rate alongside a 1% mortality rate) leads to an estimate that aligns more closely with actual conditions. When following the Applicant's approach, the PVA predicted that the CPS was 0.8725 which translates to a reduction in population size of 12.75%, with a 50th percentile value of 22.6. In terms of the population size, this implies that the median of the impacted population fell within the 22nd percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario was still within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. As stated, the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted that the CGR was 0.9961 which translates to a median reduction of 0.39% in population growth rate after 35 years. Such a decrease indicates that this level of impact would not adversely affect the population. The Scottish breeding population of common guillemot has decreased between the two most recent national censuses with a decline of 31% (Burnell *et al*., 2023) with this also reflected, albeit to a lesser extent on a UK scale (11%; Burnell *et al.,* 2023). However, these decreases come after a longer period of significant increases in both Scotland and the UK. Surveys in 2023, aimed at detecting changes in seabird breeding populations due to HPAI showed an overall 6% decrease in breeding common guillemots compared to pre-HPAI counts from monitored sites (Tremlett *et al.,* 2024). Under all scenarios the counterfactual scenario predicts a positive population growth rate and under the upper estimate of NatureScot's scenario the population growth rate remains positive meaning the population will continue to grow despite the presence of Morven South and the cumulative projects. It should also be noted that the contribution of Morven South to the total annual cumulative impact is only 1.11%. Despite the recent declining trend in the common guillemot breeding population at both a Scottish and UK scale, the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would accelerate such declines

	Cumulative effects assessment	
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		to a meaningful extent. When taking into account the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the guillemot population is of low magnitude.
Sensitivity of receptor	The sensitivity of common guillemot is considered to be as described for the assessment of Morven South alone (see paragraphs 11.11.5.29 to 11.11.5.32). Common guillemot is deemed to be of high vulnerability, high recoverability, and international value. The sensitivity of the receptor is therefore considered to be high.	The sensitivity of common guillemot is considered to be as described for the assessment of Morven South alone (see paragraphs 11.11.5.29 to 11.11.5.32). Common guillemot is deemed to be of high vulnerability, high recoverability, and international value. The sensitivity of the receptor is therefore considered to be high.
Significance of effect	Overall the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.	In all seasons, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect on common guillemot will, therefore, be of minor to moderate adverse significance. Due to the factors identified above that lead to considerable of over-estimation of the cumulative impact the PVA results suggesting that the predicted impact will have an insignificant impact on the growth rate of the population, the impact is considered minor. It is therefore deemed appropriate to categorise the impact as having a **minor adverse** significance, which is not significant in EIA terms.
Further mitigation and residual significance	No mitigation measures for common guillemot in relation to displacement are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.	No mitigation measures for common guillemot in relation to displacement are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

Razorbill

11.13.3.16 The predicted impact from the Morven Programme is presented in Table 11.70. Displacement mortalities presented in brackets in Table 11.70 are those calculated when applying the Applicant's displacement and mortality rates. The estimated percentage point increase in baseline mortality of razorbill exceeds the 0.02 percentage point threshold as defined by NatureScot (NatureScot, 2023h) when using the upper end of the displacement and mortality rates recommended by NatureScot in the post-breeding season and on an annual basis. PVA modelling has therefore been conducted with outputs for all relevant scenarios provided in Table 11.71. The 0.02 percentage point threshold is not surpassed in any season or on an annual basis when applying the displacement and mortality rates advocated by the Applicant.

Table 11.70: Predicted impacts for razorbill associated with Morven North and Morven South

Project	Breeding	Post-breeding	Non-breeding	Pre-breeding	Annual
Morven Programme assessment					
Morven North	5.7 to 9.5 (1.6)	39.2 to 117.6 (32.7)	3.2 to 9.5 (2.6)	0.7 to 2.0 (0.5)	48.7 to 138.6 (37.4)
Morven South	1.0 to 1.7 (0.3)	17.6 to 52.8 (14.7)	2.4 to 7.3 (2.0)	0.5 to 1.6 (0.4)	21.6 to 63.4 (17.4)
Total	6.7 to 11.2 (1.9)	56.8 to 170.4 (47.3)	5.6 to 16.8 (4.7)	1.2 to 3.6 (1.0)	70.3 to 202.0 (54.9)
Change in baseline mortality (% point change)	0.008 to 0.014 (0.002)	0.010 to 0.029 (0.008)	0.003 to 0.008 (0.002)	<0.001 to 0.001 (<0.001)	0.012 to 0.034 (0.009)

Table 11.71: Summary of population viability analysis results for razorbill displacement impacts after 35 years as a result of impacts associated with the Morven Programme assessment (grey cells indicate projects that do not contribute alongside Morven South in relevant seasons)

Scenario	Predicted Mortality (no. of birds)	Increase in baseline mortality (% point change)	Median population size (no. of birds)	Growth Rate (Annual GR)	Change in population (%)	Median CGR	Median CPS	Quantile – unimpacted: 50%impacted
Morven Programme assessment								
Post-breeding								
Baseline	-	-	148,341	0.9764	-56.72	-	-	-
NatureScot Upper	170.4	0.029	146,672	0.9760	-57.28	0.9997	0.9879	48.94
Annual								
Baseline	-	-	148,324	0.9763	-56.77	-	-	-
NatureScot Upper	202.0	0.034	146,365	0.9759	-57.38	0.9996	0.9861	48.90

11.13.3.17 The estimated cumulative abundance of razorbill from relevant projects is presented in Table 11.72. The impacts estimated when applying the displacement and mortality rates advocated by both NatureScot and the Applicant are calculated in Table 11.73 with the effect these impacts have on the baseline mortality of the relevant populations also provided.

11.13.3.18 In all four seasons (breeding, post breeding, non-breeding and pre-breeding) and on an annual basis the estimated percentage point increase in baseline mortality of razorbill exceeds the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). This conclusion is applicable when modelling using the displacement and mortality rates advocated by both NatureScot and the Applicant (Table 11.72) and therefore PVA modelling has been conducted with the outputs provided in Table 11.74.

Table 11.72: Mean-peak population estimates for razorbill at projects considered cumulatively

Project	Breeding	Post-breeding	Non-breeding	Pre-breeding	Annual
Tier 1					
Aberdeen	175	37	13	33	258
Aspen	79	0	33	28	140
Beatrice		0	2,087	0	2,087
Berwick Bank	4,040	8,849	1,399	7,480	21,768
Blyth Demo		94	16	0	109
Buchan		71	20	126	218
Caledonia North		1,315	126	345	1,786
Caledonia South		803	164	251	1,218
Cenos		0	0	0	0
Dogger Bank A		3,215	2,236	6,125	11,575
Dogger Bank B		3,982	2,774	7,549	14,305
Dogger Bank South		6,350	5,824	6,303	18,476
Dogger Bank C		813	1,166	2,680	4,658
Sofia		1,366	1,685	4,099	7,149
Dudgeon		108	698	449	1,254
Dudgeon Extension		923	845	320	2,088
East Anglia One		59	280	787	1,127
East Anglia ONE North		85	54	207	346
East Anglia THREE		1,122	1,499	1,524	4,145
East Anglia TWO		44	136	230	410
Five Estuaries		284	1,046	756	2,086

Project	Breeding	Post-breeding	Non-breeding	Pre-breeding	Annual
Galloper		54	138	770	962
Green Volt	457	0	58	0	515
Hornsea Project ONE		8,815	2,088	2,296	13,199
Hornsea Project TWO		4,221	720	1,668	6,609
Hornsea Project THREE		2,020	3,649	1,236	6,905
Hornsea FOUR		4,311	455	449	5,215
Humber Gateway		124	52	21	197
Inch Cape	4,671	7,469	585	764	13,488
Kincardine	64	0	0	0	64
Lincs		164	23	8	194
Moray East		0	1,421	0	1,421
Moray West		3,544	184	3,585	7,313
Morven North	316	6,534	530	109	7,489
Morven South	57	2,935	403	89	3,484
Muir Mhor	1,549	1,388	42	117	3,095
Neart na Gaoithe	1,248	0	3,101	0	4,349
Norfolk Boreas		263	1,065	345	1,673
Norfolk Vanguard		866	627	924	2,417
North Falls		248	1,781	1,741	3,770
Ossian	528	2608	138	224	3,498
Outer Dowsing		2,185	1,779	5,134	9,098
Race Bank		284	96	34	413
Rampion		5	156	513	674
Rampion 2		23	1,193	6,303	7,519
Salamander	334	0	484	0	818
SeaGreen Bravo	3,627	1,273	244	616	5,759
SeaGreen Alpha	5,502	1,337	772	945	8,555
Sheringham Shoal Extension		316	686	144	1,146
Teesside		80	6	26	112
Thanet		4	67	20	91
Triton Knoll		670	2,222	445	3,337

Project	Breeding	Post-breeding	Non-breeding	Pre-breeding	Annual
Total	24,613	81,259	46,863	67,815	220,550

Table 11.73: Assessment of predicted cumulative displacement mortality for razorbill on seasonal and annual bases against the baseline mortality of relevant regional populations

Season	Displacement rate (%)	Mortality rate (%)	Regional baseline population (no. of birds)	Baseline mortality	Displacement mortality (no. of birds)	Change in baseline mortality (% point change)
NatureScot's approach						
Breeding	60	3 to 5	88,821	0.172	443.0 to 738.4	0.499 to 0.831
Post-breeding		1 to 3	591,874		487.6 to 1,462.7	0.082 to 0.247
Non-breeding		1 to 3	218,622		281.2 to 843.5	0.129 to 0.386
Pre-breeding		1 to 3	591,874		406.9 to 1,220.7	0.069 to 0.206
Annual		3 to 5 (breeding) 1 to 3 (non-breeding seasons)	591,874		1,618.7 to 4,265.3	0.273 to 0.721
Applicant's approach						
Breeding	50	1	88,821	0.172	123.1	0.139
Post-breeding			591,874		406.3	0.069
Non-breeding			218,622		234.3	0.107
Pre-breeding			591,874		339.1	0.057
Annual			591,874		1,102.7	0.186

Table 11.74: Summary of Population Viability Analysis results for razorbill displacement impacts after 35 years as a result of impacts associated with the cumulative assessment

Scenario	Predicted mortality (no. of birds)	Increase in baseline mortality (% point change)	Median population size (no. of birds)	Growth Rate (Annual GR)	Change in population (%)	Median CGR	Median CPS	Quantile – unimpacted: 50%impacted
Cumulative assessment								
Breeding								
Baseline	-	-	26,253	0.9763	-56.85	-	-	-
NatureScot Lower	443.0	0.499	21,360	0.9705	-64.93	0.9941	0.8133	30.6
NatureScot Upper	738.4	0.831	18,578	0.9667	-69.43	0.9902	0.7083	19.7
Applicant	123.1	0.139	24,811	0.9747	-59.25	0.9984	0.9441	44.5
Post-breeding								
Baseline	-	-	152,688	0.9768	-56.00	-	-	-
NatureScot Lower	487.6	0.082	147,602	0.9758	-57.51	0.9990	0.9663	46.6
NatureScot Upper	1,462.7	0.247	138,115	0.9740	-60.23	0.9971	0.9028	40.3
Applicant	406.3	0.069	148,537	0.9760	-57.22	0.9992	0.9719	47.2
Non-breeding								
Baseline	-	-	56,483	0.9768	-56.02	-	-	-
NatureScot Lower	281.2	0.129	53,501	0.9753	-58.34	0.9985	0.9480	44.8
NatureScot Upper	843.5	0.386	48,040	0.9724	-62.48	0.9954	0.8523	35.2

Scenario	Predicted mortality (no. of birds)	Increase in baseline mortality (% point change)	Median population size (no. of birds)	Growth Rate (Annual GR)	Change in population (%)	Median CGR	Median CPS	Quantile – unimpacted: 50%impacted
Applicant	234.3	0.107	53,954	0.9755	-57.95	0.9987	0.9565	45.6
Pre-breeding								
Baseline	-	-	152,688	0.9768	-56.00	-	-	-
NatureScot Lower	406.9	0.069	148,338	0.9760	-57.27	0.9992	0.9720	47.1
NatureScot Upper	1,220.7	0.206	140,270	0.9744	-59.66	0.9976	0.9183	41.8
Applicant	339.1	0.057	149,441	0.9761	-57.09	0.9993	0.9765	47.8
Annual								
Baseline	-	-	152,688	0.9768	-56.00	-	-	-
NatureScot Lower	1,618.7	0.273	136,396	0.9737	-60.69	0.9968	0.8931	39.3
NatureScot Upper	4,265.3	0.721	113,247	0.9685	-67.41	0.9915	0.7415	23.6
Applicant	1,102.7	0.186	141,362	0.9747	-59.27	0.9978	0.9257	42.3

Table 11.75: Morven South cumulative effects assessment for razorbill in relation to displacement impacts

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
Operations and maintenance phase		
Magnitude of impact	The cumulative effects assessment for Scenario 3 considers the relevant elements of the Morven Programme (Morven South and Morven North). The estimated percentage point increase in baseline mortality associated with the impact predicted for the Morven Programme remains below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h) when applying the displacement and mortality rates advocated by the Applicant (Table 11.71) and therefore additional analysis including PVA modelling is not required. When applying the upper end of the displacement and mortality rate ranges advocated by NatureScot, the 0.02 percentage point threshold is surpassed (Table 11.71). PVA has therefore conducted for this scenario. Further information on the PVA is presented in Volume 3, Annex 11.6 Offshore Ornithology Regional Population Viability Analysis. The PVA model conducted when applying annual impact calculated using the upper range NatureScot's displacement and mortality rates indicates a median CPS of 0.9861; i.e. the population after 35 years, would be 1.4% smaller than the counterfactual population size with a	The cumulative effects assessment for Scenario 4 considers Morven South together with the Tier 1 (including Morven North), Tier 2 and Tier 3 projects where suitable data to inform the assessment are available. Breeding season The magnitude of the cumulative effect of these projects in the breeding season may result in a displacement mortality of 443.0 to 738.4 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 123.1 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for razorbill when applying the breeding season impact calculated using NatureScot's advocated parameters indicates a median CPS of 0.7083 to 0.8133; i.e. the population after 35 years, would be 18.67% to 29.17% smaller than the CPS with a 50th percentile value of 19.7 to 30.6 (Table 11.74). In terms of the population size, this means that the median of the impacted population fell within the 19th to 30th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario was still within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9902 to 0.9941 which translates to a growth rate 0.59% to 0.98% smaller than the counterfactual (unimpacted) growth rate. Under the NatureScot rates, the predicted impact represents a small but detectable change in population growth rate, however is not considered of sufficient magnitude to significantly affect the population.

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
	50th percentile value of 48.9 (Table 11.71). In terms of the population size, this means that the median of the impacted population fell within the 49th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario is still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9996 which means that the population growth rate would not be materially different to the counterfactual (unimpacted) growth rate. This indicates that this level of impact would not adversely affect the population and would only result in a slight reduction in the growth rate currently seen in the regional population and would therefore be undetectable against natural population fluctuations. The differences between the impacted and unimpacted scenarios for the post-breeding impact scenarios are naturally less pronounced than those associated with the annual impact as the same population is used in these two seasons for razorbill. As it has been concluded that the outputs for the annual impact scenarios	It should be noted that the contribution of Morven South to the total cumulative impact calculated applying NatureScot's displacement and mortality rates is only 0.23%. However, as noted earlier in section 11.11.5, research examining the displacement effects on razorbill indicates that a 50% displacement rate is more reflective, with this rate still regarded as precautionary (RoyalHaskoning, 2013; Peschko *et al*. 2020; APEM, 2022; MacArthur Green, 2023). Consequently, it is anticipated that the Applicant Approach (incorporating a 50% displacement rate alongside a 1% mortality rate) leads to an estimate that aligns more closely with actual conditions. When following the Applicant's approach, the PVA predicted that the CPS was 0.9441 which translates to a reduction in population size of 5.59%, with a 50th percentile value of 44.5. In terms of the population size, this implies that the median of the impacted population fell within the 44th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario was still within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. As stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted that the CGR was 0.9984 which translates to a median reduction of 0.16% in population growth rate after 35 years. Such a decrease indicates that this level of impact would not adversely affect the population. It should be noted that the contribution of Morven South to the total cumulative impact calculated applying the Applicant's displacement and mortality rates is only 0.24%. In addition, under the unimpacted scenario, within the PVA model, razorbill population was estimated to decline. However, the recent published Seabirds Count (Burnell *et al*. 2023) highlighted that overall, razorbill populations within the UK have increased by 18%, with SPA colonies in Scotland experiencing population changes of between -89% to +92%. It is important to note that the population models utilised in this analysis were not density dependent (to follow NatureScot guidance). As a result, population size predictions are not constrained by the model and can be predicted to grow, or decline,

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
	do not suggest any changes in the regional razorbill population that are detectable against natural fluctuations this conclusion is considered to be equally applicable to the impacts predicted in the post-breeding season. These results indicate that this level of impact would not significantly alter the trends in the regional population of razorbill predicted by the PVA with no material change in the predicted growth rate and would therefore be undetectable against natural population fluctuations. The impact is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. Therefore, the magnitude of impact is considered to be negligible.	in unrealistic ways. While the PVA models indicate a decline in population regardless of impact, this contradicts the recently published results from the Seabirds Census (Burnell *et al*., 2023), which demonstrate an increase in razorbill populations despite the model predictions. The predicted effect on the growth rate as predicted by PVA modelling is therefore not considered to be of a magnitude that would accelerate such declines to a measurable extent. As a result the magnitude of impact on the razorbill population in the breeding season is considered to be of low magnitude. This conclusion is reached by also considering the over-estimation of both the predicted impact and PVA outputs caused by the following factors: • Over-estimation of cumulative impacts. The PVA modelling does not account for changes in the predicted cumulative total due to the decommissioning of projects considered cumulative. Over the lifetime of Morven South, the cumulative impact will reduce significantly when licences for current projects expire and decommissioning occurs. The PVA metrics are therefore highly precautionary. • No consideration has been made for density dependent compensation of demographic parameters within the modelled population, nor immigration, both of which could reduce the magnitude of any population change. • The populations of razorbill at projects considered cumulatively have been estimated incorporating availability bias factors from Thaxter (2010). Dunn *et al*. (2024) presents updated monthly availability bias factors for razorbill for July to January. The correction factors provided in Dunn *et al*. (2024) are lower than those applied to calculate the population estimates used for projects considered in-cumulatively in all months except January. It is therefore considered that these populations likely represent an over-estimate of the number of razorbill present at each project between July and December.

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		• For a number of recent projects, it has been concluded as part of the Appropriate Assessments conducted that the predicted in-combination impacts are at a magnitude that represents an AEOI on the integrity on a number of SPAs. As a result these projects have been required to submit derogation cases which include compensation measures. For razorbill this is applicable to Berwick Bank, Buchan, Dogger Bank South, Five Estuaries, Green Volt, North Falls, Outer Dowsing, Ossian and Salamander. The compensatory measures associated with these projects will work to ensure there is no residual effect of these projects on the razorbill features of relevant SPAs which form part of the regional population used as part of the cumulative assessments for Morven South. The impacts associated with these projects should theoretically be reduced to take account of the proposed compensation measures within the assessments presented above, which would lead to reduced impact magnitudes and improved PVA metrics. <u>Post-breeding season</u> The magnitude of the cumulative effect of these projects in the post-breeding season may result in a displacement mortality of 487.6 to 1,462.7 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 406.3 birds/annum. This magnitude impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for razorbill when applying the post-breeding season impact calculated using NatureScot's advocated parameters indicates a median CPS of 0.9028 to 0.9663; i.e. the population after 35 years, would be 3.37 to 9.72% smaller than the CPS with a 50th percentile value of 40.3 to 46.6 (Table 11.74). In terms of the population size, this means that the median of the impacted population fell within the 40th to 46th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario was still within the margin of error of

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9971 to 0.9990 which translates to a growth rate 0.10 to 0.29% smaller than the counterfactual (unimpacted) growth rate. Under the NatureScot rates, the predicted impact represents a small but detectable change in population growth rate, however is not considered of sufficient magnitude to significantly affect the population. However, as noted earlier in section 11.11.5, research examining the displacement effects on razorbill indicates that a 50% displacement rate is more reflective, with this rate still regarded as precautionary (RoyalHaskoning, 2013; Peschko *et al*. 2020; APEM, 2022; MacArthur Green, 2023). Consequently, it is anticipated that the Applicant's approach (incorporating a 50% displacement rate alongside a 1% mortality rate) leads to an estimate that aligns more closely with actual conditions. When following the Applicant's approach, the PVA predicted that the CPS was 0.9719 which translates to a reduction in population size of 2.18%, with a 50th percentile value of 47.2. In terms of the population size, this implies that the median of the impacted population fell within the 47th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario was still within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. As stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted that the CGR was 0.9992 which translates to a median reduction of 0.08% in population growth rate after 35 years. Such a decrease indicates that this level of impact would not adversely affect the population.

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		In the post-breeding season, the main contributor to the post-breeding BDMPS population is Iceland. The Icelandic population has shown increases in the short-term but decreases over the long-term (Burnell *et al*., 2023). When taking into account the outputs of the PVA and the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the razorbill population is of negligible magnitude. <u>Non-breeding season</u> The magnitude of the cumulative effect of these projects in the non-breeding season may result in a displacement mortality of 281.2 to 843.5 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 234.3 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for razorbill when applying the non-breeding season impact calculated using NatureScot's advocated parameters indicates a median CPS of 0.8523 to 0.9480; i.e. the population after 35 years, would be 5.20% to 14.77% smaller than the CPS with a 50th percentile value of 35.2 to 44.8 (Table 11.74). In terms of the population size, this means that the median of the impacted population fell within the 35th to 44th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario was still within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9954 to 0.9985 which translates to a growth rate 0.15% to 0.46% smaller than the counterfactual (unimpacted) growth rate. Under the NatureScot rates, the predicted impact represents a small but detectable change in population growth

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		rate, however is not considered of sufficient magnitude to significantly affect the population. It should be noted that the contribution of Morven South to the total cumulative impact calculated applying NatureScot's displacement and mortality rates is only 0.85 to 0.87%. However, as noted earlier in section 11.11.5, research examining the displacement effects on razorbill indicates that a 50% displacement rate is more reflective, with this rate still regarded as precautionary (RoyalHaskoning, 2013; Peschko *et al*. 2020; APEM, 2022; MacArthur Green, 2023). Consequently, it is anticipated that the Applicant's approach (incorporating a 50% displacement rate alongside a 1% mortality rate) leads to an estimate that aligns more closely with actual conditions. When following the Applicant's approach, the PVA predicted that the CPS was 0.9565 which translates to a reduction in population size of 4.35%, with a 50th percentile value of 45.6. In terms of the population size, this implies that the median of the impacted population fell within the 45th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario was still within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. As stated, the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted that the CGR was 0.9987 which translates to a median reduction of 0.13% in population growth rate after 35 years. Such a decrease indicates that this level of impact would not adversely affect the population. It should be noted that the contribution of Morven South to the total cumulative impact calculated applying the Applicant's displacement and mortality rates is only 0.85%. In the non-breeding season, the main contributor to the non-breeding BDMPS population is Iceland. The Icelandic population has shown increases in the short-term but decreases over the long-term (Burnell *et al*., 2023). When taking into account the outputs of the PVA and the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		above, it is considered that the magnitude of impact on the razorbill population is of negligible magnitude. Pre-breeding season The magnitude of the cumulative effect of these projects in the pre-breeding season may result in a displacement mortality of 406.9 to 1,220.7 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 339.1 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for razorbill when applying the pre-breeding season impact calculated using NatureScot's advocated parameters indicates a median CPS of 0.9183 to 0.9720; i.e. the population after 35 years, would be 2.80 to 8.17% smaller than the CPS with a 50th percentile value of 41.8 to 47.1 (Table 11.74). In terms of the population size, this means that the median of the impacted population fell within the 41st to 47th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario was still within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9976 to 0.9992 which translates to a growth rate 0.08 to 0.24% smaller than the counterfactual (unimpacted) growth rate. Under the NatureScot rates, the predicted impact represents a small but detectable change in population growth rate, however is not considered of sufficient magnitude to significantly affect the population. It should be noted that the contribution of Morven South to the total cumulative impact calculated applying NatureScot's displacement and mortality rates is only 0.12 to 0.13%. However, as noted earlier in section 11.11.5, research examining the displacement effects on razorbill indicates that a 50% displacement rate is more reflective, with this

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		rate still regarded as precautionary (RoyalHaskoning, 2013; Peschko *et al*. 2020; APEM, 2022; MacArthur Green, 2023). Consequently, it is anticipated that the Applicant's approach (incorporating a 50% displacement rate alongside a 1% mortality rate) leads to an estimate that aligns more closely with actual conditions. When following the Applicant's approach, the PVA predicted that the CPS was 0.9765 which translates to a reduction in population size of 2.35%, with a 50th percentile value of 47.8. In terms of the population size, this implies that the median of the impacted population fell within the 47th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario was still within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. As stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted that the CGR was 0.9993 which translates to a median reduction of 0.07% in population growth rate after 35 years. Such a decrease indicates that this level of impact would not adversely affect the population. It should be noted that the contribution of Morven South to the total cumulative impact calculated applying the Applicant's displacement and mortality rates is only 0.12%. In the pre-breeding season, the main contributor to the pre-breeding BDMPS population is Iceland. The Icelandic population has shown increases in the short-term but decreases over the long-term (Burnell *et al*., 2023). When taking into account the outputs of the PVA and the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the razorbill population is of negligible magnitude. <u>Annual</u>

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		The magnitude of the cumulative effect of these projects on an annual basis may result in a displacement mortality of 1,618.7 to 4,265.3 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 1,102.7 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for razorbill when applying the annual impact calculated using NatureScot's advocated parameters indicates a median CPS of 0.7415 to 0.8931; i.e. the population after 35 years, would be 10.69 to 25.49% smaller than the CPS with a 50th percentile value of 23.6 to 39.3 (Table 11.74). In terms of the population size, this means that the median of the impacted population fell within the 23rd to 39th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario was still within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9915 to 0.9968 which translates to a growth rate 0.35 to 0.85% smaller than the counterfactual (unimpacted) growth rate. Under the NatureScot rates, the predicted impact represents a small but detectable change in population growth rate, however is not considered of sufficient magnitude to significantly affect the population. However, as noted earlier in section 11.11.5, research examining the displacement effects on razorbill indicates that a 50% displacement rate is more reflective, with this rate still regarded as precautionary (RoyalHaskoning, 2013; Peschko *et al*. 2020; APEM, 2022; MacArthur Green, 2023). Consequently, it is anticipated that the Applicant's approach (incorporating a 50% displacement rate alongside a 1% mortality rate) leads to an estimate that aligns more closely with actual conditions. When following the Applicant's approach, the PVA predicted that the CPS was 0.9257 which translates to a reduction in population size of 7.43%, with a 50th percentile value

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		of 42.3. In terms of the population size, this implies that the median of the impacted population fell within the 42nd percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario was still within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. As stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted that the CGR was 0.9978 which translates to a median reduction of 0.22% in population growth rate after 35 years. Such a decrease indicates that this level of impact would not adversely affect the population. When taking into account the outputs of the PVA and the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, the magnitude of impact on the razorbill population annually is considered to be of low magnitude.
Sensitivity of receptor	The sensitivity of razorbill is considered to be as described for the assessment of Morven South alone (see paragraphs 11.11.5.38 to 11.11.5.41). Razorbill is deemed to be of high vulnerability, high recoverability, and international value. The sensitivity of the receptor is therefore considered to be high.	The sensitivity of razorbill is considered to be as described for the assessment of Morven South alone (see paragraphs 11.11.5.38 to 11.11.5.41). Razorbill is deemed to be of high vulnerability, high recoverability, and international value. The sensitivity of the receptor is therefore considered to be high.
Significance of effect	Overall the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.	During the breeding season, the magnitude of the impact is deemed to be and when combined with the high sensitivity of the receptor, the resulting effect could be of minor to moderate adverse significance. However, the PVA results suggest that the predicted impact will have an insignificant impact on the growth rate and therefore the level of impact would more appropriately be classified as of **minor adverse** significance. For the pre-breeding season, post-breeding season, non-breeding season and on an annual basis, the PVA results consistently indicate no significant adverse effects. In all

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		cases, the predicted impacts are of negligible to low magnitude across these periods. The effect will, therefore, be of minor to moderate adverse significance. However, the PVA results suggest that the predicted impact will have an insignificant impact on the growth rate of the population and it is therefore considered that **minor adverse** significance is appropriate. In the post-breeding, non-breeding and pre-breeding seasons, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect on razorbill will, therefore, be of **minor adverse** significance. On an annual basis and in the breeding season, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect on razorbill will, therefore, be of minor to moderate adverse significance. Due to the factors identified above that lead to considerable of over-estimation of the cumulative impact and the PVA results suggesting that the predicted impact will have an insignificant impact on the growth rate of the population, the impact is considered minor. It is therefore deemed appropriate to categorise the impact as having a **minor adverse** significance, which is not significant in EIA terms.
Further mitigation and residual significance	No mitigation measures for razorbill in relation to displacement are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.	No mitigation measures for razorbill in relation to displacement are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

Puffin

11.13.3.19 The predicted impact from the Morven Programme is presented in Table 11.76. Displacement mortalities presented in brackets in Table 11.76 are those calculated when applying the Applicant's displacement and mortality rates. In both seasons (breeding and non-breeding) and on an annual basis the estimated percentage point increase in baseline mortality of puffin remains well below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). This conclusion is applicable when modelling using the displacement and mortality rates advocated by both NatureScot and the Applicant and therefore additional analysis including PVA modelling is not required.

Table 11.76: Predicted impacts for puffin associated with Morven South and Morven North

Project	Breeding	Non-breeding	Annual
Morven Programme assessment			
Morven North	11.3 to 18.8 (3.1)	8.3 to 24.9 (6.9)	19.6 to 43.7 (10.1)
Morven South	1.9 to 3.2 (0.5)	2.6 to 7.8 (2.2)	4.5 to 11.0 (2.7)
Total	13.2 to 21.9 (3.7)	10.9 to 32.7 (9.1)	24.1 to 54.7 (12.7)
Change in baseline mortality (% point change)	0.003 to 0.005 (0.001)	0.005 to 0.014 (0.004)	0.005 to 0.014 (0.004)

11.13.3.20 The estimated cumulative abundance of puffin from relevant projects is presented in Table 11.77. The impacts estimated when applying the displacement and mortality rates advocated by both NatureScot and the Applicant are calculated in Table 11.78 with the effect these impacts have on the baseline mortality of the relevant populations also provided.

11.13.3.21 In both seasons (breeding, and non-breeding) and on an annual basis the estimated percentage point increase in baseline mortality of puffin exceeds the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). This conclusion is applicable when modelling using the displacement and mortality rates advocated by both NatureScot and the Applicant (Table 11.76) and therefore PVA modelling has been conducted with the outputs provided in Table 11.79.

Table 11.77: Mean-peak population estimates for puffin at projects considered cumulatively (grey cells indicate projects that do not contribute alongside Morven South in relevant seasons)

Project	Breeding	Non-breeding	Annual
Tier 1			
Aberdeen	65	59	124
Aspen	355	112	467
Beatrice	2,685	2,288	4,973
Berwick Bank	4,513	8,892	13,405
Blyth Demo	207	42	249
Buchan	938	524	1,461
Caledonia North	1,309	739	2,048

Project	Breeding	Non-breeding	Annual
Caledonia South	1,209	769	1,978
Cenos	221	67	288
Dogger Bank A	119	426	545
Dogger Bank B	320	1,199	1,519
Dogger Bank South	147	373	519
Dogger Bank C	120	550	670
Sofia	151	582	733
Dudgeon		41	41
Dudgeon Extension		45	45
East Anglia One		35	35
East Anglia THREE		307	307
Green Volt	250	41	291
Hornsea Project ONE		1,534	1,534
Hornsea Project TWO		2,039	2,039
Hornsea Project THREE		127	127
Hornsea FOUR		442	442
Humber Gateway		38	38
Inch Cape	5,678	1,864	7,542
Kincardine	90	0	90
Lincs		4	4
Moray East	3,053	717	3,770
Moray West	1,115	3,966	5,081
Morven North	625	1,385	2,010
Morven South	106	433	539
Muir Mhor	1,812	1,812	3,624
Neart na Gaoithe	6,173	3,656	9,829
Norfolk Vanguard		112	112
Ossian	1,928	1,178	3,106
Outer Dowsing		414	414
Pentland		6	6
Race Bank		14	14
Rampion		0	0
Salamander	357	1,852	2,209
SeaGreen Bravo	3,582	3,863	7,445
SeaGreen Alpha	2,572	1,526	4,098

Project	Breeding	Non-breeding	Annual
Sheringham Shoal Extension		11	11
Teesside	55	56	110
Triton Knoll		57	57
Total	39,754	44,194	83,948

Table 11.78: Assessment of predicted cumulative displacement mortality for puffin on seasonal and annual bases against the baseline mortality of relevant regional populations

<table>
<tr><th>Season</th><th>Displacement rate (%)</th><th>Mortality rate (%)</th><th>Regional baseline population (no. of birds)</th><th>Baseline mortality</th><th>Displacement mortality (no. of birds)</th><th>Change in baseline mortality (% point change)</th></tr>
<tr><td colspan="7">NatureScot's approach</td></tr>
<tr><td>Breeding</td><td rowspan="3">60</td><td>3 to 5</td><td>449,089</td><td rowspan="3">0.176</td><td>715.6 to 1,192.6</td><td>0.159 to 0.266</td></tr>
<tr><td>Non-breeding</td><td>1 to 3</td><td>231,957</td><td>265.2 to 795.5</td><td>0.114 to 0.343</td></tr>
<tr><td>Annual</td><td>3 to 5 (breeding)
1 to 3 (non-breeding season)</td><td>449,089</td><td>980.7 to 1,988.1</td><td>0.218 to 0.443</td></tr>
<tr><td colspan="7">Applicant's approach</td></tr>
<tr><td>Breeding</td><td rowspan="3">50</td><td rowspan="3">1</td><td>449,089</td><td rowspan="3">0.176</td><td>198.8</td><td>0.044</td></tr>
<tr><td>Non-breeding</td><td>231,957</td><td>221.0</td><td>0.095</td></tr>
<tr><td>Annual</td><td>449,089</td><td>419.7</td><td>0.093</td></tr>
</table>

Table 11.79: Summary of Population Viability Analysis results for puffin displacement impacts after 35 years as a result of impacts associated with the cumulative assessment

Scenario	Predicted mortality (no. of birds)	Increase in baseline mortality (% point change)	Median population size (no. of birds)	Growth Rate (Annual GR)	Change in population (%)	Median CGR	Median CPS	Quantile – unimpacted: 50%impacted
Cumulative assessment								
Breeding								
Baseline	-	-	105,405	0.9718	-63.32	-	-	-
NatureScot Lower	715.6	0.159	98,744	0.9700	-65.62	0.9981	0.9365	45.1
NatureScot Upper	1192.6	0.266	94,422	0.9688	-66.99	0.9969	0.8962	42.1
Applicant	198.8	0.044	103,471	0.9713	-63.97	0.9995	0.9820	48.6
Non-breeding								
Baseline	-	-	46,502	0.9725	-62.26	-	-	-
NatureScot Lower	265.2	0.114	44,325	0.9712	-64.00	0.9986	0.9533	46.8
NatureScot Upper	795.5	0.343	40,276	0.9685	-67.32	0.9959	0.8674	39.6
Applicant	221.0	0.095	44,644	0.9714	-63.78	0.9989	0.9611	47.5
Annual								
Baseline	-	-	105,405	0.9718	-63.32	-	-	-
NatureScot lower	980.7	0.218	96,258	0.9693	-66.45	0.9974	0.9138	43.4
NatureScot Upper	1988.1	0.443	87,863	0.9667	-69.40	0.9948	0.8332	37.1

Scenario	Predicted mortality (no. of birds)	Increase in baseline mortality (% point change)	Median population size (no. of birds)	Growth Rate (Annual GR)	Change in population (%)	Median CGR	Median CPS	Quantile – unimpacted: 50%impacted
Applicant	419.7	0.093	101,504	0.9707	-64.66	0.9989	0.9621	47.1

Table 11.80: Morven South cumulative effects assessment for puffin in relation to displacement impacts

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
Operations and maintenance phase		
Magnitude of impact	The cumulative effects assessment for Scenario 3 considers the relevant elements of the Morven Programme (Morven South and Morven North). The estimated percentage point increase in baseline mortality associated with the impact predicted for the Morven Programme remains below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h) (Table 11.76). This conclusion is applicable when modelling using the parameters advocated by both NatureScot and the Applicant and therefore additional analysis including PVA modelling is not required. The cumulative effect is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be negligible.	The cumulative effects assessment for Scenario 4 considers Morven South together with the Tier 1 (including Morven North), Tier 2 and Tier 3 projects where suitable data to inform the assessment are available. Breeding season The magnitude of the cumulative effect of these projects in the breeding season may result in a displacement mortality of 715.6 to 1,192.6 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 198.8 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for puffin when applying the breeding season impact calculated using NatureScot's advocated parameters indicates a median CPS of 0.8962 to 0.9365; i.e. the population after 35 years, would be 6.35 to 10.38% smaller than the CPS with a 50th percentile value of 42.1 to 45.1 (Table 11.79). In terms of the population size, this means that the median of the impacted population fell within the 42nd to 45th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario was still within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9969 to 0.9981 which translates to a growth rate 0.19 to 0.31% smaller than the counterfactual (unimpacted) growth rate. Under the NatureScot rates, the predicted impact represents a small but detectable change in population growth rate, however is not considered of sufficient magnitude to significantly affect the population.

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		It should be noted that the contribution of Morven South to the total cumulative impact calculated applying NatureScot's displacement and mortality rates is only 0.27%. However, as noted earlier in section 11.11.5, research examining the displacement effects on puffin indicates that a 50% displacement rate is more reflective, with this rate still regarded as precautionary (RoyalHaskoning, 2013; Peschko *et al*. 2020; APEM, 2022; MacArthur Green, 2023). Consequently, it is anticipated that the Applicant's approach (incorporating a 50% displacement rate alongside a 1% mortality rate) leads to an estimate that aligns more closely with actual conditions. When following the Applicant's approach, the PVA predicted that the CPS was 0.9820 which translates to a reduction in population size of 1.80%, with a 50th percentile value of 48.6. In terms of the population size, this implies that the median of the impacted population fell within the 48th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario was still within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. As stated, the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted that the CGR was 0.9995 which translates to a median reduction of 0.05% in population growth rate after 35 years. Such a decrease indicates that this level of impact would not adversely affect the population and would likely remain undetectable against natural population fluctuations. It should be noted that the contribution of Morven South to the total cumulative impact calculated applying the Applicant's displacement and mortality rates is only 0.25%. The Scottish breeding population of puffin has decreased between the two most recent national censuses with a decline of 21% (Burnell *et al*., 2023) with this also reflected, albeit to a lesser extent on a UK scale (14%; Burnell *et al*., 2023). On a Scottish basis, this decline comes after long-term slight increases with this also reflected on a UK basis to a greater extent (Burnell *et al*., 2023).

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		Despite the recent declining trend in the puffin breeding population at both a Scottish and UK scale, the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would accelerate such declines to a measurable extent. As a result the magnitude of impact on the puffin population in the breeding season is considered to be of low magnitude. This conclusion is reached by also considering the over-estimation of both the predicted impact and PVA outputs caused by the following factors: • Over-estimation of cumulative impacts. The PVA modelling does not account for changes in the predicted cumulative total due to the decommissioning of projects considered cumulative. Over the lifetime of Morven South, the cumulative impact will reduce significantly when licences for current projects expire and decommissioning occurs. The PVA metrics are therefore highly precautionary. • No consideration has been made for density dependent compensation of demographic parameters within the modelled population, nor immigration, both of which could reduce the magnitude of any population change. • For a number of recent projects, it has been concluded as part of the Appropriate Assessments conducted that the predicted in-combination impacts are at a magnitude that represents an AEOI on the integrity on a number of SPAs. As a result these projects have been required to submit derogation cases which include compensation measures. For puffin this is applicable to Berwick Bank, Buchan, Caledonia North, Caledonia South, Cenos, Green Volt, Muir Mhor and Salamander. The compensatory measures associated with these projects will work to ensure there is no residual effect of these projects on the puffin features of relevant SPAs which form part of the regional population used as part of the cumulative assessments for Morven South. The impacts associated with these projects should theoretically be reduced to take account of the proposed compensation measures within the assessments

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		presented above, which would lead to reduced impact magnitudes and improved PVA metrics. Non-breeding season The magnitude of the cumulative effect of these projects in the non-breeding season may result in a displacement mortality of 265.2 to 795.5 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 221.0 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for puffin when applying the non-breeding season impact calculated using NatureScot's advocated parameters indicates a median CPS of 0.8674 to 0.9533; (i.e. the population after 35 years, would be 4.67% to 13.26% smaller than the CPS with a 50th percentile value of 39.6 to 46.8 (Table 11.79)). In terms of the population size, this means that the median of the impacted population fell within the 39th to 46th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario was still within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9959 to 0.9986 which translates to a growth rate 0.14% to 0.41% smaller than the counterfactual (unimpacted) growth rate. Under the NatureScot rates, the predicted impact represents a small but detectable change in population growth rate, however is not considered of sufficient magnitude to significantly affect the population. It should be noted that the contribution of Morven South to the total cumulative impact calculated applying NatureScot's displacement and mortality rates is only 0.98%.

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		However, as noted earlier in section 11.11.5, research examining the displacement effects on puffin indicates that a 50% displacement rate is more reflective, with this rate still regarded as precautionary (RoyalHaskoning, 2013; Peschko *et al*. 2020; APEM, 2022; MacArthur Green, 2023). Consequently, it is anticipated that the Applicant's approach (incorporating a 50% displacement rate alongside a 1% mortality rate) leads to an estimate that aligns more closely with actual conditions. When following the Applicant's approach, the PVA predicted that the CPS was 0.9611 which translates to a reduction in population size of 3.89%, with a 50th percentile value of 47.5. In terms of the population size, this implies that the median of the impacted population fell within the 47th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario was still within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. As stated, the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted that the CGR was 0.9989 which translates to a median reduction of 0.11% in population growth rate after 35 years. Such a decrease indicates that this level of impact would not adversely affect the population and would likely remain undetectable against natural population fluctuations. It should be noted that the contribution of Morven South to the total cumulative impact calculated applying NatureScot's displacement and mortality rates is only 1.00%. Despite the current declining trend in the puffin breeding population at both a Scottish and UK scale, the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would accelerate such declines to a measurable extent. When taking into account the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the puffin population is of low magnitude.

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		Annual The magnitude of the cumulative effect of these projects annually may result in a displacement mortality of 980.7 to 1,988.1 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 419.7 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for puffin when applying the annual impact calculated using NatureScot's advocated parameters indicates a median CPS of 0.8332 to 0.9138; i.e. the population after 35 years, would be 8.62 to 16.68% smaller than the CPS with a 50th percentile value of 37.1 to 43.4 (Table 11.79). In terms of the population size, this means that the median of the impacted population fell within the to 37th to 43rd percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario was still within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9948 to 0.9975 which translates to a growth rate 0.25 to 0.52% smaller than the counterfactual (unimpacted) growth rate. Under the NatureScot rates, the predicted impact represents a small but detectable change in population growth rate, however is not considered of sufficient magnitude to significantly affect the population. It should be noted that the contribution of Morven South to the total cumulative impact calculated applying NatureScot's displacement and mortality rates is only 0.46 to 0.55%. However, as noted earlier in section 11.11.5, research examining the displacement effects on puffin indicates that a 50% displacement rate is more reflective, with this rate still regarded as precautionary (RoyalHaskoning, 2013; Peschko *et al*. 2020; APEM, 2022; MacArthur Green, 2023). Consequently, it is anticipated that the Applicant's

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		approach (incorporating a 50% displacement rate alongside a 1% mortality rate) leads to an estimate that aligns more closely with actual conditions. When following the Applicant's approach, the PVA predicted that the CPS was 0.9621 which translates to a reduction in population size of 3.79%, with a 50th percentile value of 47.1. In terms of the population size, this implies that the median of the impacted population fell within the 47th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenario was still within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. As stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted that the CGR was 0.9989 which translates to a median reduction of 0.11% in population growth rate after 35 years. Such a decrease indicates that this level of impact would not adversely affect the population and would likely remain undetectable against natural population fluctuations. It should be noted that the contribution of Morven South to the total cumulative impact calculated applying the Applicant's displacement and mortality rates is only 0.64%. Despite the current declining trend in the puffin breeding population at both a Scottish and UK scale, the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would accelerate such declines to a measurable extent. When taking into account the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the puffin population is of low magnitude.
Sensitivity of receptor	The sensitivity of puffin is considered to be as described for the assessment of Morven South alone (see paragraphs 11.11.5.46 to 11.11.5.49).	The sensitivity of puffin is considered to be as described for the assessment of Morven South alone (see paragraphs 11.11.5.46 to 11.11.5.49). Puffin is deemed to be of medium vulnerability, high recoverability, and international value. The sensitivity of the receptor is therefore considered to be medium.

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
	Puffin is deemed to be of medium vulnerability, high recoverability, and international value. The sensitivity of the receptor is therefore considered to be medium.	
Significance of effect	Overall the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **negligible adverse** significance, which is not significant in EIA terms. A conclusion of negligible adverse significance is based on both the negligible magnitude of the predicted impacts across all seasons and on an annual basis as well as the species' limited vulnerability to displacement impacts.	Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The effect on puffin will, therefore, be of minor adverse significance. Therefore, the cumulative impact of displacement on puffin are of **minor adverse** significance, which is not significant in EIA terms.
Further mitigation and residual significance	No mitigation measures for puffin in relation to displacement are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.	No mitigation measures for puffin in relation to displacement are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

Fulmar

11.13.3.22 The predicted impact from the Morven Programme is presented in Table 11.81. Displacement mortalities presented in brackets in Table 11.81are those calculated when applying the Applicant's displacement and mortality rates. In all four seasons (breeding, post breeding, non-breeding and pre-breeding) and on an annual basis the estimated percentage point increase in baseline mortality of fulmar remains well below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). This conclusion is applicable when modelling using the displacement and mortality rates advocated by both NatureScot and the Applicant and therefore additional analysis including PVA modelling is not required.

Table 11.81: Predicted impacts for fulmar associated with Morven South and Morven North

Project	Breeding	Post-breeding	Non-breeding	Pre-breeding	Annual
Morven Programme assessment					
Morven North	5.8 to 17.3 (2.9)	0.5 to 1.4 (0.2)	1.0 to 3.1 (0.5)	0.7 to 2.0 (0.3)	7.9 to 23.8 (4.0)
Morven South	0.5 to 1.5 (0.3)	0.5 to 1.5 (0.2)	0.6 to 1.8 (0.3)	0.4 to 1.1 (0.2)	2.0 to 5.9 (1.0)
Total	6.3 to 18.8 (3.1)	1.0 to 2.9 (0.5)	1.6 to 4.9 (0.8)	1.0 to 3.1 (0.5)	9.9 to 29.7 (4.9)
Change in baseline mortality (% point change)	0.001 to 0.002 (<0.001)	<0.001 to <0.001 (<0.001)	<0.001 to 0.001 (<0.001)	<0.001 to <0.001 (<0.001)	0.001 to 0.003 (<0.001)

Table 11.82: Morven South cumulative effects assessment for fulmar in relation to displacement impacts

	Cumulative effects assessment
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)
Operations and maintenance phase	
Magnitude of impact	The cumulative effects assessment for Scenario 3 considers the relevant elements of the Morven Programme (Morven South and Morven North). The estimated percentage point increase in baseline mortality associated with the impact predicted for the Morven Programme remains below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h) (Table 11.82). This conclusion is applicable when modelling using the parameters advocated by both NatureScot and the Applicant and therefore additional analysis including PVA modelling is not required. The cumulative effect is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be negligible.
Sensitivity of receptor	The sensitivity of fulmar is considered to be as described for the assessment of Morven South alone (see paragraphs 11.11.5.54 to 11.11.5.57). Fulmar is deemed to be of medium vulnerability, high recoverability, and international value. The sensitivity of the receptor is therefore considered to be medium.
Significance of effect	Overall the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **negligible adverse** significance, which is not significant in EIA terms. A conclusion of negligible adverse significance is based on both the negligible magnitude of the predicted impacts across all seasons and on an annual basis as well as the species' limited vulnerability to displacement impacts.
Further mitigation and residual significance	No mitigation measures for fulmar in relation to displacement are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

Gannet

11.13.3.23 The predicted impact from the Morven Programme is presented in Table 11.83. Displacement mortalities presented in brackets in Table 11.83 are those calculated when applying the Applicant's displacement and mortality rates. In all three seasons (breeding, post breeding and pre-breeding) and on an annual basis the estimated percentage point increase in baseline mortality of gannet remains well below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). This conclusion is applicable when modelling using the displacement and mortality rates advocated by both NatureScot and the Applicant and therefore additional analysis including PVA modelling is not required.

Table 11.83: Predicted impacts for gannet associated with Morven South and Morven North

Project	Breeding	Post-breeding	Pre-breeding	Annual
Morven Programme assessment				
Morven North	5.6 to 16.7 (5.6)	2.4 to 7.3 (2.4)	0.2 to 0.6 (0.2)	8.2 to 24.6 (8.2)
Morven South	2.6 to 7.7 (2.6)	0.6 to 1.9 (0.6)	0.3 to 0.9 (0.3)	3.5 to 10.5 (3.5)
Total	8.1 to 24.4 (8.1)	3.1 to 9.2 (3.1)	0.5 to 1.5 (0.5)	11.7 to 35.1 (11.7)
Change in baseline mortality (% point change)	0.001 to 0.004 (0.001)	0.001 to 0.002 (0.001)	<0.001 to 0.001 (<0.001)	0.002 to 0.006 (0.002)

11.13.3.24 The estimated cumulative abundance of gannet from relevant projects is presented in Table 11.84. The impacts estimated when applying the displacement and mortality rates advocated by both NatureScot and the Applicant are calculated in Table 11.85 with the effect these impacts have on the baseline mortality of the relevant populations also provided.

11.13.3.25 In all three seasons (breeding, post breeding and pre-breeding) and on an annual basis the estimated percentage point increase in baseline mortality of gannet exceeds the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). This conclusion is applicable when modelling using the displacement and mortality rates advocated by both NatureScot and the Applicant (Table 11.61) and therefore PVA modelling has been conducted with the outputs provided in Table 11.86.

Table 11.84: Mean-peak population estimates for gannet at projects considered cumulatively (grey cells indicate projects that do not contribute alongside Morven South in relevant seasons)

Project	Breeding	Post-breeding	Pre-breeding	Annual
Tier 1				
Aspen	405	182	203	790
Beatrice	293	197	197	687
Berwick Bank	4,735	1,500	269	6,504
Blyth Demo	34	63	3	99
Buchan	235	187	53	475
Caledonia North	240	195	20	455

Project	Breeding	Post-breeding	Pre-breeding	Annual
Caledonia South	708	183	17	908
Cenos	216	132	132	479
Dogger Bank A	518	916	191	1,624
Dogger Bank B	637	1,132	235	2,004
Dogger Bank South	1,335	1,574	134	3,043
Dogger Bank C	608	378	147	1,133
Sofia	712	508	147	1,366
Dudgeon	109	45	58	212
Dudgeon Extension	417	343	47	807
East Anglia One	54	2,674	93	2,821
East Anglia ONE North	149	468	44	661
East Anglia THREE	0	895	369	1,264
East Anglia TWO	192	891	192	1,275
Five Estuaries		640	67	707
Galloper		465	218	683
Green Volt	198	24	102	324
Hornsea Project ONE	530	525	201	1,255
Hornsea Project TWO	336	773	171	1,280
Hornsea Project THREE	1,333	984	406	2,723
Hornsea FOUR	976	790	401	2,167
Humber Gateway	63	1	0	65
Inch Cape	1,240	322	83	1,646
Kincardine	120	0	0	120
Lincs	12	12	0	24
Moray East	159	18	18	196
Moray West	1,925	298	98	2,321
Morven North	796	349	40	1,185
Morven South	366	89	43	499
Muir Mhor	597	593	74	1,264
Neart na Gaoithe	1,987	605	397	2,989
Norfolk Boreas	1,350	1,723	526	3,599
Norfolk Vanguard	257	2,462	437	3,156
North Falls		287	290	577

Project	Breeding	Post-breeding	Pre-breeding	Annual
Ossian	1,393	775	42	2,210
Outer Dowsing	554	496	69	1,119
Pentland	166	24	8	198
Race Bank	116	57	19	192
Rampion		325	275	600
Rampion 2		102	123	225
Salamander	442	185	185	811
SeaGreen Bravo	964	356	147	1,467
SeaGreen Alpha	2,296	302	100	2,698
Sheringham Shoal Extension	23	295	11	329
Teesside	48	1	0	48
Thanet		13	0	13
Triton Knoll	209	294	51	554
Total	30,052	26,643	7,151	63,847

Table 11.85: Assessment of predicted cumulative displacement mortality for gannet on seasonal and annual bases against the baseline mortality of relevant regional populations

<table>
<tr><th>Season</th><th>Displacement rate (%)</th><th>Mortality rate (%)</th><th>Regional baseline population (no. of birds)</th><th>Baseline mortality</th><th>Displacement mortality (no. of birds)</th><th>Change in baseline mortality (% point change)</th></tr>
<tr><td colspan="7">NatureScot’s approach</td></tr>
<tr><td>Breeding</td><td rowspan="4">70</td><td rowspan="4">1 to 3</td><td>559,963</td><td rowspan="4">0.193</td><td>210.4 to 631.1</td><td>0.038 to 0.113</td></tr>
<tr><td>Post-breeding</td><td>456,298</td><td>186.5 to 559.5</td><td>0.041 to 0.123</td></tr>
<tr><td>Pre-breeding</td><td>248,385</td><td>50.1 to 150.2</td><td>0.020 to 0.060</td></tr>
<tr><td>Annual</td><td>559,963</td><td>446.9 to 1,340.8</td><td>0.080 to 0.239</td></tr>
<tr><td colspan="7">Applicant’s approach</td></tr>
<tr><td>Breeding</td><td rowspan="4">70</td><td rowspan="4">1</td><td>559,963</td><td rowspan="4">0.193</td><td>210.4</td><td>0.038</td></tr>
<tr><td>Post-breeding</td><td>456,298</td><td>186.5</td><td>0.041</td></tr>
<tr><td>Pre-breeding</td><td>248,385</td><td>50.1</td><td>0.020</td></tr>
<tr><td>Annual</td><td>559,963</td><td>446.9</td><td>0.080</td></tr>
</table>

Table 11.86: Summary of Population Viability Analysis results for gannet displacement impacts after 35 years as a result of impacts associated with the cumulative assessment

Scenario	Predicted mortality (no. of birds)	Increase in baseline mortality (% point change)	Median population size (no. of birds)	Growth Rate (Annual GR)	Change in population (%)	Median CGR	Median CPS	Quantile – unimpacted: 50%impacted
Cumulative assessment								
Breeding								
Baseline	-	-	1,044,862	1.0122	52.66	-	-	-
NatureScot Lower	210.4	0.038	1,028,205	1.0117	50.42	0.9996	0.9844	47.4
NatureScot Upper	631.1	0.113	996,555	1.0108	45.59	0.9987	0.9542	42.1
Applicant	210.4	0.038	1,028,205	1.0117	50.42	0.9996	0.9844	47.4
Post-breeding								
Baseline	-	-	919,044	1.0125	54.42	-	-	-
NatureScot Lower	186.5	0.041	904,269	1.0120	51.76	0.9995	0.9832	47.5
NatureScot Upper	559.5	0.123	874,148	1.0110	46.72	0.9985	0.9503	42.2
Applicant	186.5	0.041	904,269	1.0120	51.76	0.9995	0.9832	47.5
Pre-breeding								
Baseline	-	-	500,331	1.0125	54.40	-	-	-
NatureScot Lower	50.1	0.020	496,472	1.0122	53.12	0.9998	0.9915	48.9
NatureScot Upper	150.2	0.060	488,102	1.0118	50.53	0.9993	0.9752	46.3

Scenario	Predicted mortality (no. of birds)	Increase in baseline mortality (% point change)	Median population size (no. of birds)	Growth Rate (Annual GR)	Change in population (%)	Median CGR	Median CPS	Quantile – unimpacted: 50%impacted
Applicant	50.1	0.020	496,472	1.0122	53.12	0.9998	0.9915	48.9
Annual								
Baseline	-	-	1,044,862	1.0122	52.66	-	-	-
NatureScot Lower	446.9	0.080	1,010,052	1.0112	47.73	0.9991	0.9673	44.5
NatureScot Upper	1340.8	0.239	945,551	1.0093	38.18	0.9972	0.9051	33.9
Applicant	446.9	0.080	1,010,052	1.0112	47.73	0.9991	0.9673	44.5

Table 11.87: Morven South cumulative effects assessment for gannet in relation to displacement impacts

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
Operations and maintenance phase		
Magnitude of impact	The cumulative effects assessment for Scenario 3 considers the relevant elements of the Morven Programme (Morven South and Morven North). The estimated percentage point increase in baseline mortality associated with the impact predicted for the Morven Programme remains below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h) (Table 11.85). This conclusion is applicable when modelling using the parameters advocated by both NatureScot and the Applicant and therefore additional analysis including PVA modelling is not required. The cumulative effect is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be negligible.	The cumulative effects assessment for Scenario 4 considers Morven South together with the Tier 1 (including Morven North), Tier 2 and Tier 3 projects where suitable data to inform the assessment are available. Breeding season The magnitude of the cumulative effect of these projects in the breeding season may result in a displacement mortality of 210.4 to 631.1 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 210.4 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for gannet when applying the breeding season impact calculated using NatureScot's and the Applicant's advocated parameters indicates a median CPS of 0.9542 to 0.9844; (i.e. the population after 35 years, would be 1.56% to 4.58% smaller than the CPS with a 50th percentile value of 42.1 to 47.4 (Table 11.86)). In terms of the population size, this means that the median of the impacted population fell within the 42nd to 47th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenarios are still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9987 to 0.9996 which translates to a growth rate 0.04% to 0.13% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would be undetectable against natural fluctuations in the growth rate currently seen in the regional population.

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		The Scottish breeding population of gannet has increased between the two most recent national censuses with an increase of 40% (Burnell *et al*., 2023) with this also reflected on a UK scale (39%; Burnell *et al*., 2023). However, surveys in 2023, aimed at detecting changes in seabird breeding populations due to HPAI showed an overall 25% decrease in breeding gannets compared to pre-HPAI counts from monitored sites (Tremlett *et al*., 2024). However, this short-term decrease contrasts against a long-term increase in the UK gannet population. As a result the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would lead a measurable change in the UK gannet population. As a result the magnitude of impact on the gannet population in the breeding season is considered to be of low magnitude. It is also worth considering the inherent over-estimation in the cumulative totals for gannet caused by the following factors: • Over-estimation of cumulative impacts. The PVA modelling does not account for changes in the predicted cumulative total due to the decommissioning of projects considered cumulatively. Over the lifetime of Morven South the cumulative impact will reduce significantly when licences for current projects expire and decommissioning occurs. The PVA metrics are therefore highly precautionary. • No consideration has been made for density dependent compensation of demographic parameters within the modelled population, nor immigration, both of which could reduce the magnitude of any population change. • For a number of recent projects, it has been concluded as part of the Appropriate Assessments conducted that the predicted in-combination impacts are at a magnitude that represents an AEOI on the integrity on a number of SPAs. As a result these projects have been required to submit derogation cases which include compensation measures. For gannet this is applicable to Berwick Bank, Buchan, Caledonia North, Caledonia South, Cenos, Green Volt, Muir Mhor, Ossian and Salamander. The compensatory measures associated

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		with these projects will work to ensure there is no residual effect of these projects on the gannet features of relevant SPAs which form part of the regional population used as part of the cumulative assessments for Morven South. The impacts associated with these projects should theoretically be reduced to take account of the proposed compensation measures within the assessments presented above, which would lead to reduced impact magnitudes and improved PVA metrics. As a result the magnitude of impact on the gannet population in the breeding season is considered to be of low magnitude. <u>Post-breeding season</u> The magnitude of the cumulative effect of these projects in the post-breeding season may result in a displacement mortality of 186.5 to 559.5 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 186.5 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for gannet when applying the post-breeding season impact calculated using NatureScot's and the Applicant's advocated parameters indicates a median CPS of 0.9503 to 0.9832; i.e. the population after 35 years, would be 1.68 to 4.97% smaller than the CPS with a 50th percentile value of 42.2 to 47.5 (Table 11.86). In terms of the population size, this means that the median of the impacted population fell within the 42nd to 47th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenarios are still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9985 to 0.9995 which translates to a growth rate 0.05 to

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		0.15% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would be undetectable against natural fluctuations in the growth rate currently seen in the regional population. As the UK breeding population is the main contributor to the regional post-breeding population of gannet the trends in the regional post-breeding population are considered to be the same as the regional breeding population. When taking into account the outputs of the PVA and the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the gannet population is of low magnitude. Pre-breeding season The magnitude of the cumulative effect of these projects in the pre-breeding season may result in a displacement mortality of 50.1 to 150.2 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 50.1 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for gannet when applying the pre-breeding season impact calculated using NatureScot's and the Applicant's advocated parameters indicates a median CPS of 0.9752 to 0.9915; i.e. the population after 35 years, would be 0.85 to 2.48% smaller than the CPS with a 50th percentile value of 46.3 to 48.9 (Table 11.86). In terms of the population size, this means that the median of the impacted population fell within the 46th to 48th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenarios are still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9993 to 0.9998 which translates to a growth rate 0.02 to 0.07% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would be undetectable against natural fluctuations in the growth rate currently seen in the regional population. As the UK breeding population is the main contributor to the regional pre-breeding population of gannet the trends in the regional pre-breeding population are considered to be the same as the regional breeding population. When taking into account the outputs of the PVA and the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the gannet population is of low magnitude. Annual The magnitude of the cumulative effect of these projects annually may result in a displacement mortality of 446.9 to 1,340.8 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 446.9 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for gannet when applying the annual impact calculated using NatureScot's and the Applicant's advocated parameters indicates a median CPS of 0.9051 to 0.9673; i.e. the population after 35 years, would be 3.27% to 9.49% smaller than the CPS with a 50th percentile value of 33.9 to 44.5 (Table 11.86). In terms of the population size, this means that the median of the impacted population fell within the 33rd to 44th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenarios are still well within the margin of error of the non-impacted scenario, and therefore there would likely be no

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9972 to 0.9991 which translates to a growth rate 0.09% to 0.28% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would be undetectable against natural fluctuations in the growth rate currently seen in the regional population. As the UK breeding population is the main contributor to the regional population of gannet used to assess the annual impact the trends in the annual population are considered to be the same as the regional breeding population. When taking into account the outputs of the PVA and the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the gannet population of negligible to low magnitude.
Sensitivity of receptor	The sensitivity of gannet is considered to be as described for the assessment of Morven South alone (see paragraphs 11.11.5.62 to 11.11.5.65). Gannet is deemed to be of high vulnerability, high recoverability, and of international value. The sensitivity of the receptor is therefore considered to be high.	The sensitivity of gannet is considered to be as described for the assessment of Morven South alone (see paragraphs 11.11.5.62 to 11.11.5.65). Gannet is deemed to be of high vulnerability, high recoverability, and of international value. The sensitivity of the receptor is therefore considered to be high.
Significance of effect	Overall the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.	Overall, the magnitude of the impact is deemed to be negligible to low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of minor to moderate adverse significance. The PVA results suggest that the predicted impact will have an insignificant impact on the growth rate of the population and it is therefore considered that minor adverse significance is appropriate. Therefore, the cumulative

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		impacts of displacement on gannet are of **minor adverse** significance, which is not significant in EIA terms.
Further mitigation and residual significance	No mitigation measures for gannet in relation to displacement are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.	No mitigation measures for gannet in relation to displacement are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

11.13.4 Combined collision and displacement

11.13.4.1 Two species are known to be adversely affected by both displacement and collision during the operations and maintenance phase: kittiwake and gannet. For these species, impacts must be combined in order for the true magnitude of impact to be understood.

11.13.4.2 The project's considered for the assessment of combined collision and displacement are as defined for the Morven Programme and cumulative assessments for collision with rotating blades and displacement. As discussed for these two individual impacts, these impacts are not applicable to the MHPGC Project and MBAGC Project and these elements of the Morven Programme assessment are screened out of consideration. The whole project assessments associated with Scenario 1 and 2 are therefore not required and consideration of the MHPGC Project or MBAGC Project as part of Scenario 3 is also not required. Scenario 3 will therefore incorporate Morven South and Morven North only.

11.13.4.3 The combined collision and displacement mortality estimates relevant to each project considered in the cumulative assessment are presented in the following tables for each species:

- Kittiwake - Table 11.88;
- Gannet - Table 11.92.

11.13.4.4 The summaries of the Morven Programme assessments and cumulative assessments for each species for combined collision and displacement are presented in Table 11.88 to Table 11.95.

Kittiwake

11.13.4.5 The predicted impact on kittiwake from the Morven Programme is presented in Table 11.88. In all three seasons (breeding, post breeding and pre-breeding) and on an annual basis the estimated percentage point increase in baseline mortality of kittiwake remains well below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). Additional analysis including PVA modelling is therefore not required.

Table 11.88: Expected combined collision and displacement impact from the Morven Programme on kittiwake. Estimates are calculated applying NatureScot's recommended parameters. Estimates calculated applying the Applicant's recommended parameters are shown in brackets

Project	Impact	Breeding season	Post-breeding season	Pre-breeding season	Annual (no. of birds)
Morven Programme assessment					
Morven North	Collision	19.8 (4.5)	2.3 (0.5)	2.8 (0.6)	25.0 (5.6)
	Displacement	7.4 to 22.3 (7.4)	1.2 to 3.7 (1.2)	0.4 to 1.2 (0.4)	9.1 to 27.2 (9.1)
Morven South	Collision	6.6 (1.5)	1.6 (0.4)	2.0 (0.5)	10.2 (2.4)
	Displacement	1.2 to 3.5 (1.2)	0.8 to 2.5 (0.8)	0.3 to 1.0 (0.3)	2.4 to 7.1 (2.4)
Total		**35.1 to 52.3 (14.6)**	**6.0 to 10.1 (3.0)**	**5.6 to 7.1 (1.8)**	46.6 to 69.5 (19.4)
Change in baseline mortality (% point change)		**0.006 to 0.009 (0.002)**	**0.001 to 0.001 (<0.001)**	**0.001 to 0.001 (<0.001)**	0.006 to 0.008 (0.002)

11.13.4.6 The predicted combined cumulative collision and displacement impact on kittiwake is presented in Table 11.93. In all three seasons (breeding, post breeding, and pre-breeding) and on an annual basis, the estimated percentage point increase in baseline mortality exceeds the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). As a result PVA modelling has been conducted for all seasons and an annual basis. The outputs of this process are presented in Table 11.90.

Table 11.89: Expected combined collision and displacement cumulative impact on kittiwake. Estimates are calculated applying NatureScot's recommended parameters. Estimates calculated applying the Applicant's recommended parameters are shown in brackets

Project	Impact	Breeding season	Post-breeding season	Pre-breeding season	Annual (no. of birds)
Cumulative assessment					
All projects	Collision	1400.9 (470.6)	928.2 (336.5)	1039.0 (373.8)	3368.1 (1,181.0)
	Displacement	285.2 to 855.6 (285.2)	222.9 to 668.6 (222.9)	198.9 to 596.7 (198.9)	707.0 to 2,120.9 (707.0)
Total		**1,686.2 to 2,256.6 (755.8)**	**1,151.1 to 1,596.8 (559.4)**	**1,237.9 to 1,635.6 (572.7)**	4,075.1 to 5,489.1 (1,887.9)
Change in baseline mortality (% point change)		**0.293 to 0.392 (0.131)**	**0.139 to 0.192 (0.067)**	**0.197 to 0.261 (0.091)**	0.491 to 0.661 (0.227)

Table 11.90: Summary of Population Viability Analysis results for combined cumulative collision and displacement impacts on kittiwake after 35 years as a result of impacts associated with the cumulative assessment

Scenario	Predicted mortality (no. of birds)	Increase in baseline mortality (% point change)	Median population size (no. of birds)	Growth Rate (Annual GR)	Change in population (%)	Median CGR	Median CPS	Quantile – unimpacted: 50%impacted
Cumulative assessment								
Breeding								
Baseline	-	-	654,774	1.0025	9.28	-	-	-
NatureScot Lower	1686.2	0.293	580,595	0.9991	-3.19	0.9965	0.8857	38.7
NatureScot Upper	2256.6	0.392	556,894	0.9979	-7.12	0.9954	0.8499	35.5
Applicant	755.8	0.131	620,499	1.0010	3.47	0.9985	0.9469	44.9
Post-breeding								
Baseline	-	-	965,263	1.0029	10.66	-	-	-
NatureScot Lower	1151.1	0.139	910,334	1.0013	4.55	0.9984	0.9441	45.0
NatureScot Upper	1596.8	0.192	890,804	1.0006	1.95	0.9977	0.9231	43.4
Applicant	559.4	0.067	937,833	1.0021	7.61	0.9992	0.9723	47.5
Pre-breeding								
Baseline	-	-	729,117	1.0029	10.53	-	-	-
NatureScot Lower	1237.9	0.197	671,965	1.0005	1.90	0.9977	0.9214	43.2
NatureScot Upper	1635.6	0.261	654,813	0.9998	-0.75	0.9969	0.8975	41.3

Scenario	Predicted mortality (no. of birds)	Increase in baseline mortality (% point change)	Median population size (no. of birds)	Growth Rate (Annual GR)	Change in population (%)	Median CGR	Median CPS	Quantile – unimpacted: 50%impacted
Applicant	572.7	0.091	702,591	1.0018	6.46	0.9989	0.9627	46.7
Annual								
Baseline	-	-	965,263	1.0029	10.66	-	-	-
NatureScot Lower	4075.1	0.491	786,374	0.9971	-9.81	0.9942	0.8155	33.5
NatureScot Upper	5489.1	0.661	732,990	0.9951	-15.93	0.9922	0.7593	28.3
Applicant	1887.9	0.227	878,323	1.0002	0.61	0.9973	0.9098	42.4

Table 11.91: Morven South cumulative effects assessment for kittiwake in relation to combined collision and displacement

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
Operations and maintenance phase		
Magnitude of impact	The cumulative effects assessment for combined collision and displacement for Scenario 3 considers the relevant elements of the Morven Programme (Morven South and Morven North). The estimated percentage point increase in baseline mortality associated with the impact predicted for the Morven Programme remains below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h) (Table 11.88). This conclusion is applicable when modelling using the parameters advocated by both NatureScot and the Applicant and therefore additional analysis including PVA modelling is not required. The cumulative effect is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be negligible.	The cumulative effects assessment for combined collision and displacement for Scenario 4 considers Morven South together with the Tier 1 (including Morven North), Tier 2 and Tier 3 projects below, where suitable data to inform the assessment are available. Breeding season The magnitude of the cumulative effect of these projects in the breeding season may result in an impact of 1,686.2 to 2,256.6 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 755.8 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for kittiwake when applying the breeding season impact calculated using NatureScot's advocated parameters indicates a median CPS of 0.8499 to 0.8857; (i.e. the population after 35 years, would be 11.43% to 15.01% smaller than the CPS with a 50th percentile value of 35.5 to 38.7 (Table 11.90)). In terms of the population size, this means that the median of the impacted population fell within the 35th to 38th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenarios are still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9954 to 0.9965 which translates to a growth rate 0.35% to 0.46% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		be undetectable against natural fluctuations in the growth rate currently seen in the regional population. Under the Applicant's approach, the CPS was 0.9469 which translates to a 5.31% reduction in population size after 35 years. The CGR was estimated at 0.9985 which results in a reduction in growth rate of 0.15%. Such a decrease indicates that this level of impact would not adversely affect the population and would likely remain undetectable against natural population fluctuations. The Scottish breeding population of kittiwake has decreased between the two most recent national censuses with a decline of 57% (Burnell *et al*., 2023) with this also reflected on a UK scale (43%; Burnell *et al*., 2023). Surveys in 2023, aimed at detecting changes in seabird breeding populations due to HPAI showed an overall 8% increase in breeding kittiwakes compared to pre-HPAI counts from monitored sites (Tremlett *et al*., 2024). Despite the current declining trend in the kittiwake breeding population at both a Scottish and UK scale, the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would accelerate such declines to a measurable extent. As a result the magnitude of impact on the kittiwake population in the breeding season is considered to be of low magnitude. This conclusion is reached by also considering the over-estimation of both the predicted impact and PVA outputs caused by the following factors: • Over-estimation of cumulative impacts. The PVA modelling does not account for changes in the predicted cumulative total due to the decommissioning of projects considered cumulatively. Over the lifetime of Morven South, the cumulative impact will reduce significantly when licences for current projects expire and decommissioning occurs. The PVA metrics are therefore highly precautionary.

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		• No consideration has been made for density dependent compensation of demographic parameters within the modelled population, nor immigration, both of which could reduce the magnitude of any population change. • The use of grouped avoidance rates (99.29%) instead of species-specific avoidance rates (99.79%) which over-estimates the collision risk for kittiwake by over three times and the use of flight speeds that do not provide a robust representation of the behaviour of kittiwake in the modelling conducted for projects considered cumulatively (with an approximate 27% reduction if more robust flight speeds are used (Ørsted, 2018)) (see Volume 3, Annex 11.2 Offshore Ornithology Collision Risk Modelling Report for more information). • For a number of recent projects, it has been concluded as part of the Appropriate Assessments conducted that the predicted in-combination impacts are at a magnitude that represents an AEOI on the integrity on a number of SPAs. As a result these projects have been required to submit derogation cases which include compensation measures. For kittiwake this is applicable to Berwick Bank, Buchan, Caledonia North, Caledonia South, Cenos, Dogger Bank South, Dudgeon Extension, East Anglia One North, East Anglia Two, Five Estuaries, Green Volt, Hornsea Three, Hornsea Four, Muir Mhor, Norfolk Boreas, Norfolk Vanguard, North Falls, Ossian, Outer Dowsing, Rampion 2, Salamander, Sheringham Shoal Extension and West of Orkney. The compensatory measures associated with these projects will work to ensure there is no residual effect of these projects on the kittiwake features of relevant SPAs which form part of the regional population used as part of the cumulative assessments for Morven South. The impacts associated with these projects should theoretically be reduced to take account of the proposed compensation measures within the assessments presented above, which would lead to reduced impact magnitudes and improved PVA metrics. Post-breeding season

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		The magnitude of the cumulative effect of these projects in the post-breeding season may result in an impact of 1,151.1 to 1,596.8 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 559.4 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for kittiwake when applying the post-breeding season impact calculated using NatureScot's advocated parameters indicates a median CPS of 0.9231 to 0.9441; i.e. the population after 35 years, would be 5.59% to 7.68% smaller than the CPS with a 50th percentile value of 43.4 to 45.0 (Table 11.90). In terms of the population size, this means that the median of the impacted population fell within the 43rd to 45th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenarios are still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9977 to 0.9984 which translates to a growth rate 0.16% to 0.23% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would be undetectable against natural fluctuations in the growth rate currently seen in the regional population. When following the NatureScot approach the PVA indicates that the impact would be of low magnitude. Under the Applicant's approach, the CPS was 0.9723 which translates to a 2.77% reduction in population size after 35 years. The CGR was estimated at 0.9992 which results in a reduction in growth rate of 0.08%. Such a decrease indicates that this level of impact would not adversely affect the population and would likely remain undetectable against natural population fluctuations. Under the Applicant's approach the PVA indicates that the impact would be of negligible magnitude.

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		The UK population is the largest contributor to the post-breeding season BDMPS. Despite the current declining trend in the kittiwake breeding population at both a Scottish and UK scale, the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would accelerate such declines to a measurable extent. The UK population is the largest contributor to the post-breeding season BDMPS. Despite the current declining trend in the kittiwake breeding population at both a Scottish and UK scale, the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would accelerate such declines to a measurable extent. When taking into account the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the kittiwake population is of low magnitude. Pre-breeding season The magnitude of the cumulative effect of these projects in the pre-breeding season may result in an impact of 1,237.9 to 1,635.6 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 572.7 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for kittiwake when applying the pre-breeding season impact calculated using NatureScot's advocated parameters indicates a median CPS of 0.8975 to 0.9214; i.e. the population after 35 years, would be 7.86 to 10.25% smaller than the CPS with a 50th percentile value of 41.3 to 43.2 (Table 11.90). In terms of the population size, this means that the median of the impacted population fell within the 41st to 43rd percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenarios are still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9969 to 0.9977 which translates to a growth rate 0.23 to 0.31% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would be undetectable against natural fluctuations in the growth rate currently seen in the regional population. When following the NatureScot approach the PVA indicates that the impact would be of low magnitude. Under the Applicant's approach, the CPS was 0.9627 which translates to a 3.73% reduction in population size after 35 years. The CGR was estimated at 0.9989 which results in a reduction in growth rate of 0.11%. Such a decrease indicates that this level of impact would not adversely affect the population and would likely remain undetectable against natural population fluctuations. Under the Applicant's approach the PVA indicates that the impact would be of low magnitude. Despite the current declining trend in the kittiwake breeding population at both a Scottish and UK scale, the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would accelerate such declines to a measurable extent. When taking into account the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the kittiwake population is of low magnitude. Annual The magnitude of the cumulative effect of these projects on an annual basis may result an impact of 4,075.1 to 5,489.1 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 1,887.9 birds/annum. This

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for kittiwake when applying the annual impact calculated using NatureScot's advocated parameters indicates a median CPS of 0.7593 to 0.8155; i.e. the population after 35 years, would be 18.45% to 24.07% smaller than the CPS with a 50th percentile value of 28.3 to 33.5 (Table 11.90). In terms of the population size, this means that the median of the impacted population fell within the 28th to 33rd percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenarios are still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9922 to 0.9942 which translates to a growth rate 0.58% to 0.78% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact represents a small but detectable change in population growth rate, however this is not considered of sufficient magnitude to significantly affect the population. When following the NatureScot approach the PVA indicates that the impact would be of low magnitude. Under the Applicant's approach, the CPS was 0.9098 which translates to a 9.02% reduction in population size after 35 years. The CGR was estimated at 0.9973 which results in a reduction in growth rate of 0.27%. Such a decrease indicates that this level of impact would be undetectable against the natural fluctuations within the population growth rate. Under the Applicant's approach the PVA indicates that the impact would be of low magnitude. Despite the current declining trend in the kittiwake breeding population at both a Scottish and UK scale, the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would accelerate such declines to a measurable extent.

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		When taking into account the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the kittiwake population is of low magnitude.
Sensitivity of receptor	The sensitivity of kittiwake is considered to be as described for the assessment of Morven South alone (see paragraph 11.11.6.8). Kittiwake is deemed to be of medium vulnerability, low recoverability, and international conservation value. The sensitivity of the receptor is therefore considered to be high.	The sensitivity of kittiwake is considered to be as described for the assessment of Morven South alone (see paragraph 11.11.6.8). Kittiwake is deemed to be of medium vulnerability, low recoverability, and international conservation value. The sensitivity of the receptor is therefore considered to be high.
Significance of effect	Overall the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.	Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect on kittiwake will, therefore, be of minor to moderate adverse significance. Due to the factors identified above that lead to considerable of over-estimation of the cumulative impact and the limited contribution of Morven South to this total and the PVA results suggesting that the predicted impact will have an insignificant impact on the growth rate of the population, the impact is considered minor. It is therefore deemed appropriate to categorise the impact as having a **minor adverse** significance, which is not significant in EIA terms.
Further mitigation and residual significance	No mitigation measures for kittiwake in relation to combined collision and displacement are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.	No mitigation measures for kittiwake in relation to combined collision and displacement are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

Gannet

11.13.4.7 The predicted impact on gannet from the Morven Programme is presented in Table 11.92. In all three seasons (breeding, post breeding and pre-breeding) and on an annual basis the estimated percentage point increase in baseline mortality of gannet remains well below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). Additional analysis including PVA modelling is therefore not required.

Table 11.92: Expected combined collision and displacement impact from the Morven Programme on gannet. Estimates are calculated applying NatureScot's recommended parameters. Estimates calculated applying the Applicant's recommended parameters are shown in brackets

Project	Impact	Breeding season	Post-breeding season	Pre-breeding season	Annual (no. of birds)
Morven Programme assessment					
Morven North	Collision	9.7 (2.7)	0.7 (0.7)	0.2 (0.2)	10.6 (3.5)
	Displacement	5.6 to 16.7 (5.6)	2.4 to 7.3 (2.4)	0.2 to 0.6 (0.2)	8.2 to 24.6 (8.2)
Morven South	Collision	12.7 (3.4)	0.2 (0.2)	0.2 (0.2)	13.1 (3.8)
	Displacement	2.6 to 7.7 (2.6)	0.6 to 1.9 (0.6)	0.3 to 0.9 (0.3)	3.5 to 10.5 (3.5)
Total		**30.5 to 46.8 (14.3)**	**3.9 to 10.1 (3.9)**	**0.9 to 1.9 (0.8)**	**35.3 to 58.8 (19.0)**
Change in baseline mortality (% point change)		**0.005 to 0.008 (0.003)**	**0.001 to 0.002 (0.001)**	**<0.001 to 0.001 (<0.001)**	**0.006 to 0.010 (0.003)**

11.13.4.8 The predicted combined cumulative collision and displacement impact on gannet is presented in Table 11.93. In all three seasons (breeding, post breeding, and pre-breeding) and on an annual basis, the estimated percentage point increase in baseline mortality exceeds the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h). As a result PVA modelling has been conducted for all seasons and an annual basis. The outputs of this process are presented in Table 11.94.

Table 11.93: Expected combined collision and displacement cumulative impact on gannet. Estimates are calculated applying NatureScot's recommended parameters. Estimates calculated applying the Applicant's recommended parameters are shown in brackets

Project	Impact	Breeding season	Post-breeding season	Pre-breeding season	Annual (no. of birds)
Cumulative assessment					
All projects	Collision	872.8 (856.6)	124.7 (124.6)	42.2 (42.2)	1,039.7 (1,023.4)
	Displacement	210.4 to 631.1 (210.4)	186.5 to 559.5 (186.5)	50.1 to 150.2 (50.1)	446.9 to 1,340.8 (446.9)

Project	Impact	Breeding season	Post-breeding season	Pre-breeding season	Annual (no. of birds)
Total		1,083.2 to 1,503.9 (1,066.9)	311.2 to 684.2 (311.1)	92.3 to 192.4 (92.3)	1,486.6 to 2,380.5 (1,470.3)
Change in baseline mortality (% point change)		0.193 to 0.269 (0.191)	0.068 to 0.150 (0.068)	0.037 to 0.077 (0.037)	0.265 to 0.425 (0.263)

Table 11.94: Summary of Population Viability Analysis results for combined cumulative collision and displacement impacts on gannet after 35 years as a result of impacts associated with the cumulative assessment

Scenario	Predicted mortality (no. of birds)	Increase in baseline mortality (% point change)	Median population size (no. of birds)	Growth Rate (Annual GR)	Change in population (%)	Median CGR	Median CPS	Quantile – unimpacted: 50%impacted
Cumulative assessment								
Breeding								
Baseline	-	-	1,044,862	1.0122	52.66	-	-	-
NatureScot Lower	1083.2	0.193	962,378	1.0098	40.85	0.9977	0.9226	36.4
NatureScot Upper	1503.9	0.269	934,216	1.0089	36.52	0.9968	0.8942	32.1
Applicant	1066.9	0.191	964,410	1.0099	41.08	0.9977	0.9237	36.8
Post-breeding								
Baseline	-	-	919,044	1.0125	54.42	-	-	-
NatureScot Lower	311.2	0.068	894,189	1.0117	50.09	0.9992	0.9722	45.8
NatureScot Upper	684.2	0.150	864,064	1.0107	45.07	0.9982	0.9396	40.0
Applicant	311.1	0.068	894,028	1.0117	50.08	0.9992	0.9721	45.8
Pre-breeding								
Baseline	-	-	500,331	1.0125	54.40	-	-	-
NatureScot Lower	92.3	0.037	492,726	1.0120	51.98	0.9996	0.9844	47.7
NatureScot Upper	192.4	0.077	484,980	1.0115	49.37	0.9991	0.9683	45.0

Scenario	Predicted mortality (no. of birds)	Increase in baseline mortality (% point change)	Median population size (no. of birds)	Growth Rate (Annual GR)	Change in population (%)	Median CGR	Median CPS	Quantile – unimpacted: 50%impacted
Applicant	92.3	0.037	493,723	1.0120	52.06	0.9996	0.9847	48.0
Annual								
Baseline	-	-	1,044,862	1.0122	52.66	-	-	-
NatureScot Lower	1486.6	0.265	935,632	1.0090	36.74	0.9968	0.8953	32.3
NatureScot Upper	2380.5	0.425	874,487	1.0071	27.92	0.9949	0.8375	22.7
Applicant	1470.3	0.263	937,054	1.0090	36.80	0.9969	0.8965	32.6

Table 11.95: Morven South cumulative effects assessment for gannet in relation to combined collision and displacement

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
Operations and maintenance phase		
Magnitude of impact	The cumulative effects assessment for combined collision and displacement for Scenario 3 considers the relevant elements of the Morven Programme (Morven South and Morven North). The estimated percentage point increase in baseline mortality associated with the impact predicted for the Morven Programme remains below the 0.02 percentage point increase threshold as defined by NatureScot (NatureScot, 2023h) (Table 11.92). This conclusion is applicable when modelling using the parameters advocated by both NatureScot and the Applicant and therefore additional analysis including PVA modelling is not required. The cumulative effect is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be negligible.	The cumulative effects assessment for combined collision and displacement for Scenario 4 considers Morven South together with the Tier 1 (including Morven North), Tier 2 and Tier 3 projects where suitable data to inform the assessment are available. Breeding season The magnitude of the cumulative effect of these projects in the breeding season may result in an impact of 1,083.2 to 1,503.9 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 1,066.9 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for gannet when applying the breeding season impact calculated using NatureScot's advocated parameters indicates a median CPS of 0.8942 to 0.9226; (i.e. the population after 35 years, would be 7.74% to 10.58% smaller than the CPS with a 50th percentile value of 32.1 to 36.4 (Table 11.94)). In terms of the population size, this means that the median of the impacted population fell within the 36th to 32nd percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenarios are still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9968 to 0.9977 which translates to a growth rate 0.23% to 0.32% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		be undetectable against natural fluctuations in the growth rate currently seen in the regional population. Under the Applicant's approach, the CPS was 0.9237 which translates to a 7.63% reduction in population size after 35 years. The CGR was estimated at 0.9977 which results in a reduction in growth rate of 0.23%. Such a decrease indicates that this level of impact would not adversely affect the population and would likely remain undetectable against natural population fluctuations. The Scottish breeding population of gannet has increased between the two most recent national censuses with an increase of 40% (Burnell *et al*., 2023) with this also reflected on a UK scale (39%; Burnell *et al*., 2023). However, surveys in 2023, aimed at detecting changes in seabird breeding populations due to HPAI showed an overall 25% decrease in breeding gannets compared to pre-HPAI counts from monitored sites (Tremlett *et al*., 2024). However, this short-term decrease contrasts against a long-term increase in the UK gannet population. As a result the predicted effect on the growth rate as predicted by PVA modelling is not considered to be of a magnitude that would lead a measurable change in the UK gannet population. As a result the magnitude of impact on the gannet population in the breeding season is considered to be of low magnitude. It is also worth considering the inherent over-estimation in the cumulative totals for gannet caused by the following factors: • Over-estimation of cumulative impacts. The PVA modelling does not account for changes in the predicted cumulative total due to the decommissioning of projects considered cumulatively. Over the lifetime of Morven South, the cumulative impact will reduce significantly when licences for current projects expire and decommissioning occurs. The PVA metrics are therefore highly precautionary.

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		• No consideration has been made for density dependent compensation of demographic parameters within the modelled population, nor immigration, both of which could reduce the magnitude of any population change. • The use of flight speeds that do not provide a robust representation of the behaviour of gannet in the modelling conducted for projects considered cumulatively (see Volume 3, Annex 11.2 Offshore Ornithology Collision Risk Modelling Report for more information). This leads to an approximate over-estimate of 7% at each project. • For a number of recent projects, it has been concluded as part of the Appropriate Assessments conducted that the predicted in-combination impacts are at a magnitude that represents an AEOI on the integrity on a number of SPAs. As a result these projects have been required to submit derogation cases which include compensation measures. For gannet this is applicable to Berwick Bank, Buchan, Caledonia North, Caledonia South, Cenos, Green Volt, Muir Mhor, Ossian and Salamander. The compensatory measures associated with these projects will work to ensure there is no residual effect of these projects on the gannet features of relevant SPAs which form part of the regional population used as part of the cumulative assessments for Morven South. The impacts associated with these projects should theoretically be reduced to take account of the proposed compensation measures within the assessments presented above, which would lead to reduced impact magnitudes and improved PVA metrics. As a result the magnitude of impact on the gannet population in the breeding season is considered to be of low magnitude. <u>Post-breeding season</u> The magnitude of the cumulative effect of these projects in the post-breeding season may result in a displacement mortality of 311.2 to 684.2 birds/annum when applying NatureScot’s preferred displacement and mortality rates. When applying the Applicant’s

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		preferred displacement and mortality rates the equivalent impact is 311.1 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for gannet when applying the post-breeding season impact calculated using NatureScot's advocated parameters indicates a median CPS of 0.9396 to 0.9722; i.e. the population after 35 years, would be 2.78 to 6.04% smaller than the CPS with a 50th percentile value of 40 to 45.8 (Table 11.94). In terms of the population size, this means that the median of the impacted population fell within the 45th to 40th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenarios are still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9982 to 0.9992 which translates to a growth rate 0.08 to 0.18% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would be undetectable against natural fluctuations in the growth rate currently seen in the regional population. Under the Applicant's approach, the CPS was 0.9721 which translates to a 2.79% reduction in population size after 35 years. The CGR was estimated at 0.9992 which results in a reduction in growth rate of 0.08%. Such a decrease indicates that this level of impact would not adversely affect the population and would likely remain undetectable against natural population fluctuations. As the UK breeding population is the main contributor to the regional post-breeding population of gannet the trends in the regional post-breeding population are considered to be the same as the regional breeding population. When taking into account the outputs of the PVA and the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		above, it is considered that the magnitude of impact on the gannet population is of negligible magnitude. Pre-breeding season The magnitude of the cumulative effect of these projects in the pre-breeding season may result in a displacement mortality of 92.3 to 192.4 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 92.3 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for gannet when applying the pre-breeding season impact calculated using NatureScot's advocated parameters indicates a median CPS of 09683. to 0.9844; i.e. the population after 35 years, would be 1.56 to 3.17% smaller than the CPS with a 50th percentile value of 45.0 to 47.7 (Table 11.94). In terms of the population size, this means that the median of the impacted population fell within the 45th to 47th percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenarios are still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9991 to 0.9996 which translates to a growth rate 0.04 to 0.09% smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would be undetectable against natural fluctuations in the growth rate currently seen in the regional population. Under the Applicant's approach, the CPS was 0.9847 which translates to a 1.53% reduction in population size after 35 years. The CGR was estimated at 0.9996 which results in a reduction in growth rate of 0.04%. Such a decrease indicates that this level

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects
		of impact would not adversely affect the population and would likely remain undetectable against natural population fluctuations. As the UK breeding population is the main contributor to the regional pre-breeding population of gannet the trends in the regional pre-breeding population are considered to be the same as the regional breeding population. When taking into account the outputs of the PVA and the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the gannet population is of negligible magnitude. Annual The magnitude of the cumulative effect of these projects annually may result in a displacement mortality of 1,486.6 to 2,380.5 birds/annum when applying NatureScot's preferred displacement and mortality rates. When applying the Applicant's preferred displacement and mortality rates the equivalent impact is 1,470.3 birds/annum. This magnitude of impact exceeds the 0.02 percentage point threshold recommended by NatureScot and therefore PVA modelling has been conducted. The PVA model conducted for gannet when applying the annual impact calculated using NatureScot's advocated parameters indicates a median CPS of 0.8375 to 0.8953; (i.e. the population after 35 years, would be 10.47% to 16.25% smaller than the CPS with a 50th percentile value of 22.7 to 32.3 (Table 11.94)). In terms of the population size, this means that the median of the impacted population fell within the 22nd to 32nd percentile of the unimpacted population (a value of 50 would indicate that they are the same). This suggests that the impacted scenarios are still well within the margin of error of the non-impacted scenario, and therefore there would likely be no adverse effect to the population. However, as stated the CGR is considered a more robust metric compared to the CPS in this analysis due to the models being conducted with density independence, in line with NatureScot (2023h) guidance. The PVA model predicted a median CGR of 0.9949 to 0.9968 which translates to a growth rate 0.31% to 0.50%

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		smaller than the counterfactual (unimpacted) growth rate. Such a decrease indicates that this level of impact would not adversely affect the population and would be undetectable against natural fluctuations in the growth rate currently seen in the regional population. Under the Applicant's approach, the CPS was 0.8965 which translates to a 10.35% reduction in population size after 35 years. The CGR was estimated at 0.9969 which results in a reduction in growth rate of 0.31%. Such a decrease indicates that this level of impact would not adversely affect the population and would likely remain undetectable against natural population fluctuations. As the UK breeding population is the main contributor to the regional population of gannet used to assess the annual impact the trends in the annual population are considered to be the same as the regional breeding population. When taking into account the outputs of the PVA and the factors that result in an over-estimation of the cumulative impact discussed in relation to the breeding season impact above, it is considered that the magnitude of impact on the gannet population is of negligible magnitude.
Sensitivity of receptor	The sensitivity of gannet is considered to be as described for the assessment of Morven South alone (see paragraph 11.11.6.13). Gannet is deemed to be of high vulnerability, high recoverability, and of international value. The sensitivity of the receptor is therefore considered to be high.	The sensitivity of gannet is considered to be as described for the assessment of Morven South alone (see paragraph 11.11.6.13). Gannet is deemed to be of high vulnerability, high recoverability, and of international value. The sensitivity of the receptor is therefore considered to be high.
Significance of effect	Overall the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.	Overall, the magnitude of the impact is deemed to be negligible to low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of minor to moderate adverse significance. The PVA results suggest that the predicted impact will have an insignificant impact on the growth rate of the population and it is therefore considered that minor adverse significance is appropriate. Therefore, the cumulative

Cumulative effects assessment		
	Scenario 3: The Morven Programme (Morven South + Morven North + MHPGC Project + MBAGC Project)	**Scenario 4: Morven South and Tier 1, Tier 2 and Tier 3 Projects**
		impacts of displacement on gannet are of **minor adverse** significance, which is not significant in EIA terms.
Further mitigation and residual significance	No mitigation measures for gannet in relation to combined collision and displacement are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.	No mitigation measures for gannet in relation to combined collision and displacement are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 11.26) is not significant in EIA terms.

11.13.5 Proposed monitoring

11.13.5.1 Site specific monitoring is not proposed because the assessment concluded that Morven South would not give rise to significant effects on offshore ornithology, either alone or when considered cumulatively with other plans, projects, or activities. The Applicant will, however, continue to liaise with MD-LOT, NatureScot, and other key stakeholders to help identify opportunities for proportionate, evidence-led regional or strategic monitoring that can improve the understanding of the environmental implications of offshore wind, particularly where recognized evidence gaps exist. This may include contributing to, or participating in, relevant ongoing initiatives under the ScotMER programme (Scottish Government, 2026).

11.14 Transboundary effects

11.14.1.1 A screening of transboundary impacts has been carried out (see Volume 3, Annex 6.2: Transboundary Effects Screening). The potential for significant transboundary effects with regard to offshore ornithology to result from Morven South upon the interests of other European Economic Area (EEA) States has been assessed as part of the EIA. The potential transboundary impacts are summarised below:

- collision with rotating blades;
- displacement;
- combined collision and displacement.

11.14.2 Displacement

11.14.2.1 There is potential for displacement impacts (including impacts on species which may have connectivity to UK SPAs) during the operations and maintenance phase. Overall, the effect will be of negligible adverse significance, which is not significant in EIA terms.

11.14.3 Collision with rotating blades

11.14.3.1 There is potential for collision risk (including impacts on species which may have connectivity to UK SPAs) during the operations and maintenance phase. Overall, the effect will be of negligible adverse significance, which is not significant in EIA terms.

11.14.4 Combined collision and displacement

11.14.4.1 There is potential for combined collision risk and displacement impacts (including impacts on species which may have connectivity to UK SPAs) during the operations and maintenance phase. Overall, the effect will be of negligible adverse significance, which is not significant in EIA terms.

11.15 Inter-related effects

11.15.1.1 Inter-relationships are considered to be the impacts and associated effects of different aspects of Morven South on the same receptor. Inter-related effects are considered to be either:

- Lifetime effects: Assessment of the scope for effects that occur throughout more than one phase of Morven South (construction, operations and maintenance and decommissioning), to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in these three project stages (e.g. underwater sound effects from piling, operational wind turbines, vessels and decommissioning).
- Receptor-led effects: Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor. As an example, all effects on offshore ornithology, such as collision with rotating blades and displacement, may interact to produce a different, or greater effect on this receptor than when the effects are considered in isolation.

Receptor-led effects may be short-term, temporary or transient effects, or incorporate longer-term effects.

11.15.1.2 A description of the likely inter-related effects arising from Morven South on offshore ornithology is provided in Volume 2, Chapter 21: Inter-related and Ecosystem Effects.

11.15.1.3 For offshore ornithology, the following potential impacts have been considered within the inter-related effects assessment:

- Direct temporary habitat loss/disturbance;
- Changes in prey availability due to temporary habitat loss/disturbance;
- Attraction to light.

11.15.1.4 Table 11.96 lists the inter-related effects (Morven South lifetime effects) that are predicted to arise during the construction, operations and maintenance and decommissioning of Morven South and the inter-related effects (receptor-led effects) that are predicted to arise for offshore ornithology receptors.

Table 11.96: Summary of likely significant inter-related effects on the environment from individual effects occurring across the construction, operations and maintenance and decommissioning phases of Morven South and from multiple effects interacting across all phases (receptor-led effects)

C= Construction, O= operations and maintenance, D= Decommissioning phases

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

Description of impact	Phase			Likely significant inter-related effect	Significance
	C	O	D		
Morven South lifetime effects					
Direct temporary habitat loss/disturbance	✓	✓	✓	The majority of the disturbance/habitat loss during all project phases will be highly localised and the habitats affected are predicted to recover quickly following completion of operation and maintenance activities with prey species for seabirds recovering into the affected areas. Therefore, across the lifetime of Morven South, the effects on seabird receptors are not anticipated to interact in such a way as to result in inter-related effects of greater significance than the assessments presented for each individual phase.	Negligible adverse significance which is not significant in EIA terms
Changes in prey availability due to temporary habitat loss/disturbance	✓	✓	✓	The majority of changes in prey availability impacts during all project phases will be highly localised and temporary. Therefore, across the lifetime of Morven South, the effects on seabird receptors are not anticipated to interact in such a way as to result in inter-related effects of greater significance than the assessments presented for each individual phase.	Negligible adverse significance which is not significant in EIA terms
Attraction to light.	✓	✓	✓	The nature of lighting in all project phases is not anticipated to be of a level that would attract seabird species that may be vulnerable to attraction to light sources. The effects on seabird receptors are therefore not anticipated to interact in such a way as to result in inter-related effects of greater significance than the assessments presented for each individual phase.	Negligible adverse significance which is not significant in EIA terms
Receptor led effects					
For species at risk of both displacement and collision, an assessment has been included in section 11.11.8 for the project alone and section 11.13.4 for the cumulative assessment of Volume 2, Chapter 11 Offshore Ornithology. It is not expected that there is potential for other impacts to interact to cause additive/synergistic/antagonistic effects that may lead to a significant effect.					

Description of impact	Phase			Likely significant inter-related effect	Significance
	C	O	D		
Direct temporary habitat loss/disturbance and changes in prey availability due to temporary habitat loss/disturbance, take into account the effects on other prey receptors (i.e. shellfish, fish and benthic invertebrates) as part of their assessment. As a result, the receptor-led effects are of negligible adverse significance which is not significant in EIA terms.					

11.16 Summary of impacts, mitigation, Likely Significant Effects and monitoring

11.16.1.1 Information on offshore ornithology within the Morven South Offshore Ornithology Study Area as defined in Section 11.2 was collected through review of available literature, other offshore wind farm assessments, UK statutory guidance, detailed analysis of the data collected during the site-specific DAS, and consultation with relevant stakeholders.

11.16.1.2 Table 11.97 presents a summary of the potential impacts, mitigation measures and the conclusion of LSE[1] on offshore ornithology in EIA terms. The impacts assessed include: direct temporary habitat loss/disturbance, changes in prey availability due to temporary habitat loss/disturbance, collision with rotating blades, displacement, combined collision and displacement, barrier effects and attraction to light.

11.16.1.3 Overall, it is concluded that there will be no LSE[1] arising from Morven South during the construction, operations and maintenance or decommissioning phases.

11.16.1.4 Table 11.98 presents a summary of the potential cumulative impacts, mitigation measures and the conclusion of LSE[1] on offshore ornithology in EIA terms. The cumulative effects assessed include: collision with rotating blades, displacement and combined collision and displacement. Overall, it is concluded that there will be no likely significant cumulative effects from Morven South alongside other projects.

11.16.1.5 No likely significant transboundary effects have been identified with regard to the effects of Morven South.

Table 11.97: Summary of Likely Significant Effects, mitigation and monitoring

C= Construction, O= Operations and Maintenance, D= Decommissioning phases

Description of impact	Phase			Designed in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional mitigation measures	Significance of residual effect	Proposed monitoring
	C	O	D							
Direct temporary habitat loss/disturbance	✓	✓	✓	MM-7	Common guillemot C: Negligible O: Negligible D: Negligible Razorbill C: Negligible O: Negligible D: Negligible Puffin C: Negligible O: Negligible D: Negligible	Common guillemot C: Medium O: Medium D: Medium Razorbill C: Medium O: Medium D: Medium Puffin C: Medium O: Medium D: Medium	Common guillemot C: Negligible adverse O: Negligible adverse D: Negligible adverse Razorbill C: Negligible adverse O: Negligible adverse D: Negligible adverse Puffin C: Negligible adverse O: Negligible adverse D: Negligible adverse	None	Common guillemot C: Negligible adverse O: Negligible adverse D: Negligible adverse Razorbill C: Negligible adverse O: Negligible adverse D: Negligible adverse Puffin C: Negligible adverse O: Negligible adverse D: Negligible adverse	None
Changes in prey availability due to temporary habitat loss/disturbance	✓	✓	✓	None	Kittiwake C: Negligible O: Negligible	Kittiwake C: High O: High	Kittiwake C: Minor adverse O: Minor adverse	None	Kittiwake C: Minor adverse	None

Description of impact	Phase			Designed in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional mitigation measures	Significance of residual effect	Proposed monitoring
	C	O	D							
					D: Negligible Great black-backed gull C: Negligible O: Negligible D: Negligible Common guillemot C: Negligible O: Negligible D: Negligible Razorbill C: Negligible O: Negligible D: Negligible Puffin C: Negligible O: Negligible D: Negligible Fulmar C: Negligible O: Negligible D: Negligible Gannet C: Negligible O: Negligible	D: High Great black-backed gull C: Medium O: Medium D: Medium Common guillemot C: Medium O: Medium D: Medium Razorbill C: Medium O: Medium D: Medium Puffin C: Medium O: Medium D: Medium Fulmar C: Medium O: Medium D: Medium Gannet C: Medium O: Medium	D: Minor adverse Great black-backed gull C: Negligible adverse O: Negligible adverse D: Negligible adverse Common guillemot C: Negligible adverse O: Negligible adverse D: Negligible adverse Razorbill C: Negligible adverse O: Negligible adverse D: Negligible adverse Puffin C: Negligible adverse O: Negligible adverse		O: Mino adverse r D: Minor adverse Great black-backed gull C: Negligible adverse O: Negligible adverse D: Negligible adverse Common guillemot C: Negligible adverse O: Negligible adverse D: Negligible adverse Razorbill C: Negligible adverse O: Negligible adverse D: Negligible adverse Puffin C: Negligible adverse	

Description of impact	Phase			Designed in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional mitigation measures	Significance of residual effect	Proposed monitoring
	C	O	D							
					D: Negligible	D: Medium	D: Negligible adverse Fulmar C: Negligible adverse O: Negligible adverse D: Negligible adverse Gannet C: Negligible adverse O: Negligible adverse D: Negligible adverse		O: Negligible adverse D: Negligible adverse Fulmar C: Negligible adverse O: Negligible adverse D: Negligible adverse Gannet C: Negligible adverse O: Negligible adverse D: Negligible adverse	
Collision with rotating blades	×	✓	×	MM-43	Kittiwake O: Negligible Great black-backed gull O: Negligible Gannet O: Negligible Migratory waterbirds O: Negligible	Kittiwake O: High Great black-backed gull O: High Gannet O: High Migratory waterbirds O: Medium	Kittiwake O: Minor adverse Great black-backed gull O: Minor adverse Gannet O: Minor adverse Migratory waterbirds	None	Kittiwake O: Minor adverse Great black-backed gull O: Minor adverse Gannet O: Minor adverse Migratory waterbirds	None

Description of impact	Phase			Designed in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional mitigation measures	Significance of residual effect	Proposed monitoring
	C	O	D							
					Migratory seabirds O: Negligible	Migratory seabirds O: High	O: Negligible adverse Migratory seabirds O: Minor adverse		O: Negligible adverse Migratory seabirds O: Minor adverse	
Displacement	×	✓	×	None	Kittiwake O: Negligible Common guillemot O: Negligible Razorbill O: Negligible Puffin O: Negligible Fulmar O: Negligible Gannet O: Negligible	Kittiwake O: Medium Common guillemot O: High Razorbill O: High Puffin O: Medium Fulmar O: Medium Gannet O: High	Kittiwake O: Negligible adverse Common guillemot O: Minor adverse Razorbill O: Minor adverse Puffin O: Negligible adverse Fulmar O: Negligible adverse Gannet O: Minor adverse	None	Kittiwake O: Negligible adverse Common guillemot O: Minor adverse Razorbill O: Minor adverse Puffin O: Negligible adverse Fulmar O: Negligible adverse Gannet O: Minor adverse	None
Combined collision and displacement	×	✓	×	MM-43	Kittiwake O: Negligible Gannet O: Negligible	Kittiwake O: High Gannet O: High	Kittiwake O: Minor adverse Gannet O: Minor adverse	None	Kittiwake O: Minor adverse Gannet O: Minor adverse	None

Description of impact	Phase			Designed in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional mitigation measures	Significance of residual effect	Proposed monitoring
	C	O	D							
Barrier effects	×	✓	×	None	All receptors O: Negligible	All receptors O: Medium	All receptors O: Negligible or minor adverse	None	All receptors O: Negligible adverse	None
Attraction to lights	✓	✓	✓	MM-34	European storm petrel C: Negligible O: Negligible D: Negligible Leach's petrel C: Negligible O: Negligible D: Negligible Fulmar C: Negligible O: Negligible D: Negligible Manx shearwater C: Negligible O: Negligible D: Negligible	European storm petrel C: Medium O: Medium D: Medium Leach's petrel C: Medium O: Medium D: Medium Fulmar C: Medium O: Medium D: Medium Manx shearwater C: Low O: Low D: Low	European storm petrel C: Negligible adverse O: Negligible adverse D: Negligible adverse Leach's petrel C: Negligible adverse O: Negligible adverse D: Negligible adverse Fulmar C: Negligible adverse O: Negligible adverse D: Negligible adverse Manx shearwater	None	European storm petrel C: Negligible adverse O: Negligible adverse D: Negligible adverse Leach's petrel C: Negligible adverse O: Negligible adverse D: Negligible adverse Fulmar C: Negligible adverse O: Negligible adverse D: Negligible adverse Manx shearwater	None

Description of impact	Phase			Designed in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional mitigation measures	Significance of residual effect	Proposed monitoring
	C	O	D							
							C: Negligible adverse O: Negligible adverse D: Negligible adverse		C: Negligible adverse O: Negligible adverse D: Negligible adverse	

Table 11.98: Summary of likely significant cumulative effects, mitigation and monitoring

C= Construction, O= Operations and Maintenance, D= Decommissioning phases

Description of impact	Phase			Designed-in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional measures	Significance of residual effect	Proposed monitoring
	C	O	D							
Scenario 3										
Collision with rotating blades	×	✓	×	MM-43	Kittiwake O: Negligible Great black-backed gull O: Negligible Herring gull O: Negligible Gannet O: Negligible	Kittiwake O: High Great black-backed gull O: High Herring gull O: High Gannet O: High	Kittiwake O: Minor adverse Great black-backed gull O: Minor adverse Herring gull O: Minor adverse Gannet O: Minor adverse	None	Kittiwake O: Minor adverse Great black-backed gull O: Minor adverse Herring gull O: Minor adverse Gannet O: Minor adverse	None
Displacement	×	✓	×	None	Kittiwake O: Negligible Common guillemot O: Negligible Razorbill O: Negligible Puffin O: Negligible Fulmar: O: Negligible Gannet O: Negligible	Kittiwake O: Medium Common guillemot O: High Razorbill O: High Puffin O: Medium Fulmar: Medium Gannet O: High	Kittiwake O: Negligible adverse Common guillemot O: Minor adverse Razorbill O: Minor adverse Puffin O: Negligible adverse Fulmar O: Negligible adverse Gannet O: Minor adverse	None	Kittiwake O: Negligible Common guillemot O: Minor adverse Razorbill O: Minor adverse Puffin O:Negligible adverse Fulmar O: Negligible adverse Gannet O: Minor adverse	None

Description of impact	Phase			Designed-in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional measures	Significance of residual effect	Proposed monitoring
	C	O	D							
Combined collision and displacement	×	✓	×	MM-43	Kittiwake O: Negligible Gannet O: Negligible	Kittiwake O: High Gannet O: High	Kittiwake O: Minor adverse Gannet O: Minor adverse	None	Kittiwake O: Minor adverse Gannet O: Minor adverse	None
Scenario 4										
Collision with rotating blades	×	✓	×	MM-43	Kittiwake O: High Great black-backed gull O: High Gannet O: High	Kittiwake O: High Great black-backed gull O: High Gannet O: High	Kittiwake O: Minor adverse Great black-backed gull O: Minor adverse Gannet O: Minor adverse	None	Kittiwake O: Minor adverse Great black-backed gull O: Minor adverse Gannet O: Minor adverse	None
Displacement	×	✓	×	None	Kittiwake O: Medium Common guillemot O: High Razorbill O: High Puffin O: Medium Gannet O: High	Kittiwake O: Medium Common guillemot O: High Razorbill O: High Puffin O: Medium Gannet O: High	Kittiwake O: Minor adverse Common guillemot O: Minor adverse Razorbill O: Minor adverse Puffin O: Minor adverse Gannet O: Minor adverse	None	Kittiwake O: Minor adverse Common guillemot O: Minor adverse Razorbill O: Minor adverse Puffin O: Minor adverse Gannet O: Minor adverse	None

Description of impact	Phase			Designed-in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional measures	Significance of residual effect	Proposed monitoring
	C	O	D							
Combined collision and displacement	×	✓	×	MM-43	Kittiwake O: High Gannet O: High	Kittiwake O: High Gannet O: High	Kittiwake O: Minor adverse Gannet O: Minor adverse	None	Kittiwake O: Minor adverse Gannet O: Minor adverse	None

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